Original Article

Pesticide use pattern among farmers in a rural district of West Bengal, India

Indranil Banerjee, S. K. Tripathi, A. Sinha Roy[1], Parama Sengupta[2]

Department of Clinical and Experimental Pharmacology, Calcutta School of Tropical Medicine, [1]Department of Medicine, R.G. Kar Medical College, [2]Department of Pharmacology, N.R.S. Medical College, Kolkata, West Bengal, India

Address for correspondence:
Dr. Indranil Banerjee, 10P, D.P.P. Road, Kolkata - 700 047, West Bengal, India.
E-mail: dronineo@yahoo.co.in

Abstract

Background: A vast majority of Indian population are engaged in agriculture. While pesticides help in increasing crop production, inappropriate pesticide storage practice and inadequate protective measures frequently causes accidental poisoning among farmers. **Objective:** The present study was conducted to explore the pattern of pesticide use among farmers in a district of India with an attempt to identify the lacunae in their knowledge and awareness level on risks and hazards of pesticides use. **Materials and Methods:** A cross-sectional questionnaire based study was conducted in the district of Burdwan, West Bengal, to address the study objective. Data analysis was performed by using descriptive statistical methods: Frequency, percentage, mean, standard deviation. **Results:** In the present study alpha-cypermethrin (46%) was the most commonly used pesticide followed by methyl parathion (25.6%), imidacloprid (16.4%), dichlorvos (7.8%) and phorate (4.2%). The farmers used to store pesticides mostly in cowshed (48.4%) followed by storeroom (29.6%). During spraying of pesticides, farmers experienced headache (29.8%) followed by nausea (26%), burning sensation in eyes (9.8%), cough (9.2%), muscle cramps (2%). Regarding the personal protective measures taken by the farmers for spraying, covering nose, mouth with cloth combined with bath after spraying was the most common practice (27%). When asked about suggested actions to be taken if anybody becomes sick following exposure to pesticides, 86% of farmers prefer consulting a doctor. **Conclusion:** The study suggested that farmers of Burdwan were exposed to highly hazardous, restricted and banned pesticides, with insufficient protection. In this situation, educational and training interventions on pesticide handling and safety precautions are urgently needed.

Key words: Awareness level, farmer, pesticide, study

INTRODUCTION

Pesticides are chemical compounds that are used to kill pests, including insects, rodents, fungi and unwanted plants, which are widely used in agriculture.[1] A vast majority of the population in India (56.7%) is engaged in agriculture and is therefore exposed to pesticides.[2] While pesticides help in increasing crop production, their indiscriminant use adversely effects environment and human health making it an important concern in public health. According to International Labor Organization, as much as 14% of all occupational injuries are due to exposure to pesticides and other agrochemical constituents and 10% of these are fatal.[2] The World Health Organization (WHO) and the United Nations Environmental Program estimated that one to five million cases of pesticide poisoning occur among agricultural workers each year with about 20000 fatalities.[3,4] The primary reasons for accidental poisoning among agricultural workers include inappropriate use, inadequate knowledge and awareness about pesticide storage, protective measures. A literature search revealed that there is a dearth of studies in India relating to pesticide use pattern and knowledge and awareness level of farmers on risks and hazards of pesticides use. Our study was conducted against this backdrop to explore the pattern of pesticide use among farmers in a district of India with an attempt to identify the lacunae in their knowledge and awareness level on risks and hazards of pesticides use.

Access this article online	
Quick Response Code:	Website: www.jnsbm.org
	DOI: 10.4103/0976-9668.136173

MATERIALS AND METHODS

A prospective cross-sectional study was conducted in the district of Burdwan, West Bengal, India to address the study objective for a period of 18 months commencing from January 2008. Bardhaman Thana Co-operative Agricultural Marketing Society Ltd. was the main government-run pesticide procuring unit of the district of Burdwan, West Bengal. The source population included farmers of the district of Burdwan, who used to buy pesticides from that store. The number of farmers to be included in the study (participants) was determined using single population proportion formula.

$$n = \frac{(Z\alpha / 2)^2 \, p(1 - p)}{d^2}$$

Where,

$(Za/2)$ = Reliability coefficient = 1.96,

n = Sample size,

P = 50% assuming that 50% of the farmers had a low level of perceptions and beliefs on risks and hazards of pesticides use.

d = assumed marginal error (5%),

$$n = \frac{(1.96)^2 (0.50)(0.50)}{(0.05)^2} = 384$$

20% non-response rate was added to the final sample size.

Accordingly, $n = 384 + 20/100\ (384) = 384 + 76.8 = 460.8$.

For better precision, we took an additional forty of them. Thus, a total of 500 farmers procuring pesticide from Bardhaman Thana Co-operative Agricultural Marketing Society Ltd during the study period were included in the study.

During the study period, the study team made daily visits in the Bardhaman Thana Co-operative Agricultural Marketing Society Ltd. The farmers who visited there for buying pesticides were approached by the study team. They were explained about objectives of the study following which written consent was obtained from them. The farmers who consented into the study were asked to fill up a pre-designed questionnaire written in vernacular language. The questionnaire included questions related to: Basic demographic information (age, sex, education), names of pesticides commonly used by them in the spraying season, place in the household where they store the pesticide, personal protective measures taken by the farmers while spraying, symptoms experienced by the farmers during/after spraying and suggested actions taken by the farmers if somebody becomes sick following exposure to pesticides. The filled up questionnaires were checked for completeness and analyzed.

Statistical analysis

The returned questionnaires were checked for completeness of data and then analyzed in computer by using Statistical Package for Social Sciences (SPSS) program version 10 (SPSS Inc, Chicago IL, USA) Data were analyzed by a statistician who was not involved in the study. Data analysis was performed byusing descriptive statistical methods: Frequency, percentage, mean, standard deviation (SD).

RESULTS

In the present study, it was found that age of 70% of farmers interviewed lie between 21 years and 40 years (mean ± SD: 36.04 ± 10.76) with absolute male dominance (99%). The educational status of them was poor with only 34% illiterates. Details of demographic characteristics of study participants are provided in Table 1. Alpha-cypermethrin (46%) was the most commonly used pesticide followed by methyl parathion (25.6%), imidacloprid (16.4%), dichlorvos (7.8%) and phorate (4.2%). Regarding the storage of pesticides, cowshed was most common place of storage (48.4%) followed by storeroom (29.6%). The farmers also stored the pesticides in places such as kitchen (3.2%), bathroom (10.8%) where their families were unknowingly exposed to their toxic effects. During spraying of pesticides, headache (29.8%) was the most common symptom experienced by farmers followed by nausea (26%); burning sensation in eyes (9.8%), cough (9.2%) and muscle cramps (2%). Regarding the personal protective measures taken by the farmers for spraying, covering nose, mouth with cloth combined with bath after spraying was the most common (27%). When asked about suggested actions to be taken if anybody became sick following exposure to pesticides, 86% of farmers prefer consulting a doctor. Details of pesticide use by the study participants are provided in Table 2.

Table 1: Demographic profile of the farmers who participated in the study

Parameter	No. of farmers	Percentage
Age (in years)		
Mean±SD	36.04±9.12	
Sex		
Male	495	99
Female	5	1
Educational status		
Illiterate	170	34
Up to primary	160	32
Up to secondary	134	26.8
Higher secondary	36	7.2

SD: Standard deviation

DISCUSSION

WHO periodically publishes list of hazardous chemicals, which sets out a classification system to distinguish between the more and the less hazardous forms of selected pesticides based on acute risk to human health (that is the risk of single or multiple exposures over a relatively short period of time). It takes into consideration the toxicity of the technical active substance and also describes methods for the classification of formulations.[5] The recent version of this classification (2009) has classified pesticides as - Ia: Extremely hazardous, Ib: Highly hazardous, II: Moderately hazardous, III: Slightly hazardous and U: Unlikely to present acute hazard.[6]

The present study revealed that alpha - cypermethrin (II) was the most commonly used pesticide followed by methyl parathion (Ia), imidacloprid (II). dichlorvos (Ib), phorate (Ia). A similar study performed in La Paz county in Bolivia[7] showed methamidophos (II) to be the most common one followed by cypermethrin (II), parathion (Ia), lambda cyhalothrin (II) while in another one carried out on farmers at Gaza strip methamidophos was the most commonly used one followed by chlorpyriphos.[8] Though there is a slight difference in the list of pesticides used by farmers in different countries, which might be attributable to the differences in pest pressure, types of crops cultivated-they have one thing in common: Majority of the farmers use potentially toxic pesticides being unaware of their toxic nature.

Table 2: Pesticide use pattern among farmers

Responses to the questionnaire	Number of respondents	Percentage
Pesticides used by the farmers in the last spraying season		
α-Cypermethrin	230	46
Methyl parathion	128	25.6
Imidacloprid	82	16.4
Dichlorvos	39	7.8
Phorate	21	4.2
Storage practices of pesticides by farmers		
Storeroom	148	29.6
Cowshed	242	48.4
Bathroom	54	10.8
Macha	40	8
Kitchen	16	3.2
Personal protective measures taken by farmers		
Cover nose, mouth+wash	135	27
No protection	106	21.2
Cover nose, mouth	103	20.6
Wash after spraying	92	18.4
Cover nose, mouth+wash+hat	64	12.8
Symptoms experienced by the farmers during or immediately after spraying		
Headache	149	29.8
Nausea	130	26
Burning sensation in eyes	49	9.8
No symptoms	96	19.2
Cough	46	9.2
Muscle cramp	10	2
Burning sensation in nose	20	4
Suggested actions taken if anybody becomes sick following exposure to pesticides		
Take patient to health center	226	45.2
Consult local doctor	204	40.8
Consult Panchayat pradhan (local political chief)	60	12
Take patient to Ojha (local quacks)	10	2

The study also revealed that the farmers stored pesticides in places such as storeroom (29.6%) kitchen (3.2%), bathrooms (10.8%) where it was easily accessible to family members including children or in cowsheds (48.4%) where it posed a threat to cattle health and well-being. In a study carried out in Western Uttar Pradesh,[9] 21% of the farmers were found to store pesticides in unsafe places.

The fact that farmers were oblivious of the toxic nature of the compounds was quite evident as 21.2% of them did not use any protective measures while spraying and an additional 18% just washed their clothes after spraying. Similar results are observed in the study carried out in Uttar Pradesh where 75% of farmers regard hand washing after spraying as their personal protection.[9] The lack of knowledge regarding taking suitable personal protection while spraying could be due to the low level of education among farmers leaving many as functional illiterates. The inappropriate personal protective measures taken by the farmers lead to frequent development of signs and symptoms of intoxications in the spraying seasons. In the present study, almost 85% of farmers reported some signs or symptoms of intoxications with headache being the most common one followed by nausea, red eyes, cough and muscle cramp. In a study carried out in Bolivia 70% of the farmers using pesticides reported having experienced symptoms of intoxication in connection with one or more spraying sessions during the previous year.[7] The most frequent symptoms mentioned were headache, dizziness, tiredness, blurred vision and vomiting. The study carried out on farmers in Gaza strip revealed burning sensation in the eyes as the most common one.[8]

Regarding suggestive course of action to be taken if somebody becomes sick after exposure to pesticide, 84% of farmers could appreciate the importance of taking the person to nearby medical facility. However, 12% of farmers would like to consult panchayat pradhan, the local political representative while 4% would take the exposed person to ojhas, the local quacks. Thus, our study indicated that farmers of Burdwan and their family members were both directly and

indirectly exposed to highly hazardous, restricted and banned pesticides, with insufficient protection. With a view to educate farmers regarding use of pesticides in the last two decades government of India, Non-Governmental Organizations and international agencies have been working together to organize training, which helps farmers to learn about the ecology of their fields thus enabling them to make and implement decisions which are safe, productive and sustainable. This ecological approach to plant protection is called integrated pest management (IPM). It not only involves minimizing the use of pesticides but also involves a wide range of other practices aimed at growing a healthy crop and encourages the use of biopesticides. The training approach, which has been used to help rural people learn about IPM is called the farmers field school.[10] Such educational and training interventions on pesticide handling and safety precautions are urgently needed in the district of Burdwan to change the existing situation.

The present study was limited by the fact that it was conducted in the main government approved pesticide procuring center of the district while better precision would have been obtained if the study could consider all the shops in the district.

CONCLUSIONS

The present piece of work suggests that farmers of Burdwan and their family members were exposed to highly hazardous, restricted and banned pesticides, with insufficient protection. In this situation, educational and training interventions on pesticide handling and safety precautions are urgently needed in order to change the existing situation. Governmental interventions and efforts, such as restrictions on hazardous pesticides, monitoring of labels and enforcement of good agricultural practices are needed to decrease pesticide exposure of farmers and the general population.

REFERENCES

1. Available from: http://www.who.int/topics/pesticides/en/. [Accessed on 2009 Sep 21].
2. ILO. Wage workers in agriculture: Conditions of employment and work; sectoral activities programme. Report for discussion at the tripartite meeting on improving conditions of employment and work of agricultural wage workers in the context of economic restructuring. Geneva: International Labor Organization; 1996.
3. WHO. Public Health Impact of Pesticides Used in Agriculture. Geneva: World Health Organization; 1990.
4. Economic and Social Council. Economic Social and Cultural Rights; Commission on Human Rights. 58th Session. New York: United Nations; 2002. [Item 10 of the provisional agenda].
5. Available from: http://www.who.int/ipcs/publications/pesticides_hazard/en/index.html. [Accessed on 2010 Aug 20].
6. Available from: http://www.who.int/ipcs/publications/pesticides_hazard_2009.pdf. [Accessed on 2010 Aug 20].
7. Jørs E, Morant RC, Aguilar GC, Huici O, Lander F, Baelum J, *et al*. Occupational pesticide intoxications among farmers in Bolivia: A cross-sectional study. Environ Health 2006;5:10.
8. Yassin MM, Abu Mourad TA, Safi JM. Knowledge, attitude, practice, and toxicity symptoms associated with pesticide use among farm workers in the Gaza Strip. Occup Environ Med 2002;59:387-93.
9. Mahantesh N, Singh A. A study on farmers' knowledge, perception and intensity of pesticide use in vegetable cultivation in Western Uttar Pradesh. Pusa Agric Sci 2009;32:63-9.
10. FAO (Food and Agriculture Organization of the United Nations). Farmer field schools on integrated pest management for cotton in Indi, Rome, 2008. Available from: http://www.fao.org/docs/eims/upload/269236/CB_CaseStudy02_India.pdf. [Accessed on 2010 May 24].

How to cite this article: Banerjee I, Tripathi SK, Roy AS, Sengupta P. Pesticide use pattern among farmers in a rural district of West Bengal, India. J Nat Sc Biol Med 2014;5:313-6.

Source of Support: Nil. **Conflict of Interest:** None declared.