



Pesticides Usage, Perceptions, Practices and Health Effects among Farmers in North Gaza , Palestine

KEYWORDS

North Gaza ; farmers; Pesticide; Health; knowledge; behavior

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ABSTRACT

Background: Pesticides are used for pest management and vector control in agricultural areas, but many farming communities are not adequately informed about the hazards associated with the chemicals . As a result, farmers use pesticides without full understanding of their impact on human health and environment. Although their unfavorable effects on environment quality and human health, they have been randomly used by most farmers. Methods: A cross-sectional randomized approach was used to investigate the practices, perception, behaviors of ninety five in four agricultural communities in North Gaza (Al-Atatra, Abu-Halob, Tean Wanis and Abu-Halema areas). Based on the tools of the study (questionnaires and interviews), results were analyzed using Pearson Chi-square test, Student t-test and ANOVA.Results: The results of this survey indicated a wide variety of chemicals were being applied and sprayed as pesticides by the farmers. Although 36 different pesticides were reported by farmers which were being used in North Gaza, yet it could practically be lower than the actual number of pesticides being applied. The vegetable farmers depended heavily on use of pesticides for control of different pests and diseases. Majority of pesticides were insecticides ,fungicides and few herbicides were also being used in the studied area. The study showed that the literate farmers had higher percent of healthy behavior than the illiterate ones; most illiterate farmers didn't use protection tools during using pesticides and vegetable harvesting. Moreover, they overuse, misuse, and neither aware of safe handling nor proper disposal of empty containers. Only 29% of the farmers attended general agricultural training courses. Pesticide-related health symptoms (Dizziness, Breathlessness, headache, Cough and Nausea) are observed. The results will contribute to the reformation of pesticide policies in Gaza Strip. Conclusion: The study demand that the governmental, the NGO's and the interested parties should cooperate to minimize the environmental and health risks caused by the misuse of pesticides.

INTRODUCTION

There is an increasing concern regarding the widespread use of pesticides and their potential impacts on public health. Pesticides are of vital importance in the fight against diseases, for production and storage of food, they are being widely used for pest control in agriculture, gardening, homes and soil treatment [9,20].

Farmers in North Gaza, as other farmers in developing countries, use pesticides without full understanding of their impact on human health and the environment. Humans come into contact with pesticides, whether in the field, during pesticide application, harvesting, re-entry to collect vegetables, or in their homes to kill mosquitoes, cockroaches, fleas and flies. Storing pesticides may lead into acute and/or chronic exposures, with adverse health consequences. Pesticide-related illness suffered by one or more members of household may affect the overall performance and the productivity of the family farm since households normally supply labour input, especially in smallholder agriculture in developing countries.

Similar findings of low awareness amongst health care providers of the problem of pesticide poisoning have been reported in East Africa [27,34], South Africa [26], and in Costa Rica [45]. Also, many of those vulnerable to pesticide-related symptoms are poor farmers who are often illiterate.

A significant progress was made in the environmental awareness studies on pesticide hazards and their health impacts in Third World countries during the 1990s. This is in fact true, when compared with the negligence of pesticide impacts during the last few decades. Surveys were conducted in different countries e.g. Brazil [15,41], India [35], Pakistan [8], Kenya [13] and Sudan [2]. These studies are considered important steps in strengthening the role of research in planning and policy-making. This leads to strengthen the capacity building and awareness of the farmers, the govern-

mental and the non-governmental organizations and/or institutions [3]. In the Gaza Strip, agriculture is considered as the backbone of the income of many families. Farmers tend to use more fertilizers and pesticides than basically required to increase the agricultural production.

Lack of following safety measures among north Gaza farmers has many reasons: illiteracy, unavailability of protective devices, low awareness about the danger of pesticide contamination and the neglect of legislation regulating pesticide use [5,12].

Farmers' knowledge and perception about pesticide risks play an important role in determining the use of pesticides protection devices (PPD) [28]. Education status has an important role in increasing knowledge about pesticides' risks [21,39]. However, knowledge is not sufficient if farmers have low confidence in their ability to apply safety measures related to pesticides use [7]. Health locus of control, which is the degree to which individuals believe that their health is controlled by internal or external factors, can be one of the explanation of farmers unsafe behaviors related to pesticides [24].

Objectives

The purpose of the research is to provide data of pesticide policy aimed at pesticide exposure reduction and hence reduced health consequences due to pesticides, whilst still allowing farmers to produce cost-effectively sustainable and environmentally friendly. This paper describes pesticide use practices; perceptions and health effects amongst farmers in North Gaza , Palestine.

Material and methods

Study setting

The study was conducted in the North Gaza governorate, Palestine. This region was selected because agriculture is the

main occupation in the area and different types of pesticides are used due to the diversity of crops such as fruits and vegetables.

Target areas and population

This study was conducted between March and April 2014. It consisted of interviews with farmers and farm workers in rural areas in Bait Lahia, Northern Gaza governorate where horticultural crops (vegetables, fruits) were mostly cultivated using farm inputs, particularly pesticides. The sample comprised 95 farmers (23 from each area except AlAtatra area 26 samples). The selected areas are AlAtatra, Tenwanis, Abu Halob and Abu Halema rural districts.

Data Collection

A questionnaire was designed based on published literature on the subject as well as experiences of the authors in the field. Data were collected through a farm survey by face-to-face interviews with farmers/farm workers and field observations during farming activities. The questionnaire was designed in English and translated into Arabic, the national language.

The interviews were conducted by the researchers and four volunteers from the Palestinian Commission for Development and Environment Protection where the researchers and the volunteers live in the same targeted areas. The research team trained the interviewers on the interview methodology, including the proper and standardized application of the questionnaire. The questionnaire consisted of three criteria. The first section deals with personal data as: age, marital status, educational status, History of acute pesticide poisoning and attendance of training courses.

The second part talks about the types common pesticides used by the farmers in the four areas (see table 2)

The third part includes 12 behavior questions focusing on methods of protection during mixing and spraying of pesticides, putting a mask during spraying, washing clothes used during pesticide application, pesticide comes in contact with the body, mixing pesticides with water, wearing special clothes during spraying, taking a bath after application, eating, drinking and smoking during pesticide application, disposal of pesticide container, reading labels on pesticide container, storing of pesticides, using of protective devices and changing clothes after pesticides application.

The fourth section includes 8 Knowledge questions about Symptoms of acute poisoning with pesticides, higher concentration of pesticides leads to increase rate of poisoning, Pesticides can be absorbed through skin, wearing long sleeves and trousers during pesticide application, pesticides have negative effect on health, re-entry of field following pesticide spraying, all pesticides have same negative effects on health, pesticide can reach underground water and eating, drinking and smoking in the field increases pesticide toxicity.

The last section handles Self-reported pesticide poisoning symptoms amongst vegetable farmers in the target area (see table 5).

Data Analysis

Data were collected, coded, analyzed, and tabulated using the Statistical Package for Social Sciences (SPSS) and the Chi-square test was used to compare the categorical data. ANOVA test was used for the quantitative data significance at $P\text{-value} \leq 0.05$.

Results

The age structure of the respondent farmers revealed that 19% of farmers ranged between 15-25 years old, 24% were from 26 to 35 years, 41% were between 36 and 45 years of age, 10% were between 46 to 55 years old while 6% of the farmers were 56 years and above. 78% farmers were

married. The farmers without formal education constituted about 63% and only 37% had access to education (Table 1). 29% of the farmers said that they attended training courses in various agricultural topics, where pesticides were part of the training material. While 71% of the farmers pointed out that they have never attended such training courses nor invited to those activities. This is of course, backdated since they started their work, where we stressed on this point during our survey. 22% of farmers had a history of acute poisoning with pesticides (Table 1).

The results of this survey indicated a wide variety of chemicals were being applied and sprayed as pesticides by the farmers. Although 36 different pesticides (Table 2) were reported by farmers which were being used in North Gaza, yet it could practically be lower than the actual number of pesticides being applied. The vegetable farmers depended heavily on the use of pesticides for control of different pests and diseases. The majority of pesticides were insecticides, fungicides and few herbicides were also being used in the studied area.

Although eating and drinking are prohibited during handling and application of pesticides, only (4%) of the interviewed farmers admitted that they drink or eat. Regarding smoking, 58% of the farmers smoke during application of pesticides, while 42% do not smoke. The low percentage of the non-eaters or drinkers during work was due to the fact that farmers definitely know that pesticides are toxic and may harm the human body during eating or drinking. The high percentage of smokers is attributed to the fact that all of them do not know that smoking could have harmful impacts on the human body during application of pesticides. 100% of them neither wear a protective uniform nor use special clothing during pesticide application and 97% of the farmers don't put a mask during spraying. Only 27% of the sample takes a bath and 9% change their clothes following pesticides application. One of the striking results of this study is that 76% of the farmers store pesticides in their homes or houses, while only 24% store them in the farms. Some of the farmers were asked why they used their homes for pesticide storage and they answered that pesticides may be lost or stolen in the farm, because they do not have safe stores in their farms. (Table 3)

Most of the empty pesticide containers are considered as one of the dangerous hazardous wastes if they were not thoroughly washed and rinsed after use. 51% of the farmers dispose those containers either by burning or burial in the farm depending on the type of the material which the container is made of (paper, plastic or metal). 46% of the farmers throw those containers away in usual trash. Both of these do not rinse the containers after use. 3% of the interviewed farmers admitted that they could use these empty containers for domestic purposes when the size and the shape are affordable for some kinds of uses.

The results show that the literate participants had higher percent of healthy behavior than the illiterate ones. They had a higher percentage regarding: reading labels on pesticides containers, mixing pesticides using gloves, washing skin coming in contact with pesticides, putting a cloth on nose and mouth during spraying, washing hands and face and taking a bath following pesticide application and they had a low percentage of using pesticide containers at home. While there was no significant difference between those receiving school education and those who did not regarding wearing protective uniform or special clothes during spraying, changing and washing clothing after pesticide application and eating or drinking during pesticide spraying. There was a significant difference between the two groups in the total mean score of knowledge.

The results show that the percentage among the whole sample was high regarding the ability of pesticides to reach

underground water (91%), negative effect of pesticides on health (80%) and the effect of higher concentration of pesticides on health (62%). The low percentage was about: re-entry of field following pesticide application (7%) and wearing long sleeves and trousers during spraying (7%). 35% of farmers had wrong belief that all pesticides have same health hazards and 32% of them believed that pesticides can't be absorbed through skin. Whereas Symptoms of acute poisoning with pesticides was 33%. (Table 4).

Regarding the relation between knowledge and educational status, table four shows that farmers who received school education had higher levels of knowledge than those who did not. This difference was most obvious regarding knowledge about absorption of pesticides through skin (12% illiterate versus literate 66%), the effect of different types of pesticides on health (%15 versus 69%), Symptoms of acute poisoning with pesticides (25% versus 46%) and the effect of high concentration of pesticides on health (47% versus 89%). The smallest difference in knowledge between the two groups was about wearing long sleeves and trousers during pesticide application. The difference in total mean score was significant between the two groups. Table 4).

In general, the majority of farmers reported having felt sick in the previous years after routine application of pesticides. The most common symptoms that were reported by the interviewees are shown in (Table 5). Dermal effects (36%), headache (28%) and dizziness (28%) were more commonly reported and nausea (17%) and stomach ache (15%), less commonly reported.

Table 1: Socioeconomic Characteristics and health conditions of the study sample

Factors	Categories	Frequency	%
Age (yrs)	15-25	18	19
	26-35	23	24
	36-45	39	41
	46.55	9	10
	56 and above	6	6
	Total	95	100
Marital Status	Single	21	22
	Married	74	78
	Total	95	100
Education status	Illiterate	60	63
	literate	35	37
	Total	95	100
Attendance of training courses	Yes	28	29
	No	67	71
	Total	95	100
History of acute pesticide poisoning	Yes	21	22
	No	74	88
	Total	95	100

Table 2: Types of pesticides used by farms in North Gaza

Pesticide	Usage Frequency			
	AlAtatra	Tenwanis	Abu Halob	Abu Halema
Phytoselulus persimilis	1	1	2	1
Abamectin	2	0	2	5
Tebufenpyrad	5	2	1	3
Sodium fluosilicate	4	2	0	2
lufenuron	0	0	2	2
Chlorfluzuron	1	2	0	2
Bacillus thuriniensis	1	4	2	1
Novaluron	2	2	0	2
Aphidius colemanl	1	1	1	2
Thiamethoxam	1	1	1	1
Abamectin	1	2	1	1
Chlorothalonil	4	2	2	5
Prochloraz Mangane	5	2	2	5
Propamocarb HCl	1	1	1	1
Tolyfluanid	3	4	1	3
Penconazole	0	1	2	1
Fulfur	2	0	0	1
Kresoxim Methyl	3	1	2	1
Potassium bicarbonate	1	0	0	1
Iprodione	1	1	1	3
Glufosinate Ammonium	2	2	1	1
Oxyfluorfen	3	1	2	1
Oxadiazon	2	1	1	2
Glyphosate	3	4	1	1
Temik	1	1	3	1
Smash	5	2	1	3
Prodex	1	1	1	2
Leopard	2	0	1	4
Linurex	3	3	0	3
Prometrex	2	1	1	0
Roundup	3	2	1	4
Signum	2	1	0	2
Stroby	2	0	2	1
manebgan	3	2	1	3
Bavistin	1	2	2	1
Etigan	4	3	2	2
Total	76	45	43	75

Table 3: behaviors of farmers during pesticide handling and application

Behaviors	Illiterate N = 60		literate N=35		Total sample N=95		χ^2
	no.	%	no.	%	no.	%	
Put mask during spraying	58	97%	34	98%	92	97%	1.92
No	2	3%	1	2%	3	3%	
Wash clothes used during pesticide application separately	55	92%	29	83%	84	88%	1.50
No	5	8%	6	17%	11	12%	
Pesticide comes in contact with the body	48	80%	16	46%	64	67%	37.92**
Do nothing	12	20%	19	54%	31	33%	
Mix pesticides with water	32	53%	7	20%	39	41%	34.26**
Hand covered with cloth or plastic bag	28	47%	25	80%	56	59%	
Using gloves							
Wear special clothes during spraying	60	100%	35	100%	95	100%	1.93
Wearing everyday clothes	0	0%	0	0%	0	0%	
Have special clothes for spraying							
Take a bath following pesticide application	46	77%	23	66%	69	73%	7.93**
No	14	23%	12	34%	26	27%	
Eating and Drink during pesticide application	57	95%	34	97%	91	96%	3.57
No	3	5%	1	3%	4	4%	
Yes							
Smoking during pesticide application	14	23%	26	74%	40	42%	11.24**
No	46	77%	9	26%	55	58%	
Yes							
Disposal pesticide container	32	54%	16	47%	48	51%	18.92**
Burned	26	43%	18	50%	44	46%	
Disposed with usual trash	2	3%	1	3%	3	3%	
Used in house							
Read labels on pesticide container	46	77%	15	43%	61	64%	50.01**
No	14	23%	20	57%	34	36%	
Yes							
Storage of pesticides	42	70%	30	86%	72	76%	3.24
Home	18	30%	5	14%	23	24%	
Farm							
Protect himself during spraying	60	100%	35	100%	95	100%	3.22
Just take care	0	0%	0	0%	0	0%	
Wearing protective uniform							
Change clothing after pesticide application	56	93%	30	86%	86	91%	2.36
No	4	7%	5	14%	9	9%	
Yes							

Table 4: knowledge of farmers during pesticide handling and application

knowledge	Illiterate N = 60		literate N=35		total sample N=95		χ^2
	no.	%	no.	%	no.	%	
Symptoms of acute poisoning with pesticides	15	25%	16	46%	31	33%	20.01 **
Higher concentration of pesticides leads to increase rate of poisoning	28	47%	31	89%	59	62%	63.06**
Pesticides can be absorbed through skin	7	12%	23	66%	30	32%	106.10**
Wearing long sleeves and trousers during pesticide application	2	3%	5	14%	7	7%	10.12**
Pesticides have negative effect on health	42	70%	34	97%	76	80%	34.03**
Re-entry of field following pesticide spraying	3	5%	4	11%	7	7%	68.01**
All pesticides have same negative effects on health	9	15%	24	69%	33	35%	96.15**
Pesticide can reach underground water	52	87%	34	97%	86	91%	15.19**

Table 5 : Self-reported pesticide-poisoning symptoms amongst farms in North Gaza (n=95)

Symptom	Frequency	(%)
Headache	27	28
Excessive sweating	26	27
Skin problems	34	36
Sneezing	25	26
Cough	20	21
Stomach ache	14	15
Nausea	16	17
Dizziness	27	28

Discussion

The results of this survey showed that farmers depended heavily on the use of pesticides for control of different pests and diseases and over 36 different formulations were used. This is probably because they believe that the only solution to pest problems is to spray more frequently and using different types of pesticides. Previous research in some of the southern Gaza Strip [3,6,11,37,38] showed that farmers were not receiving agricultural extension service, and relied heavily on pesticide use when dealing with pest problems but were constrained by the lack of appropriate knowledge. However, pesticide usage in the study area seems to be highly influenced by pesticides vendors who were carrying out their business right in the farming communities and very interested in achieving large sales of their pesticides. This situation is also true in many developed countries where the choice of pesticides to be used by farmers is influenced by the suppliers [14,4]. In African countries, many government planned extension programs to encourage the use of pesticides [1], but did not consider their effects on the environment and health risks. As a result and coupled with lack of basic knowledge of pesticides, farmers' decisions on what pesticides and how to use do not have a bearing on health or safety of the environment. Some researchers observed that farmers used more pesticides because they based the applications on calendar spray pesticides program without necessarily giving much priority to health and environmental considerations[14]. Insecticides were the most used because insect pests were the most serious problem in vegetable production in the study area. This was followed by fungicides usage as fungal attacks ranked second to insect pests. Herbicides were least in use probably because weeding could easily be done manually by deploying community members. This is contrary to the situation in Ghana where herbicides are the predominant pesticides type in use in vegetable production [33]. The community members, in North Gaza, including women and children were deployed in duties such as transplanting, weeding and harvesting. It was common scenery in this study to see women and children transplanting, weeding and harvesting in farms. This trend of labor division exposed the whole community to pesticides hence the majority of households in the farming communities was likely to be adversely affected by pesticides in one way or the other.

Regarding behaviors related to pesticides use, most of the farmers (64%) did not read labels or instructions on the pesticide containers. This corresponds with the study conducted in Ethiopia where most of farmers didn't read instructions on pesticides packages due to illiteracy or they are just reluctant to read them[6].

The results show that 100% of farmers didn't use protective devices which is consistent with the results of many studies conducted in many parts of the world [28,30,32,42,46] and another agricultural areas in Egypt [19,44]. The reasons for not using protective devices among the present sample could be due to low level of knowledge about the safety measures, unavailability of protective devices at governmental agricultural association and their high cost at private sectors. In addition, hot weather was among the causes of low use of protective devices as reported by studies conducted in USA [36].

Most of the farmers neither take a bath nor change/wash their clothes after pesticide application. The majority of farmers disposed pesticide containers by using them at home or discarding them with usual trash which is consistent with the results of two studies conducted in Greece and in Gaza [10,47]. In contradiction, a study conducted in Iran reported that more than half of the farmers sell empty containers for recycling[29]. Fortunately, the Farmers in the present sample had no notion about recycling.

The percent of safe behaviors was higher among literate farmers and that can be explained by their higher level of knowledge. This is consistent with studies reporting that low education level limits the ability of farmers to fully understand all the health risks of pesticides and the importance of safety measures [18,47]. Most of the sprayers, regardless their literacy status, ate and drank during pesticide work. Similar behaviors were reported in other developing countries[16,22].

The study shows that among the total sample, the highest percentage was about the ability of pesticides to reach underground water followed by awareness of negative effect of pesticides on health (91% and 80% respectively) which is contradictory to the results of a study conducted in Gaza where farmers had low awareness about the ability of pesticides to reach groundwater [47]. On the other hand, the lowest percentage was about wearing long sleeves during spraying and time of re-entry to the field.

The state of being literate or illiterate is an influential factor in all the aspects of knowledge. The difference was specially noticed in knowledge about absorption of pesticides through skin and all pesticides have not the same health effects. These results confirmed the findings of the earlier studies indicating that there are a significant relation between farmers' educational level and their level of knowledge [29,47].

A large number of the farmers in this study reported having different symptoms of diseases after spraying, which was generally considered as common phenomenon after working in the fields. It has been reported that farmers assume that pesticides poisoning symptoms were normal so they get used to them[23]. The former source indicated that there were few farmers who reported to the health care centers for treatment resulting from pesticides use and hence the reason for low expenditure on health costs. Similar studies carried out in Indonesia. and in Co'te d'Ivoire [4] reported that pesticide applicators tended to accept a certain level of illness as an expected and normal part of the work of farming and therefore do not report the symptoms in official health centers for formal medical assistance.

Health and environmental problems cannot be isolated from economic concerns due to the fact that inappropriate pesticide use results not merely in yield loss but also in health problems and possible air, soil and water pollution. The problem of farmers' health should be an important concern for policymakers when looking at the economic and efficiency of pesticides in horticultural production [31]. Other factors, such as the strong influence of pesticides vendors and quick results obtained in the short term after pesticide applications were presumably encouraging farmers to rely more on pesticide use than on other pest control methods. This high dependence on pesticides by vegetable farmers is also an indication that they are not aware of other pest management strategies that are effective, inexpensive and yet friendly to the environment. Pest management strategies including intercropping [25] and ploughing and crop rotation [17] have been shown to significantly reduce insect pests. There is a need to bring to the attention of these farmers to the existing alternative pest management strategies that are cost-effective and environmentally friendly. In Zimbabwe, although small-scale vegetable farmers use some cultural control methods and occasionally botanical pesticides, pest control is predominantly by the use of synthetic pesticides[40].

Conclusions

We can conclude from the study that the farmers lack appropriate knowledge on safe handling and use of pesticides. This is attributed to by almost the absence of extension services and training. This is a call to develop a training programme on pest management especially on pesticide use in agriculture and hence contribute to reform the pesticide policy in Gaza strip, Palestine. There are also strong indications that there are substantial human health problems associated with the use of pesticide in horticultural farming in Gaza strip, but these are inadequately documented.

Moreover, the combination of using hazardous pesticides and lack of availability of appropriate precautionary tools are detrimental to the farmers health. The re-entry of farmers into the field for work after pesticides use was sometimes in less than 24 hours. The continuation of pesticides spraying and other farming activities concurrently in the field can lead to exposure to pesticides as they may be still be dispersed spraying area. Pesticides used for more than a decade implies that a large number of farmers were exposed to pesticides and that may lead to chronic health problems amongst farmers and their families.

The health complaints (coughing, headache, skin rashes, chest pains and difficulty in breathing) were reported as most of the activities related to pesticide handling and application, where done in an improper and unhealthy way. These phenomena are the important components of the environmental health and awareness among the farmers in north Gaza Governorate.

Recommendations

The present situation in North Gaza farms is deteriorating with time due to the lack or inadequacy of the provided agricultural services. Based on the findings of the study, we recommend that governmental and non-governmental sectors should work hard to raise farmers awareness regarding the importance of using personal protective measures. The ministry of agriculture should encourage farmers to reduce, if not eliminate the use of pesticides through offering incentives to shift from synthetic pesticides to biopesticides and organic farming to prevent land and water degradation, environmental pollution and health risks. Finally, farmers would not be able to determine the active ingredients in pesticides for better crop yield and disease cure or otherwise without attending workshops about pesticides management.

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