Impact of Pesticides on Farmer's Health of Western Odisha

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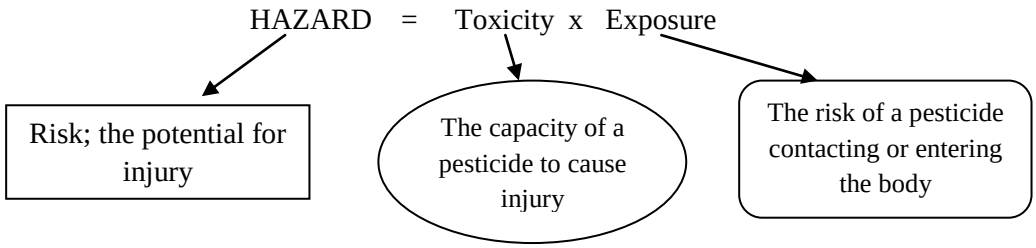
Abstract— *Agriculture is the basic need of human being to survive. Increase in human population, increases the food production. Largest areas are under rice cultivation. Rice plants were prone to attack by insect and pest. So, for its survival use of pesticide is necessary, but this had lead risk behaviour among rice farmers. The study was based on the farmers of Bargarh and Sundargarh District of Odisha regarding pesticide usage condition .100 farmers were interviewed from both the district, using questionnaire methods from February to April 2015. A questionnaire survey on personal history regarding agricultural labour, pesticide use and health history was conducted. Descriptive statistics was used for analysis of quantitative data. The most frequently used pesticides included organophosphates, carbamates. 2-3 times pesticide was applied after 15 days, after 1 month and also before the production time. Demographic data shows 87 respondents were male farmers rests were female farmers out of 100 respondents. Only 85 respondents were using sprayer for spraying pesticides out of 100 but 36 respondents were only using protective covers. 12 farmers only follow the instruction given on the pesticide container. 33 respondents have the knowledge of colour coding present in the pesticide bottle. Health symptom showed less frequently, in farmers using protective covers. Out of 100 respondents 58 had skin contact, 12 respondents suffer from eye irritation, and 28 respondents feel drowsiness after strong smell of pesticides while 31 farmers suffer from headache. Major factors of pesticide poisoning are due to lack of attention to safety precautions and lack of training before using of pesticide. So, training programme is necessary to improve safer pesticide behaviours, create more awareness among the farmers and also introduction of using bio pesticide instead of using pesticide.*

Keywords— Farmer, Health Impact of Pesticides, Pesticide Exposure.

I. INTRODUCTION

Agriculture is the backbone of Indian economy. 70% of people is engaged in farm sector directly or indirectly. There is rise in Indian population, which needs farm produce. So, in recent years the importance of sustainable agriculture has risen to become one of the most important issues in agriculture. In order to increase the production, addition of plant diseases and attack of insect pest continue to play a major limiting role in agriculture production. For controlling of this plant diseases and attack of insect pest, regular use of pesticides raises which leads to health impact. Pesticides are destroying the health and beauty of biosphere. The use of toxic pesticides to manage pest problems has become a common practice around the world. Pesticides are designed to kill and because their mode of action is not specific to one species, they often kill or harm organisms other than pests, including humans.

Pesticides have been linked to a wide range of human health hazards, ranging from short-term impacts such as headaches and nausea to chronic impacts like cancer, reproductive harm, endocrine disruption and nervous system (Alavanja et al.2004; Blondell et al.2007; Calvert 2008; Keifer et al.2007; MOPH 2009; Klein-Schwartz et al.1997; Weisenburger et al.1992; Winchester et al.1993; Robson et al. 2001). A July 2007 study conducted by researchers at the Public Health Institute, the California Department of Health Services, and the UC Berkeley School of Public Health found a sixfold increase in risk factor for autism spectrum disorders (ASD) for children of women who were exposed to organochlorine pesticides. In February 2009, the Agency for Toxic Substances and Disease Registry published a study that found that children who live in homes where their parents use pesticides are twice as likely to develop brain cancer versus those that live in residences in which no pesticides are used. Use of large amounts of pesticides has raised human health and environmental concerns (Hemmi & cool 1995). Siriwong et al. (2008) found ecological risk and contamination of human food sources from Organochlorines in this area. Over the past three decades, the indiscriminate use and improper handling of pesticides in agriculture have caused serious human health problems in many developing countries (Dasgupta et al. 2007). Incorrect dosage, incorrect timing and targeting, poorly maintained equipment, mixing with bare hands, lack of personal protective equipments and lack of hygienic precautions during and when spraying may result in acute poisoning (Abate et al. 2000). Approximately 2,20,000 workers die from pesticide exposure every year with the majority of deaths occurring in developing countries (WHO 1990; Rosenstock et al. 1990; Pimental et al. 1992).



II. OBJECTIVE OF MODULE

The present study deals with the agriculture practices of the farmers regarding pesticide use and its impact on farmer's health. To assess different types of chemical pesticides commonly used by the farmers. Recognizing and Reporting Pesticide-Related Illnesses and Injuries. To recognize the signs and symptoms of acute organophosphate, carbamate, and pyrethrins/pyrethroids poisoning. Assessment of farmer's perceptions of pesticide safety labels, pesticide handling and field spraying practices which might expose them to chemical Hazards and also to assess the impacts of pesticides on farmer's health.

III. STUDY AREA

Two districts namely Bargarh and Sundargarh of Western Odisha were selected for study area. Bargarh District lies on the western most corner of Odisha between 20 degree 43' to 21 degree 41' north latitude and 82 degree 39' to 83 degree 58' east longitude. The District is surrounded by Chhatisgarh state on the north, Sambalpur District on the east, Balangir and Subarnapur on the south and Nuapada District on the west. Bargarh District is known as the rice bowl of Odisha because of extremely paddy production. For this purpose Bargarh district is selected for study area. Sundargarh district is located between latitude 21 degree 36' N to 22 degree 32' N and longitude 83 degree 32' E to 85 degree 22' E. The population of this District is 2,080,664, this being the fifth most populous District of the state. Most of the people of this district depends on the rice production. For this purpose Sundargarh district is selected for study area.

MAP OF THE BARGARH AND SUNDARGARH OF WESTERN ODISHA

IV. METHODOLOGY

To study the long term health effects of pesticides, ecological method was used for comparison of two geographical regions, Case-control method used to see exposures of people with and without a health problem was noticed, Cohort method to follow the exposed people to see the health problem , Case series method used to know the cases seen by the doctors.

4.1 Field Survey

The field survey was conducted in February, March and April 2015. An interview survey was done using a questionnaire method regarding the personal history of agricultural labour, pesticide use and its impact on health. The research instruments

were health beliefs on pesticide use questionnaire and pesticide use behaviour questionnaire. The health beliefs on pesticides use questionnaire include severity, benefits of taking action and barriers to action in using pesticides.

4.2 Selection of sample households

In each of the two districts 50 households were selected who were engaged in rice cultivation and pesticide applicators. Thus, total sample consist of 200 households.

4.3 Stratification of sample households

For the construction of strata, cumulative square root frequency method was used (Singh et al.1995). The small farmers were those who had land up to 2.08 hectare and the large farmers having land more than 2.08 hectare.

4.4 4.4 Data Collection and analysis

The study is based on primary data. The primary data was collected using questionnaire through a personal interview. The data were collected on different aspects like farmers and family character, type of insect pest in rice plant, time and frequency of spraying pesticide, yield per year, health effect after using pesticide and Knowledge, Safety practice and attitude during pesticide handling and application. Some of the collected data had been analyzed by percentages only. The data were also collected from Government hospital of Sundargarh District and Private Hospital of Bargarh district to know the pesticide's impact on farmer's health.

V. RESULT AND DISCUSSION

Results in Table 1 show demographic data of the farmers. In general Men were more (87) as compared to female (13). Maximum falls in the age group of 31-50. 37 respondents were in the age group of 41-50 and 32 respondents were in the age group of 31-40. Maximum education level of the respondents was up to secondary school.

TABLE 1
DEMOGRAPHIC DATA

Characteristics (n=100)	Number
Gender	
Male	87
Female	13
Age (Years)	
≤ 30	4
31-40	32
41-50	37
51-60	19
> 60	8
Education	
Uneducated	0
Primary School	9
Secondary School	52
Under Bachelor Degree	22
Bachelor Degree & Higher	17

Maximum farmers fall in the large size category. 33 farmers from Sundargarh district and 41 farmers from Bargarh district were in large category of farmers i.e there agriculture land is more than 2.08 hectare but 17 farmers from Sundargarh districts and 9 farmers from bargarh district were in small category i.e there agriculture land is less than 2.08 hectare. (Table 2)

TABLE 2
FARM SIZE (HECTARE) CATEGORY OF SAMPLE HOUSEHOLDS

Category of Farmers	Land Holding (hectare)	Block and Sample size		
		Sundargarh	Bargarh	Total
Small	Upto 2.08	17	9	26
Large	> 2.08	33	41	74
Total		50	50	100

Different types of rice were used for cultivation. More than 50% of Puja, pratikhiya , 1001, 1010 and swarna were found to be used maximum but least number of Jui AND Sahabhagi is used which is less than 50%. It was found that these rice plants were attacked by different type of insect and pest. The rice plant was attacked by 21% of green horned caterpillar and yellow stem borer , 15% of brown leaf hopper, 13% of white plant hopper, 11% of caseworm, 10 % of green leaf hopper, 6% of mole cricket and 3% of rice leaf folder. (Table 3)

TABLE 3
TYPES OF RICE CROPS AND ATTACK OF INSECT PEST

Types of Rice Crops	Numbers	Types of Insect Pest	Numbers
Puja	94	Brown Leaf Hopper	63
Pratikhiya	89	Yellow stem borer	89
1001	83	Mole Cricket	26
1010	51	Rice leaf folder	13
Jui	17	Green horned caterpiller	92
Swarna	59	Green leaf hopper	43
Sahabhagi	46	Caseworm	48

Farmers were using pesticides for last 10 to 12 years. The 12 self-reported pesticides used by farmers were classified according to the WHO hazard grades (1990). All the pesticides fall in the category II which is slightly hazardous. 63% of Organophosphate + Pyrethroid and 68% Buprofenzin pesticides was used by maximum farmers as compared to others pesticides (Table 4). But now *****Acephate introduced in the year 2016 and it is used in broad spectrum. It is most effective for hiding insect. Most of the studies have shown extended use of class I pesticides in developing countries but the present study shows class II pesticides. Jors et al.(2006) in Bolivia found most of the farmers used Methamidophos pesticide, which is classified as highly hazardous class Ib. Also class I pesticide was found to be used by Vietnam farmers though many of them were banned (Dasgupta et al.2007). Keifer (2000) found that nevertheless class II pesticides are still classified as moderately hazardous and known to have severe negative effect on human health and Environment, So less dangerous alternatives should still be promoted.

TABLE 4
TYPE OF PESTICIDE USE BY FARMERS

Pesticide Name	Chemical Family	WHO Class	Number
Matador (Lambda- Cyhalothrin)	Pyrethroid	II	18
Superkiller	Pyrethroid	II	24
Doom	Pyrethroid	II	13
Classic 20 (Chlorpyrifos 20 % EC)	Organophosphate	II	44
Ulka 505 (Chlorpyrifos 50 % + Cypermethrin 50 %)	Organophosphate + Pyrethroid	II	58
Rocket 44 EC (Profenofos 40 % + Cypermethrin)	Organophosphate + Pyrethroid	II	63
Dichlorvos	Organophosphate	II	15
Caldan 4G (Cartap Hydrochloride)	Thiocarbamate	II	39
Demon Max (Cypermethrin)	Pyrethroid	II	6
Areva (Thiamethoxam 25%)	Neonicotenide		57
*Acephate	Neonicotenide		80
Buprofenzin	Insect growth regulator		68

WHO Hazard grades: moderately hazardous (II), Slightly hazardous (III) and unlikely to present acute hazard in normal use (U). No pesticides were classified as extremely hazardous (Ia) or highly hazardous (Ib)

Data reveals numbers of sprayer used, time of spray and whether the use of pesticides had any action on insect pest. 85 respondents use the sprayer for spraying pesticides but 15 don't use sprayer. 96% spray pesticide before flowering, 93% spray during flowering, 89% spray during fruiting due to the attack of insect pest. 96% respondents agree that using of pesticides controls insect and pest.(Table 5)

TABLE 5
PESTICIDE USE

Factors	Numbers			
Number Of Sprayer Used	85	√	15	×
Time of Spray				
Before Flowering	96 % (15 Days, 30 Days)			
During Flowering	93%			
During Fruiting	89%			
Do pesticides Kill insect pest				
Yes	96 %			
No	0			

From both the Sundargarh and Bargarh districts it was found that 64 respondents were non user of protective covers while spraying of pesticides but only 36 respondents use protective covers. Only 16% were using the full kit while spraying pesticides. Maximum farmers were using only towels in their head while spraying, but only 27 respondents use hand gloves and 8 respondents use full pant and full shirt. The main reason behind not using were, 42% respondent don't have interest in wearing, 13 % feel uncomfortable while wearing and 9 % thinks it is unnecessary to wear protective covers (Table 6). Abate et al. (2000) found that farmers and their families who don't use protective covers like gloves, masks or hats are at high risk of causing health problems.

TABLE 6
USE OF PROTECTIVE MEASURES WHILE SPRAYING

Particulars	No of respondents
User	36
Non User	64
Use of Kit	
Fully	0
Partially	16
Not Using	84
Measures Used	
Hand Gloves	27
Boots	0
Towels	31
Full pant and Full Shirt	8
Reasons for non-use	
Not interested	42 %
Uncomfortable	13%
Unnecessary	9%

Results show farmers perception about the effect of prolonged use of pesticides. 82 respondents thinks that pesticide have negative impact on health but 11 respondents have no knowledge on effect of pesticides.47 % respondents only follow the instruction on pesticide containers and colour coding while using it but 35 % don't follow and about 18 % respondents don't know at all that whether any instruction is given in the pesticide container (Table 7). Fig 1. Shows percentage of different degree of effects of pesticides according to farmer's perception. 49% respondents feels pesticides are very highly affected, 32 % response was very high, 13% very little but 6% feels pesticides were extremely affected. Yassin et al .(2002) found that due to lack of knowledge and practice on pesticide classification systems, application rates, re-entry periods, mixing and storage of pesticides , the farmers were unable to make good crop decision and exercise proper practices.

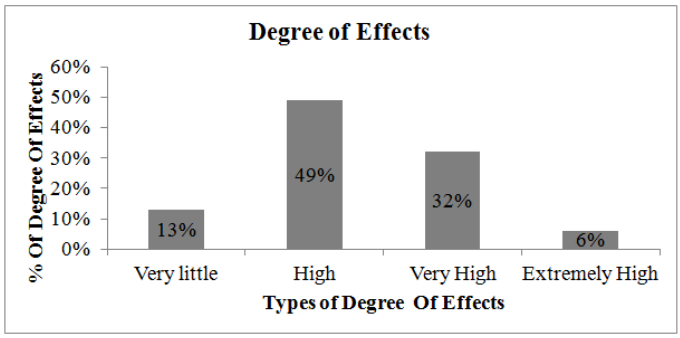


FIG 1: DEGREE OF EFFECTS

FIG 2

FIG 3

TABLE 7
FARMERS PERCEPTION ABOUT THE EFFECT OF PROLONGED USE OF PESTICIDES

Particulars	Numbers		
	Yes	No	Don't Know
Do you think pesticides can have negative effect on your health	82	7	11
Can you understand instruction on pesticide containers and colour coding	47	35	18

Maximum farmers suffer from skin irritation, Eye irritation headache and drowsiness while spraying pesticides. 7 respondents attack by paralysis, 13 respondents suffer from cancer and 5 respondents had neurological disorder. 87 % of respondents don't visit any hospital while effecting but only 23 % take medical treatment while effecting from pesticides only when it is severely affected (Table 8). Organophosphates and carbamates which were responsible for the most acute toxic symptoms was reported by Jors et al.(2006) and Ngowi et al.(2001). The main symptoms reported were skin irritation, headache, extreme tiredness, excessive sweating, blurred vision and dizziness which are consistent with other studies.

TABLE 8
PESTICIDE POISONING : SYMPTOMS OF PESTICIDES

Symptoms	Percentage Of respondents
Eye irritation	31
Headache	47
Drowsiness	28
Vomit	0
Skin irritation	58
Paralysis	7
Cancer	13
Neurological Disorder	5
Availing clinic facilities	
Yes	23 %
No	87 %

Some of the Case series were also reported form the Doctors of Government Hospital of Sundargarh district and private Hospital of Bargarh districts. The maximum symptoms found due to pesticides effects were, genetic disorder (chromosome mutation), fatal disease such as carcinogenesis (Carcinoma lungs, leukaemia, bone cancer).These all happens due to bio molecular changes, shortening of life, infertility, foetal developmental abnormalities and others variable features like decrease appetite, diarrhoea, skin changes, diffuse pigmentation, hair changes like texture may be modified, alopecia.

VI. CONCLUSION

The use of WHO class II grades pesticides and those of lower toxicity is seen in combination with inadequate knowledge and practices among the farmers and also lack of training for using pesticides. These pose a danger of acute intoxications, chronic health problems and environmental pollution. So, the findings after the questionnaire aim at improving pesticide safety behaviours and reducing pesticide exposure in farmers. Most of the research studies were carried on using of bio pesticides and integrated pest management (IPM) but farmers don't have any knowledge of using it. So, bio pesticide and IPM should be used for having a safe environment and healthy life.

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REFERENCES

[1] Abate T, Van HA, Ampofo JK. Pest management strategies in traditional agriculture: an African perspective. *Annu Rev Entomol* , 2000, **45**:631-659.
[2] Alavanja M, Hoppin J, & Kamel F. Health effects of chronic pesticide exposure: cancer and neurotoxicity. *Annu Rev Public Health*,2004, **25**:155–197.
[3] Blondell J M. Decline in pesticide poisonings in the United States from 1995 to 2004 *Clin Toxicol*, 2007, **45**:589–892.
[4] Calvert G M, Karnik J, Mehler L, Beckman J, Morrissey B, Sievert J, Barrett R, Lackovic, M, Mabee L, Schwartz A, Mitchell Y, & Moraga-McHaley S. Acute pesticide poisoning among agricultural workers in the United States, 1998–2005. *Am J Ind Med*, 2008, **5**:883–898.
[5] Dasgupta S, Meisner C, Wheeler D, Xuyen K, and Lam N T . Pesticide Poisoning of farm workers- implications of blood test result from Vietnam. *Int. J.Hyg. Environ. Health*, 2007, **210**: 121-132.
[6] Hemmi K, & Cool J C . Educating New Environmental Leadership for Asia. Arlington, VA: Winrock International Institute for Agricultural Development,1995.
[7] Jors E, Morant RC, Aguilar GC, Huici O, Lander F, Baelum J, Konradsen F. Occupational pesticide intoxications among farmers in Bolivia: a cross-sectional study. *Environ Health*, 2006, **5**:10.
[8] Keifer M C. Effectiveness of interventions in reducing pesticide overexposure and poisonings. *Am J Prev Med.* 2000, **18**:80-89.
[9] Keifer M C, & Firestone J.Neurotoxicity of pesticides. *J Agromed* , 2007,**12**:17–25.
[10] Klein-Schwartz W, & Smith G. Agricultural and horticultural chemical poisonings: mortality and morbidity in the United States. *Ann Emerg Med*, 1997, **29**:232–38.
[11] Ngowi AV, Maeda DN, Partanen TJ, Sanga MP, Mbise G. Acute health effects of organophosphorus pesticides on Tanzanian small-scale coffee growers. *J Expo Anal Environ Epidemiol*, 2001, **11**:335-339.
[12] Pimental D, Acquacy H, and Biltonen M . Environmental and economic costs of pesticide use. *Bioscience*, 1992, **42**:750-760.
[13] Robson M, Hamilton G, & Brachman G. Case study on chronic organophosphate poisoning. *New Solut* , 2001, **11**:243–249.
[14] Rosenstock L, Keifer M, Daniell W E, McConnell R, and Claypoole K . Chronic central nervous system effects of acute organophosphate pesticide intoxication. *Lancet*, 1991, **338**:223-227.
[15] Singh R, and Mangat N S . Elements of survey sampling. Kluwar Academic Publishers. London, 1995, 135.
[16] Siriwong W, Thirakhupt K, Sitticharoenchai D, Rohitrattana J, Thongkongowm P, Borjan M, & Robson M. A preliminary human health risk assessment of organochlorine pesticide residues associated with aquatic organisms from the Rangsit Agricultural Area, Central Thailand. *Human Ecol Risk Assess*, 2008, **4**:1086–897.
[17] Weisenburger D D. Human health effects of agrichemical use. *Human Pathology* 1993, **24**(12): 1383-6.
[18] WHO. Public health impact of pesticides used in agriculture, Geneva: World Health Organization, 1990.
[19] Winchester P d, Huskins J, & Ying J. Agrichemicals in surface water and birth defects in the United States. *Acta paediatrica*, 1992, 98:664–9.
[20] www.Knowledgebank.iiri.org
[21] Yassin MM, Mourad TA, Safi JM . Knowledge, attitude, practice, and toxicity symptoms associated with pesticide use among farm workers in the Gaza Strip. *Occup Environ Med*, 2002, 59: 387-393.