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Research Article

RISK EXPOSURE OF AGRO CHEMICALS AND INTERVENTION AMONG AGRICULTURAL WORKERS TO REDUCE HEALTH HAZARDS

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Abstract: Globally the use of pesticides is considered as most attractive method of controlling pests which involves less labour and characterizes higher output per hectare of land. However, extensive use of such pesticides results in substantial health and environmental threats. In developing countries agricultural workers will continue to use pesticides in increasing quantities because of the lack of alternatives to pesticides, ignorance of the sustainability of pesticide use, *etc.* Pesticides have been linked to a wide range of human health hazards. The study was conducted to determine the prevalence of self-reported occupational health hazards related to pesticide exposure, to intervene the Personal Protective Measures and finally to evaluate occurrence of self-reported occupational health hazards. The agriculture workers who had been involved in pesticide application were interviewed regarding determinants of pesticide exposure. Then the occurrence of self-reported occupational health hazards were reported. It can be concluded that the agricultural workers who used pesticides without protective measures could be protected to pesticides exposure level with the use of personal protective measures against acute health symptoms.

Keywords: Agro chemicals, Health hazards, Personal protective measure

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Introduction

Globally the use of pesticides is considered as most attractive method of controlling pests which involves less labour and characterizes higher output per hectare of land [1]. However, irrational use of the pesticides has ill health and environmental repercussions. The pesticide poisoning for workers leads to fatal accidents in many countries. In developing countries agricultural workers will continue to use pesticides in increasing quantities because of the lack of alternatives to pesticides, ignorance of the sustainability of pesticide use and the weak enforcement of regulations and laws on pesticide use. The green revolution during mid 60's has enabled India to expand the cultivable area to increase the crop production and productivity. The results were: irrigated area increased; HYV seeds were introduced; chemical inputs were applied; intensity of land use increased; credit network has been extended and extension activities have been strengthened. All these were responsible for increasing the agriculture production and productivity at least in some pockets like Punjab, Haryana, Western Uttar Pradesh and some parts of south India. The desired results were being witnessed. At least the production and productivity of fine cereals have been increased significantly [2]. In India together they account for around 57% of the total pesticide consumption. While the wheat and pulses contribute of about 4 %, vegetable 9 % and the other plantation crops 7 % [3]. State wise Andhra Pradesh is the highest pesticides consuming state (23%) followed by Punjab & Maharashtra. Increase in the use of chemicals as pesticides can result in various health and environmental problems like pesticides poisoning of farmers and farm workers, cardiopulmonary, neurological and skin disorders, fetal deformities, miscarriages, lowering the sperm count of applicators, *etc.* [4]. But often farmers use a high dosage of chemicals for speedy and immediate effect on the crops without following precautionary measures such as using a mask and gloves. Laborers are thus affected by severe skin diseases besides suffering from nausea and vomiting. It is found that rice growers while applying poisonous pesticides don't adopt any precautionary measures.

Though many farmers immediately do not feel an impact on their health, in the long run this does create health disorders [5]. To provide health care facilities the governments need to spend huge amount of money. Therefore, the study was conducted to determine the prevalence of self-reported occupational health hazards related to pesticide exposure, to intervene the Personal Protective Measures (PPM) and finally to evaluate occurrence of self-reported occupational health hazards before and after intervention programme.

Materials and Methods

The main aim of the study was to analyse the nature, pattern and health effects of pesticide use among the agricultural workers and intervene PPM in one of the cash crop zone of Uttarakhand State.

Tool used

Survey method and Participatory Rural Appraisal technique were adopted to determine the knowledge and practice concerning the use of pesticides of the farm workers based on proposed objectives.

Selection of locale

The Major crops are wheat, rice and sugarcane. The area where the study took place is district Haridwar, in Uttarakhand, India and it has becoming a high level of pesticide usage area and there are no previously published studies regarding pesticide knowledge and practice of agricultural workers. This was a cross-sectional study that involved agricultural workers working in open field using pesticides. The technique of simple random sampling was used to obtain cross-sectional data for this study. Four villages, are purposively randomly selected out of 6 blocks. The farms were selected randomly from the selected villages. As a result, a total of 80 agricultural workers were selected randomly. Interview Schedule was developed for this study. A pilot study was carried out for 40 farmers and necessary modifications are carried out.

Data collection procedure

The agriculture workers who had been involved in pesticide application were interviewed regarding determinants of pesticide exposure: Types, treatment equipment, use of personal protection and safety measures during the application/treatments and knowledge of the risks of pesticide exposure. Finally, PPM were intervened to lessen the health risks involved. Pesticides were mostly applied with manual equipment using Knapsack and they were using Tractor-mounted sprayer also in orchards and sugarcane fields.

Statistics

All data were coded, entered, and then analyzed using the Statistical Package for Social Sciences (SPSS) programme. Descriptive results were expressed as frequencies, percentages and means.

Results and Discussion

Agro Chemicals Exposure Route

The [Table-1] shows exposure route of various generally used agro chemical in the body of agricultural workers and examples of commonly used pesticides [6].

Table-1 *Examples of Agro chemical and their exposure route*

Chemical/chemical class	Examples of pesticides	Route of exposure[b]
Arsenicals	Arsenic trioxide, CCA, sodium arsenate	O, R, D(rarely)
Borates (insecticide)	Boric acid, borax	O, R, D(broken skin)
Carbamates (insecticide)	Carbaryl, thiram, aldicarb, mecarbam	O, D
Chlorphenoxy compounds (herbicides)	Di/tri- chlorophenoxyacetic acid, MCPP	O,D
Calciferol (rodenticide)	Cholecalciferol, ergocalciferol	O
Chloralose	Chloralose	O
Copper compounds (fungicide)	Copper acetate, copper oleate	O, R, D
Coumarins (rodenticide)	Brodifacoum, warfarin, pindone	O, D(possible)
Diethyltoluamide (insect repellent)	DEET (N,N-diethyl-meta-toluamide)	O,D
Dipyridil (herbicide)	Paraquat, diquat	O, D(via broken skin)
Phosphonates (herbicide)	Roundup, glyphosate	O, R
Fluoroacetate (rodenticide)	Sodium fluoroacetate	O, D(possible)
Mercury, organic (fungicide)	Methyl mercury	O, R, D
Metal phosphides (rodenticide, fumigant)	Zinc-, aluminium-, magnesium- phosphide	O, R, D
Halocarbons (fumigant)	Cellfume, Methyl bromide	O, R, D
Nitrophenolic and nitrocresolic herbicides	Dinitrophenol, dinitrocresol, dinoseb, dinosarn	O, R, D
Organochlorines (insecticide)	Aldrin, dieldrin HCB, endrin, lindane	O, R, D
Organophosphates (insecticides)	Malathion, parathion, dichlorvos, chlorpyrifos	O, D
Organotin (fungicide)	Fentin acetate, fentin chloride	O, R, D
Phenol derivatives (Fungicide, wood preservative)	Pentachlorophenol, dinitrophenol	O, R, D
Pyrethrins, Pyrethroids	Allethrin, cyfluthrin, permethrin	R, D
Strychnine (rodenticide)	Strychnine	O
Thallium (rodenticide)	Thallium sulfate	O
Triazines (herbicide)	Atrazine, prometryn	O, R, D

Studies shows that they are very harmful and sometimes fatal for the pesticide users. Many countries have banned uses of a few pesticides in crops [7]. However in India these agro chemicals are freely used.

Precaution and Handling of Pesticides

Handling of concentrated pesticide formulation and application of diluted formulation requires use of appropriate personal protection measure as a precaution against pesticide exposure. This would include the use of gloves, masks, protective clothes, personal hygiene, appropriate footwear, head gear *etc.*, as indicated in the respective pesticide labels [8].

Table-2 *Use of Personal Protective Measures (PPM) during pesticide application before and after the intervention programme (N1=80, N2=40)*

PPM used/ not used	Before intervention		After intervention	
	F	%	F	%
Wearing protective clothes and gloves	0	0.00	72	90.00
Wearing of special facemask	3	3.75	76	95.00
Eating, drinking and smoking during the application of pesticides	49	61.25	18	22.50
Reading and following label instructions	32	40.00	64	80.00
Using leftover pesticide solution in the same day	31	38.75	63	78.75
Washing hands after pesticide application	51	63.75	76	95.00
Using the leftover pesticide container for further eatables	60	75.00	8	10.00
Washing contaminated clothes separately	4	5.00	67	83.75
Using cocktail of different kinds of pesticides	68	85.00	10	12.50
S.D.	24.42		27.64	

[Table-2] revealed that the agricultural workers in the study were not much keen to take necessary personal protective measures while handling pesticides. The 68 percent of agricultural workers prefer to make a cocktail of different kinds of pesticides before spraying. It was found that maximum amount of pesticides were sprayed on fruits, cucurbits, leafy vegetables and other vegetables grown in kharif season. Agricultural workers used to mix different pesticides in a plastic or metal drum with water or sometimes they use pesticides later. All the agricultural workers mix pesticide directly using bare hands and 97 percent did not use special scarf/mask during pesticide spraying. The condition is much worse especially regarding use of gloves by the agricultural workers (i.e. none) during spraying and mixing of pesticides in the field, while some of them use plastic carry bags as an alternative to gloves. It is pertinent to note that due to bad smell, eye irritation, throat infection and many other reasons majority of the agricultural workers (49 percent) chewed either tobacco/gutkha or smoke while spraying [9-10].

Pesticides and Health Impacts

There are two types of health effects resulting from exposure to pesticides: acute and chronic. Acute poisoning has generally been the most recognized form of effects. These days chronic poisoning too is gaining attention. Added to this, pesticides also aggravate existing medical conditions, both acute and chronic such as asthma and allergies, heart and immune system disorders [11].

Table-3 *Signs and Symptoms among the Agricultural workers during pesticide application before and after the intervention programme (N1=80, N2=40)*

Signs and symptoms	Before intervention		After intervention	
	F	%	F	%
Eye irritation	65	81.25	14	17.50
Nausea	51	63.75	28	35.00
Giddiness	42	52.50	37	46.25
Breathing problems	56	70.00	23	28.75
Fever	28	35.00	56	70.00
Vomiting/ dehydration	31	38.75	48	60.00
Cramps	24	30.00	55	68.75
Itching	77	96.25	24	30.00
Convulsions	12	15.00	67	83.75
Burning sensation	10	12.50	69	86.25
Hives	59	73.75	20	25.00
Diarrhoea	10	12.50	70	87.50
Tremor	9	11.25	71	88.75
S.D.	22.53		20.48	

The signs and symptoms related to pesticide exposure were included in the interview schedule. The agricultural workers who are actually involved in pesticide using were asked whether they experienced these signs and symptoms before and after using PPM. These symptoms and signs were reported by a large number of agricultural workers. Skin problems are the most common health problem linked to pesticide use in Haridwar region, itching (96.25 percent), eye-irritation symptoms 981.25 percent) are also reported, for which agricultural workers either go to a doctor or hospital. These include breathing problems (70.51 percent), dehydration/ vomiting (39.74 percent), cramps and diarrhea (30.00 percent). It was found that agricultural workers are relatively free from illness after intervention programme. However, during the informal interview it was observed that among men there is a higher frequency of signs and symptoms, but some of

the female agricultural workers were also facing stomach problems sometimes during or after spraying. Prolonged pesticide exposure includes liver malfunction, immune malfunction, neurologic impairment, and reproductive effects yielded inconclusive results. An excess mortality from cardiovascular and respiratory diseases was uncovered, possibly related to the psycho-social consequences of the accident in addition to the chemical contamination. Recent research supports the early notion that dioxin is carcinogenic to humans and corroborates the hypotheses of its association with cardiovascular- and endocrine-related effects, both are notorious pesticide components [12].

Conclusion

Agricultural workers frequently performed tasks involving additional exposure to pesticides (mixing chemicals or washing equipment). Majority of the agricultural workers /applicators used no personal protection measures or used it defectively/partially. Most of the agricultural workers did not bother for safety and health risks of pesticide exposure. Occupational health hazards associated with pesticide use showed that common symptoms among the agricultural workers were skin rash, headache, excessive sweating, nausea, diarrhea and sometimes loss of senses. Efforts were made to intervene PPM to decrease the pesticide exposure of agricultural workers irrespective of their experience in this field of agriculture. It can be concluded that the agricultural workers who used pesticides without protective measures could be exposed to pesticides at levels sufficient to be associated with acute health symptoms. Hence, a proper training and execution of PPM is needed not only to enhance the knowledge but also to motivate agricultural workers to practice at least known safety measures.

Application of research: The study is applicable for the researchers, scholars and scientists working in rural areas. The agricultural workers and various other stakeholders in agriculture have direct implications in their field of work regarding safe use of agro chemicals.

Research Category: Agro chemicals, occupational hazards, personal protective measures (PPM)

Abbreviations: PPM: Personal Protective Measures

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References

[1] Kumari P.L. and Reddy K.G. (2013) *Journal of Agriculture and Veterinary Science,* 6(2), 1-8.
[2] Tholkappian C., Rajendran S. (2011) *International Journal of Science & Technology,* 1(2), 56-59.
[3] Bhardwaj T. and Sharma, J.P. (2013) *International Journal of Agricultural and Food Science Technology*, 4(8), 817-822.
[4] Bag D. (2000) *Economics and Political Weekly*, 6(16), 20-21.
[5] Mencher J.P. (1991) *Economics and Political Weekly, XXIV*(39), 2263-68.
[6] Thundiyil J.G., Stober J., Besbelli N. and Pronozuk J. (2008) *Bulletin of the World Health Organization*, 86 (3), 205-209.
[7] Report of Directorate of plant protection, Quarantine and storage. May (2017) *India.*
[8] FAO (1990) *Guidelines for personal protection when working with pewsticides in tropical climate, UN*.
[9] Chen S. Y., Zhom J., Liz J. and Wu Y. Q. (2004) *Bulletin of World Health Organization*, 22, 364-367.
[10] Eddleston M., Sudarshan K., Senthilkumaran M., Reginald K., Karalliedde L. and Senarathna L. (2006) *Bulletin of World Health Organization*, 84, 276-282.
[11] Patil D.A., Katti R. J. (2012) *Journal of rural development*, 31(3), 305-318
[12] Pier A.B., Consonni D. (2001) *American Journal of Epiderm*, 153 (11), 1031-1044.