Research Article

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Knowledge and Practice of Pesticides among the Farmers of Bhaktapur Municipality, Nepal

Nisha Humagain[1,5*], Nitu Humagain[2], Kishor Maharjan[3], Anil Kumar Sah[4], Joshan Neupane[5], Grishu Shrestha[1]

[1] MPH, Nobel College, Kathmandu, Nepal
[2] Macquarie University, Sydney Australia
[3] Tri-Chandra College, Kathmandu, Nepal
[4] Annapurna Research Center, Kathmandu, Nepal
[5] Nepalgunj Neuro Trauma and Multispecialty Hospital, Nepalgunj, Nepal

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***Corresponding author**
Nisha Humagain
Email address: nissah29@gmail.com

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Abstract

Background: Pesticides are substances used in agriculture to prevent and manage pests, weeds, and plant diseases, thus improving food and agricultural production processes. While they boost productivity, their use also carries adverse effects. This study investigates the knowledge and practices regarding pesticide use among farmers in Bhaktapur municipality.

Methodology: A cross-sectional study was conducted among 196 farmers of Bhaktapur municipality. Data collection was done using a semi-structured questionnaire. Descriptive statistics were used, and the association was measured using chi-square.

Results: This study comprised 54.1% (n=106) females and 45.9% (n=90) males from Bhaktapur municipality. The study presented that most pesticide users were aware of the environmental impacts of pesticides. Regarding pesticide storage, nearly half of the respondents store pesticides in dedicated pesticide stores. Additionally, it was observed that more than half of the respondents obtained information about using pesticides from the salesman. Knowledge of PPE and the educational status of the respondents were found significantly associated with the use of PPE.

Conclusion: Inadequate awareness of pesticide hazards requires a dual focus on knowledge enhancement and implementation of Personal Protective Equipment (PPE). Initiatives like targeted awareness programs and accessible PPE provision are essential to mitigate pesticide exposure among farmers.

Keywords: Farmers, Pesticides, Knowledge, Practice, Pesticide management

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Tweetable Abstract: Farmers' limited schooling is linked with use of PPE. Enhancing knowledge and safety practices is crucial for safeguarding health and environment.

Introduction

Pesticides are substances used in agriculture to control and prevent unwanted pests, weeds, and various plant diseases. Similarly, it is also used to process, store, and transport food and agricultural commodities [1]. The various forms of pesticides are nematicides, rodenticides, insecticides, fungicides, and weedicides. Out of these, insecticide is a major constituent, and this can be used in agriculture, animal husbandry practices, and even in public health [2].

Reports indicate that pesticide exposure leads to hundreds of thousands of deaths annually worldwide [3]. While pesticides are crucial in modern farming for pest control, they also pose risks to various organisms, including humans. Studies highlight these risks, such as poisoning, reproductive issues, dermatological and neurological complications, and cancer [4,5]. Pesticides also affect the overall productivity of farming families and can create financial burdens for health and insurance organizations due to farmers' insufficient awareness of their harmful effects on health and the environment [6]. Neglecting safety measures or misusing pesticides can result in adverse health effects, including skin diseases, neurotoxicity, chemical burns, respiratory illnesses, and methemoglobinemia in infants. Additionally, certain pesticides are associated with hematopoietic cancers [7,8].

Hazards resulting from exposure to pesticides often stem from the improper use of highly toxic substances, failure to adhere to preventive principles, lack of protective measures, or the use of defective protective equipment during chemical pesticide exposure [9]. Studies conducted in developing countries revealed low to moderate levels of awareness regarding pesticides, lack of usage of personal protective equipment (PPE), unsafe storage of pesticides at homes, improper disposal of empty pesticide containers, misuse of pesticides, and relatively limited understanding of pesticide safety labels [3,4].

Because of the unfavorable working circumstances and low educational attainment of farmers in underdeveloped nations,

numerous researchers have focused on the detrimental health impacts of pesticide exposure [10,11]. According to reports, one of the biggest factors in reducing pesticide biohazards is farmers' awareness of the risks associated with pesticide exposure. Evaluating farmers' knowledge, attitudes, and practices about pesticide application is crucial for creating any training program to lower the risks associated with pesticide use [7].

Bhaktapur is one of the districts in Kathmandu Valley where a substantial portion of the population has been involved in farming for generations. The farmers are using pesticides to increase production. Although a small scale study, this will provide essential baseline data about the knowledge and practices regarding pesticide use among farmers.

Materials and methods

The study was conducted in Bhaktapur Municipality, located in the east corner of the Kathmandu Valley in Nepal. Out of the total of 11,900 hectares of land in Bhaktapur, 8,077 land hectares have been cultivated. Agriculture is one of the important parts of people's earning and livelihood here. Because of this Bhaktapur municipality was selected as the study site for the study. Using a descriptive cross-sectional study design, 196 farmers were recruited for the study. A convenient sampling technique was used for the data collection. A semi-structured questionnaire was developed after the literature review and pretesting was conducted among 10% of the total sample size. Data were entered and analyzed using SPSS. Descriptive statistics (frequency and percentage) were used and the association between dependent and independent variables were measured using the chi-square. Ethical approval was taken from the IRC of Nobel College and written consent was obtained from each participant recruited in the study.

Results

Demographic characteristics of the farmer

Table 1 illustrates that a few (11.2%) of the respondents were below the age of 30, approximately two-thirds (69.9%) of the respondents were above 40 and female respondents (54.1%) accounted for slightly higher than male respondents. Regarding educational status 32.7% of respondents were illiterate and only 8.1% of the respondents studied up to higher secondary. Most of the respondents (68.4%) were engaged in agriculture for more than 10 years whereas only 17.3 % were engaged for less than 5 years.

Farmer's knowledge regarding pesticide use

The study revealed that almost half (49.0 %) of respondents use pesticides to increase production in agriculture, more than half (55.1%) of respondents use pesticides to destroy pests, nearly one-third (23.0%) use pesticides to increase crop quality and only 7.7% use pesticides to lower labor costs. Most of the respondents (80.1%) were aware of the environmental impact of pesticides. The study revealed that the majority (70.9%) of the total respondents knew about organic pesticides. Furthermore, a maximum (92.9%) of the respondents knew personal protective equipment (PPE), and almost half of the respondents (49.5%) believed that pesticides enter the body through the skin, whereas a maximum (85.2%) believed that pesticides enter the body through breathing (**Table 2**).

Table 1: Sociodemographic Characteristics of the Respondents

Characteristics	Frequency	Percentage(%)
Age		
< 30	22	11.2
30-40	37	18.9
> 40	137	69.9
Sex		
Female	106	54.1
Male	90	45.9
Education		
Illiterate	64	32.7
Able to read and write	27	13.8
Primary	53	27.0
Secondary	36	18.4
Higher Secondary	16	8.1
Duration of work (in years)		
< 5	34	17.3
6 -10	28	14.3
> 10	134	68.4

Table 2: Farmers' knowledge and understanding of pesticides (n = 196)

Characteristics	Frequency	Percentage(%)
Reason for using pesticides*		
Increase in agriculture production	96	49.0
Destroying pest	108	55.1
Increase in crop quality	45	23.0
Lower the labor cost	15	7.7
Knowledge about the environmental impacts of pesticides		
Yes	157	80.1
No	39	19.9
Knowledge about organic pesticides		
Yes	139	70.9
No	57	29.1
PPE knowledge		
Yes	182	92.9
No	14	7.1
Pesticides enter body		
Through skin	97	49.5
Through breathing	167	85.2

* Multiple Response

Farmer practice regarding pesticide use

Farmers' practices towards storing pesticides, following instructions while using pesticides, using PPE, and hygiene measures after using pesticides are shown in **Table 3**. The majority (66.3%) of the

total respondents store pesticide containers elsewhere on the farm, 40.8% store in dedicated pesticide stores, 23.5% store pesticides in general stores within the house, 4.1% store them in the kitchen, and 7.1% store them in the toilet.

Table 3: Farmer's practice regarding pesticide use (n=196)

Characteristics	Frequency	Percentage (%)
Store pesticide*		
General store within the house	46	23.5
Dedicated store	80	40.8
Elsewhere on the farm	130	66.3
Kitchen	8	4.1
Toilet	14	7.1
Follow instructions		
Yes	187	95.4
No	9	4.6
Advised by whom*		
Salesman	136	69.4
Read the instruction on the pest container before	33	16.8
Neighbors/friend	53	27.0
Family member	39	19.9
Self	22	11.2
PPE use		
Yes	177	90.3
No	19	9.7
PPE use while spraying*		
Mask	108	55.1
Gloves	75	38.3
Boots	30	15.3
Apron/plastic covering	9	4.6
All the above	65	33.2
Mix Pesticides		
By bare hands	63	32.1
By wearing gloves	133	67.9
Personal hygiene measures after spraying		
Changing clothes only	5	2.5
Washing hands	52	26.5
Washing body	25	12.8
All the above	114	58.2

*Multiple Response

The instruction to use pesticides is followed by almost all of the respondents (95.4%) and among them, a maximum (69.4%) follow the instruction by the salesman, 16.8% of the respondents read the instruction on the pesticide container, nearly one third (27%) of the respondents follow the instruction from neighbors/ friend, 19.9% of them follow from family members and the remaining 11.2% follow as they wish.

More than half of the respondents (55.1%) use masks as PPE while 38.3% use gloves, 15.3% use boots, 4.6% use aprons/plastic covers, and 33.2% of respondents use all masks, gloves, boots, and aprons while spraying pesticides. Similarly, one-third (32.1%) of the respondents mix pesticides with bare hands while a maximum (67.9%) mix pesticides by wearing gloves. In the study, more than half (58.2%) of the respondents change clothes and wash hands, and body as a personal hygiene measure after spraying while nearly one-third (26.5%) only wash their hands as a personal hygiene measure.

Perceived symptoms in connection with pesticides

Regarding perceived symptoms, 116 (59.2%) perceived the symptoms in connection with pesticide spraying while the remaining 80 (40.8%) did not perceive any kind of symptoms in connection with pesticide spraying.

Self-reported symptoms in connection with pesticides

Regarding symptoms perceived by the respondents, the headache was the most perceived symptom (48.0%) of the respondents. Additionally, dizziness was perceived by 18.3%, tiredness by 11.4%, and nausea/vomiting by 12.0% whereas the least perceived symptoms were blurred vision, skin disease, respiratory problems, and eye problems which were perceived by 1.1%, 2.2%, 5.1% and 1.7% of the respondents respectively (Table 4).

Table 4: Symptoms perceived by the farmers in connection with pesticide spraying

Symptoms perceived (N=175)	Frequency (%)
Headache	84(48.0)
Dizziness	32(18.3)
Tiredness	20(11.4)
Blurred vision	2(1.1)
Nausea/Vomiting	21(12.0)
Skin disease	4(2.2)
Respiratory disease	9(5.1)
Eye problem	3(1.7)

Association between respondents' knowledge of PPE and its use while spraying pesticides

In **Table 5**, among the total respondents who use PPE 27.7%, 20.3%, 9%, 12.4% and 30.5% had education of primary, secondary, higher secondary, able to read and write and illiterate respectively. Similarly, among total respondents who do not use PPE 21.1%, 0.0%. 0.0%, 26.3%, and 52.6% had the educational status of primary, secondary, higher secondary, able to read and write and illiterate respectively. Additionally, the association between respondent educational status and use of PPE was found to be statistically significant (p-value=0.028).

Association between perceived symptoms in connection with pesticides and use of PPE while spraying pesticides

In **Table 5**, it was found that among the total respondents who use PPE 59% respondents had perceived symptoms in connection with pesticides while 40.7% of the respondent who use PPE had not perceived any kind of symptoms in connection with pesticides. Similarly, among the total respondents 57.9% who do not use PPE perceived symptoms in connection with pesticides while 42% who do not use pesticides did not perceive any kind of symptoms in connection with pesticides. Additionally, the association between respondent's perceiving symptoms in connection with pesticides and the use of PPE was found to be statistically not significant. (P-value = 0.904).

Table 5: Association between educational status and use of PPE

Characteristics	Use of PPE		P-value
	Yes n(%)	No n(%)	
Educational status of the respondents			
Primary	49(27.7)	4(21.1)	0.028
Secondary	36(20.3)	0(0.0)	
Higher secondary	16(9)	0(0.0)	
Able to read and write	22(12.4)	5(26.3)	
Illiterate	54(30.5)	10(52.6)	
Perceived symptoms in connection with pesticides			
Yes	105(59.3)	11(57.9)	0.904
No	72(40.7)	8(42.1)	

Discussion

The result of this survey shows that almost one-third of the respondents in this study were illiterate (32.7%) or had limited formal education (13.8%) which may be the main factor responsible for not being able to read and understand the labels of pesticides for the safe and correct use of pesticides. Similar types of results were seen in the study conducted in Kavre and Kuwait [11,12]. Few (17.3 %) were engaged for less than 5 years whereas in the study conducted in Ethiopia, a maximum of them worked as a farmer for less than 5 years [8].

The use of PPE is inadequate. It was found that more than half the farmers used at least one personal protection when handling pesticides. Face masks were used by 55.1% of the respondents, indicating their concern about covering their mouths and noses. In Kavre, Karmacharya found that 50% of respondents use masks and cloths on the mouth, 6.3% use gloves, and no one uses both the mouth cover and gloves in combination [12]. The study conducted in Ghana, Tanzania, and Kuwait also found similar findings regarding PPE use [3,11,13]. The findings closely resemble other studies which indicate a prevailing concern among individuals for the inadequacy of proper pesticide handling practices. Due to discomfort and/or excessive cost, adequate use of PPE is often neglected. In the study, most of the respondents, i.e., 67.9% mix the pesticides by using gloves whereas in Dhading almost half of the farmers mix the pesticides with their bare hands and only about one-sixth (16.6%) by wearing gloves [14].

Regarding the storage of pesticides, this study showed some worrying practices. The pesticides are often stored unguarded by most farmers in Bhaktapur. In comparison to the Tanzanian study, more respondents store pesticides on the farm. This may be because the respondents of the Tanzanian study were well-educated and aware of the consequences of pesticide poisoning [3]. In developing countries, the farmers are unable to read and write, so an interactive and participatory training model is required. The pictograms can be used to simplify pesticide labels and communicate risk information [13].

The most common symptoms reported by the farmers were headache (48.0%), dizziness (18.3%), and nausea and vomiting (12.0 %). Similar findings of symptoms perceived have been reported in studies conducted in Ethiopia, India, Ghana, Tanzania, and Kuwait [3,8,11,13,15]. People were found confused in differentiating APP symptoms and symptoms from other disease conditions which may contribute to the over-reporting of APP symptoms.

Conclusion

This study revealed that agricultural workers demonstrate a satisfactory level of pesticide knowledge. However, the farmers often neglect the safety measures, especially by not using proper PPE. Notably, the salesmans are the predominant source of information for farmers. Deficiencies in knowledge about proper pesticide storage, associated with lower education levels and insufficient information sources, underscore the imperative for focused government initiatives encompassing education and training programs. Such programs are deemed essential to augment farmer awareness and promote best practices in pesticide management.

Disclosure

The authors declare no conflicts of interest in this work.

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