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Exposure and Vulnerability: Health Related Symptoms, Attitudes and Practices towards Handling Agricultural Pesticides among Vendors of Central Punjab, Pakistan

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ABSTRACT

The influence of exposure to pesticides on the health of pesticide retailers/vendors in central Punjab, Pakistan, was evaluated. The study group consisted of 61 pesticides retailers/vendors (mean age ± SD: 33.82 ± 11.5 years). A structured questionnaire was used for the evaluation of attitudes, practices and self-reported health-related symptoms. Prevalence of health-related symptoms was observed in the following sequence: sweating, skin irritation, skin rashes, sore throat, uncertainty, staggering gait numbness, loose motions, coughing, nausea, blurred vision, blinking of eyes, depression, tachycardia, drowsiness, urinary urgency, burning nose, salivation, muscle weakness, abdominal pain, headache, watering of eyes, eyes redness, muscle fibrillation, blood pressure, irritation of eyes, watering nose, fits, vomiting, sexual potency decline, muscle spasm, chest pain, breathlessness, variations in sexual potency and/or coma. Participants that smoked and those with unhygienic habits not following the protective measures had more adverse health-related symptoms compared to non-smoker participants and those practicing hygienic habits and following protective measures. Results revealed that 41-50 years age group had significantly higher values of respiratory problems than the other age groups studied.These findings suggest association between ill-health symptoms and exposure to pesticides. To promote safety from pesticide usage, recommendations to the government, based on the findings of the present study were made to include the adverse pesticides scenario in future policy making for handling the agricultural pesticides by the retailers.
Key Words: pesticide toxicity; practices; health-related symptoms

INTRODUCTION

Pesticides usage has a wide range in most fields of the agrarian production to stop or reduce damage due to pests with the overall objective of boosting up quality and yield of the products. (Oerke *et al*., 2004; Cooper *et al*., 2007). These chemicals can also upgrade the nutritional worth of food along with its protection sometimes (Boxall *et al*., 2001; Damalas *et al*., 2009). Despite their extensive use and popularity, these chemicals are of serious health-related concern to various workers who are frequently exposed to these chemicals (Van der Werf *et al*., 1996; Soares *et al*., 2009). Although in developing countries, such as Pakistan, pesticides usage is 20% compared to nearly 80% in the developed countries, however, the mortality rate due to pesticides is 13% higher in the developing countries compared to that in the developed countries, and the probable reason for this is the improper and haphazard use of pesticides (WHO/UNCEP, 1990). Due to occupational activities, human population may be exposed to pesticides (Atreya *et al*., 2008; Karabelas *et al*., 2009; Tariq *et al*., 2007; Martínez-Valenzuela *et al*., 2009). Human exposure to pesticides may be due to poor pesticides storage, spillage, improper handling/mishandling (Jaga *et al*., 2003), or negligence and carelessness to read and follow pesticide labels. Some common problems associated with pesticides retail organizations have been reported from many countries, for example, a study conducted in Vietnam presented poor storage, absence of proper permits and sale of prohibited pesticides by pesticide retailers (Huang, 2001). The environmental and human risks involved in the picking up of pesticides from retailers organizations is an important complication in under-developed countries due to the absence of proper infrastructure (FAO, 1998). Many workers have poor knowledge about the adverse effects of the pesticides usage as well as the importance of precautions that are necessary for the proper application of pesticides (Yassin *et al*., 2002; Recena *et al*., 2006). Moreover, farmers mostly depend upon pesticide retailers for pesticides use

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instructions and information which often is inadequate and as a result suffer from severe ill-effects of the pesticides (Lekei *et al*., 2014). Epidemiological studies concerning the ill-effects of pesticides have been carried out by many researchers, for example, Sapbamrer & Nata (2014) reported many health-related symptoms (breathing, chest pain, dry throat, cramps, numbness, anxiety and diarrhoea) among pesticides-exposed individuals. Other health-related symptoms, such as skin irritation, dizziness or headache, chest discomfort, and feeling depressed or being nervous were reported by Martin *et al*. (2002) in individuals exposed to pesticides. Smoking habit of some of the pesticides-exposed individuals aggravates respiratory-related problems, like phlegm and cough, wheezing (Lam *et al*., 1998). Preliminary evidence indicated that pesticides usage may increase the prevalence of chronic bronchitis (Hoppin *et al*., 2007). Research conducted (1998 to 2005) in the USA revealed that workers at two pesticides retail outlets had significantly increased prevalence of pesticide poisoning (Calvert *et al*., 2008). Another recently reported research showed that pesticides retailers in Mexico had higher incidence of skin burning sensations compared to controls (Salameh *et al*., 2011). In Punjab, Pakistan, according to our knowledge, up to the present, no research has been conducted concerning retailers' practices, knowledge, and attitude. The present research was, therefore, conducted about retailers' qualifications, safety practices, work experience, and health-related symptoms in order to help prevent or reduce incidence of ill-effects on humans due to exposure to pesticides.

MATERIALS AND METHODS

Study Population

This epidemiological study involving pesticide retailers/vendors (mean age: 33.82 ± 11.5 years) was conducted during 2013-2014, in Lahore Division, central Punjab, Pakistan, an extensively vegetables grown areas covering almost 16, 104 km² and supporting a population of 14, 248, 641, comprising Lahore, Sheikhupura, Nankana Sahib and Kasur (Fig., 1). The chlorpyrifos and imidacloprid were the pesticides used in the study area.

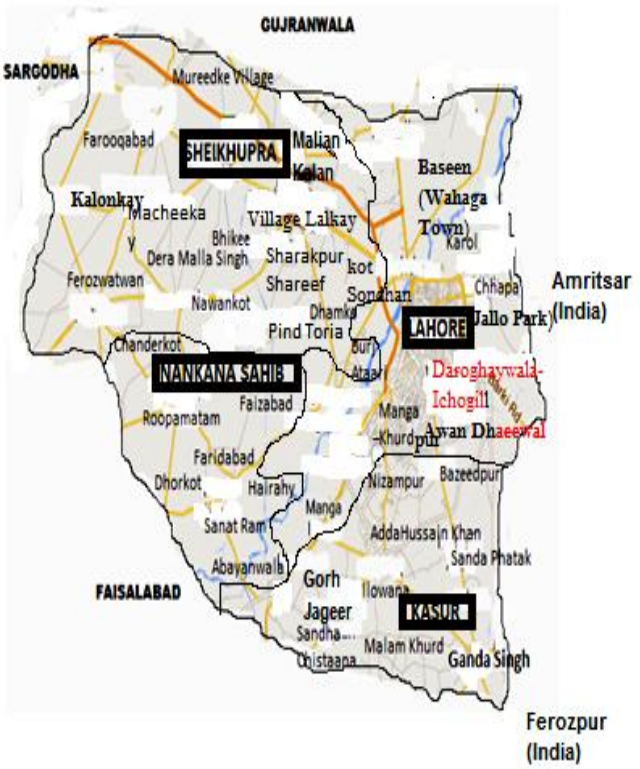

Fig., 1: Map of the study area, Lahore Division, central Punjab, Pakistan, showing sampling areas.

A total of 61 male pesticide retailers/vendors {mean age ± SD (years) 33.82±11.5; mean body weight ± SD (kg) = 61.459 ± 9.26; mean height ± SD (Feet) = 5.6 ± 0.34} were included in this investigation. Prior to the interview process for the investigation, the consent of Punjab Agricultural Department as well as of the individual participants was obtained to avoid any legal complications arising later. Each participant was provided a self-structured questionnaire containing details of physical nature of life, or experience, and adverse health-associated symptoms. To avoid any non-understandable information, the questionnaire was prepared in the native language, Urdu, and the filled in information was later translated into English. This was done to make the understanding easy for the interviewee as well as the interviewer. The principal researcher himself visited the study sites and collected the interview data. Completed data were subjected to statistical analysis through SPSS, version 18.

RESULTS

Table I: Demographic parameters of investigated subjects

Characteristics		*n*	%
1. Age range (years)			
	10-20	9	14.8
	21-30	17	27.9
	31-40	19	31.1
	41-50	9	14.8
	51-60	6	9.8
	61-70	1	1.6
5. **Gender**			
	Male	61	100.0
	Female	0	00.0
5 .**Education**			
	Illiterate	3	4.9
	Primary	48	78.7
	Elementary	7	11.5
	Intermediate	2	3.3
	Masters	1	1.6
6. **Family structure**			
	Separated Family	4	6.6
	Joint Family	57	93.4
7. Marital status			
	Unmarried	13	21.3
	Married	48	78.7
8. **Work experience at the establishment**			
	1 years or < 5 years	17	19.3
	5 years	31	35.2
	10 years	8	9.1
	15 years or more	5	5.7
8.**Smoking habit**			
	Non-smoker	19	21.6
	Smoker	42	47.7

Table II: Practices and hygiene-related habits of the pesticide vendors while at work

Habit	Smoking		Use of eatable things		Use of beverages		Use of PAAN/ chewing gum		Changing of clothes		Changing of shoes after work		Eating without washing hands after working at establishment*	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Never	18	29.5	18	29.5	17	29.8	17	27.9	19	31.1	19	31.1	38	62.3
Occasionally	31	50.8	32	52.5	30	50.8	32	52.5	29	47.5	29	47.5	19	31.1
Often	8	13.1	9	14.8	7	11.5	6	9.8	9	14.8	8	13.1	4	6.6
Always	4	6.6	2	3.3	1	1.6	2	3.3	4	6.6	5	8.2	0	0.0

Total *n*; 61, *Start of other routine works after working at pesticide establishment without taking any protective measures

Most of the pesticides vendors had poor hygienic practices as during business hours it was common among them to use the premises for food consumption (70.6%), drinking of beverages (70.5%), eating PAAN/chewing gum (73.1%), changing clothes (69.9%), changing shoes after work (69.9%), eating without washing hands during breaks (69.9%) and starting other routine job after leaving pesticide establishment without taking any protective measures

Table III: Practices and use of protective measures by workers at the pesticide establishments

	Use of gloves		Use of mask		Washing hands after working		Changing cloths after working		Use of cap/ hat	
Habit	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Never	17	27.9	18	29.5	17	27.9	17	27.9	18	29.5
Sometimes	29	47.5	29	47.5	29	47.5	29	47.5	31	50.8
Often	4	6.6	3	4.9	4	6.6	5	8.2	8	13.1
Always	11	18.0	11	18.0	11	18.0	10	16.4	4	6.6

Total *n* = 61, % = 100

Table IV: General health variations in vendors due to exposure to pesticides

Health parameter	Gastro intestinal		Respiratory		Cardiac		Urinary Urgency		Nervous System		Skin		Eye	
Severity	*N*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Normal	2	44.3	2	37.7	3	62.3	2	39.	2	34.	2	36.	2	39.
	7		3		8		4	3	1	4	2	1	4	3
Mild	2	39.3	2	37.7	1	23.0	2	37.	2	47.	2	47.	2	39.
	4		3		4		3	7	9	5	9	5	4	3
Moderate	4	6.6	1	16.4	7	11.5	1	18.	8	13.	5	8.2	8	13.
			0				1	0		1			1	
Severe	6	9.8	5	8.2	2	3.3	3	4.9	3	4.9	5	8.2	5	8.2

Total *n* = 61, % = 100 Sequence of general health-related problems

In the pesticide vendors, prevalence of various health-related problems in descending order was; nervous system > skin > respiratory > urgency; eye > gastrointestinal > cardiac.

Table V: Self-reported health-related symptoms in pesticides retailers/vendors

Severity		Normal		Mild		Moderate		Severe	
Health-related symptoms		*N*	%	*n*	%	*n*	%	*N*	%
Sexual potency	Variations in sexual potency	46	75.4	5	8.2	8	13.2	2	3.3
	Decrease in sexual potency	40	65.6	5	8.2	11	18.0	5	8.2
Urinary urgency	Urinary urgency	18	29.5	26	42.6	11	18.0	6	9.8
Gastro-intestinal	Vomiting	24	40.0	20	32.2	11	18.0	6	9.8
	Abdominal pain	20	32.8	35	57.4	5	8.2	1	1.6
	Nausea	18	29.5	26	44.7	10	16.0	6	9.8
	Loose motions	17	27.9	28	45.9	10	16.4	6	9.8
Cardiac	Heart attack	56	91.8	3	4.9	2	3.3	0	0
	Blood pressure	21	34.4	35	57.4	4	6.6	1	1.6
Nervous system	Headache	20	32.8	35	57.4	5	8.2	1	1.6
	Drowsiness	18	29.5	23	37.7	14	23.0	6	9.8
	Muscle weakness	19	31.1	25	41.0	11	18.0	6	9.8
	Fits	23	37.7	34	55.7	3	4.9	1	1.6
	Muscle spasms	42	68.9	2	3.3	12	19.7	5	8.2
	Tachycardia	18	29.5	26	42.6	11	18.0	6	9.8
	Salivation	19	31.1	25	41.0	11	18.0	6	9.8
	Coma	55	90.2	5	8.2	0	0	1	1.6
	Numbness	17	27.9	26	42.6	11	18.0	6	9.8
	Staggering gait	17	27.9	26	42.6	12	19.7	6	9.8
	Sweating	16	26.2	27	44.3	12	19.7	6	9.8
	Muscle fibrillation	21	34.4	35	57.4	4	6.6	1	1.6
	Uncertainty	17	27.9	27	44.3	11	18.0	6	9.8
	Depression	18	29.5	26	42.6	11	18.0	6	9.8
Eye	Blinking of eyes	18	29.5	25	41.0	12	19.7	6	9.8
	Blurred vision	18	29.5	26	42.6	11	18.0	6	9.8
	Redness	21	34.4	35	57.4	4	6.6	1	1.6
	Watering of eyes	21	34.4	35	57.4	4	6.6	1	1.6
	Irritation of eyes	22	36.1	35	57.4	3	4.9	1	1.6
Respiratory	Burning nose	19	31.1	25	41.0	11	18.0	6	9.8
	Breathlessness	43	70.5	2	3.3	11	18.0	5	8.2
	Watering nose	22	36.1	35	57.4	4	6.6	0	0
	Sore throat	17	27.9	25	41.0	13	21.3	6	9.8
	Coughing	18	29.5	26	42.6	11	18.0	6	9.8
	Chest pain	43	70.5	1	1.6	12	19.7	5	8.2
Skin	Skin rashes	17	27.9	26	42.6	11	18.0	7	11.5
	Skin irritation	17	27.9	28	45.9	10	16.4	6	9.8

In the pesticide vendors health-related symptoms were observed in the following descending order: sweating (74.8%) > Skin irritation > skin rashes > sore throat > Uncertainty > staggering gait > numbness > loose motions > Coughing > nausea > blurred vision > blinking of eyes > depression > tachycardia > drowsiness > urinary urgency > burning nose > salivation > muscle weakness > abdominal pain, headaches > watering of eyes > redness of eyes > muscle fibrillation > blood pressure > irritation of eyes > Watering nose > fits > vomiting > decrease in sexual potency > muscle spasms > chest pain > breathlessness > variations in sexual potency > coma.

Table VI: Practices and variations in health-related symptoms in relation to the use of protective measures.

Health parameters	**Eye**	**Skin**	**Nervous System**	**Urgency**	**Cardiac**	**Gastro-intestinal**	**Respiratory**
P ≤ 0.05	*F* = 52.54, *P* =. 001	*F* = 12.33, *P* =. 001	*F* = 41.59, *P* =. 001	*F* = 10.78, *P* =. 001	*F* = 12.33, *P* =. 003	*F* = 23.08 *P* = .001	F=24.03, P=.001
Protective Measures	**M ean ± SD**	**Mean ± SD**	**Man e± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**M±SD**
Never	3.80 ± 0.45	3.00 ± 1.22	3.40 ± 0.89	2.40 ± 1.34	2.60 ± 1.14	3.40 ± 1.34	3.20 ± 1.30
Sometimes	2.88 ± 0.64	2.63 ± 1.19	2.75 ± 0.71	2.75 ± 1.16	2.00 ± 1.20	2.75 ± 1.16	3.13 ± 0.64
Often	1.85 ± 0.46	1.93 ± 0.55	1.89 ± 0.32	2.04 ± 0.52	1.44 ± 0.58	1.78 ± 0.42	1.93 ± 0.55
Continuous	1.14 ± 0.48	1.29 ± 0.46	1.19 ± 0.40	1.24 ± 0.54	1.29 ± 0.64	1.14 ± 0.36	1.24 ± 0.54
Total	1.90 ± 0.93	1.89 ± 0.88	1.89 ± 0.82	1.89 ± 0.88	1.56 ± 0.83	1.82 ± 0.94	1.95 ± 0.94

Total *n* = 61, never = 5, sometimes = 8, often = 27, continuous = 21
Participants who used protective measures had significantly less health-related symptoms score compared to the subjects who did not practice protective measures.

Table VII: Variations in health-related parameters in relation to practicing of hygienic conditions

Health parameter	Hygienic conditions	Mean ± SD	*F* value	*P* ≤ 0.05
Eye	Very poor	2.16 ± 0.97	4.31	.018
	Poor	1.50 ± 0.62		
	Good	1.40 ± 0.89		
	Total	1.90 ± 0.93		
Skin	Very poor	2.13 ± 0.88	4.84	.011
	Poor	1.56 ± 0.78		
	Good	1.20 ± 0.45		
	Total	1.89 ± 0.88		
Nervous System	Very poor	2.18 ± 0.80	9.59	.001
	Poor	1.50 ± 0.62		
	Good	1.0 ± 0.01		
	Total	1.89 ± 0.82		
Urinary urgency	Very poor	2.26 ± 0.86	13.71	.001
	Poor	1.33 ± 0.49		
	Good	1.0 ± 0.01		
	Total	1.89 ± 0.88		
Cardiac	Very poor	1.76 ± 0.88	3.63	.033
	Poor	1.28 ± 0.67		
	Good	1.0 ± 0.01		
	Total	1.56 ± 0.83		
Gastro-intestinal	Very poor	2.13 ± 1.02	7.07	.002
	Poor	1.39 ± 0.50		
	Good	1.0 ± 0.01		
	Total	1.82 ± 0.94		
Respiratory	Very poor	2.29 ± 0.96	9.02	.001
	Poor	1.50 ± 0.62		
	Good	1.0 ± 0.01		
	Total	1.95 ± 0.94		

n = 61; very poor = 38, poor = 18, good = 5

Health of pesticides retailers/vendors with unhygienic habits had significantly higher scores concerning health-related symptoms in comparison to the participants taking hygienic measures.

Table VIII: Variations in health-related symptoms in relation to smoking habit

Health parameters	Smoking habit	Mean ± SD	*F* value	*P* ≤ 0.05
Eye	Smoker	2.19 ± 0.92	16.53	0.001
	Non-smoker	1.26 ± 0.56		
	Total	1.90 ± 0.93		
Skin	Smoker	2.14 ± 0.90	14.17	0.001
	Non-smoker	1.32 ± 0.48		
	Total	1.89 ± 0.88		
Nervous system	Smoker	2.19 ± 0.77	26.82	0.001
	Non-smoker	1.21 ± 0.42		
	Total	1.89 ± 0.82		
Urinary Urgency	Smoker	2.12 ± 0.89	11.20	0.001
	Non-smoker	1.37 ± 0.60		
	Total	1.89 ± 0.88		
Cardiac	Smoker	1.67 ± 0.85	2.41	0.126
	Non-smoker	1.32 ± 0.75		
	Total	1.56 ± 0.83		
Gastro-intestinal	Smoker	2.10 ± 0.98	14.12	0.001
	Non-smoker	1.21 ± 0.42		
	Total	1.82 ± 0.94		
Respiratory	Smoker	2.24 ± 0.93	15.74	0.001
	Non-smoker	1.32 ± 0.58		
	Total	1.95 ± 0.94		

Total *n* = 61, Smokers = 42, Non-smokers = 19

Concerning health-related symptoms among vendors, smokers were more affected compared to nonsmokers.

Table IX: Variations in health-related symptoms in relation to the age of participants

Total *n* = 61, 10-20 = 9, 21-30 = 17, 31-40 = 19, 41-50 = 9, 51-60 = 6, 61-70 or higher = 1

Health parameters	**Eye**	**Skin**	**Nervous System**	**Urgency**	**Cardiac**	**Gastro-intestinal**	**Respiratory**
***P* ≤ 0.05**	**F = 0.57 *P* = 0.24**	***F* = 1.10 *P* = 0.371**	***F* = 2.29 *P* = 0.58**	***F* = 1.37 *P* = 0.252**	***F* = 1.37 *P* = 0.252**	***F* = 1.09, = 0.374**	***F* = 2.62, *P* = 0.034**
Age (Years)	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**
10-20	1.44 ± 0.73	1.33 ± 0.50	1.22 ± 0.44	1.33 ± 0.50	1.11 ± 0.33	1.22 ± 0.44	1.11 ± 0.33
21-30	2.06 ± 1.03	2.00 ± 1.00	2.29 ± 0.92	1.88 ± 0.99	1.65 ± 1.00	1.94 ± 1.03	2.06 ± 0.97
31-40	2.0 ± 0.88	2.00 ± 0.94	1.89 ± 0.66	2.00 ± 1.00	1.89 ± 0.88	2.00 ± 0.94	2.11 ± 0.94
41-50	1.89 ± 0.93	2.00 ± 0.50	1.78 ± 0.67	2.33 ± 0.50	1.44 ± 0.73	1.89 ± 0.93	2.44 ± 0.73
51-60	1.83 ± 1.17	2.00 ± 1.10	1.83 ± 1.17	1.67 ± 0.82	1.17 ± 0.41	1.83 ± 1.17	1.83 ± 1.17
61-70 or higher	2.00 ± 0.	1.00 ± 0	2.00 ± 0	2.00 ±0	1.00 ± 0	1.00 ± 0	1.00 ± 0
Total	1.90 ± 0.93	1.89 ± 0.88	1.89 ± 0.82	1.89 ± 0.88	1.56 ± 0.83	1.82 ± 0.94	1.95 ± 0.94

Among the different age groups; 41-50 (years) age group had significantly high values of respiratory problems scores due to the exposure to pesticides.

DISCUSSION

Due to the rather rapid population growth in Pakistan, the agricultural sector is also growing fast and as a result field use of chemical pesticides is escalating. These chemicals are used mostly in the form of a variety of mixtures and research investigators all over the world are involved in evaluating the ill-effects of pesticides on human health. Although Pakistan is an agrarian country, up to the present, no studies concerning risk assessments to pesticides handlers/vendors and farm workers in terms of exposure to pesticides have been conducted. In the present study, survey was made regarding pesticides retailers' qualifications, working experience, observed safety measures and hygienic practices, smoking habits and adverse health effects.

At the premises of most vendors, good hygienic conditions lacked because during business hours it is common to use the premises for food consumption, drinking of beverages, eating PAAN/chewing gum, changing clothes , changing shoes after work , eating without washing hands during breaks , and starting other routine works after leaving pesticide establishment without taking any protective measures (Table II). Most of the pesticide vendors were very careless about handling of pesticides and did not use gloves, mask, and cap/ hat during work, and wash hands and put on fresh clothes, etc. (Table III). An important connection was observed between washing of hands after pesticide use and health-related symptoms by Recena (2006).

Due to malpractices in terms of handling of pesticides, incidence of health-related problems in vendors were observed in the following descending order: sweating > skin irritation, skin rashes, sore throat, uncertainty, staggering gait, numbness, loose motions > coughing, nausea, blurred vision, blinking of eyes, depression, tachycardia, drowsiness, urinary urgency > burning nose, salivation, muscle weakness > abdominal pain, head aching > watering of eyes, redness of eyes, muscle fibrillation, blood pressure > irritation of eyes, watering nose > Fits > vomiting > decrease in sexual potency > muscle spasm > chest pain, breathlessness > variations in sexual potency > coma.

It has been reported that high prevalence of many health-related symptoms, e.g. difficulty in breathing, chest pain, dry throat, numbness, cramps, diarrhoea, anxiety, etc. were observed in pesticides exposed subjects (Sapbamrer & Nata, 2014; Sapbamrer & Hongsibsong, 2014). It has also been reported that pesticides usage may promote respiratory disorder like chronic bronchitis and some general symptoms like muscle weakness, muscle pain, fatigue, fever , chills, eye itchiness, blurred vision, dizziness, headache, etc. (Hoppin *et al*., 2007; Lu, 2005). It has been established that in pesticides-exposed individuals that health illnesses (salivation, itching (eyes/hands), respiratory symptoms, chest pain, dizziness, stomach ache/burn, cough, decreased vision/pain, itchy throat, dry skin, nervousness, and body tremors may occur (Ribeiro *et al*., 2012). Pesticides exposure caused chest symptoms (29.2%), itching/skin irritation (37.5%) and burning sensation in eyes/ face (62.5%) (Mourad Abu, 2005).

The staff members at most pesticides retail establishments were poorly trained; also, first aid kits and personal protective measures generally lacked at these outlets (FAO, 2010; Huang, 2001). These unhygienic practices may contribute to increased risks in pesticides-exposed subjects (retailers as well as end users/farmers); mostly the subjects were poorly trained in terms of handling of pesticides; thus, it could be expected that the retailers' staff may misguide the end users/farmers/sprayers which ultimately could lead to pesticide poisoning, therefore, proper training of pesticide retailers/vendors and revision of policy about retailers is vital. Serious enforcement procedures for handling of pesticides with the help of well-trained pesticide inspectors as well as budgeted financial support for inspection are required. For the implication of proposed suggestions government should develop a clear policy on health-related effects and safe usage of pesticides.

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