Pesticides and Associated Impact on Human Health: A Case of Small Farmers in Southern Sindh, Pakistan

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Abstract: The unbridled use of pesticides in agriculture sector poses a serious environmental degradation problem besides, being intimately associated with public and workers health hazard. Although the use of pesticides help to considerably control diseases, hence reduce crop losses and result in better yield of the crops. Pesticides are particularly under use to improve production of crops like corn, vegetables, potatoes and cotton, although their unfavourable effects on environmental quality and human health have frequently been reported and well documented. Pesticides mismanagement starts at the local area but always exhibits local and global impacts.with universal dimensions.

The study aimed at determining the extent of pesticide use and farmers' knowledge of the pesticides and their use on the field. One hundred farmers were interviewed concerning pesticides usage patterns from amongst farmers in vegetable production area in Lower Sindh, Pakistan. Information was obtained through structured Questionnaire coupled with personal interviews. The results revealed that 27 different pesticides were used by farmers and majority of pesticides were insecticides. All pesticides used were registered by Government of Pakistan. Toxicity class of majority pesticides belonged to Class-II, which WHO classifies as moderately hazardous and one highly hazardous pesticide with the class-Ib was also being used. Okra and tomato were more affected by the insect pests. Majority of farmers relied on nicotinoid and organophosphate groups of pesticides. A considerable number of farmers had received education at middle school level only. The source of farmers knowledge of pesticide use was the pesticides dealer who advised them when to spray the crops (s). Half of farmers had no safety protection gears/tools during pesticide application and vegetable harvesting. The survey has shown some overuse, misuse and abuse of pesticides. Farmers were not aware of pesticide hazards and they lacked appropriate knowledge on safe handling and use of pesticides, which can be attributed to inadequate agriculture extension services and state of art trainings to the farmers at their door steps along with lack of education. Since these pesticides were being traditionally used by the farmers in the near by fields and on the same fields with out their deleterious effect knowledge to the farmers, soil and environment combined together as most of the farmers were not educated but also ill equipped about the knowledge of the kind/type of pesticide being used/sprayed what to talk of its chemical nature leading to harmful effects.

Keywords: Pesticide, farmers, vegetables.

INTRODUCTION

Agriculture is the single largest sector of Pakistan's economy with 21 percent contribution to GDP and employing about 44 percent of the workforce. Pests and diseases are principal hazards in vegetable production which require intensive pest management. Each year these pests destroy almost half of the world's food crops. Besides, indiscriminate use of pesticides in agriculture sector poses serious environmental issues including public/workers health related problems.

Worldwide usage of pesticide has increased manifold since the 1960s. The use of pesticides has helped considerably to reduce crop losses and to get better yield of the crops such as corn, vegetables, potatoes and cotton. On other side, their unfavorable effects in the form of environmental degradation and human health have also been well documented. The main issue of pesticides mismanagement starts at the local area where it causes severe damage to land, soil water, farmer's/worker's health and the environment as whole including pollution of atmosphere but is also reflected globally from region to region and continent to continent [1-5].

Pesticides not only pollute the soils and water but also persist in the vegetables and then enter the food chain, and enter the body system, blood and organs. In addition, pesticides also contribute to environmental pollution, biodiversity losses and deterioration of natural habitats [5]. There have also been reported instances of pest resurgence, development of resistance to pesticides, secondary pest outbreaks and destruction of non target species. Despite the fact that pesticides are also used in other sectors, agriculture is being perceived as the most important source of adverse effects [6].

The vegetables such as okra, chilies, tomato cauliflower, brinjal, bitter gourd and onions are severly attacked by insect pests. Farmers mostly use pesticides belonging to organochlorine, carbamate, pyrethroid and neo-nicotinoid groups for the control of these pests. The use of pesticides in Asia, Africa, Center and South America is increasing due to high demand for food quality products and urgent need for self

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sufficiency in food production in various regions [7]. Besides, cost effectiveness and easy availability of the above chemicals also lures farmers to use them.

There is dearth of studies related to these issues in Sindh. A study which looks into the health effects of acute pesticides among the vegetable farmers of Sindh is a positive step to fill this research gap. Specific studies dealing with the farming practices of the farmers regarding pesticide use and its impact on the health of workers in the field and over bioecology of the area need to be investigated with particular reference to Sindh province in an effort to develop a policy for its appropriate management minimizing all the hazards associated. Therefore, study was initially undertaken among the farmers of southern Sindh to look into the various aspects of pesticide use in growing vegetables and its impact on environmental degradation and human health.

METHODOLOGY

Study Area

The study area targeted mainly the vegetable growing farmers of Matiari, Tando Allahyar, Mirpurkhas and Hyderabad districts of Sindh province, where population heavily depends on agronomic and horticultural crops specially the vegetables for their livelihood. Information from 100 vegetables farmers (20 from each district) was collected for the research study through structured questionnaire and personal interviews.

Interview Questionnaire

The interview questionnaire was designed to elicit details on land ownership, planting, farmer's currently working place, exposure to pesticides, the use of pesticides, the commonly used pesticides and the precautions if any taken. The source of information also included the signs and symptoms of any illness related to pesticide exposure. Structured questionnaire was developed in consultation with experts of Agriculture Extension and Plant Protection Departments of Sindh Agriculture University, Tandojam, Pakistan. The questionnaire was pilot tested in an adjacent village. After feedback from the interviewers it was accordingly revised to improve the data harnessing. It also included and related to timing of the pesticide spraying.

Data Collection

Four students of Institute of Food Sciences & Technology from Sindh Agriculture University Tandojam were trained as Interviewers by the research team. The research team trained interviewers on the interview methodology, including the proper and standardized application of the questionnaire. Specific instructions were given by the senior faculty members, acting as supervisor to the interviewers for collecting data regarding pesticide use from the vegetables growing farmers of Sindh. Sample farmers were interviewed. The farmers were informed about the purpose of the study and the interviewers obtained verbal consent before proceeding with the interviews. The interviews were conducted in local language, namely Sindhi, under the supervision of the members of the research team although structured questionnaire was in English yet it was translated in local language by the team members (interviewers). Each interview took about 50-60 minutes to be completed. The interviewed data were collected at the end of the each day, checked, coded and stored for data entry.

Data Analysis

The coded data was entered in Microsoft Excel, cleaned and further data analysis was done in statistical software SPSS and frequencies.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Farmers in the Study Group

The age structure of the respondent farmers revealed that 20% of farmers ranged between 15-25 years of age, 25% were from 26 to 35 age bracket, 40% were between 36 and 45 years of age, 10% were between 46 to 55 years old while 5% of the farmers were 56 years and above. 69% farmers were married. The farmers with out formal education were about 15%, 65% had primary education and only 20% had access to secondary education (Table **1**).

Availability and Source of Information of Pesticides

Majority respondents reported that principal source of information to them was from pesticides agro-chemicals companies, which was to the extent of 37% where as 30% farmers reported that they received information from commercial media. Only 15% farmers reported that they received information from government agriculture personnel. Since the packed material also contained some information which was in english, it could not help them because of limited or no education.

Table 1: Socioeconomic Characteristics of Farmers Status to Farmers

Factors	Categories	Frequency	% Age
Age (yrs)	15-25	20	20
	26-35	25	25
	36-45	40	40
	46.55	10	10
	56 and above	5	5%
	Total	100	100%
Marital Status	Single	31	31
	Married	69	69
	Total	100	100%
Education	No formal education	15	15
	Primary education	65	65
	Secondary Education	20	20
	Total	100	100%

Commonly Used Pesticides

The results of this survey indicated a wide variety of chemicals were being applied and sprayed as pesticides by the farmers. Although 27 different pesticides (Table **3**) were reported by farmers which were being used in southern Sindh, yet it could practically be lower than actual number of pesticides being applied. The vegetable farmers depended heavily on use of pesticides for control of different pests and diseases. This is probably because they believe that the only solution to pest problems is to spray more frequently by using different types of pesticides mixtures and formulations [8]. Although, farmers were not receiving agricultural extension services, yet they relied heavily on pesticide use when dealing with pest problems but were handicapped due to lack of appropriate knowledge [9]. Majority of pesticides were insecticides and few fungicides were also being used in the area studied. The classification of these pesticides by the type of pests they control, active ingredient, chemical group and WHO hazard Category are reflected in the above table. All the pesticides were registered by agriculture research department of Pakistan. Toxicity class of majority pesticides belonged to class-II (WHO Recommended Classification of Pesticides by Hazard). The use of extremely hazardous insecticides, including endosulfan (moderately hazardous) and carbofuran (class-Ib of Carbamate group) were also being practically used in the area.

CONCLUSIONS AND RECOMMENDATIONS

Most farmers in our study were not aware of the health hazards caused by the inappropriate handling of pesticides. The combination of use of hazardous pesticides in addition to lack of availability of appropriate precautionary gear and 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 and in the air of farmers spraying arena. Pesticides use for more than a decade implies that a large number of farmers get exposed to pesticides over the duration, which may lead to chronic health problems amongst farmers and their families. Young people seem to be engaged in pesticides spraying more than the older people, which may be due to limitation of activity by the elderly workforce on account of past exposure to pesticides and associated health problems.

Data is scarce in relating pesticide exposure to chronic disease like diabetes, hypertension, ophthalmic disorders etc. The farmers may not have been aware whether they had other chronic diseases like diabetes, hypertension etc. because they may not have been tested for it. The prevalence of these diseases was computed on the basis of self reported data so there could be underestimation of these numbers.

It is however, recommended that awareness needs to be created on use of personal protective measures

Table 2: Sources of Information about Pesticide Use

Source of Information	Frequency	% Age
Commercial media (television, radio, newspaper, leaflets, and pamphlets)	30	30
Government agricultural personnel (agricultural extension officers, and agriculture research officers)	15	15
Village leaders, opinion leaders, and neighbors	18	18
Sales persons from agro-chemical companies/ consultant dealer	37	37

Table 3: Pesticides and Various Formulations Commonly Used by the Farmers

Pesticide	Group	Usage Frequency			
		Matiary	Hyderabad	Mirpur Khas	Tando Allahyar
Metalaxyl	Anilide	1	4	4	1
Abamectin	Avermectins	2	1		5
Emamectin	Avermectins	7	NR		3
Thiophanate Methyl	Benzimidazole	NR	NR	NR	NR
Carbofuran	Carbamate	NR	NR	NR	NR
Difenoconazole	Conazole	1	2	NR	NR
Mancozeb	Dithiocarbamate	1	4	2	1
Copper oxychloride	Inorganic	2	NR	NR	NR
Sulphur	Inoranic	NR		1	NR
Monomehypo	Nereistoxin	1	2	1	1
Acetamiprid	Nicotinoid	4	2	5	6
Imidacloprid	Nicotinoid	9	2	6	9
Thiamethoxam	Nicotinoid	1	NR	NR	NR
Endosulfan	OC	3	4	1	3
Acephate	OP	NR	1	2	1
Dimethoate	OP	2	NR	NR	1
Malathion	OP	NR	2	1	NR
Profenophos	OP	3	NR	2	1
Indoxacarb	Oxadiazine I	NR	NR	NR	1
Cypermethrin	Pyrethorid	1	1	1	3
Bifenthrin	Pyrethroid	2	NR	1	1
Deltamethrin	Pyrethroid	NR	12		1
Lambda Cyhalothrin	Pyrethroid	NR	NR	NR	NR
Chloranttraniliprole	Unclassified	NR	NR	NR	1
Pyridaben	Unclassified	1	6	3	1
Diafenthiuron	Urea	6	5	2	3
Lufenuron	Urea	1	1	NR	2
Total		48	38	32	47

including use of protective gear and tools among farmers, while handling pesticides. Farmers needs to be encouraged to reduce, if not eliminate the use of pesticides. There must be introduction of incentives to the farmers to help them shift from synthetic pesticides to biopesticides and organic farming to prevent land and water degradation, environmental pollution and health risks to farming community.

The research findings also provide the guidelines to researchers, scientists, health practitioners in Sindh province regarding use of pesticide and related environmental (soil, water and air) and health hazards through protective use of gear/tools and education/ training. The situation on ground is getting worse with time which can be attributed to lack or inadequacy of agriculture services and trainings. Without training,

farmers are unable to make good decisions of pesticides usage. Additionally, farmers would not be able to determine the active ingredients in pesticides for better crop yield and disease cure or otherwise.

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