



Impacts of Pesticide Exposure on Paddy Farmers' Health

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Abstract

Effects of pesticide exposure on farmer's health are conducted mostly in developed countries, which is rare in least developed countries like Bangladesh. Here farmers had less guidance and instruction about the preventive measures to protect themselves and environment. This work was studied to assess the impacts of pesticide exposure on the paddy farmer's health in two different Upazilas of Manikganj, Bangladesh. The study was conducted as cross-sectional study with quantitative and qualitative components. Five hundred eighty two farmers (368 sprayers and 214 non-sprayers) were interviewed. Chi-squared tests and multinomial logistic regression analysis were performed for statistical analysis. Three hundred sixty eight farmers (64.3%) sprayed pesticides and were directly exposed to chemicals. Among them 64.22% and 9.06%, farmers used moderately and highly hazardous pesticides, respectively. 257 farmers (69.8%) were not taken any protective measures to handle pesticides. Excessive sweating, burning eyes and fatigue were reported by 26.3%, 24.4% and 18.8% of the farmers, respectively. These types of symptoms were significantly associated among male farmers. The study reveals that due to lack of awareness, occupational exposures of pesticides among farmers are common in Bangladesh and it also emphasize the importance of use of personal protective equipments.

Keywords: *Pesticide exposure, Health, Paddy farmer, Bangladesh*

Introduction

Consumption of pesticides has been increased in recent decades in Bangladesh to ensure food security. About 70% pesticides are used only on paddy fields (PAB, 2000) and most of the people of this country are directly or indirectly related to agriculture. Farmers rely on chemical pesticides including toxic chemicals in compare to traditional method and IPM (Parveen and Nakagoshi, 2001; Meisner, 2004). Thus, use of pesticides is increased over the years in this country (Meisner, 2004). Due to lack of training facilities to farmers about the environmental and safety concern, they spray excessive amount of harmful chemicals without taking any protective measures (Parveen and Nakagoshi, 2001). The consequences of the overuse of insecticides lead to ecological imbalance and environmental pollution. Farmers are exposed to pesticides by different routes of exposure such as inhalation, ingestion and dermal contact. Acute and chronic health effects are reported due to exposure of pesticides (Chitra et al., 2006).

Related studies about the pesticide poisoning among famers in Bangladesh are very limited. Few data about acute and chronic health impacts due to pesticide exposure are available to bring change in agriculture practices. A study of health effect of pesticide among farmers of vegetable farms by Dey (2010) was a positive attempt to fill the knowledge gap. Therefore, the present

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study was conducted to document the impact of indiscriminate use of pesticides on the farmer's health in Manikganj district of Bangladesh.

Methods

The study was conducted at Ghior and Manikganj Sadar upazila (Figure 1). Kaliganga River is passed through these upazilas. A cross-sectional study was conducted among 572 farmers of paddy fields of two upazilas of Manikganj district of Bangladesh. The present study was conducted from November 2009 to June 2010. Manikganj district is one of the major rice producing districts of this country.

Inclusion criteria was set because of directly handling pesticide (i.e. spraying, mixing, disposal of pesticide and weeding) and worked in same manners for at least six months. Farmers who had severe illness (requiring treatment in the last 30 days) were excluded from the present study. The farmers were informed about the purpose of the study and a verbal consent was taken before interview. The questionnaire was consisted of four pages with 38 items. All items were rephrased as statements in either a five point scale (completely true or false) and (always or never) or a dichotomous statement (yes-no).

The key dependent variable of the present study was illness related with pesticide exposure. Independent variables included in the initial analyses were socio-demographic factors, knowledge about pesticide, the commonly used pesticides, attitude related with handling harmful insecticides, sign and symptom of illness related with pesticide exposure and access to health education and health counseling.

Signs and symptoms about diseases were self-reported by famers. Specific instructions of medical officer of Manikganj Modernized Sadar Hospital were followed regarding to collection of data. Pesticide related information was collected from local pesticide retailers and farmers. All analyses were done using SPSS 16.0 (Statistical Package for the Social Sciences). Univariable analyses were based on Chi-squared tests for trend. The multivariable analyses were done using multinomial logistic regression analysis. The accepted level of significance 0.05 was considered for confidence interval.

Results

Demographic Profile of the study population is presented in Table 1. Primary exposure was based on spraying pesticide. Among the 582 interviewed farmers, 368 farmers sprayed pesticides directly. Rest of them performed replanting and watering of paddy fields. Ninety six point seven percent (96.7%) male farmers were pesticide sprayers (Table 1). The majority of the sprayer farmers were 19–28 years of age, with only 5.9% older than 50. The mean age of the subjects was 27.02 (\pm 3.08) years. 37.2% of farmers had less than 5 years of schooling. Most of the farmers (39.7%) had monthly income in between USD \$ 143- 285. Forty three point three per cent (43.3%) farmers worked as sprayers for more than 3 years and the mean duration of exposure was 4.52 \pm 0.32 years.



Figure 1. Site map of Manikganj District

Table 2 summarizes the use of agriculture chemicals by farmers of the study area. Two hundred twenty three (60.6%) farmers applied pesticides without counseling with agricultural officers. They collected information about the pest and regarding pesticides from employee of shop. One hundred thirty two (35.8%) farmers discussed with other famers before applying insecticide whereas, only 13 (3.6%) farmers relied on information of agricultural officers. Dioxathion (31.8%), Diazinon (22%), Cypermethrin (21.6%) and Chlorpyrifos (11.5%) were mostly used by farmers. 9% farmers applied highly hazardous pesticides (i.e. Carbofuran and Edifenfos) into their paddy fields. 2.9% farmers used Malathion, which is a slightly hazardous pesticide. A great majority of sprayers (257, 69.8%) and non-sprayers (179, 87.8%) did not use any personal protective equipment (PPE). 39 (10.6%) farmers were used gloves for handling pesticide. Rags were used as masks by 38 (10.3%) famers. Proper use of PPE was not addressed during the study period.

Table 1: Demographic Profile of the study population.

Characteristics	Sprayers		Non sprayers	
	Number	Percentage	Number	Percentage
Sex				
Male	356	96.7	167	76.9
Female	12	3.3	47	23.1
Age				
Less than 20	64	17.3	22	10.8
20-30	123	33.4	67	32.9
30-40	75	20.4	59	28.9
40-50	49	13.4	41	20
More than 50	57	15.5	15	7.4
Education				
Illiterate	39	10.6	27	13.2
Less than 5 years of schooling	137	37.2	89	43.7
6 to 10 years of schooling	124	33.7	79	38.7
More than 10 years of schooling	68	18.5	9	4.4
Monthly income				
Less than USD \$ 142	129	35	87	42.6
USD \$ 143- 285	146	39.7	61	29.9
Above USD \$ 286	93	25.3	56	27.5
Duration of performing same activity				
Less than 1 year	81	22	55	27
1-3 years	128	34.7	67	32.8
More than 3 years	159	43.3	82	40.2

Table 2: Types of Pesticides used by farmers of paddy field in Manikganj, Bangladesh.

Name	Hazard characteristics*	WHO categorized class	Chemical type	Farmers (n= 368)	
				Number	Percentage
Carbofuran	Highly hazardous	Class Ib	Carbamate	27	7.3
Edifenfos	Highly hazardous	Class Ib	organophosphate	6	1.7
Monocrotophos	Highly hazardous	Class Ib	organophosphate	3	0.8
Cypermethrin	Moderately hazardous	Class II	Pyrethroid	79	21.6
Cyhalothrin	Moderately hazardous	Class II	Pyrethroid	2	0.4
Diazinon	Moderately hazardous	Class II	organophosphate	81	22
Dioxathion	Not classified	-----	organophosphate	117	31.8
Chlorpyrifos	Moderately hazardous	Class II	organophosphate	42	11.5
Malathion	Slightly hazardous	Class III	organophosphate	11	2.9

*WHO classification of pesticides.

Table 3 summarizes the attitude of farmers regarding handling pesticides. One hundred seventy four (47.2%) farmers mixed water with pesticides using bare hands. Most of the sprayers (87.5%) had not washed their hand with soap after application of pesticides. 78 (21.1%) farmers smoked during the time of spraying pesticides.

Table 3: Attitude related with handling of pesticides among farmers of paddy fields.

Attitude	Sprayers		Non sprayers	
	Number	Percentage	Number	Percentage
Use of personal protective equipment (PPE)				
No use of PPE	257	69.8	179	87.8
Use only gloves	39	10.6	13	6.3
Use only masks	38	10.3	3	1.5
Use only boots	18	4.9	2	0.9
Use gloves and boots	2	0.6	5	2.6
Use gloves and masks	11	2.9	2	0.9
Use masks and boots	3	0.9	0	0
Use all PPEs	0	0	0	0
Washing hand with soap after handling pesticide				
Yes	46	12.5	23	11.3
No	322	87.5	181	88.7

Table 4 describes the reported signs and symptoms among farmers due to pesticide exposure. Sprayers experienced signs and symptoms of illness during or immediate use of pesticides. Prevalence of excessive sweating (35.1%), burning/stinging/itching eyes (34.3%), fatigue (21.7%) and skin redness/white patches on skin/ skin scaling (18.9%) were addressed among farmers.

Prevalence of signs and symptoms are summarized in Table 5. The exposure factor of spraying pesticides was significantly associated with fatigue, burning/stinging/itching eyes, excessive sweating, nausea/vomiting, skin redness/white patches on skin/ skin scaling, dizziness and burning nose with relative risk values above 1 (1.85, 1.61, 1.58, 1.46, 1.42, 1.31 and 1.11, respectively). Diabetes, hypertension, asthma and tuberculosis were addressed among the farmers. A great majority of farmers (81.9%) were free from these diseases. 10.8% (61) farmers had diabetes. 5.1%, 1.6% and 0.6% farmers were suffered by hypertension, asthma and tuberculosis, respectively.

Table 4: Signs and symptoms of illness related with the pesticide exposure among farmers.

Signs and Symptoms	Sprayers (n=368)		Non sprayers (n=204)		Total (n=572)	
	Number	Percentage	Number	Percentage	Number	Percentage
Excessive sweating	103	27.9	48	23.5	151	26.3
Burning/stinging/itching eyes	99	26.9	41	20.1	140	24.4
Fatigue	78	21.2	30	14.7	108	18.8
Dizziness	69	18.7	39	19.1	108	18.8
Nausea/vomiting	34	9.23	21	10.2	55	9.61
Skin redness/white patches on skin/skin scaling	98	26.63	39	19.1	137	23.9
Burning nose	53	14.4	28	13.7	81	14.1
Cough	41	11.2	29	14.2	70	12.3
Diarrhoea	46	12.7	30	14.7	76	13.3
Wheezing	19	5.1	9	4.4	28	4.9

Table 5: Prevalence of signs, symptoms, and relative risk among male farmers.

Signs and Symptoms of illness	Sprayers (n=356)	Non sprayers (n=167)	Relative Risk*	95% CI
Excessive sweating	98	29	1.58*	1.09-2.29
Burning/stinging/itching eyes	93	27	1.61*	1.09 - 2.37
Fatigue	71	18	1.85*	1.14 – 3
Dizziness	59	21	1.31	0.82 - 2.09
Nausea/vomiting	25	08	1.46	0.67 – 3.18
Skin redness/white patches on skin/ skin scaling	88	29	1.42	0.97-2.07
Burning nose	45	19	1.11	0.67-1.83
Cough	34	21	0.75	0.45 - 1.26
Diarrhoea	38	21	0.84	0.51 - 1.39
Wheezing	12	6	0.93	0.35 - 2.45

*p <0.05, significant

Discussion

The present study documented use of highly and moderately hazardous pesticides in paddy farming. Improper knowledge about the harmful chemicals influences to use these pesticides to prevent crop loss. A majority of farmers used pesticides, which either not registered for use in Bangladesh or restricted by WHO in underdeveloped countries (WHO, 2004; Jors et al., 2006; Shetty et al., 2011). Awareness about the occupational exposure among farmers was not adequate. They did not read or follow the safety manual and they had no training on proper management of pesticide use (Dey, 2010). A great majority of farmers did not maintain personal hygiene (i.e. washing hands with soap after application of pesticides etc.) and smoked while spraying in the field. Similar behavioural pattern is reported in India (Devi, 2002). Besides that, monthly incomes of the famers were not adequate to buy personal protective equipments (PPEs). Great majority farmers (69.8%) had not used any PPEs (WHO, 2004; Dey, 2010). Rags were used as mask to protect themselves, which increased the person's personal absorption rate of pesticides (Chitra *et al.*, 2006).

Farmers were not familiar with the fate of pesticides (Khatoon et al., 2004). A great majority of famers (412, 72.07%) had worked in same fields immediately after the application of pesticides. This behaviour had caused direct exposure through inhalation and dermal contact (Antonella et al., 2001). Direct exposure of pesticide of female is able to cause reproductive health problems (Sifakis, 2001). The present study is an attempt to identify health problems of male farmers rather than female farmers.

Farmers in the age of 20-40 years old were highly exposed to pesticide (Dey, 2010). Most of farmers (43.3%) sprayed pesticide for more than three years; this is able to cause chronic health effect (Angeles et al., 1993; Chitra et al., 2006). Chronic diseases i.e. diabetes, hypertension and tuberculosis were not identified among great majority of the farmers (81.9%). Pesticide exposure correlated with higher rates of asthma was prevalent among 1.6% farmers. Data about chronic diseases were self-reported by famers as a result, prevalence of these diseases is not able to be calculated without clinical test. Farmers experienced acute pesticide poisoning with various signs

and symptoms. Prevalence of these signs and symptoms was higher in male sprayers in comparison with non-sprayers. Similar findings were also reported in previous study in India (Manachini et al., 2005; Chitra et al., 2006; Dey, 2010; Shetty et al., 2011) in Indonesia (Kishi et al., 1995) and in Bangladesh (Rahman and Alam, 1997; Hossain et al., 2004).

Conclusions

Occupational pesticide exposure is common among the farmers of the paddy fields. The present study showed that hazardous chemicals were applied in Bangladesh without taken any protective measures by farmers. Due to inadequate knowledge about the pesticide handling, farmers were experienced acute pesticide poisoning. Use of personal protective equipments and integrated pest management are possible solutions to mitigate the present situation.

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