

Assessment of Baneful Health Outcomes Caused by Exposure to Pesticides among Farm workers in selected villages of Chitradurga District

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Date of Submission: 01-08-2021

Date of Acceptance: 18-08-2021

ABSTRACT

Introduction: Farm workers use pesticides to eliminate or to control agricultural pests that can damage crops and reduce farm productivity. These pesticides are capable of causing occupational disease in farm workers.

Objective: The aim of the study was to assess the knowledge of farm workers about pesticides and safety measure that must be undertaken while handling pesticides and also to assess the prevalence of baneful health effects in farm workers caused by the exposure to pesticides.

Materials and methods: A prospective observational study was conducted on a total of 303 farm workers in selected 10 villages of Chitradurga district for a period of 6 months. Data was collected from farm workers during one to one interaction by using self designed questionnaire.

Results: A total of 303 farm workers including (76.6%) males and (24.3%) of females were enrolled into the study. Nearly (85.1%) were literates and (14.9%) were illiterates. It was found that only (5.6%) of the farm workers had satisfactory knowledge about the pesticides. The prevalence of baneful health outcomes caused by the exposure to pesticides was (48.9%) i.e. 1 in every 3 members exposed to pesticide will develop health issues. Almost (42%) of the farm workers didn't know the name of the pesticides they use. It was found that Insecticide (23%) was most commonly used followed by Fungicides (15%) and Pesticides (10.2%).

Conclusion: Even though most of the farm workers were educated they did not have adequate knowledge about pesticides and the safety measures that must be followed during the use of pesticides. Due to this nearly half of the study population were experiencing baneful health outcomes. Hence agricultural officers should

promote the use of PPE through education and by developing training tools.

Keywords: Farm workers, Health effects, Pesticides, Pesticide Protective Equipment

I. INTRODUCTION

Agriculture is considered as one of the sectors with noble employment and it employs more than 49% of the population in India. After independence there was gradual development in agricultural sector. Massive changes took place after two years of severe drought in 1965 and 1966, due to which agriculture policy was reformed, that paved way for Green Revolution and Yellow revolution. Today India is the second largest producer of wheat, rice, fruits, vegetables, fresh water aquaculture and largest exporters of spices and cashew. Karnataka is India's 8th large state and agriculture is the major occupation for a majority of rural population. As per the population census 2011, agriculture supports 13.74 million people.¹

To feed the fast growing population the agriculture production is increasing. The increase in agricultural production has led to the augmentation of the consumption of pesticides and fertilizers. The estimation by UN Food and Agriculture Organization states that in developing countries pests, weeds and disease destroy about 40% of the crops. To overcome this, utilization of pesticides and fertilizers has found to be increased.² Environment and social standard 5- Environmental and social management guidelines defines pesticides as any substance or mixture of substances of chemical or biological ingredients intended for repelling, destroying or controlling any pest or regulating plant growth.³ Farmers use pesticides to eliminate or to control a variety of agricultural pests that can damage crops and reduce farm productivity. There are different kinds of pesticides;

Herbicides- kill unwanted weeds.

Insecticides- kill insects. They include ovicides and larvicides.

Fungicides- kill parasitic fungi or their spores.

Rodenticides- kill rodents.

Bactericides-kill bacteria.⁴

These pesticides are capable of causing occupational disease in farm workers. Occupational exposure to pesticides are while loading, mixing, cleaning the equipment and disposing the empty containers. Other activities that cause exposure to pesticides are sowing pesticide preserved seeds, weeding, and harvesting previously sprayed crops. These exposures to pesticides cause various health effects in the farm workers. It also leads to acute and chronic poisoning conditions in the farm workers when proper safety measures are not undertaken while handling these agents.³This study aims at assessing the knowledge about the pesticides and safety measures that must be undertaken by farm workers, and also to assess the prevalence of baneful health effects in the farm workers caused by the exposure to pesticides in the selected villages of Chitradurga district.

II. MATERIALS AND METHODS

Study site: The study was carried out in the selected 10 villages of Chitradurga district. The villages were selected randomly according to the convenience.

The villages are: Kodenahatti, Medehally, Singapura, Annehala, Madakaripura, Chikkagondenahalli, Tamatakallu, Janakonda, Chikkappanahalli and Hireguntanuru.

Study approval: This study was approved by the “Institutional Human Ethics Committee” of S J M College of Pharmacy, Chitradurga, Vide no.IEC no: SJMCP/IEC-11/2019-20.

Study Duration: The study was carried out for a period of 6 months.

Study Design: A community based prospective observational study

Study Criteria: The study was carried out by considering following criteria

Inclusion Criteria:

- Farm workers using chemical crop protective agents.
- Farm workers with at least 6 months of experience.

Exclusion criteria:

- Farm workers using organic crop protective agents only.
- Farm workers with less than 6 months of experience.

Source of data:

- A questionnaire based study was conducted in the selected 10 villages of Chitradurga district.
- The questionnaire consisted questions to assess the basic demographic information, knowledge of farm workers regarding pesticide, work practices and safety measures undertaken by them, most commonly used pesticides and the prevalence of health effects in farm workers caused by exposure to pesticides.
- To ensure efficient data collection, the questionnaire was translated into Kannada.

Study Procedure:

- The study was carried out in the selected 10 villages of Chitradurga district after obtaining the Ethical Clearance from Institutional Human Ethics Committee.
- Informed consent was obtained from all the participants prior to enrolment in the study.
- The data was collected from farm workers in a suitably designed questionnaire during one to one interaction with them.
- Awareness about the safe use of pesticides was given to the farmers by means of information leaflets.

Statistics:

The collected data was entered in Microsoft Excel spreadsheet and the results were analysed by using SPSS 27. Descriptive methods were applied for the analysis of data.

III. RESULTS

1. Basic information

In this study 303 farm workers from selected 10 villages were included. Among them 232 (76.5%) were males and 71(23.4%) were females. Nearly half of the males (47.8%) were in the age group 31-50 and most females were in the age group 21-40. Larger part of the participants 258(85.1%) were literates. About 40.6% of them were farming from 10-20 years. Majority of the farm workers (89.4%) were using pesticides from 1-20 years and the mean years of pesticide usage was 11.10yrs. The Results are depicted in Table 1.

Table 1 Basic Information of the Participants (N=303)

Category	Variables	No. of Participants		Percentage	
Gender	Male	232		76.5	
	Female	71		23.4	
Years of farming	1-10	111		36.6	
	10-20	123		40.6	
	20-30	56		18.5	
	30-40	13		4.3	
Years of using pesticides	1-10	158		52.1	
	10-20	113		37.3	
	20-30	24		7.9	
	30-40	08		2.6	
Age group		Male	Female	Male	Female
	21-30	28	21	9.2	6.9
	31-40	78	20	25.7	6.6
	41-50	67	16	22.1	5.2
	51-60	49	14	16.1	4.6
	61-70	10	00	3.3	00
Education status		Male	Female	Male	Female
	Literates	193	65	63.6	21.5
	Illiterates	39	06	12.8	1.9

2. Assessment of knowledge about pesticides

Out of 1818 responses recorded (responses for questions Q1-Q6), 103(5.6%) of the responses show that farm workers have satisfactory knowledge about pesticides and 1715(94.3%) of the responses show that farm workers have unsatisfactory knowledge about pesticides. The results are shown in Table 2.1 and 2.2.

3. Assessment of knowledge about safe work practices to be followed while handling pesticides

Out of 3636 responses recorded (responses for questions Q7-Q18), 1915(52.6%) of the responses show that farm workers have satisfactory knowledge about safe work practices to be followed while handling pesticides and 1721(47.3%) of the responses show that farm workers have unsatisfactory knowledge about safe work practices to be followed while handling pesticides. The results are depicted in table 2.1 and 2.2.

Table 2.1 Assessment of Knowledge about Pesticides and Safe Work Practices

Sl. No.	Questions asked	Farm worker's satisfactory response(yes)		Farm worker's unsatisfactory response(no)	
		Frequency	Percentage	Frequency	Percentage
Q2	Are you aware about recommended pesticide against different pest?	5	1.7	298	98.3
Q3	Are you aware about recommended pesticide classification based on toxicity?	8	2.6	295	97.4

Q4	Are you aware that Monocrotophos is banned for use on vegetables?	71	23.4	232	76.6
Q5	Are you aware about the recommended pesticides against different pests?	5	1.7	298	98.3
Q6	Are you aware about the pesticide classification based on toxicity?	8	2.6	295	97.4
Q7	Do you use empty pesticide bottle for house/farm purposes?	12	4	291	96
Q8	Do you follow/undertake safety measures while storing/mixing/spraying pesticides?	297	98	6	2
Q9	Do you wash your hands after using pesticides?	303	100	00	00
Q10	Do you have separate set of clothes to wear while using pesticides?	70	23.1	233	76.9
Q11	Do you bath after using pesticides?	129	42.6	174	57.4
Q12	Do you read the directions for use and safety information mentioned on the pesticide container?	60	19.8	243	80.2
Q13	Do you eat/smoke/chew tobacco/beetle leaves while using pesticides?	129	42.6	174	57.4

Table 2.2 Assessment of Knowledge about Pesticides and Safe Work Practices

Sl.no.	Question asked	Farm worker's response	No. of responses	Percentage
Q1	What is pesticide?	Chemical that destroy insects	18	5.9
		Chemicals that destroy weeds and insects	219	72.3
		Chemicals that destroy bacteria, weeds and insects	47	15.5
		Chemicals that destroy fungi, bacteria, weeds and insects	5	1.7
		Chemicals that destroy	8	2.6

		rodents, weeds and insects			
		All of the above	6	2.0	
Q14	How you will receive information regarding the pesticide usage?	Directions for use mention on the pesticide container	28	9.2	
		Farmer help line center, number	9	2.9	
		From pesticide retailers	265	87.4	
		By experience	1	0.3	
Q15	How will you measure the pesticides?	Bottle Cap	154	50.8	
		Bare Hand	4	1.3	
		Spoon	98	32.3	
		Match Box	47	15.5	
Q16	How will you mix pesticides?	Stick	141	46.5	
		Plastic mug	71	23.4	
		Stick and Plastic mug	91	30.0	
Q17	Best first aid you follow	Induce vomiting if swallowed	67	22.1	
		Washing the affected area with water	22	7.3	
		Washing the affected area with soap water	207	68.3	
		All of the above	7	2.3	
Q18	What are the things you use to protect yourself while using pesticides?	Head cap and Nose mask	24	7.9	
		Head cap, Nose mask and Gloves	41	13.5	
		Head cap, Goggles and Gloves	04	1.3	
		Head cap, Nose mask, Gloves, Goggles, Shoes	02	0.7	
		Others(G)	Towel	158	52.1
			Plastic cover	05	1.6
		None of the above (reason)	It causes discomfort while working	03	1.0
			It makes difficult to perform the tasks	22	7.3
			Unavailability	30	10.0
			It brings additional costs	14	4.6

4. Most commonly used pesticides

Among 303 farm workers, (42%) did not know the names of the pesticides they were using. Insecticides were majorly used 70 (23.1%). Insecticide Chlorpyrifos was most commonly used

20 (6.7%), followed by fungicides 45 (14.8%) pesticides 31 (10.2%) herbicides 23 (7.5%) and bactericides 7 (2.3%). The results are depicted in figure no.1.

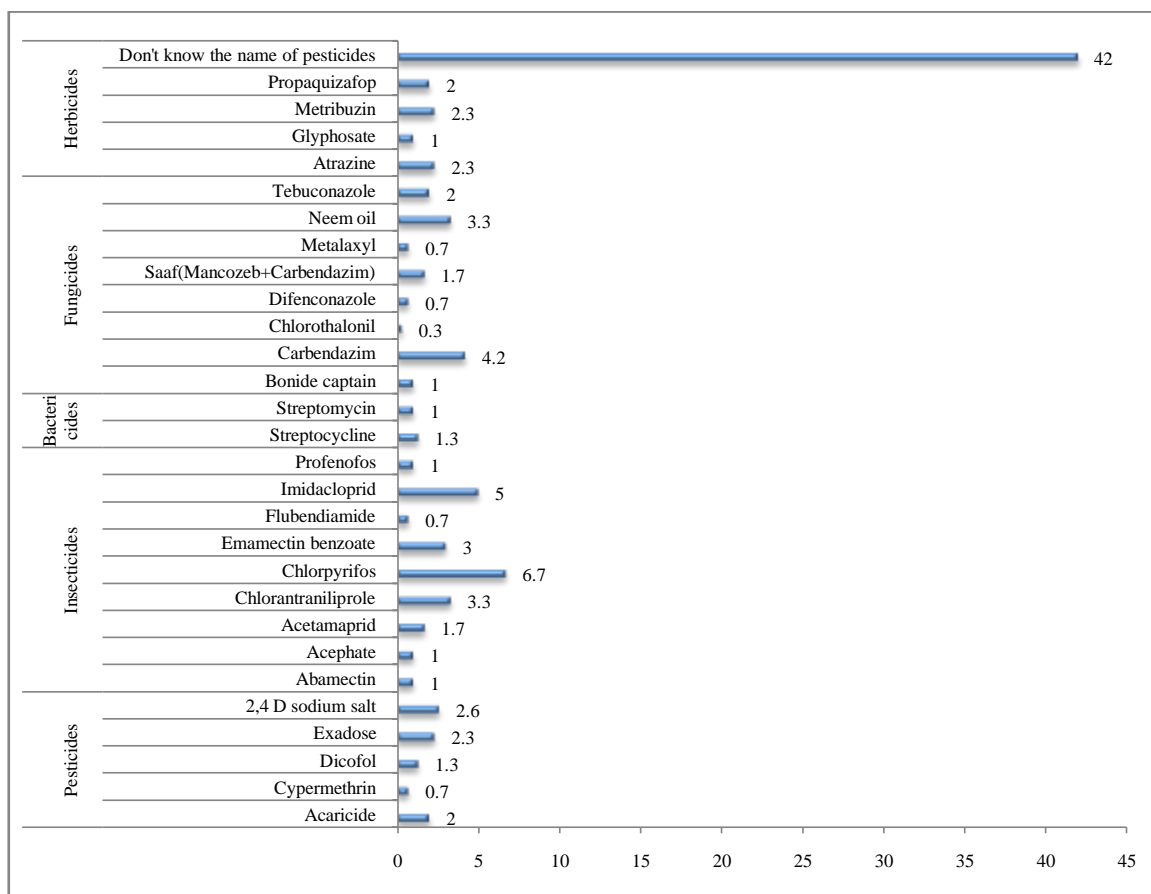


Figure no.1. Most commonly used pesticides

5. Assessment of prevalence of health effects

About 49.8% of farm workers reported that they had experienced health effects due to exposure to pesticides, among them only 11.2% of farm workers reported that they would consult doctor if the symptoms were serious. Skin irritation, eye irritation, nausea, bad odor and breathlessness were the symptoms reported by the farm workers and they had experienced more than two symptoms. Their duration of experience of

symptoms were from few minutes to few hours 36%, few hours to days 6.6%, days to weeks 3.2% and weeks to months 4%. The results are represented in table no.4.1 and graphically in figure no.2.

The prevalence of baneful health outcomes caused by the exposure to the pesticides is found to be 49.83% that is 1 in every ≈3 members exposed to pesticides will develop health issues.

$$\text{Prevalence} = \frac{\text{Number of population with disease at a given time}}{\text{Total number of population at a given time}} \times 100$$

$$= 151/303 * 100$$

$$= 49.83$$

Table 4.1 Assessment of Health Problem Caused by Pesticide Exposure

Question asked	Response given	No. of responses	Percentage
Have you observed pesticide's effect on health during storing/mixing/spraying pesticide?	yes	Consult doctor	17
		Ignore it	61
		Follow home	41
			11.2
			40.3
			27.1

If yes, what will you do if the symptom is serious?		remedies		
		Self medication	32	21.1
	no		152	50.2

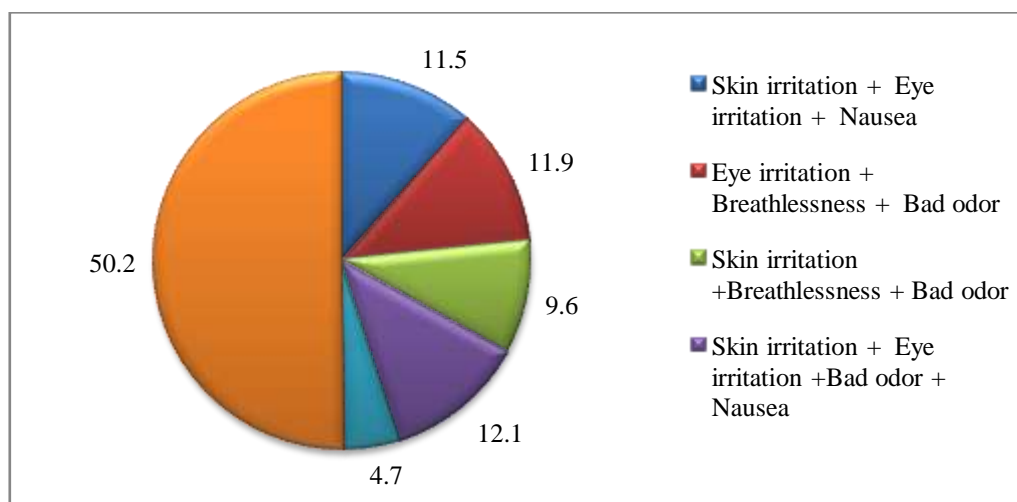


Figure no.2. Most common health problem observed during the usage of pesticides

IV. DISCUSSION

In recent times most of the farm workers are knowingly or unknowingly experiencing health effects caused by the exposure to pesticides due to improper or no use of safety measures while handling pesticides. Hence this study conducted to assess the prevalence of baneful health outcomes in farm workers caused by the exposure to pesticides.

Comprehensively 303 farm workers including 232(76.6%) males and 71(23.4%) females of age group (21-70 yrs) from 10 different villages of Chitradurga district were enrolled in the study. Majority of the study participants belong to age group (31-40 yrs) followed by (41-50 yrs). Education status was considered to assess their ability to read and understand labelling and other information regarding pesticides, and to educate them about safe use of pesticides. Out of 303 farm workers 258 (85.1%) were literates and 45 (14.9%) were illiterates. Our results were in line with the study conducted by Lamichhane R⁵ et al.,

About 71(23.4%) of farm workers were aware that monocrotophos was banned for use on vegetables and 141(46.5%) of farm workers used stick, 71(23.4%) used plastic mug and 91(30%) used both stick and plastic mug to mix pesticides.

Similar result was found in the study conducted by Vemuri S⁶ et al.,

When enquired "How you will receive information regarding the usage of pesticides" 4 (1.3%) of the farm workers replied 'Directions for use mentioned on the pesticides container (B)', 2(0.7%) replied 'Farmer helpline centre/number (c)', 241 (79.5%) replied 'From pesticides retailers' (0.3%) replied '(d) By experience', 2(0.7) replied 'B&C', 2(0.7%) replied 'B,C&D', 46 (15.2%) replied 'B&D' and 5(1.7) replied 'C&D'. A similar study was conducted by Shammi M⁷ et al., in which only (28%) of famers reported pesticides dealers as their source of information.

To prevent exposure to pesticides 2(0.7%) of farm workers used PPE, 24(7.9%) used 'head cap and nose mask', 41(13.5%) used 'head cap, nose mask and gloves', 04(1.3%) used 'head cap, goggles and gloves', 158(52.1%) used 'towel', 05 used 'plastic cover' and 69(30%) did not use any of the things. A similar study was conducted by Sai SVM⁸ et al., in which (58.48%) farmers used face mask commonly as safety ware.

Nearly half i.e. 151(49.8%) of farm workers observed pesticides effect on health during storing/mixing/spraying pesticides. Among them 17(11.2 %) replied that they will consult doctor if the symptom is serious. 61(40.3%) replied that

they would ignore the symptoms, 41(27.1%) replied they will follow home remedies and 32(21.1%) replied that they will take medication. Our result were in line with the study conducted by Sai SVM⁸ et al.,

Most commonly used pesticide was 'Insecticide' 42(13.6%) followed by 'Fungicide', 31(10.2%) 'Pesticides', 23(7.6%) 'Herbicide' and 7(2.3%) Bactericides. The widely used insecticides were chlorpyrifos and Imidacloprid. Widely used pesticide Exadose and 2,4 D sodium salt. Widely used fungicides were Carbendazim and Neem oil. Similar result was found in the studies conducted by Deviprasad GA⁹ et al., and Banerjee I¹⁰ et al.,

V. CONCLUSION

The outcome of this work reveals that insecticides were most commonly used followed by fungicides, pesticides, herbicides and bactericides. Nearly half of the study population did not know the name of the pesticides they use. Even though most of the farm workers were educated they did not have adequate knowledge about the pesticides and most of them were depending upon pesticide retailers for the information about pesticides.

The results of the study also exhibited that the prevalence of baneful health outcomes caused by the exposure to pesticides is nearly 50% that is 1 in every three members exposed to the pesticides will develop health issues owing to the practice of poor protective methods. Hence the agricultural officers should promote the use of PPE through education and by developing training tools. The agricultural department should design and distribute the PPEs that are easily adaptable by the farm workers. On regular basis the farm workers should be given training regarding safety ways of pesticide storage, application, methods, preparation and disposal after which the assessment must be done. Govt should make stringent policies on licensing for use and sale of pesticides also should design and enforce Community- Focused Exposure and Risk Screening Tool (C-FERST) for monitoring pesticide exposure in farm workers. Farm workers must also be motivated to use bio-pesticide and follow organic farming to reduce the dependency on chemical pesticides in addition it lessens the baneful impact of pesticides on human health and environment.

ACKNOWLEDGEMENTS

We are happy to express our deep sense of thanks and gratitude to the management of SJM College of Pharmacy, Chitradurga, Dr. Abubaker

Siddiq, Assistant Professor, Department of Pharmacology and Dr. Bharathi D R, HOD, Department of Pharmacology SJM College of Pharmacy for supporting us to carry out this work.

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