

Agricultural pesticide use and misuse: A study to assess the cognizance and practices among North Indian farmers

Beena Sachan, Sunil Dutt Kandpal, Arvind K. Singh, Amit Kaushik, Sugandha Jauhari, Arshi Ansari

Department of Community Medicine, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, Uttar Pradesh, India

ABSTRACT

Introduction: Farmers' cognizance regarding pesticide use and overuse is limited and their practices for handling of pesticides is unsatisfactory. However, their perception concerning risks and safety of pesticides play a very important role in safe spraying and indirectly protect them from adverse health hazards. **Objective:** To assess the cognizance about use and risks of overuse of pesticides and evaluate practices for the storage, preparation, and disposal of pesticides. **Material and Methods:** A cross-sectional study was conducted among 387 farmers of Lucknow who fulfilled the inclusion criteria. A multistage random sampling was done to interview the farmers. A pretested structured questionnaire was to collect the information regarding the cognizance about use and risks of overuse of pesticides and evaluate practices for the storage, preparation, and disposal of pesticides. **Results:** More than half (55%) of the farmers did not read and follow the pesticide label. Maximum (80.2%) were unaware that pesticides are banned or restricted for use. Thirty-seven percent did not know that some pesticides may cause lethal intoxications. Majority of the farmers (42.6%) stored the pesticides anywhere in the house. More than two-thirds of the farmers (69.7%) mixed only needed pesticides followed by a low percentage of them applying on other crops (15.8%) and dispose in the field (11.7%). **Conclusion:** The study concludes that cognizance and practices of the farmers for pesticide use and risks associated with it was not satisfactory and exposes them to adverse health outcomes.

Keywords: Cognizance, farmers, pesticide, practices

Introduction

Nowadays pesticides are perceived essential for agriculture and are used extensively throughout the world. According to Food and Agriculture Organization (FAO), pesticides are any substance or mixture of substances of chemical or biological ingredients intended for repelling, destroying, or controlling any pest, or for regulating plant growth.^[1]

These substances have been heavily promoted by the industry as a mean to increase agricultural productivity, but at the same time have created environmental health problems. According to World Health Organization (WHO) and United Nations Environment Program, approximately 20,000 workers are dying from exposure every year, especially in developing countries.^[2]

Farmers' cognizance of pesticide use and overuse and also practices for pesticide handling, play a very important role in safe spraying. Sai *et al.*^[3] (2019) had observed in their study among farmers of south India that about 61% of the farmers knew the harmful effects of pesticides. However, 22% of them were mixing the pesticides using their bare hands and 26% were not wearing any protective clothing during spraying pesticides. Around 67%

Address for correspondence: Dr. Sugandha Jauhari, Senior Resident, Department of Community Medicine, Dr. Ram Manohar Lohia Institute of Medical Sciences, Vibhuti Khand, Lucknow - 226 010, Uttar Pradesh, India. E-mail: beenasachankgm@gmail.com

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were carelessly disposing the leftover pesticides in the open fields. Skin problems and neurological system disturbances were the most common pesticide-related health symptoms. Similarly, researchers of other low- and middle-income countries have also reported inadequate knowledge and practices for pesticides among the farmers.^[4-6]

Pesticide-related hazards can be minimized by education. However, in Lucknow, studies regarding pesticides use among farmers are very limited and such data need to be analyzed so that proper planning may be done for imparting education about the ill effects of pesticide overuse among the primary users, that is, farmers. Hence, there was a need to study awareness about pesticide use and associated risks of improper storage, usage, or disposal among farmers of Lucknow.

Objectives

1. To assess the cognizance about use and risks of overuse of pesticides.
2. To evaluate practices for the storage, preparation, and disposal of pesticides.

Materials and Methods

Study design and setting

The present cross-sectional descriptive study was carried out among farmers in rural areas of Lucknow district. An optimum sample size of 387 farmers aged 18 years and above was interviewed. The study was conducted between July 2020 and January 2021.

Study duration

Six months.

Study participants

Farmers in rural areas of Lucknow aged 18 years and above.

Sampling

Sample size

It was calculated using the formula, $n = (Z_{\alpha})^2 \times p \times (1 - p) / d^2$ where Z statistic: for the level of confidence of 95%, which is conventional, Z value is 1.96. P = expected prevalence, d = precision. Taking awareness of pesticides hazards among farmers as 41.0% (p),^[7] and d = 5%, the sample size yielded was 387.

Sampling technique

Multistage random sampling technique was used to select the requisite number of eligible farmers.

First stage: Rural Lucknow was divided into eight blocks of which two blocks were randomly selected.

Second stage: In the next step from each block, six villages were selected by simple random sampling.

Third stage: simple random sampling (using the last digit of currency) was used to select farmers till the desired number of persons were met from each of the 12 villages.

Inclusion criteria

1. Occupation is only farming.
2. Owns his own agricultural land and been in farming for a minimum of 5 years.
3. Has been using pesticides for minimum 5 years

Exclusion criteria

1. Involved exclusively in organic farming.
2. Noncooperative attitude or not willing to participate in the study.

Data collection

Baseline sociodemographic data were collected from the farmers. A structured interview schedule was developed and pretested on farmers other than the ones selected for the study. The pretested schedule was modified after pretesting and finalized. A predesigned and pretested structured schedule was used to collect the relevant information regarding pesticide use and misuse. Sociodemographic details like name, age, gender, current locality of residence, and educational qualifications were elicited.

Statistical analysis

Data were entered in Microsoft Office Excel and analyzed with Statistical Package for the Social Sciences (SPSS) version 23.0. Frequency tables and percentages were used to report the study results.

Ethical standards

The study protocol was submitted to the Institutional Ethical Committee (IEC No. 32/20) and clearance was obtained. Informed written consent of farmers was taken before the study.

Results

One-third (34.4%) farmers belonged to 30–39 years age group. Majority (72.8%) of them were males. Maximum (84.7%) farmers were Hindu by religion and half (50.5%) of them belonged to other backward class (OBC) category. A total of 43.5% and 40.8% of farmers had primary and intermediate school education, respectively. Furthermore, 74.5% were owner of the farming land and 65.2% had more than 5 years of exposure to pesticide [Table 1].

Majority of the farmers (32.6%) obtained information about pesticide use from the pesticide retailers while the other source of information's was communication between farmers (28.7%), media (21.4%), and government extension services (17.3%) [Table 2 and Figure 1]

A total of 55% of the farmers did not read and follow the pesticide label and had no information about organic farming. Only 56%

understood the toxicity label. Three-fourths of the farmers did not know that pesticides affect surface water (74.3%) and soil fertility (77.6%). In addition, 61.0% had not heard about alternative to synthetic pesticides. Two-thirds (65%) of them were not aware that pesticides should be handled using personal protective equipment (PPE). Maximum (80.2%) were unaware about banned or restricted for use pesticides. In addition, 37% did not know that some pesticides may cause lethal intoxications [Table 3].

Majority of the farmer (42.6%) stored the pesticides anywhere in the house. More than two-thirds of the farmers (69.7%)

Category	Variables	No.	%
Age	<30	71	18.2
	30-39	133	34.4
	40-49	116	30.0
	≥50	67	17.4
Sex	Male	282	72.8
	Female	105	27.2
Religion	Hindu	328	84.7
	Muslim	51	13.1
	Others	08	2.2
Caste	General	100	25.8
	OBC	195	50.5
	SC/ST	92	23.7
Education	Illiterate	49	12.8
	Primary-junior high school	169	43.6
	High School- Intermediate	158	40.8
	Graduate/Postgraduate	11	2.8
Occupation	Farmer (owner)	288	74.6
	Farmer (employee)	99	25.4
Years of pesticide exposure	<5 years	135	34.8
	≥5 years	252	65.2

Sources	No.	%
Communication between other farmers	111	28.7
Government extension services	67	17.3
Pesticide retailers	126	32.6
Media	83	21.4

Variables	Yes		No	
	No.	%	No.	%
Read and follow pesticide label	174	45.0	213	55.0
Understand toxicity label	217	56.0	170	44.0
Have you ever heard about alternative to synthetic pesticides	151	39.0	236	61.0
Do you have information about organic farming?	189	48.8	198	51.2
Pesticides affect surface water	99	25.7	288	74.3
Pesticides affect soil fertility	87	22.4	300	77.6
Pesticides may cause lethal toxicity	243	63.0	144	37.0
Pesticides should be handled using PPE	135	35.0	252	65.0
Know about banned or restricted for use pesticides	77	19.8	310	80.2

mixed only needed pesticides followed by a low percentage of them applying on other crops (15.8%) and dispose in the field (11.7%) [Table 4].

Discussion

In developing countries pesticides exposure for farmers is high. Due to which, they suffer from ill-health, both short and long term.^[8] As per World Health Organization, 20% of the pesticides manufactured in the world were being used in developing countries.^[2] Unsafe use and misuse of pesticides has been observed in earlier studies.^[9,10] The major reason being the lack of awareness regarding the hazardous nature of these pesticides. These practices can have deleterious consequences on human health.^[4]

Sociodemographic profile of the farmers

Majority of the farmers in our study were males and between the age group of 30 and 39 years and this agreed with other studies.^[3,5,6,11] Maximum farmers in our study had education level up to primary school only and this was in consensus with the study by Kumar *et al.* and Mohanty *et al.*^[4,12] Similarly, Paltasingh *et al.*^[13] has reported that education plays a pivotal role in enhancing the farming expertise and productive competencies. Education also enables them to follow the instructions about adequate and recommended doses of pesticides. However, most of the researchers have observed in their studies among farmers from developing countries that they have poor educational qualifications. Poor education results in lack of awareness and unhealthy practices.^[4,5,11,14-16]

Pesticide use and misuse: Cognizance of the farmers

Our study has observed that the knowledge among the farmers regarding hazards of pesticides was unsatisfactory and similar findings has been reported in other studies also.^[4,7,14-16] Mahantesh *et al.*^[7] in his study among farmers of western Uttar Pradesh found that 59% were unaware about the hazards of pesticides. More than half of the farmers did not read and follow the pesticide label, and this agreed with the study by Kumar *et al.* and Ali

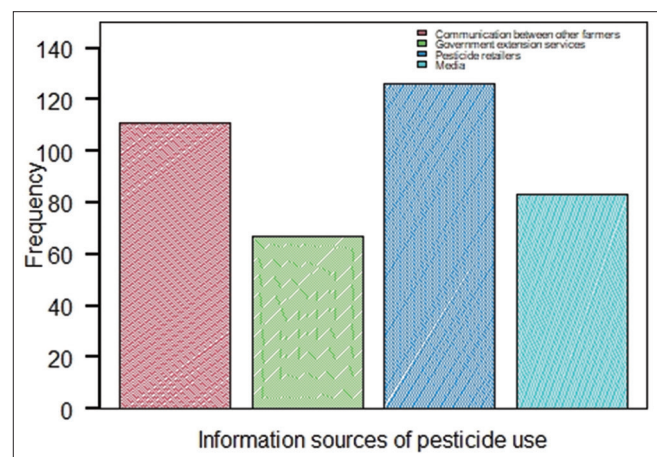


Figure 1: Source of Information for Pesticide Use

Table 4: Storage, preparation, and disposal of pesticides practices

Variable	Response	No	%
Sites for pesticides storage	Anywhere in house	165	42.6
	Locked storage room	132	34.2
	Animal house	20	5.2
	Farm site	70	18.0
Disposal of unused leftover (mixed, diluted) pesticides	Dispose in the field	45	11.7
	Mix only needed pesticides	270	69.7
	Use on other crops	61	15.8
Empty pesticide containers	Dispose in sewer	11	2.8
	Discard on farm	48	12.4
	Place in trash or dumpster	72	18.7
	Reuse for other purposes	267	68.9

et al.^[12,17] Moreover, Abbassy reported in his study among farmers from a developing country (Egypt) that only 2.3% partially read the instructions written on the pesticide containers. This behavior is due to illiteracy and poor educational status among farmers due to which they are ignorant or not interested to read it.^[16] Majority of the farmers (32.6%) had obtained information about pesticide use from the pesticide retailers and same was seen in study by Sai *et al.*^[3] who concluded that applying the information regarding pesticide use and safety through advertisements in real scenarios is difficult. Maximum (80%) farmers in our study were not aware that pesticides are banned or restricted for use. The ministry of agriculture and farmers welfare in India have banned many pesticides in India but still there is lack of efforts in implementation of such regulations at the grass root level, which indirectly puts the farmers at risk of various health hazards.^[18]

In our study, two-thirds of the farmers had no knowledge about wearing PPE's while handling pesticides. This finding was similar with study by other researchers from India and developing countries.^[7,15-16,19] Mohanty *et al.*^[4] observed in his study among farmers of south India that nonuse of PPE's during spraying varied between 40% and 78%. There was a significant association between use of protective equipment's and knowledge among farmers. This result was in consensus with Rostami *et al.*^[5] where more than half of the farmers had the affirmation use of PPE during the pesticides application was not difficult but in practice, only 50% farmers used PPE. Even percentage of farmers using protective spectacles during spraying was low, although on the contrary they were having high level of irritation in eyes. It should be noted that for people working with hazardous and dangerous substances, it is mandatory to use PPE's. Adequate protection can increase not only the safety of the workers but also work productivity.^[20]

Practices of the farmers regarding pesticide use and misuse

A common practise was observed among the farmers in our study that majority of them (42.6%) stored pesticides anywhere in the house indicating hazardous behavior. Our results were contrary to that by Sai *et al.*^[3] who reported better storage

practices among south Indian farmers. They observed that 51.47% farmers used separate room for storage, 36.25% stored outside the houses while 12.28% stored inside the houses. This can be subjected to the fact that literacy rate is high in south India as compared with north. Even Mubushar *et al.*^[15] in their study said that a majority of the respondents (59.5%) always stored pesticides at home in a separate place. As far as disposal of pesticides were concerned, maximum farmer had good practices as they mixed only the needed pesticides or applied the unused ones on other crops. Various studies have showed poor disposal practices among farmers.^[7,14-17,19-20,21] Mohanty *et al.*^[4] observed that 81% of the farmers had poor knowledge for disposal of pesticides and threw it indiscriminately. Kumar *et al.*^[12] found that only one-third farmers used the unused pesticides on the same day on other crops. However adequate knowledge and practice is required for both storage and disposal of pesticides to protect the farmer from exposure to hazardous substance.

Strengths and limitations

In a systematic review on pesticide usage among farmers, it has been observed that there is neglected evidence on awareness and practices of farmers for pesticides and associated health risks.^[22] Hence, the strength of the study is that it unravels the cognizance and practices of north Indian farmers when there is paucity of evidence from this region. This will be helpful in planning of ways by which awareness can be generated among them regarding pesticide toxicity and training can be given for using these pesticides. The study has few limitations. First, conducting study by interviewing the farmers does not reflect their proper practices for pesticide use and a qualitative design would be beneficial in understanding the magnitude of problem. Second, no causal relationship can be established from our study regarding the harmful health effects of pesticides among the farmers.

Conclusion

More than half (55%) of the farmers did not read and follow the pesticide label. Maximum (80.2%) were unaware that pesticides are banned or restricted for use. Majority of the farmers (42.6%) stored the pesticides anywhere in the house. Overall, the study concludes that cognizance and practices of the farmers for pesticide use, and risks associated with it was not satisfactory and exposes them to adverse health outcomes.

Key take-home message

The first human contact of pesticides is at farmer level, who are exposed to highest concentrations of these chemicals. It is important that the farmers are aware of correct use and toxic effects of these chemicals to avoid harm to themselves, their consumers, and environment. The current study shows that the current mode of IEC through printed labels, etc., are not effective for farmers in India. They need to be educated through alternative methods so that misuse of pesticides is reduced.

Declaration of patient consent

The authors certify that they have obtained all appropriate farmer consent forms. In the form, the farmers have given their consent for giving their sociodemographic details and information related to pesticide use and misuse to be reported in the journal. The study participants understand that their names and initials will not be published, and due efforts will be made to conceal their identity.

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Conflicts of interest

There are no conflicts of interest.

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