

Effects of pesticide use in agriculture and its impact on human health

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ABSTRACT

Going by the characterization of pesticides, they are chemical substances that are made use of to eliminate animals, insects, plant and fungal bugs in cultivation, at home as well as in institutions. Therefore, the objective of this study is to evaluate the various aspects of pesticide use in agriculture and to study the effect of pesticides use in agriculture on human health. Agricultural community was taken for this study and areas were randomly chosen. All farmers, both men and women were interviewed if they were working in an agricultural field. The most commonly used pesticides according to the sprayers were Rogar/Dimethoate (55%), Ekalux/Qunalphos (49.4 %), Endosulphan (48.5%) and Monocrotophos (45.9%). While pesticides were sprayed, non sprayers (40.1%), including women (19.3%) continued to work in the same field, which exposed them to pesticides (Table 5). Time of reference for the non-sprayers was while working in the field during or after pesticide spraying. These signs and symptoms were reported by a large number of sprayers. 373 sprayers (86.1%) and 156 (78.8%) of non-sprayers reported at least one of these signs and symptoms.

Key words: Pesticides, Monocrotophos, Endosulphan, Health, Ekalux, Agriculture.

INTRODUCTION

Exposure to pesticides both occupationally and environmentally causes a range of human health problems. It is estimated that nearly 10,000 deaths annually to use of chemical pesticides worldwide, with about three-fourths of these occurring in developing countries [1]. At present, India is the largest producer of pesticides in Asia and ranks twelfth in the world for the use of pesticides with an annual production of 90,000 tons. A vast majority of the population in India (56.7 percent) are engaged in agriculture and are therefore exposed to the pesticides used in agriculture [2, 3]. Pesticides being used in agricultural tracts are released into the environment and come into human contact directly or indirectly. Humans are exposed to pesticides found in environmental media (soil, water, air and food) by different routes of exposure such as inhalation, ingestion and dermal contact. Exposure to pesticides results in acute and chronic health problems. These range from temporary acute effects like irritation of eyes, excessive salivation to chronic diseases like cancer, reproductive and developmental disorders etc [4].

It is important to note that the growth of the fetus is also impinged on owing to exposure to pesticides. In addition, the limits set by the regulatory bodies for the use of different pesticides too are impractical as well as dangerous [5]. Moreover, a child's nature or behavior, like frequently putting the hand in mouth and the time they spend playing on the ground, put them at a greater danger of being exposed to the poisonous chemicals contained in the pesticides. According to a report on poisoning through insecticides, approximately 56 per cent of such cases take place in children below the age of six [6].

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Specific studies dealing with the agricultural practices of the farmers regarding pesticide use and its health impacts is needed to make informed policy decisions to bring about changes in the agricultural practices in India. Therefore, we undertook a study among the farmers of Nalgonda district, Telangana to look into the various aspects of pesticide use in agriculture and its impact on human health. The main objectives of the study are to evaluate the various aspects of pesticide use in agriculture and to study the effect of pesticides use in agriculture on human health.

MATERIALS AND METHODS

Study area

The study targeted mainly the agricultural community of Nalgonda district of the State of Telangana State. Nalgonda is ranked first in the production of rice in the state. The other crops grown in the area include betel leaf cultivation, sugarcane, cotton, some vegetables.

Interview questionnaire

The interview questionnaire was designed to elicit details on land ownership, plantation where the farmer is currently working, exposure to pesticides, the use of pesticides, the commonly used pesticides, precautions taken, the source of information, signs and symptoms of illnesses related to pesticide exposure etc.

Some signs like, tremors, skin lesions, wheezing which can be chronic in nature were observed at the time of the interview. Being a cross-sectional survey, details on signs and symptoms were collected as self reported by the farmers. The questionnaire was pilot tested in an adjacent panchayat the feedback from the interviewers and some respondents were considered and the questionnaire was revised to improve the data gathering ability of the same. Data collected was with reference to the time of pesticide spraying.

Data collection

It was decided that for the convenience of the farmers, interviews should be taken in the field, in the fore noon hours. With the help of the local government agricultural authorities, areas with higher agricultural activity (i.e. extended land areas with year round agriculture) were identified.

Six areas (Chintapally, Marriguda, Chandur, Munugode, Chityal, Kanagal) were randomly chosen for conducting the survey. All farmers, both men and women were interviewed if they were working in an agricultural field. On encountering farmer/s working in a particular field, 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 the local language, namely Telugu. Each interview took about 30- 45 minutes to be completed. The completed interviews were collected at the end of each day, checked, coded and stored for data entry.

Data analysis

The data was entered in Excel (version 4), cleaned and further data analysis was done in statistical software SPSS (version 11). Univariate and bivariate analyses were carried out. Relative Risk (RR) values were calculated followed by Chi-square test for proportions (where appropriate) and a p-value of less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Characteristics of the sample population

The primary exposure status to pesticides was ascertained based on whether or not the farmer sprayed pesticides. Out of the 631 farmers interviewed, 433 reported that they sprayed pesticides by themselves (we refer to them as "sprayers"). The remaining 198 were involved in other agricultural activities (like weeding, replanting, watering etc) (we refer them as "non-sprayers"). Majority of sprayers were men (429, 79.9%). The average age of farmers was 38.9 years (Table 1). 23.5% of farmers received no formal schooling. 207 farmers (32.8%) were currently working on betel leaf plantation; 143 (22.6%) were working on paddy fields and the rest were involved in cultivation of other agricultural products such as brinjal, banana and sugarcane etc (Table-1).

Table-1. Characteristics of the sample population

Age group	Male		Female		Total
	Sprayers	Non sprayers	Sprayers	Non sprayers	
<20	21	12	1	6	40
21-30	122	17	0	24	163
31-40	140	18	1	32	191
41-50	73	21	2	15	111
51-60	50	21	0	15	78
>60	23	19	0	6	48
Total	429	108	4	90	631

Commonly used pesticides

The most commonly used pesticides according to the sprayers were Rogar/Dimethoate (55%), Ekalux/Qunalphos (49.4 %), Endosulphan (48.5%) and Monocrotophos (45.9%). 7.7% of the sprayers used pesticides which are extremely hazardous. Rogar, Ekalux

and Endosulfan is classified as moderately hazardous by WHO (2004), while Monocrotophos is classified as highly hazardous. Only a very few farmers (43 ie. 0.2%) used the pesticides in the class III (Slightly hazardous). The retail shop owners were the major source of information regarding usage of pesticides (56.1%).

Table-2. Formers and continuation of farming activities while spraying pesticides

	Sprayers (n=433) No. (%)	Non sprayers (n=192) NO. (%)	Total (n=625) No. (%)
Male	155 (35.8)	40 (20.8)	533 (85.3)
Female	1 (0.2)	37 (19.3)	92 (14.7)
Total	156 (36)	77 (40.1)	625 (100)

Information source for the farmers

Sprayers used mainly the retail shop owner as the information source for knowledge regarding the pesticides they used (56.1%). 35.3% of farmers consulted other farmers and only 9.5% of sprayers considered government or any other agricultural authorities as their source of information.

Factors affecting direct exposure to pesticides

Duration of spraying pesticides

The period of exposure ranged from 10 year to 15 years with an average duration of 11.8 years. A majority of them, 255 (58.9%), have been spraying pesticides for the past ten years. 203 farmers (46.9%) had sprayed some kind of pesticides within a month. The characteristic features of samples population is described in [Table-1](#).

Personal habits while pesticide spraying

Handling of pesticide concentrations and application of diluted formulation requires the use of appropriate personal protection equipment as a precaution against pesticide exposure. This would include the use of gloves, masks, protective clothes, personal hygiene, appropriate footwear, head gear etc., as indicated in the respective pesticide labels [7]. The sprayers in our study did not take necessary personal protective measures while handling pesticides.

382 sprayers (88%) reported that they took no precaution while handling and spraying pesticides. 244 (56.4%) farmers made a cocktail of different kinds of pesticides before spraying. The farmers mixed the different pesticides in a vessel with water or they poured it directly into the spraying can and then mixed the pesticides in the spraying can itself. 117 (27%) mixed or diluted pesticides

using bare hands. The common alternative to this practice was to use a stick. Use of gloves was 2.7%, while a few of them also used old cotton cloths as masks. While spraying, 147 sprayers (33.9%) chewed either tobacco or gum and 16 (3.7%) of them smoked.

Table-3: Signs and symptoms of illness among study population (as percentage)

Signs and Symptoms	Sprayers (n=433)	Non sprayers (n=198)	Overall (n=631)
Excessive sweating			
Burning/Stinging/	38.6	31.8	36.5
Itching eyes	37.6	31.8	35.7
Sore throat	27.3	21.7	25.5
Fatigue	26.3	39.4	30.4
Dizziness	25.6	34.3	28.4
Skin redness/white	21.9	1.7	20.6
patches	21.7	28.8	23.9
Numbness/muscle	18	13.1	16.5
Weakness	16.2	29.3	20.3
Blurred vision	15.7	28.8	19.8
Chest pain	15	23.2	17.6
Cough	14.8	12.6	14.1
Excessive salivation	7.4	11.6	8.7
Nausea/vomiting	6	16.7	9.4
Stomach pain	5.3	10.1	6.8
Diarrhoea			

Factors affecting indirect exposure to pesticides

Other farming activities during pesticide spraying 37.3% farmers (156 sprayers and 77 non sprayers) reported that other farming activities continued in the farm while pesticides were sprayed. While pesticides were sprayed, non sprayers (40.1%), including women (19.3%) continued to work in the same field, which exposed them to pesticides ([Table 2](#)).

Signs and symptoms of illness among farmers

The signs and symptoms related to pesticide exposure was included in the questionnaire. The sprayers were asked whether they experienced these signs and symptoms during or immediately after pesticide spraying. Time of reference for the non-sprayers was while working in the field during or after pesticide spraying. These signs and symptoms were reported by a large number of sprayers. 373 sprayers (86.1%) and 156 (78.8%) of non-sprayers reported at least one of these signs and symptoms ([Table-2](#)).

Some of the signs and symptoms with a higher prevalence were excessive sweating (36.5%), eyes/stinging eyes/itching eyes (35.7%), fatigue (30.4%), dizziness (28.4%), dry/sore throat (25.5%) and numbness/ muscle weakness/ muscle cramps (23.9) ([Table-3](#)). As these signs and symptoms are self reported by the farmers, it was

difficult to discriminate and confirm the occurrence of a specific sign or symptom, like excessive sweating, to pesticide exposure or to other environmental factors like hot weather.

The other signs and symptoms with Relative Risk values were fatigue (1.02), dizziness (1.1), skin redness/white patches on skin/skin scaling (1.46), runny/ burning nose (1.64), shortness of breath/cough (1.06), excessive salivation (1.46), nausea/ vomiting (1.34) and wheezing (1.38). 75% (473) farmers were free from any chronic diseases like diabetes, hypertension, asthma, tuberculosis etc. 14 (2.2%) farmers suffered from asthma. 10 (1.5%) farmers suffered from diabetes, 16 (2.5%) from hypertension, 5 farmers (0.8%) from tuberculosis and 88 (13.9%) reported reduced vision.

Most farmers in our study were not aware of the health hazards caused by the inappropriate handling of pesticides. The use of cotton apparel as protective clothing was common among them. Studies show that wet cotton clothing and cotton cloth masks in fact increase the person's personal absorption rate of pesticides [8]. The practise of chewing or smoking while spraying "to reduce the nauseating feeling" is also hazardous to health. This may also indicate that the farmers were symptomatic enough to self-medicate during a pesticide spraying session. But many are unwilling to follow the necessary precautions attributing non-availability and high cost of personal protection products, and the prevailing hot and humid weather conditions.

These reasons were similar to experiences of other developing countries like Indonesia [9, 10]. Combining more than one pesticide together, many of which are duplicates (different trade names but the same common name and thus the same active ingredient) should be discouraged. This could be a dangerous concoction, because mixing of pesticides can alter their chemical properties, thereby increasing its detrimental effects. The combination of use of hazardous pesticides and the absence of appropriate precautions are detrimental to the farmers' health [11, 12, 13].

CONCLUSION

This study concludes that, the farmers experienced a variety the signs and symptoms related to pesticide. Among men, the prevalence of signs and symptoms related to pesticide exposure was higher among the sprayers. In contrast, the higher percentage of some signs and symptoms among the non-sprayers could be due to their "direct" exposure to pesticides or due to previous exposure to pesticides. Awareness needs to be created on use of personal protective measures among farmers, while handling pesticides. Farmers needs to be encouraged to reduce, if not eliminate the use of pesticides, with the introduction of incentives to the farmers to help them shift

from synthetic pesticides to bio pesticides and organic farming.

Conflicts of Interest

Authors declare that there is no conflict of interests regarding the publication of this paper.

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