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Knowledge, attitude and practice of pesticide safety measures among paddy farmers in south India

Vijay Kautilya D[1,*], Shruti P. Hegde[2], Khatija Begum[3], Prithika Chandrashekaran[4]

[1]Associate Professor, Dept. of Forensic Medicine & Toxicology, [2]Associate Professor, Dept. of Ophthalmology, [3,4]UG Student, Shri Sathya Sai Medical College & Research Institute, Chennai

***Corresponding Author:**
Email: kautilya.dactroo@gmail.com

Abstract

Introduction: Indian has been an agricultural nation where most of the population is involved in agriculture. Yet the farmers are a neglected section of the society. Use of pesticides has been rampant in agriculture and this has made the farmers vulnerable to the risks of pesticide application. Our aim was to survey the level of awareness of the farmer regarding pests, pesticides and their correct methods of use as this data can help us design interventional programs tailored for the population under study.

Materials and Method: A Cross-sectional questionnaire based survey was conducted among 172 paddy farmers in Kancheepuram district of Tamil-Nadu, India. The questionnaire consisted of both open ended and closed ended questions directed toward collecting demographic data and other relevant data on crops being cultivated, general knowledge and attitude on pesticide handling, safety, risk perception and protection ideas. The results were analyzed using (SPSS version 20) for descriptive statistics.

Results and Discussion: Of the 172 farmers 93% denied knowledge of any pesticide regulations and only 18.6% accepted reading the instructions given on the pesticide labels before application. Considering the safety precautions 94 (54.1%) of the subjects accepted not using any safety precaution while spraying. Of the 172 farmers in the study, 104 (60.5%) followed advice given by the retailers from whom they buy the pesticide. Even the dosage was being prescribed by the retailers. In only 37.2% of cases the pesticides were being sprayed in the fields by skilled labors.

Conclusion: It is clear from the study is that the farmers need training, education and financial support. Safety gears need to be provided at a subsidized rates and their proper use must be demonstrated. Farmers also need to understand the use of integrated pest management.

Keywords: Knowledge, Pesticides, Educational status, Safety.

Introduction

India has been known as primarily an agricultural country with agriculture accounting for 16.1% of its GDP and more that 49% of the working population involved in agriculture.(1) With growing demand for food and limited availability of land for cultivation, farmers today have been pushed into adopting newer methods of cultivation to increase the yield risking their own health and also the health of the environment.

Farmers rightfully believe that most crop losses are accounted due to pests and weeds. This has been found to true all over the world. Fertilizers and pesticide use has been thought to be necessary to achieve higher yields. It was in 1966 that green revolution was adopted in India with a target of increasing the agricultural yield. They wanted to modernize agriculture by introducing Pesticides.(2) But the hazards of pesticides were not considered significant. The green revolution did successfully increase the agricultural yield but it did this with a cost. The first case of pesticide mass poisoning was reported in India in Kerala where nearly 100 people died due to pesticide contaminated food grains.(3)

WHO is reported that annually there are about 20000 deaths directly reported due to the effect of pesticides every year and nearly 800000 people have been reported dead due to pesticide effect since the start of green revolution. This risk has also been acknowledged by the Indian government which has introduced the Insecticide Act, 1971 making pesticides a regulated substance.(4) India has now become the second largest producer of pesticides in the world and consumes about 2% of the pesticide market. 76% of the pesticides used in India are insecticides.(5) It is peculiar, as people have realized the risks of pesticide use but still continue to use them.

Pesticide use, though can't be termed as completely safe, has shown some benefits by increasing the production capability. Pesticide use not only helped in control of agricultural pests but it is also helped control various mosquito borne diseases.(5) However excessive, in judicious, unscientific use has been shown to result in a series of health risks these days.

Farmers have frequently shown to be unaware of the scientific approach towards the application and use of these hazardous chemicals. They are found to be negligent of the risks harbored by their practices and incur risks leading to complication of pesticide use.(6) Poverty, illiteracy and ignorance usually drives farmers to flout safety norms leading to wide spread consequences and this occupational hazards of pesticide use. Many previous studies have brought out the unsafe practices adopted by farmers. Farmers have been found to uses poor quality leaky equipment without any

protective gear. Inappropriate clothing and mixing techniques have been reported. The farmers are also unaware of proper application and disposal methods.[7,8,9,10] One study has also reported the use of domestic utensils for mixing of the pesticides.[9] All these factors influence the bad outcome of the pesticide use.

In this Cross-sectional Interview based analytical study we have tried to access the levels of awareness among farmers regarding the pests in rice cultivation, use of pesticides and safety precautions. We have tried to gauge the extent of this occupational hazard, educate the farmer on the health risks involved and suggest alternative avenues available for safe pest management.

Objectives

Our aim was to survey the level of awareness of the farmer regarding pests, pesticides and their correct methods of use as this data can help us design interventional programs tailored for the population under study.

Materials and Method

This Cross-sectional interview based analytical study was conducted in Kancheepuram district of Tamil Nadu, India. The data was collected near Thiruporur town which is located between 11° 00' to 12° 00' latitudes and 77° 28' to 78° 50' longitudes. In this town 16.8% of the population is involved in agriculture and are reported to consume over 2332 metric tons of pesticide dust annually. Paddy is the primary crop in cultivation with annual production amounting to 30,095 metric tons.[11]

A standardized questionnaire was prepared after through literature review and a pilot study among the local population. The questionnaire consisted of both open ended and closed ended questions directed toward collecting demographic data and other relevant data on crops being cultivated, general knowledge and attitude on pesticide handling, safety, risk perception and protection ideas.

This study was conducted over a period of four months between Septembers to December 2013 after obtaining ethical clearance from the Institutional Ethics committee of Shri Sathya Sai Medical College & Research Institute. The interview was conducted by the two undergraduate students who participated in this study. After taking consent from the village heads the farmer's were selected bases on purposive non probability sampling methods keeping in mind our selection criteria. The farmers had to have experience in farming and also handling pesticides in the farm. All the participants selected were above 18 years of age.

The minimum sample size was calculated predicting the response distribution to be 50% and confidence level of 95% at $p< 0.05$. With the Absolute error at 8% the minimal sample size required was 150.

Over four months 172 farmers consented and participated in the study. The farmers were interviewed based on the standardized questionnaire. An attempt was made to understand their attitude towards reading the labels, and taking the safety precautions. The data collected was statistically analyzed using the SPSS (version 20) software. The data is presented in terms of rates, ratios, percentages and other descriptive statistics for the age, sex, socio-demographic data, work experience, pesticide risks, attitude towards pesticide etc.

Results and Discussion

In the process of collecting the data, a total of 172 subjects were interviewed and the results of the interpretation are presented here.

Demographics of the Farmers in the study: Among the sample included in the study 152 (88.2%) were male and 20 (11.6%) were female with the average age being 44yrs. The subjects ranged from 20-73 years of age with majority being in the age group of 31-50 yrs. 80.2% of the participants were primarily farmers. The rest of the subjects practiced farming along with other business or education. More than 76% of the subjects owned the land they cultivated compared to only 3.5% who worked as agricultural labor.

91.9% of the farmers claimed to be middle socio income group. Only 8.1% of the farmers had completed graduation. More than 25.6% were illiterate and had never had any formal schooling. However among the farmers who took part in the study, the average experience claimed in farming was 17 years and only 9% had experience less than 5 years.

Crop Patterns: All the farmers selected for the study cultivated paddy as the primary crop in their fields. The most common variety of rice grown were ponni, BPT, ADT-43, deluxe ponni, super ponni etc. From the Table 1 it can be noted that more than 65% of them cultivated only one crop a year. The seeds of the crop also majority depended on the previous crop (68.6%).

Table 1: Table showing the Crop and storage patterns identified among the study group

Variable	Variable sub groups	Percentage (n= 172)
No. of crops per year	One	112(65.1%)
	Two	52 (30.2%)
	Three	8(4.7%)
Source of seeds for cultivation	Last Crop	118 (68.6%)
	Government agency	20 (11.6%)
	Private agency	32 (18.6%)
	Others	2 (1.2%)
Choice of crop variety is based on what factor	Grows well and high yielding	160 (93%)
	Cheap	6 (3.5%)
	High market value	4 (4.3%)
	As elders suggest	2 (1.2%)
	Choose pest resistant variety	Nil
Storage of food grains cultivated	Community sheds	10 (5.8%)
	Government provided sheds	10 (5.8%)
	Self owned sheds	44 (25.6%)
	Private Sheds	6 (3.5%)
	Sold Immediately	102 (59.3%)

Pattern of use of pesticides: All farmers accepted having pest related problems and believed that use of pesticides is beneficial for the crop. This is similar to what is reported in previous studies.[12] When asked if all pests were considered dangerous (Table 2), 64% didn't believe so and considered some pests to be beneficial. One good thing to note from the Table 2 is that all the farmers were able to identify the pests to some extent. This is a positive finding as we can encourage the farmers to participate in integrated pest management. This would save farmer from the use of pesticides. However, it can also be noted that more than 62% of the farmers used pesticides even in the mere presence of pests or by a calendar method where they spray irrespective of presence of pests on a specific schedule. Only 18.6% followed scientific measurement of pest density before spraying.

Table 2: Table showing the pesticide application and use patterns among the farmers

Variable	Variable sub groups	Percentage (n= 172)
Farmers able to Identify pests	Complete	28 (16.3%)
	Partial identifies pests	144 (83.7%)
	Does not identify pests	Nil
Decision on when to spray pesticide is taken after.	Presence of pest in field	38 (22.1%)
	Presence of pest or Checking Pest density.	28 (16.3%)
	Only after checking pest density	32 (18.6%)
	Calendar method	32 (18.6%)
	Presence of pest or calendar method	42 (24.5%)
Number of sprayings per crop	Once every crop	4 (2.3%)
	Twice every crop	16 (9.3%)
	Thrice every crop	80 (46.5%)
	More than thrice every crop	72 (41.9%
Who gives advice on the pesticide to be used?	Other farmers and elders	14 (18.1%)
	Retailer	104 (60.5%
	Government agency	2 (1.2%)
	No advice is taken	52 (30.2%
Amount of pesticide purchased in one buy	Enough for one year	1 (1.2%)
	Enough for one crop	18 (10.5%)
	Enough for one use	152 (88.4%)
Who sprays the pesticide	Self	22 (12.8%)
	Trained Paid labour	64 (37.2%)
	Regular untrained sprayer in the village	22 (12.8%)
	Self or Regular sprayer	64 (37.2%)

Of the 172 farmers in the study, 104 (60.5%) followed advice given by the retailers from whom they buy the pesticide. Even the dosage was being prescribed by the retailers. In only 37.2% of cases the pesticides were being sprayed in the fields by skilled labors.

Awareness of pesticide safety measures: As a pesticide spraying is considered a dangerous practice, safety precautions need to be followed. The farmers were interviewed and an attempt was made to assess their awareness of these safety norms and the results are presented in Table 3. As was noted before, majority of the farmers were illiterate or partially literate. Of the 172 farmers 93% denied knowledge of any pesticide regulations and only 18.6% accepted reading the instructions given on the pesticide labels before application. 82.1 % didn't know that there is a risk label and instruction sheet provided along with the pesticide. Most of the farmers (41.9%) mixed the pesticide in the retailer shop and brought the diluted, ready to spray solution to the field. All the farmers suggested using liquid sprayers for spraying the pesticide.

Table 3: Table showing the level of awareness of pesticide safety measure among the farmers

Measure practiced	Yes	No	Don't know
Take a bath after spraying	164 (95.3%)	8 (4.7%)	Nil
Wash the apparatus post use	116 (67.4%)	56 (32.6%)	Nil
Avoid contamination in water source	66 (38.4%)	106 (61.6%)	Nil
Dispose the empty bottle safely	88 (51.2%)	84 (48.8%)	Nil
Wash the clothes worn	118 (68.6%)	54 (31.4%)	Nil
Use safety precautions	12 (7%)	160 (93%)	Nil
Re-entry period &signboards	4 (2.3%)	168 (97.7%)	Nil
Avoiding feeding in the field	76 (44.2%)	96 (65.8%)	Nil
Spray in the direction of wind	162 (94.2%)	10 (5.8%)	Nil
Regularly service the sprayer	72 (41.9)	100 (58.1%)	Nil
Pesticides can be explosive	10 (5.8)	112 (65.1%)	50 (29.1)
Pesticides can be absorbed through skin	94 (54.7%)	68 (39.5%)	10 (5.8%)
Place a danger sign board outside field after spraying	12 (7%)	160 (93%)	Nil

Discussion

Crop patterns: Farmers use seeds from the previous crop for cultivation as this was considered primarily as a cost cutting measure adopted by the farmers. Government agencies played little role in supplying seeds to the farmers. The most important criteria for selecting the type of rice cultivated were the yield and quality with 93% of farmers opting for this. Surprisingly though even when the farmers accepted having pest problems, pest resistant variety of rice were not preferred as it was considered a costly affair to purchase the seeds. Storage of the produce was not an issue as 59.3% of the farmers sold of the produce immediately after harvest. This saves the burden of using pesticides for storage.

Pattern of use of pesticides: Facilities for identifying pest density before spraying are not very available to the farmers. The government operated labs are remote and don't respond well to the needs of the farmers. More over the farmers believe that if neighboring farms sprays pesticides, so does he as it is felt that the pest might just switch over to his crop. Of the 172 farmers 168 (96.5%) of the farmers believed that the use of pesticides decrease their crop loss and use pesticides.

Pesticide application was being carried out at least three times by more than 46.5% of the farmers. Multiple combinations of pesticides were being applied by more than 41.9% of the farmers. This is an alarming and dangerous practice. Most often as reported by other researchers across the world the combinations are prepared in an unscientific way. The collective effect of these unscientific combinations can have far reaching consequences on the soil and water resources as well.[13]

Most of the times it was the farmer himself or another regular unskilled sprayer who applied the pesticide in the field. On an average during one spraying cycle in a field the sprayers applied continuously for 2.5 hrs at a stretch. This has been reported in similar other studies done in rural India.[8,9,12] Most of the farmers rely on the information provided by the retail shop owners mostly because they are the only ones available 24/7. Though government agencies and NGO's do their best to reach the farmers their efforts have been found to be negligible by the farmers.[12] The farmers also lack practical demonstration and as the literacy rates among the farmers are low they are unable to follow the instruction on the labels.[10,12] A major factor explaining pesticide poisoning in developing countries is the inability of the mostly illiterate farmers to understand and follow label instructions.[6]

Awareness of pesticide safety measures: From the table no 3 it is good to know that most of the farmers are aware of these safety measures. However it is alarming to note some findings like only 7% agreed to use safety precautions. Considering the safety precautions 94 (54.1%) of the subjects accepted not using any safety precaution while spraying. Some of the

sprayers were found to be bare clothed and dressed only in undergarments while spraying. This was done to prevent cloths from soiling. We can also note from the table that farmers are unaware of Re-entry period. Once Pesticide are sprayed in the field one need to avoid entering into the fields for at least three days as the pesticide residues in the field can still cause significant exposure. This period of restriction is known as reentry period. This also requires that farmers place a danger sign on the field where pesticides have been recently sprayed. Awareness regarding this was just 7% among the farmers. Another risk behavior noted was that pesticides were also sprayed close to the harvest. 146 (84.9%) subjects accepted spraying just 20 days before harvest. And 142(82.5%) subjects also accepted growing vegetables immediately after the harvest. This not only increases the risk for the people working in the fields but also increases the risk of high levels pesticide concentrations in the vegetables grown.

It has been reported in previous research that farmers rarely use protective gear like gloves, goggles, gum boots or head gear.[6,7,8,12] More than 97% of the studies reported that the farmers don't use gloves, face masks etc.[6] At least in India these behaviors can be explained by the hot and humid climate which makes it uncomfortable for the farmers to continue working wearing all the protective gear. Another probable explanation to consider is the economic constrains. Most of the time, as noted in this study, the farmers belong to low socio-economic groups and further more the persons spraying the pesticide could be a contract laborer who doesn't himself afford these protective gear. Hence these conditions provoke the risk taking behavior among the workers who also have been found to believe that the symptoms caused by the pesticide spraying are minor, unavoidable side effects of their occupation.[12]

Conclusion

Farmers are generally considered a weaker section of the Indian community. More over as found in the study majority of the farmers are either illiterate or poorly educated. Their training in farming is primarily got from elders advising them and training them. No formal education or training is received by most of these farmers. When a relatively modern technique like application of pesticides is entrusted to a relatively untrained group of people, the results will defiantly be adverse as reported above. One thing which needs to be emphasized again from the results of this study is that the farmers need training and education. This has to be further enforced by financial support. As found in this study like most other studies, farmer's choices are not just driven by his knowing the right thing. Decisions are more frequently economical. Safety gears need to be provided at a subsidized rates and their proper use must be demonstrated. Farmers also need to understand the use of integrated pest management. This if followed can decrease the belief and reliance on conventional chemical pesticides.

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