

Health Risk Perceptions, Awareness and Handling Behaviour of Pesticides by Farm Workers¹

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Abstract

The level of awareness regarding pesticide use/ handling has been reported in the farms of Kerala and the same has been compared with the adoption pattern and experiences of health risk episodes, in a society with high level of literacy. The understanding on various aspects of pesticide-use has revealed better awareness in certain aspects and poor understanding in certain others. The workers have not been given adequate training to understand the toxicity level by looking at the colour code on the packet, though they have been found aware about the different options available in the market. Often their perceptions of toxicity level of chemicals they handle are not in conformity with the actual situation; they have been found handling toxic chemicals considering them to be safe ones. Despite a high literacy level, most of them do not care to read the instructions and follow them. The study has found that a majority of the respondents are of satisfactory health status by the body mass index values. The short-term health risk upon occupational exposure has been reported very common; its frequency increases as one gets more years of experience in the work. It has been attributed to their inadequate understanding of the toxicity levels, unscientific handling practices and poor personal protective mechanism. The study has highlighted the need for targeted trainings to farm labourers besides farmers on the scientific management of pesticides and undertaking of massive awareness generation programmes.

Introduction

Pesticide use in most of the developing countries is reported to be unscientific and unregulated, causing serious damages to the ecosystem and human health. The trade-off between the health impacts and financial benefits of crop production have been reported by various researchers across the globe (Rola and Pingali, 1993; Pingali *et al.*, 1994; Antle and Pingali, 1994; Crissman *et al.*, 1994). Despite this, pesticide-use policies and regulations are in their infancy in many developing countries and as a result, pesticide misuse is prevalent (Tjornhom *et al.*, 1997). Several instances

of chronic toxicity or deaths have been reported among the exposed farm population due to occupational, accidental or intentional poisoning. Using/consuming of a pesticide is the major mode of committing suicides among the farmers in distress in the state of Kerala due to its easy access. However, pesticides still continue to be a major pest management strategy.

This paper has analyzed the awareness regarding pesticide use and handling, behavioural responses and perceptions of health impacts among farm workers in the state of Kerala.

Study Area, Subjects and Methodology

The state of Kerala lies in the southern most part of Indian sub-continent. Kuttanad is a low-lying area near the coast of Kerala, with a total population of 1.4 million. It is called the 'rice bowl' of Kerala. Rice cultivation in Kuttanad is of a special type, as the land

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is on an average three metres below the Mean Sea Level (MSL). Paddy is virtually the only crop grown and the poor drainage conditions make most of the land in the area unsuitable for other crops. The main rice crop of the area is the *Punja* (summer crop) and in some areas a second crop (*Viruppu*) is also possible. The *Punja* season is generally the period from October/November to March/April, i.e. after the cessation of the north-east monsoon and before the ingress of saline water during the summer months.

Rice fields are usually demarcated as *padasekharams*. A contiguous stretch of wetlands bounded by waterways or other natural features is called a *padasekharam*, which is a homogeneous physical entity. For the purposes of this study, pesticide-related information was collected from a sample of pesticide applicators (who generally undertake the pesticide-spraying job and are considered skilled labourers for this type of work). Two Community Development Blocks were randomly selected from each of the three districts which form the Kuttanad area, and from each block two *panchayats* (the base level administrative unit) were identified randomly. From each selected *panchayat*, three *padasekharams* were chosen on a random basis and these *padasekharams* formed the study area. Data was collected from 280 pesticide applicators.

Data collection was carried out through a structured pre-tested questionnaire, by the personal interview method. Direct observations were also made wherever possible. The questionnaire included questions related to general socio-economic aspects, health indicators and self-reported health impacts, perceptions and practices related to the use and handling of pesticides. The data analysis was mainly based on the tabular method.

To assess the general health status of the respondents, the Body Mass Index (BMI) was estimated using Equation (1):

$$\text{BMI} = \frac{\text{Weight (in kg)}}{\text{Height}^2 \text{ (in m)}} \quad \dots(1)$$

Fourteen questions were asked from each farm worker to get response on their attitude and behavioural pattern with respect to pesticide handling and use. The precautionary measures while handling the chemicals were noted by observing them on work or through their response.

Socio-economic Profile

The socio-economic profile of the respondents has been presented in Table 1. The average age of pesticide applicators in the sample was 45 years, the minimum being 23 years and maximum 70 years. Though some of the respondents had studied up to university level, most of them had studied only up to the 7th standard. All could read and write the local language. It may be pointed out that Kerala state ranks first in India with the literacy rate of 90.92 per cent against the all-India average of 65.38 per cent.

Table 1. Socio-economic profile of pesticide applicators in farms of Kerala

(N=280)

Description	Pesticide applicators		
	Mean	Min	Max
Age (years)	45	23	70
Education	2.26	1	4
Body Mass Index	21.72	15.57	30.61
Duration of work (hours/day)	2.18	0.5	5
Wages (Rs/hour)	73	20	200
Average earnings per day (Rs/hour)	159	10	1000

Pesticide application, as a general practice, is of shorter duration than other wage labour in both the agricultural and non-agricultural sectors. The average work was for 2.18 hours a day. The risky nature of the job was cited as the reason for it. It was reflected in the wage structure too. Pesticide applicators were paid more than twice the wages in the agricultural sector. But, on a per day basis the average earnings were less for the pesticide application work as the average wage rate was not enough to offset the lower work duration. However, more focused research is warranted to find whether the wage rates compensate for the risks.

The Health Status

The effect of pesticides largely depends on the individual's health status. The Body Mass Index, as suggested by the Indian Council for Medical Research, was constructed for each individual. The presumptive diagnosis and results have been reported in Table 2. It was seen that a majority (72.02 per cent) of farm workers were of normal health status. About 15 per cent were in low weight category and 7 per cent were

Table 2. Health status indicators of pesticide applicators
(N=280)

Body Mass Index (BMI)	Persumptive diagnosis	Percentage of respondents
< 16.0	CED Grade 2	0.52
16 –17	CED Grade 3	3.64
17.0-18.5	CED Grade 1	1.55
18.5-20	Low Weight	15.02
20-25	Normal	72.02
25-30	Obese Grade I	7.25
>30	Obese Grade II	0

Methodology source: Naidu *et al.* (1991)

in grade I obese group. As expected, obesity was not found to be a serious health problem among farm workers. About 5 per cent of the workers had poor health status.

Awareness about Pesticide Use

The respondent's awareness with regard to the pesticide toxicity levels, health impacts and resultant behaviour decides the level and extent of negative externalities associated with pesticide use. The responses of pesticide applicators to the questions related to this aspect have been recorded in Table 3. These questions were related to reading the instructions and following them, awareness about toxicity,

ecological impacts, human health impacts and training support.

One-third of the workers reported about reading the label on the pesticide packet either themselves or through help. But, only less than 3 per cent followed the instructions. The workers often related the toxicity of pesticides to the odour of the chemical and more pungent ones were considered as more toxic. The scientific categorization based on colour code was rarely understood. About two-thirds (63 per cent) of the farm workers knew that pesticides with different levels of toxicity were available in the market, starting from relatively safe ones to highly toxic. But, almost all of them (99.5 per cent) could not understand the toxicity level after reading the colour code on the bottle. The respondents were asked about their understanding of the toxicity level of pesticides they were handling by giving four options, based on the colour code suggested by World Health Organization. Simultaneously, the chemical they actually sprayed was also verified. Nearly three-fourths workers thought they were handling safer chemicals (slightly/moderately toxic), while actually most of them (69.65 per cent) were spraying toxic (highly/extremely) ones. Unfortunately, they were not trained to understand the level of toxicity by reading the colour code on the label.

The behavioural pattern with respect to personal health and hygiene, while handling the pesticides,

Table 3. Awareness about pesticide use and handling

(N=280)

Sl No.	Particulars	Respondents, %	
		Yes	No
1	Do you read the labels on the package?	33.0	67.0
2	If you cannot read, do you seek help from others?	3.0	97.0
3	Do you follow the instructions given on the label?	2.5	97.5
4	Are you aware of pesticide toxicity levels?	63.0	37.0
5	Are you able to understand the level of toxicity, reading the sign on the label?	0.5	99.5
6	Do you eat, drink or smoke while spraying pesticides?	80.0	20.0
7	Do you take bath right after spraying?	93.0	7.0
8	Do you change clothes right after spraying?	9.0	91.0
9	Do you keep the pesticide bottle along with food items?	42.0	58.0
10	Do you store food items in pesticide bottle after use?	0.0	100.0
11	Do you wash the sprayer/bottle in the pond/canal/river/others?	0.0	100.0
12	Do you determine the wind direction first and then spray?	97.0	3.0
13	Do you spray when it is windy?	97.0	3.0
14	Have you attended any training / workshop / discussions on pesticide use and care?	4.0	94.0

however, showed the desirable pattern. The applicators generally did not take food or smoked while spraying and took bath and changed the clothes immediately after the spraying work. None of them kept the pesticide containers along with food items at home and did not use the empty containers for storage of food items. But, when it came to social behaviour, the care was comparatively less. The ecological impacts of pesticide spray can be assessed by the spraying pattern and disposal habits of empty containers. About 42 per cent of the respondents washed the bottle/sprayer in the nearby water bodies. Most of them considered the wind direction while spraying. But, they did not postpone the spraying even when there was wind. This resulted in higher chances of drift, affecting the non-target population.

The institutional support mechanism for creating awareness on pesticide-use and handling is mainly managed by the department of agriculture. They conduct training programme on the topic on a regular basis. But, it was found that only 4 per cent of the respondents had ever attended the training on pest control aspects. It was revealed that the department trainings were mostly focused on farmers. But, our study showed that in majority of cases of spraying (79 per cent), the farmers did not supervise and preferred to stay away from the field, entrusting the work to the applicators. This highlights the need for refocusing the training programme targeting the farm labourers.

The scientific handling of pesticides includes the use of protective gadgets. None of the applicators was found using the suggested protective gadgets, which included a face-mask with replaceable filters, goggles, head-cover, rubber gloves, full-sleeved shirts and full pants, and boots. Jeyaratnam *et al.* (1987) and Sivayoganathan *et al.* (1995) have also reported similar situations in the case of Sri Lanka and Yassin *et al.* (2002) in Palestine. The findings of some other studies conducted in the developing countries also supported this aspect (Wilson, 1998; Gomes *et al.*, 1999; Murphy *et al.*, 1999; Salameh *et al.*, 2004; Atreya, 2007). The cost factor (which made the applicators reluctant to adopt the recommended gadgets and opt instead for cheaper substitutes), general lethargy, and the discomfort associated with the use (in the hot and humid climate and under puddled paddy land conditions) were reported as the reasons for non-adoption of proper protective gadgets. Moreover, there existed no

monitoring mechanism also to ensure their use. Nevertheless, some form of protective covering of body parts was adopted by 71 per cent of the respondents while spraying. In 21 per cent of the cases, it was mainly the full-sleeved shirts. However, it was noted that some rolled up their sleeves while doing spraying/mixing. About 48 per cent respondents tied a piece of cloth around the nose. A mere 1 per cent used some form of eye protection (e.g. ordinary spectacles, which were actually there even otherwise), though most of them reported eye irritation after spraying. These unscientific methods of aversion often failed to achieve the desired objectives.

Health Risks

Pesticides cause health damages of two types — short-term (which get manifested within hours to days of exposure) and long-term (which take years to get manifested). The respondent's perception regarding these two types of health risks has been furnished in Table 4. More than half of the respondents were of the view that there was only mild health risk for a short-term. On the contrary, they considered the long-term effect as more profound and fatal. Surprisingly, one-fourth of the workers believed that there was no adverse health effect in the long-run. Under this background, we further explored their experiences in this regard based on self-reporting.

Table 4. Perception about pesticide exposure and health impact

Impact severity	(N=280)	
	Respondents' perception, %	
	Short-term health impact	Long-term health impact
No	15.55	24.87
Mild	51.29	12.6
Some	27.98	7.21
Large	4.66	31.09
Fatal	0.52	24.87

A majority (81 per cent) of the respondents were found working as pesticide applicators for the past more than 10 years, and the remaining 19 per cent were working for the past 5-10 years. The respondents were asked if there had been any incidence of seeking professional medical help immediately after the pesticide spray. It was found that every three out of

four respondents had experienced at least one episode of severe health damage immediately after the spray and had sought medical help or hospitalization. Some of them reported more than one instance of hospitalization. But, the exact number of times of seeking medical help and details there of, could not be gathered from such individuals owing to recall bias problems (Table 5).

Table 5. Spraying experience and health risks of pesticide applicators

Experience in spraying of pesticides (years)	Percentage of respondents	Respondents seeking medical help (%)
< 5	2.62	25.10
5-10	16.58	28.13
> 10	80.80	46.25

There was an increase in the absolute number of respondents getting sick as experience in the job goes up. Proportionately, more applicators were seeking medical help as they continued to remain in the job (25.10-46.25 per cent). It could be due to following reasons:

- Use of more poisonous chemicals,
- General carelessness as one becomes more familiar with the work,
- Cumulative effect of pesticide exposure, and
- Increasing awareness about health effects that they seek medical help.

But reports from Gaza strip showed that there was no direct relationship between the years of exposure and self-reported health damage symptoms (Yassin *et al.*, 2002).

As evidenced by the literature, the conclusive cause effect relationship is difficult to be established in the case of long-term health impacts of pesticide exposure and we could not gather data on those aspects. However, it was revealed from the results that the perceptions about short-term health damages were not in agreement with their own experiences. Moreover, despite a high literacy rate, the awareness level was low and the health risk perceptions and avertive actions were not scientific.

Conclusions

Despite low level of consumption, the externalities due to pesticide-use have been reported high in most of the developing countries. It may be attributed to the level of awareness, handling and use-pattern of pesticides. This paper has analyzed the level of awareness regarding pesticide use/ handling and has compared it with the adoption pattern and experiences of health risk episodes, in a society with high level of education and literacy.

The responses to the key factors on scientific use of pesticides have reflected that the awareness regarding the handling practices are fairly good in certain aspects, while in certain others, it is quite low. The workers are not given adequate training and education to understand the toxicity level of pesticide by looking at the colour code on the packet, though they have been found aware of the different options available in the market. Often their perceptions of toxicity level of chemicals they handle have not been found in conformity with the actual situation and they handle toxic chemicals thinking them to be safe. Despite high literacy level, most of them do not care to read the instructions on the packets and follow them.

Though a majority of the respondents have satisfactory health status, as evidenced by the body mass index values, most of them have reported short-term health risks upon occupational exposure. Surprisingly, their perceptions in this matter do not match with their experience. The frequency of health risk episodes increases as one has more years of experience in the work. It has been attributed to their inadequate understanding of the toxicity levels, unscientific handling practices and poor personal protective mechanism. Similar to the situations in other developing countries, the workers do not adopt scientific personal protective gadgets, though they are aware about the health risks and impacts.

The study has highlighted the need for targeted trainings to farm labourers on scientific management of pesticides and undertaking of massive awareness creation programmes. The literacy level may be a contributing factor in the easy dissemination of information, though it seems not a sufficient condition for awareness generation.

References

- Antle, John M. and Pingali, P. L. (1994) Pesticides, productivity, and farmer health: A Philippine case study, *American Journal of Agricultural Economics*, **76** (3): 418-430.
- Atreya, K. (2007) *Pesticide Use in Nepal: Understanding Health Costs from Short-term Exposure*, South Asian Network for Development and Environmental Economics (SANDEE) Working Paper No. 28-07, Aquatic Ecology Centre, Kathmandu University, Dhulikhel, Nepal.
- Crissman, C.C., Antle, J. M. and Capalbo, S. M. (1994) *Economics, Environmental and Health Trade-offs in Agriculture: Pesticides and Sustainability of Andean Potato Production*, International Potato Centre, Kluwer Academic Publishers, Dordrecht.
- Gomes, J., Lloyd, O. L. and Revitt, D. M. (1999) The influence of personal protection, environmental hygiene and exposure to pesticides on the health of immigrant farm workers in a desert country, *International Archive on Occupational & Environmental Health*, **72**:40-45.
- Jeyaratnam, J., Luw, K. C. and Phoon, W. O. (1987) Survey of acute pesticide poisoning among agricultural workers in four Asian countries, *Bulletin of the World Health Organization*, **65**(4): 521-527.
- Murphy, H. H., Sanusi, A., Dilts, R. *et al.* (1999) Health effects of pesticide use among Indonesian women farmers: Part I: Exposure and acute health effects, *Journal of Agromedicine*, **6**: 61-85.
- Naidu, N.A., Neela, J. and Rao, P.N. (1991) Maternal body mass index and birth weight, *Nutrition News* (National Institute of Nutrition, Hyderabad), **12**(2).
- Pingali, P. L., Marquez, C.B., Palis, F. G. and Rola, A.C. (1994) The impact of pesticides on farmers health: A medical and economic analysis in the Philippines, *Impact of Pesticides on Farmer Health and the Rice Environment*, Ed. P.L. Pingali and P.A. Roger, International Rice Research Institute (IRRI), Manila, Philippines.
- Rola, A.C. and Pingali, P.L. (1993) *Pesticides, Rice Productivity and Farmers' Health: An Economic Assessment*, International Rice Research Institute, Manila, Philippines and World Resources Institute, Washington, DC, USA.
- Salameh, P. R., Baldi, I., Brochard, P. *et al.* (2004) Pesticides in Lebanon: A knowledge, attitude and practice study, *Environmental Research*, **94**:1-6.
- Sivayoganathan, C., Gnanachandran, S. and Lewis, J. (1995) Protective measures use and symptoms among agro-pesticide applicators in Sri Lanka, *Social Science and Medicine*, **40**: 431-436.
- Tjornhom, J.D., Norton, G.W., Heong, K.L., Talekar, N.S. and Gapud, V.P. (1997) Determinants of pesticide misuse in Philippine onion production. *Philippines Entomology*, **11**:139-149.
- Wilson, C. (1998) Cost and policy implications of agricultural pollution with special reference to Pesticides, *Ph.D. Thesis*, Department of Economics, University of St Andrews, Scotland, UK.
- Yassin, M.M., Mourad, A.T.A. and Safi, J.M. (2002) Knowledge, attitude, practice and toxicity symptoms associated with pesticide use among farm workers in the Gaza strip. *Occupational and Environmental Medicines*, **59**: 387-394.