



Effect of Occupational Exposure of Pesticides on Health of Farmers of the Agricultural Fields of Sorbhug Area of Lower Assam

Ranjit Hazarika

Department of Zoology, M. C. College, Barpeta-781 315, Assam, India

Nat. Env. & Poll. Tech.
Website: www.neptjournal.com

Received: 14-6-2010

Accepted: 8-12-2010

Key Words:

Occupational exposure
Agricultural fields
Pesticide intoxication
health hazard

ABSTRACT

Background-Indiscriminate use of pesticides in the agricultural field is a matter of concern. This study was conducted in Sorbhug area of Barpeta district, Assam on 14 villages on the work practice, different types of pesticides used, and sign and symptoms of the illness of the agriculture workers who are directly exposed to pesticides. To assess the magnitude and intensity of occupational intoxication, the study was conducted on 150 volunteer farmers covering interview and clinical examination. Out of 150 farmers, 100 farmers were selected directly from the agricultural field and taken as exposed group, and 50 were selected as control group. Control group was engaged in agricultural activity other than spraying of pesticides. All the data were subjected to statistical analysis, and chi square test was performed for proportions and relative risk. P-value less than 0.05 was considered statistically significant. More than 60% of farmers used highly hazardous pesticides and 35% farmers used moderately hazardous pesticides. 5 % farmers used mild exposure of pesticide. They obtained pesticide related information from pesticide retail shop owner. They were reported to have the sign and symptoms of pesticide intoxication like high blood pressure (2%, RR=.41), asthma (20%, RR=.95), depression (73%, RR=1.5), running nose (30%, RR= 1.6), watery itchy eyes (60%, RR=1.5), dizziness (90%, RR=.68), loss of appetite (72%, RR=1.6), and feeling excessively angry (87%, RR= 1.2). The studies showed that the pesticide intoxications were common among the spray man of the agricultural workers. Pesticides pose probably one of the largest toxicological problems in the third world countries especially in India. Combined action of local authorities, society and international bodies may limit the pesticide related health hazards in these countries.

INTRODUCTION

Since pesticide are toxic chemicals, they pose a deleterious effect to the nontarget organisms including humans. The hazard from exposure depend upon the magnitude and severity of exposure as well as inherent toxicity of chemicals.

Pesticide applicators in agricultural field are at special risks, since they directly comes in contact of pesticides and absorb them through intact skin and clothing. Pesticide can also be readily inhaled into lungs and cause not only serious health hazard but also permanent damage to health. In those subjects, toxic effects were pronounced due to continued and severe exposure (Kishi et al. 1995).

Exposure of pesticide results in acute and chronic health problems. The acute effects like skin, eye irritation, headache, vomiting, skin irritation and chronic problems like cancer, reproductive problem, developmental disorder were observed in the field workers (Maroni et al. 2000).

For assessing the long term impact of these chemicals on the community, which is continually exposed to relatively small concentrations, a study has been undertaken to investigate the health hazards in pesticide applicators of agricultural field exposed to a combination of pesticides in the Sorbhug area of Barpeta district, Assam.

MATERIALS AND METHODS

Study area: The study area was agricultural farms of Sorbhug area of Barpeta district of Assam. Rice is the main crop in this area. The study is based on the information provided by extension officers and village level agricultural workers of twelve villages nearby the agriculture fields of the study area.

Interview questionnaire: Questionnaire was designed following Agricultural Health Study, National Institute of Agricultural Health (USA) (Alvesta (1996).

Interview reflects the type of plantation, pesticides used, work practice, occupational information, activity and physical information, medical history and toxic symptoms related to pesticide exposure. Some toxic symptoms were acute and some were chronic in nature. Insomnia, headache, nervousness, cramps, weakness, skin irritation, gastrointestinal problems, nausea, vomiting, stomach ach, watery and itchy eyes, irregular heart beat, depression and loss of appetite were the common acute symptoms. The chronic problems included heart disease, asthma, lung disease, diabetes, angina, high blood pressure, goiter, kidney stone, etc. A cross-sectional study was undertaken with details, sign and symptoms collected from the self study report by the farmers. From the

feed back of the interviewer, questionnaire was revised to improve the data collection (Erik Jars 2006). Pesticide applicators of agricultural field were selected randomly. One hundred and fifty (150) workers comprising of one hundred (100) exposed and fifty (50) control workers were interviewed from the middle of December 2009 to March 2010.

Sample size and selection: To find the exposed individuals, 100 farmers were interviewed in the field. The unexposed 50 subjects comparable with respect to age, sex and socioeconomic status but not occupationally exposed to pesticide were studied as control.

Data were entered in Excel (Version 4) and analysed with statistical software spss (Version 11.0). Relative risk (RR) values were calculated by chi-square test for proportion (where appropriate) and P-value less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Pesticide use: Pesticides used by farmers were BHC (10% dust), Lindane, Carbofuran (3% CG), Pretlacher (50% EC), Butachlor (50% EC), Endosulfan (35% EC), Cypermethrine (25% EC), Dimethoate (30% EC), Fenvalerate and Profanphos (Table 1).

Pesticides commonly used by farmers were classified by WHO as extremely hazardous (Ia), highly hazardous (Ib), slightly hazardous (III), moderately hazardous (II) and unlikely and acute hazard (II) (International Centre for Pesticide Safety 1999) (Table 1).

It is to be ascertained from the interview that whether or not 100 farmers are spraying pesticide in the field. All the worker were reported that they sprayed pesticide by themselves (sprayers). The remaining 50 worker were involve in other agricultural activities like replanting, watering, weeding, etc. (non sprayers).

Information sources of the farmers: 52.4% sprayers used mainly the retail shop owner as the information source of knowledge regarding the pesticides they used. 34.5%

farmers consult with other farmers. Only 13.1% sprayer consult with government or other agricultural authorities as their source of information.

Factors directly affecting sprayers: (a) Duration of exposure: The period of exposure ranges from a month (2-3 week in a month) in a year to 20 years or more. Majority (55%) of them spray pesticide more than 6 to 10 years (Table 2). (b) Habit of farmers during spraying: 35% farmers use protective equipment 10 years ago, but at present 45% farmers are using protective device at the time of spraying. 55% workers never used any protective device at present. 5% sprayers change cloths after mixing and applying pesticides. Arms (73%), hands (99%) and legs (58%) of the workers directly came in contact with pesticides. Faces of 33% and body of 29% workers come in contact with pesticide. 67% workers repair their own equipment and 31% workers have their home less than 100 meter from the field of application (Table 3).

Toxicity symptoms in farmers: The sign and symptoms related to pesticide exposure were included in the questionnaire. The sprayers were asked whether they experience the symptoms during and immediately after pesticide spray. The symptoms mentioned here were reported by large number of workers. From the clinical examination, it was confirmed that the symptoms developed after spraying were weakness in arms and legs (30%), insomnia (33%), watery and itchy eyes (6%), blurred vision (1%), skin disease (skin redness 9%), vomiting and nausea (69%), loss of appetite (72%), nervousness (69%), depression (73%), feeling excessively angry (87%), chronic disease like fast heart rate (39%) and asthma (20%).

Toxicity symptoms of the exposed group are given in Table 4. It shows that relative risk (95% confidence limit) were above 1 in the symptoms like loss of appetite, shaking of heart, difficulty in balance, watery and itchy eyes, depression, flu, stuffy and running nose, feeling excessively angry and being absent minded using combination of pesticides more than 10 years.

Table 1: Classification of pesticides according to WHO and their used by farmers in Sorbhug, Assam.

Sl. No.	Chemical name of pesticide and composition	Group	Percentage used by farmers	WHO's classification
1	Endosulfan 35% EC	O.C.	36%	II
2	Lindane and r-HCH 6.5% WP	O.C.	11%	II
3	Dimethoate	O.P	37%	II
4	Carbofuran 3% CG	Carbamate	60%	1b
5	Cypermethrine 10% DC	Synthetic Pyrethrums	73%	II
6	Pretlacher 40%	Herbicide	7%	II
7	Fenvalerate Product 50% EC	Herbicide	47%	II

O.C = Organochlorine, O.P=Organophosphate

Table 2: Distribution of exposed subjects in relation to different pesticides as per duration of years.

S. No.	Name of pesticide	Very mild (less than 1 year)	Mild (2-5 years)	Moderate (6-10 years)	Heavy (11-20 or more)
1	Cypermethrine product	0	28 (73.68%)	40 (72.72%)	5 (71.42%)
2	Carbofuran product	0	23 (60.52%)	33 (60%)	4 (57.14%)
3	Profenfosse product	0	1 (2.63%)	2 (3.63)	0 (0%)
4	Endosulfan product	0	5 (13.15%)	6 (10.91%)	1 (14.28%)
5	Lindane&BHC product	0	5 (13.15%)	6 (10.91%)	0 (0%)
6	Dimethoate product	0	4 (10.52%)	29 (52.72%)	4 (57.14%)
7	Triazophose product	0	3 (7.89%)	5 (9.09%)	2 (28.57%)
8	Fenvalerate product	0	25 (65.78%)	31 (56.35%)	1 (14.28%)

Figures in parentheses indicate number of percentage studied.

Table 3: Distribution of pesticide applicators in relation to their work practice.

S. No.	Work place	Within 12 month (n=100)	10 yr before (n=30)
1	Insecticides mixed or applied using protecting device	45 (45)	!7 (56)
2	Never used any protective equipment	55 (55)	28 (93.34)
3	Using cloth cover the face as an protective equipment	40 (40)	2 (6.6)
4	Using cloth all over as an protective equipment	15 (15)	0 (0)
5	Right away change in to clean cloth after mixing or applying pesticides	5 (5)	4 (13.34)
6	At the end of the work changing cloth after mixing applying or applying pesticide	24 (24)	5 (16.47)
7	Hands come in to contact with pesticide	99 (99)	30 (100)
8	Arms come in to contact with pesticide	73 (73)	29 (96.6)
9	Legs come in contact with pesticide	58 (58)	28 (93.3)
10	Face come in to come into contact with pesticide	33 (33)	28 (93.3)
11	Body come in to come into contact with pesticide	29 (29)	28 (93.3)
12	Hand/arms washed right way or applying pesticide	10 (10)	3 (10)
13	Complete bath at the after applying or mixing with pesticide	12 (12)	5 (16.67)
14	Complete bath mixing or applying pesticides	8 (8)	4 (13.4)
15	Complete bath at the end of the day after mixing with pesticide	10 (10)	3 (10)
16	Pesticides store in home	70 (70)	16 (53.34)
18	Pesticide stored in attested out building	30 (30)	14 (46.67)
19	Repair own spraying machine	67 (67)	25 (83.34)
20	Less than 100 meters far in the home from the nearest field where pesticide are applied	31 (31)	9 (83.34)
21	200 to 199 meter far is the home from the nearest field where pesticide are applied	23 (23)	7 (23.34)
22	100 to 299 meter far is the home The nearest field where pesticide Are applied	18 (18)	6 (20)
23	3to 5 hours spend lifting or carrying heavy objects during a typical days in a growing season	20 (20)	10 (33.34)
24	6 to 10 hours spend lifting or carrying heavy objects during a typical days in a growing season	51 (51)	12 (40)
25	More than 10 meters spend lifting or carrying heavy objects during a typical days in a growing season	29 (29)	8 (26.67)

Figures in parentheses indicate percentage.

The use of wide range of pesticides highly hazardous and moderately hazardous for the long term is a matter of concern. About 65% farmers used these type of pesticides, which are banned in developed countries (Gupta 1984). Extremely hazardous pesticides should not be used. Moderately hazardous pesticide should be avoided in these countries. But in India, both the types of pesticides are generally used by common farmers (Grace Chitra 2006).

The situation is that more than 70% sprayers use pesticides, either not registered for use in India or restricted by law of Govt. of India or International law. Pesticides of all kinds are sold to everyone on the street and in shops where salesman mostly sale the pesticide without license as

observed by Erik Jar (2006).

Pesticides are, sometimes, keep next to food stuff. This not only contaminate the foot stuff and environment, but also cause accidents and self harm. Pesticide use is common method of suicidal attempt (Helen 1999).

Most of the farmers in the society are not aware of health hazards caused by pesticide (Maroni et al. 2000). The use of protective clothing was common among them. Studies show that the wet cotton clothes due to sweat absorbed more pesticides. Smoking at the time of spraying to reduce the nauseating feeling is also hazardous as reported by Chitra Grace et al. (2006) and Antonella et al. (2001). Though 24% farmers change cloths after mixing or applying pesticides, but

Table 4: Prevalence of sign and symptoms and relative risk, among exposed and non exposed groups.

S. No.	Toxicity symptom	Exposed applicators N=150	Un exposed applicators N=50	Relative Risk	95 % CL
1	Irregular heart beat	2 (2)	0	0.784	1.40-1.952
2	High blood pressure	2 (2)	5 (10)	0.4169	0.1285-1.3521
3	Fast heart rate	39 (39)	11 (22)	0.945	0.746-1.197
4	Asthma	20 (20)	11 (22)	0.959	0.7183-1.282
5	Rheumatoid arthritis (joint pain)	37 (37)	29 (59)	0.7474	0.584-0.956
7	Vomitting	69 (69)	17 (34)	0.877	1.2503-2.177
8	Loss of appetite	72 (72)	19 (38)	1.667	1.2498- 2.224
9	Shaking of head	3 (2)	-	1.340	1.235-1.453
10	Difficulty in sleeping	3 (3)	1 (2)	1.59	1.104-2.09
11	Weakness in arms	30 (30)	29 (58)	0.6610	0.502-0.870
12	Difficulty in balance	6 (4)	-	1.240	1.240-1.463
13	Watery of itchy eyes	60 (40)	-	1.555	1.374-1.759
14	Blurred vision	1 (1)	1 (2)	0.7474	0.186-3.00
15	Dizziness	90 (90)	41 (82)	0.6828	0.398-1.168
17	Nervousness	69 (69)	17 (34)	0.877	1.259-2.177
18	Depression	73 (13)	22 (44)	1.565	1.70-2.09
19	Flu	30 (30)	13 (26)	1.479	0.201-1.74
20	Stuffy running nose	30 (30)	23 (46)	1.213	1.006-1.462
21	Feeling excessively angry	87 (87)	40 (80)	1.211	0.831-1.767
22	Being absent minded	7 (7)	1 (2)	1.33	1.001-1.781

Figures in parentheses indicate percentage.

they did not take any bath after operation. So, 58.4% worker's hands, face, arms and legs come in contact with pesticides at the time of spraying. As many are unwilling to follow the necessary precautions attributing nonavailability or high cost of personal protection equipments. Prevailing hot and humid weather is also another cause of pesticide absorption.

Similar observations were also recorded by Mancini et al. (2005) and Hoppin Jan et al. (2002) elsewhere, and among the farmers of Indonesia (Helen H Murphy et al. 1999) and Bolivia (Eric Jars et al. 2006). 67% farmers repairing their own equipments without proper knowledge. This may affect spraying and pollute the environment subsequently. Sometimes, farmers spray pesticide less than 100 meters around the home. Particles of pesticides contaminate whole environment, which affect the farmer families. The re-entry of farmers into the field, after pesticide spraying within 24 hours for another activity other than spraying in the field, can lead to direct exposure as the particles of pesticide still dispersed in air. Humidity, temperature, direction of wind may be other factors of pesticide intoxication. Young people engaged in spraying more than older people may be due to the possible attribution of elderly workforce (Kishi et al. 1995).

Chronic diseases like hypertension, ophthalmic disorder, asthma, heart problem, cataract, etc. prevalent among the farmers are associated with long term exposures of pesti-

cides. The farmers are not aware of their chronic diseases as they have not checked up their health. Reporting of these diseases may be based on short term examination or self reported data (Lakew 1997). Workers reported that at the time of spraying they suffer from various toxic symptoms related to pesticide exposure. Symptoms were frequently observed in highly exposed groups in relation to control group where these symptoms were not seen. This implies that the short term disease may be due to the pesticide exposure (Hazarika 2006, Eric Jars et al. 2006, Murphy et al. 2006, Chitra Grace et al. 2006, Lakew 1997). Less acute toxic symptoms in non-sprayers of pesticides as compared to sprayer group were also reported by Solomon (2000).

The present study shows that occupational exposure of pesticides common among the farmers and intoxication is related to the intensity of exposure. Relative risk from the exposure of pesticide was measured in this study along with 95% CL (Table 4). Such type of study was also carried out by Grace Citra et al. (2006).

The farmers have a very little knowledge of toxic effects of pesticide, pollution legislation and protective measures as observed in this study. Similar findings were recorded by Murphy et al. (1999).

Use of organic pesticides in the Sorbhug area of Barpeta district is a matter of concern. NGOs and government agencies should come forward to organize meetings and workshops about toxic effects of organic pesticides to train the

farmer for using biopesticides, and to encourage for organic farming.

ACKNOWLEDGEMENT

The author is thankful to UGC, New Delhi for financial assistance to complete this work.

REFERENCES

- Alvesta, M.C.R. 1996. Farmers applicator questionnaire coded manual PDF version of the Questionnaire OMB# 0925-0406 PHS. Washington D.C 20503.
- Antonella, F., Bent Iverseb, Manuela Tiramani, Saravisentin and Marco Marnoni 1997. Preventing health risk from the use of pesticide in the agriculture protecting workers health. Series Edited by International Centre for Pesticide Safty, WHO, Genera.
- Erik Jars, Rafael Cervantes Morant, Guido Condarco Aguitar, Omar Meici, Flemming Lancer, Jasper Bailum and Flemming Konradsen 2006. Occupational pesticide intoxications among farmers in Bolivia a cross sectional study. *Environmental Health, A Global Access Science Source*. <http://www.ehjournal.net/content/5/1/10>.
- Grace Chitra A., Muruleedharan, V.R., Swaminathan, T. and Veeraraghavan, D. 2006. Use of pesticide and its impact on human health – A case of farmers in south India. *Int. Journal of Occupational Environmental Health*, 12(3): 228-32.
- Gupta, P. K. 1984. Toxicology of Pesticides: A review of the problem. In: *proc.sem.effect Aq. Fau.*, 19-36.
- Hazarika, R. 2006. Health surveillance in the workers of Barpeta Road area of Barpeta District, Assam, India. *Nature Environment and Pollution Technology*, 5: 469-472.
- Hoppin, Jane, A., David, M., Umbach Steptianie, J. London, Alavanja Michael, C. R., Dale, P. and Sandler, J. A. 2002. Chemical predictors of wheeze among farm pesticide applicator in the agricultural health study. *Am. J. Respir. Crit. Care. Med.* 165: 168-169.
- International Centre for Pesticide Safety 1999. The consequences of reducing the use of pesticide have now been clarified. *Pesticide Safety News*, 2(3): 1-7.
- Kishi, M., Hirschhorn, N., Dijajadisastra, M., Satterlee, L.N., Strowman, S. and Dilts, R. 1995. Relationship of pesticide spraying to signs and symptoms in Indonesian farmers. *Scan. J. Work. Environmental Health*, 43: 124-33.
- Lakew, K. Mekonney 1997. Use of pesticide and casual factor of poisoning, a study among agricultural workers in the Ethiopia. *Afr. News Letter on Occupational Health and Safety*, 7: 68-70.
- Mancini, F., Van Braggen, A.H.C, Jiggins, J.L.S., Ambatipudi, A.C. and Murphy, H. 2005. Acute pesticide poisoning among female and male cotton grower in India. *Int. J. Occup. Environ. Health*, 11: 221-232.
- Maroni, M., Colosio, C. and Fai A. Vinsentins 2000. Occupation exposure to pesticide in the developing world - Health effect and strategies. *Asian-Pacific News Letter*, 6: 68-71.
- Murphy Helen H., Arik Sanusl, Russell Dilts, Marlinda Diajadisastra and Narbet Hirschhorn 1999. Health effect of pesticide use among Indonesian woman farmer, Part I. Exposure and acute health effects. *J. of Agronomics*, 6(3).
- Solomon, G., Ogunseitan, O.A. and Kirsch, J. 2000. Pesticide and human Health: A resource for health care professionals. *Physicians for Social Responsibility and Californians for Pesticide Reform*, 79 May.