

# Perceptions, Practices and Health Hazards, of Agricultural Workers from Rural Central India with Regard to Pesticide Use - A Cross Sectional Study

Rahul Thakur<sup>1</sup>, Prashil Jumade<sup>2</sup>, Rutuj Waghmare<sup>3</sup>, Shobha Joshi<sup>4</sup>, Abhishek Joshi<sup>5</sup>

<sup>1, 2, 3, 4, 5</sup> Department of Community Medicine, Datta Meghe Institute of Medical Sciences, Sawangi (M), Wardha, Maharashtra, India.

## ABSTRACT

### BACKGROUND

Agriculture is a major field of India's economy. Agriculture is the primary livelihood for over 58 % of rural households. 500,000 - 1,000,000 people globally suffer from health consequences as a result of pesticide poisoning every year, according to the World Health Organisation. In countries such as India, pesticide poisoning is a major health problem and is more prevalent. The purpose of this study is to find out the perceptions & practices followed by agricultural workers from study area with regard to use of pesticides.

### METHODS

This was a community-based cross-sectional study. 380 Agricultural workers across three villages participated in the study and all agricultural workers who were > 18 years of age and were handling pesticides for > 1 year were included in study. Simple random sampling method was used, and data was collected using interview schedule.

### RESULTS

35 % of the study participants were educated up to middle school and 49.21 % were in age group of 38 - 57 years. 63.84 % participants thought pesticides are harmful while only 25 % knew about route of entry of pesticides into the human body. 52.1 % of the study participants had headache as a morbidity feature followed by skin irritation in 44.2 %. The association between perception of harmful effects of pesticides and gender, age, education & socio-economic status was found to be statistically significant ( $p = 0.012$ ,  $p = 0.004$ ,  $p < 0.001$ ,  $p < 0.001$  respectively).

### CONCLUSIONS

About 2 / 3<sup>rd</sup> of study participants thought that pesticides are injurious to health & environment. While only 1 / 4<sup>th</sup> participants knew about of route of entry of pesticides into the body. Headache followed by skin irritation were the commonest reported toxic effects of pesticide use. Association between perception of harmful effects of pesticides and socio-demographic profile was found to be statistically significant.

### KEY WORDS

Pesticides, Agricultural Workers, Health Hazards, Rural Central India

*Corresponding Author:*

*Dr. Abhishek Joshi,  
Associate Professor,  
Department of Community Medicine,  
Datta Meghe Institute of Medical Sciences,  
Sawangi (M), Wardha, Maharashtra, India.  
E-mail: abhishekunjoshi@yahoo.com*

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## BACKGROUND

Agriculture is a major field of India's economy. Agriculture is the primary source of income for over 58 % of rural households.<sup>1,2</sup> 500,000 - 1,000,000 people globally suffer from health consequences as a result of pesticide poisoning every year, according to the World Health Organisation.<sup>3</sup>

The term pesticide refers to any chemical substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest." FIFRA's definition of pesticides includes plant growth regulators, defoliators, and desiccants.<sup>4</sup> Pesticides production is monitored by stringent regulatory mechanism that ensure minimal impact on human and environment health; serious health risks as a result of occupational exposures, as well as residues in food and drinking water, have been raised.

A wide variety of pesticides are widely used in citrus, vegetable and other crop areas in order to enhance agricultural production, including organochloride, bio-phosphorus, carbamate and pyrethroid insecticides, fungicides and herbicides.<sup>5</sup>

Pesticide poisoning is a major global health problem and is more prevalent in countries like India. It has a well-established adverse effect on humans in the form of acute and chronic toxicity due to pesticide. Chronic exposure has, moreover, been linked to the other health problems described in several publications, for example, polyneuropathy, dermatitis, compartmental changes, and cancer. Accidental chronic toxicity due to failure to implement adequate preventive measures during spraying is known, but few studies in this regard have been conducted. Most of the insecticide exposure workers on the farm are illiterate, with insecticide absorption through the skin, breathing or oral tract, which can cause acute toxicity and are unaware of the necessary toxic effects and preventive measures. Long term exposure to sub-toxic doses leads to harmful effects on different systems, for example. Neurotoxicity, toxicity to neuro-endocrines, cancer, etc.<sup>6</sup>

The Occupational Safety and Health Administration (OSHA) reports that 243 agricultural workers every day experience a severe loss of working time injury. Five percent of the wounds are permanently affected. In 2010, the loss rate was 20 percent higher for agricultural workers than for all employees. This is a reasonable calculation because many other incidents are never recorded and many injuries are attributed to underreported family members. Many agricultural and ranch injuries could be prevented or reduced by the use of personal safeguards by farmers.<sup>7</sup>

Pesticides have caused deaths, and debilitation across India, either through self-poisoning, deliberate or accidental poisoning. Within the easy of reach of the depressed and stressed persons, pesticides have become a causal factor in the loss of numerous lives, of agricultural works, women, girls, boys, and children.

The purpose of this study was to find out the perceptions & practices followed by agricultural workers from study area with regard to use of pesticides and to determine the morbidity pattern with regard to pesticide use.

## METHODS

After obtaining approval from Institutional Ethical Committee a community-based cross-sectional study was carried out in three villages which were adopted by the institute for various community related activities. Study was conducted from July 2019 to Feb 2020. Written informed consent was obtained from each study participants before the start of interview.

### Sample Size and Sampling Method

The sample size was calculated by using sample size formula.

$$n = \frac{X^2 \cdot N \cdot P \cdot (-P)}{C^2 (N-1) + X^2 P (1-P)}$$

Where,

Total population of all villages = 19539 (census 2011)

X<sup>2</sup> = chi-square value for 1 df at 5% level of significance = 3.84

P = 50 % proportion = 0.50

C = Confidence interval of one choice (95 % CI) = 0.05

$$N = \frac{3.84 \times 19539 \times 0.50 \times 0.50}{0.05^2 \times 19539 + 3.84 \times 0.50 \times 0.50}$$

$$= 376.59$$

Hence, rounding up the sample size for the study was 380. The study participants to be interviewed from each village was determined by using sample in proportion to population of each village. The list of eligible participants as per inclusion criteria was obtained from Gram panchayat office which was utilised as sampling frame and the estimated numbers from each village were achieved by using simple random sampling method.

Sl. No.	Village Name	Population (Census 2011)	Sample in Proportion to Population
1	Umari (Meghe)	7916	154
2	Waigaon (Nipani)	8154	159
3	Salod	3469	67
<b>Total</b>		<b>19539</b>	<b>380</b>

*Table 1. Distribution of Villages under Study*

### Study Participants

Agricultural workers > 18 years of age working in their own farm or other's farms for more than 1 year and who are using pesticides were included in the study. Agricultural workers who were not willing to take part in the study were excluded.

### Study Tool

A pre-designed and semi-structured questionnaire was prepared, edited and modified and finalized as per inputs of piloting, the finalized tool was validated by the project guide and implemented for data collection using interview technique. Data collection was done by principal investigator to avoid inter-observer bias & the final tool comprised of following components

- Socio-demographic profile of the agricultural workers included age, sex, education, total family income, mode of farming etc.

- Perceptions & practices regarding the use of pesticides.
- Health hazards reported by agricultural workers after using pesticides.

**Statistical Analysis**

Data collected was entered into Microsoft excel spreadsheet and data were analysed by using Epi Info statistical software. Percentage & proportions were calculated for descriptive statistics and association was tested using chi square test.

**RESULTS**

Characteristic	n = 380	%	
Education	Illiterate	51	13.42
	Primary school	119	31.31
	Middle school	133	35
	High school	51	13.42
	Higher secondary school	19	5
	Graduate	5	1.31
Age	Post Graduate	2	0.52
	18 - 37	113	29.74
	38 - 57	187	49.21
Type of Family	58 >	80	21.05
	Joint	182	55.26
Mode of farming	Nuclear	132	41.31
	Three generation	13	3.42
Socioeconomic status (Modified BG Prasad scale)	Full time	272	71.57
	Seasonal	108	28.42
Socioeconomic status (Modified BG Prasad scale)	Class - 1	12	3.15
	Class - 2	37	9.73
	Class - 3	162	42.63
	Class - 4	169	44.47

**Table 2. Socio-Demographic Details**

The above table shows the socio-demographic details of the present study participants. About 35 % of the study participants were educated up to middle school followed by 31.31 % educated up to primary school.

While only 2 participants were educated up to post-graduate level. Maximum 49.21 % study participants belonged to the age group of 38 to 57 years and 21.05 % study participants were of age more than or equal to 58 years. When asked about the type of family, it was found that about 55.26 % were living in the joint family while, only 3.42 % were living in three generation family. About 3 / 4<sup>th</sup> of the study participants were having full time farming. When asked about socio-economic status, it was observed that about 44.47 % study participants belonged to class 4 socio-economic status by Modified B.G. Prasad classification.

Think Pesticides are Harmful	n	%
Yes	243	63.94
No	137	36.05
<b>Pesticide Entry in Human Body</b>		
Through Skin	33	8.68
Inhalation	39	10.26
Oral	9	2.36
Eye Contact	8	2.10
All of the Above	5	1.31
Don't Know	286	75.26
<b>Read, Understand and Follow Label on Pesticides</b>		
Always	170	44.73
Never	186	48.94
Some Time	24	6.31
<b>Hand Washing Practices</b>		
Wash Hands Using Soap	162	42.63
Wash Hands Using Plain Water	214	56.31
Don't Wash	4	1.05

**Table 3. Knowledge & Perception Regarding Pesticide Use**

From the above table we came to know that about 63.94 % study participants were having knowledge that pesticides are harmful. But, about 75.26 % were not having knowledge regarding the way of entry of pesticide in the human body. While, 10.26 % study participants told that pesticide enter body through inhalation and about 8.68 % study participants told that pesticides enter the body through skin. When asked about reading the instruction on the pesticide label, it was found that maximum 48.94 % study participants never read the instruction. While, about 44.73 % study participants always read the instruction and about 6.31 % study participants read it sometime. Also, it was found that maximum 56.31 % study participants washed their hand with plain water after pesticide use and about 1.05 % did not even wash their hands. While, about 42.63 % study participants washed their hand with soap.

Symptoms	n	%
Headaches	198	52.10
Dizziness	32	8.42
Skin Irritation	168	44.21
Nausea	139	36.57
Itchy Eyes	121	31.84
Vomiting	89	23.42
Coughing	105	27.63
Shortness of Breath	18	4.73
Excessive Sweating	27	7.10
Fatigue	123	32.36
Stomach Ache	11	2.89
Blurred Vision	105	27.63

**Table 4. Toxic Effects of Pesticide Use**

When asked for the toxic effects from the pesticide use, maximum 52.1 % study participants complained about having headache followed by 44.21 % having skin irritation. About 36.57 % study participants experienced nausea, 31.84 % had itchy eyes & 32.36 % had fatigue. While, only 4.73 % & 2.89 % study participants were having shortness of breath & stomach ache respectively.

Variables	Think Pesticides are Harmful		X <sup>2</sup> & P-Value
	Yes	No	
Gender	Male	201 (61 %)	Fisher Exact Test applied p = 0.012*
	Female	42 (79 %)	
Age	18 - 37	65 (58 %)	X <sup>2</sup> = 11.124 p = 0.004*
	38 - 57	123 (66 %)	
	58 >	55 (69 %)	
Education	Illiterate	6 (12 %)	X <sup>2</sup> = 22.853 p < 0.001*
	Primary, Middle, High & Higher Secondary School	172 (68 %)	
	Graduate, Post Graduate	80 (32 %)	
	Graduate, Post Graduate	7 (100 %)	
Socio-economic Status	Class - 1	9 (75 %)	X <sup>2</sup> = 66.733 p < 0.001*
	Class - 2	3 (25 %)	
	Class - 3	32 (86 %)	
	Class - 4	5 (14 %)	
Socio-economic Status	Class - 3	99 (61 %)	p < 0.001*
	Class - 4	63 (39 %)	

**Table 5. Association between Socio-Demographic Details & Perception of Harmful Effects of Pesticide Use**

Out of all males, about 61 % & out of all female study participants, about 79 % thought pesticide were harmful for the human being. The association between gender & thinking of pesticides being harmful was found to be statistically significant (p-value = 0.012). When compared with the age, it was found that of all age groups more than half of the study participant thought pesticide as harmful and the association between age group & perception regarding harmfulness of the pesticide were found to be statistically significant (p-value =

0.004). All the study participants educated up to graduation & post-graduation thought that pesticide are harmful, while about 88 % of those who are illiterate did not think pesticide as harmful. The association between education & perception of study participants regarding harmfulness of pesticide were found to be statistically highly significant ( $p$ -value < 0.001). Thus, we can say that more the education of the person, better is the perception regarding the harmfulness of the pesticide. Also, out of all study participants belonging to class 1 about 75 % thought pesticides were harmful. While out of all study participants belonging to class 3 & 4 about 39 % each did not think pesticide as harmful. The association between socio-economic status & perception of study participants regarding harmfulness of pesticide was found to be statistically highly significant ( $p$ -value < 0.001) indicating better the socio-economic status better the perception regarding pesticide.

## DISCUSSION

In the present study, 380 participants participated in the study out of which 327 were males and 53 were females with age group 18 - 27 year (6 %), 28 - 37 year (23.68 %), 38 - 47 year (29.73 %), 48 - 57 year (19.47 %), 58 - 67 year (15.78 %), 68 - 77 year (4.21 %), and 78 year or above (1.05 %). (Un-tabulated data)

Similar results was found in a study done by Ali Javed, et al which showed 15 - 30 years (54 %), 30 - 45 years (30 %) and 45 or above (14 %) age range in Karachi.<sup>8</sup>

In the present study, 13.42 % participant were illiterate, 86.58 % participants were educated in which 31.31 % educated up to primary school, middle school (35 %), high school (13.42 %), the higher secondary school (5 %), graduate (5 %), postgraduate (0.52 %).

In the current study, 55.26 % of participants belonged to the joint family, 41.31 % belonged to the nuclear family and 3.42 % belonged to the three-generation family. 71.57 % of participant used to do full-time farming and 28.42 % participant used to do seasonal farming. Study done by Norkaewl Saowanee et al<sup>9</sup> on knowledge, attitude, and practice of using Personal Protective Equipment (PPE) for chilli growing farmers in Huarua sub-district, Mueang district, Ubon Ratchathani province, Thailand they found that 53 % study participant were males and 47 % were females. There were 3 % never educated, 71.2 % primary school educated, 15.2 % high school educated and 1.5 % of the participants had a bachelor's degree.

In the present study, we found that the majority of the participants had knowledge of pesticide about 63.4 % agricultural workers knew that pesticides were harmful, 58.15 % participant purchased pesticide from Krushi Kendra, 15.26 % participant from private shop and 26.57 % participant purchased from co-farmers.

In a study conducted by Bhanti et al<sup>10</sup> in rural block of Agra region found that 90 % farmers thought that pesticides are harmful, the difference in knowledge could be due to difference in socioeconomic background and literacy levels amongst study participants. This study shows that 36.31% of participant used sticks to mix pesticide while 45 % used bare hands for mixing (non-tabulated data). Almost 42.63 % of

study participants claimed to wash their hands with soap and 56.31 % participant with plain water after using the pesticide.

It was observed that in regards to storage practices of pesticides the majority of participants 126 (33.15 %) stored pesticides in the storeroom, 57 (15 %) stored pesticides outside the house and 197 (51.84 %) stored pesticides inside the house. Washing practices of pesticide equipment was found that the majority of 187 (49.21 %) participants were washing equipment on the farm 165 (43.42 %) were washing equipment outside the home and 28 (7.365 %) were washing equipment at home (non-tabulated data).

In a study conducted by MV Sai et al<sup>11</sup> knowledge and perception of farmers regarding pesticide usage in a rural farming village southern India found that most farmers (52.63 %) learned regarding pesticides by communicating with retailers while 25.73 % knew about it by interacting with co-farmers and 21.64 % used consultancies to make themselves aware. Almost all the farmers (93.57 %) claimed to wash their hands with soap after using pesticides. The difference in our study findings may be due to different socio economic and literacy levels.

In our study more than half of the study participants reported headache as major complaint followed by skin irritation in about 44.21 % participants while only 4.73 % and 2.89 % study participants were suffering from shortness of breath and stomach ache respectively. In a study conducted by Sunil Mittal et al<sup>12</sup> in Malwa region of Punjab concluded that there was a sharp increase in pesticide related cancers, reproductive disorders and mental retardation. The affected region and the most affected individuals were agricultural workers who were directly involved in pesticide handling.

We found significant association between literacy levels, socio economic status, gender and age groups and perception regarding harms caused by pesticides, this are similar to study done by Lekei EE et al<sup>13</sup> in villages in Tanzania where they found that respondents with higher education levels were significantly less likely to store pesticides in their home (PRR High / Low = 0.3 ; 95 % CI = 0.1 - 0.7) and more likely to practice calibration of spray equipment (PRR high / low = 1.2; 95 % CI = 1.03 - 1.4). However they found that knowledge of routes of exposure was not associated with safety practices particularly for disposal, equipment wash area, storage and use of personal protective equipment.

## CONCLUSIONS

About two thirds of the study participants thought that pesticides are injurious to health & environment. While only one fourth of the participants knew about of route of entry of pesticides into the body. A variety of toxic clinical symptoms associated with pesticide exposure including headaches, dizziness, skin irritation, nausea, itchy eyes, vomiting, coughing, shortness of breath, excessive sweating, fatigue, stomachache, and blurred vision were seen. Association between perception of harmful effects of pesticides and socio-demographic profile was found to be statistically significant indicating that socio-demographic profile had a crucial role in determining the perception regarding pesticides.

**Limitations**

- This cross-sectional study was conducted in only 3 adopted villages thus study finding may not be generalized for other settings; hence, external validity of study findings is limited.
- Many variables determining the perception and practices related to the use of pesticide & PPE are not sufficiently understood through quantitative studies and qualitative research is necessary to determine the behaviour pattern with regard to use of pesticides and PPE.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.

Financial or other competing interests: None.

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