Journal of Manmohan Memorial Institute of Health Sciences (JMMIHS) Vol 10 | Issue 2 | 2025

ORIGINAL ARTICLE

HEALTH IMPACTS OF PESTICIDE USE AND ASSOCIATED SAFETY PRACTICES AMONG FARMERS IN A RURAL PLACE IN PALPA DISTRICT OF NEPAL

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Received: 13 October 2025
Accepted: 7 December 2025
Published: 15 December 2025

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https://doi.org/10.3126/jmmihs.v10i2.87186

How to Cite

Lamsal, S., Poudel, K., Sharma, R., Poudel, J., Khanal, A., & Sharma, V. Health Impacts of Pesticide Use and Associated Safety Practices among Farmers in A Rural Place in Palpa District of Nepal . Journal of Manmohan Memorial Institute of Health Sciences, 2025, 10(2), 45–49. https://doi.org/10.3126/jmmihs.v10i2.87186

ABSTRACT

Introduction: The unsafe and indiscriminate use of pesticide in agriculture represents a major human health problem. The aim of this study was to assess the level of safety practices regarding pesticides use and its effect on health among farmers of Rampur municipality.

Method: The research was a descriptive cross-sectional study in the rural area of the Lumbini Province and purposive sampling was used to collect data. The study assessed pesticide safety practices and health effects among 227 farmers in Rampur Municipality, Palpa.

Result: While all farmers recognized pesticides as harmful, 79.29% used them in crops, and 96.5% had no formal training. Unsafe practices were common, including storing pesticides in living areas (26.11%) and improper disposal methods. Pesticide exposure occurred mainly via the oral route (48.5%), with 14.5% unaware of the entry route. Only 31.11% bathed fully after pesticide use. Despite high awareness, safety practices were poor.

Conclusion: The study recommends safety training, stricter law enforcement, and promotion of integrated and non-synthetic pest control methods. Strengthening farmers' access to protective equipment and ensuring routine monitoring and follow-up will further support safer pesticide handling and reduce long-term health risks.

Key words: Agriculture; Farmer; Nepal; Pesticides; Public Health

INTRODUCTION

The health of the agriculture and society also comes through greatly because of the pesticides. Nevertheless, respiratory, integumentary, cardiovascular gastrointestinal and neurological problems can result as a consequence of pesticide exposure. Even though the pace of the global pesticide overuse has slowed compared to the 1990s, in most of the developing countries, pesticide usage continues to multiply considerably.[1,2] It is estimated that 1- 41 million people worldwide are sickened each year, with at least 300,000 estimates of the person-related deaths with 99 percent occurring in low- and middle-income countries.[3]

In Nepal, there are 62% household and 67% population engaged in agriculture.[4] The application of pesticides is increasing year by year at 10-20 per cent rate with an average application of 396 g/ha. According to common use, pesticides widely used in Nepal are organochlorine (Benzene Hexachloride and Dieldrin, etc.), organophosphates (ethyl parathion, and methyl parathion, etc.), carbamates and synthetic pyrethroids.[5] Regrettably, the farmers are usually not educated on the type of pesticides, level of toxicity, and precautionary measures as well as risks they present on human health and environment. Also, personal protective equipment (PPE) is lacking, and education about correct application of PPE and techniques of spraying is insufficient, which also predisposes the farmers to receiving pesticide poisoning.[6,7] Very little has been done on factors revolving around pesticide issues in Nepal.[8] and very little information may be found on the situation as regards to pesticide poisoning in the country. It is worrying that the information relevant to pesticide hazards is not captured in the national health management and information system as the routine information.

METHODS

The study employed a descriptive cross-sectional design and was conducted in the rural communities of Lumbini Province. According to the 2011 national census, Rampur Municipality comprised 8,158 households with a total population of 35,396. The municipality consisted of 10 wards, of which Wards 6, 7, 8, and 9 were purposively selected for the study. Data were collected through face-to-face interviews using semi-structured questionnaires. A purposive sampling technique was applied to identify eligible respondents. At the end of each day, completed questionnaires were reviewed for completeness, accuracy, and consistency. Coding of responses was carried out during the data-entry process.
The sample size was calculated using the formula $n = Z^2pq/d^2$, where n represented the required sample size, Z = 1.96 at a 95% confidence interval, p = 0.84 (the proportion of farmers who had good knowledge of pesticides and insecticides), and q = 1 – p. Using this formula, the initial sample size was computed as 206. After adding a 10% non-response rate, the final sample size became 227. Thus, the required sample size for the study was 227 participants.[9-11]

Data analysis was performed using SPSS Version 20. All interviews were conducted by the researcher. Descriptive statistics were used to calculate frequencies and percentages. Prior to data collection, the questionnaire was pretested on 10% of the sample population to evaluate its clarity, reliability, and overall effectiveness. Ethical approval for the study was obtained from the Shree Medical and Technical College Ethical Review Committee.

RESULTS

Table 1 shows socio-demographic characteristics where Farmers those who are engaged in agriculture are participated in the interview. As far as sex distribution (52.4) %119 were male. The table illustrates that ethnicity of the respondent i.e. (44.9) % 102 were Brahman. Among that (98.2) %223 were Hinduism. Among that head of the family members of the respondent (41.4) %94 was father. In the table main occupation of the respondent i.e. (20.3) %46 was service, (30) % 68 were foreign. Among that academic

Qualification of the respondent (7.5) % 17 were ORW, (21.1) % 44 were primary, (32.1) % 67 were secondary and (46.9) % 98 were Higher secondary and above. In the interview type of the family i.e. (17.2) % 39 were nuclear, (77.5) % 176 were joint family and (5.3) % 12 were extended family. In the table represent that how many months does your family main income last i.e. (6.2) % 14 were below 6 months, (50.2) % 114 between 6-12 months and (43.6) % 99 were above 12 months. Among the respondent question related to monthly income of the family of respondent. i.e. (9.7) % 22 were less than NRS 10,000, (20.7) % 47 were NRS 10,000 to 20,000, (38.3) % 87 were NRS 20,000 to 30,000 and (31.3) % 71 were above NRS 30,000.

Table 1: Distribution of the respondents by their sociodemographic characteristics

Characteristics	Number(n=227)	Percent
Age		
Under 24 Years	14	6.16
25 to 34 Years	33	14.53
35 to 44 Years	53	23.34
45 to 54 Years	79	34
55 to 64 Years	46	20.26
above 65 Years	02	0.88
Gender		
Male	119	52.42
Female	108	47.6
Ethnicity		
Brahman	102	44.9
Chhetri	21	9.3
Madhesi	03	1.3
Dalit	25	11
Jana Jati	73	32.2
Muslim	03	1.3
Religion		
Hinduism	223	98.2
Buddhism	02	0.9
Muslim	02	0.9
Head of Family Member		
Father	94	41.4
Mother	42	18.5
Grandparents	19	8.4
Husband	26	11.5
Self	46	20.2
Main occupation		
Service	46	20.3
Foreign	68	30
Employment	95	41.9
Business Man	227	100
Farmers Labor	37	16.3
Education Status (n=227)		
Illiterate	01	0.4
Literate	226	99.6
Academic Qualification (n=226)		
Only Read and Write (ORW)	17	7.52
Primary	44	19.47
Secondary	67	29.65
Higher secondary and above	98	43.56
Family Types (n=227)		
Nuclear Family	39	17.2
Joint Family	176	77.5
Extended Family	12	5.3
Main Income Last For(n=227)		
Below 6 months	14	6.2
Between 6 to 12 months	114	50.2
Above 12 Months	99	43.6
Monthly Income of the Family of the respondent (n=227)		
Less than NRs 10,000	22	9.7
NRS20,000-10,000	47	20.7
NRS30,000-20,000	87	38.3
Above 30,000	71	31.3

Table 2: Distribution of the respondent's knowledge regarding pesticide use and its effects

Characteristics	Number(n=227)	Percent
Heard about pesticides(n=227)		
Yes	227	100
No	0	0
Sources of heard about pesticides (multiple response)		
Health workers Teacher/friends	104	45.8
Through media TV/Radio	227	100
Neighbor	112	49.3
Meaning Of Pesticides (n=227)		
Don't know	9	3.96
Pesticides are substances that are meant to control pets	118	51.98
Pesticides are used to control weeds, insect infestation and diseases and increase the productivity of agriculture	100	44.06
Health effect of pesticides use(n=227)		
yes	227	100
Symptoms/Effects of pesticides after its use (multiple response)		
Headache	203	89.42
Nausea and Vomiting	104	45.8
Skin Irritation	98	43.2
Blur Vision	53	23.3
Shortness of Breath	45	19.8
Dizziness	97	42.7
Cough	44	19.4
Itchy Eyes	21	9.3

Characteristics	Number(n=227)	Percent
Slow Heart Beats	66	29.1
Stomach Cramps	53	23.34
Use of Pesticides in your crops(n=227)		
yes	180	79.30
No	47	20.70
How Long Have You Been using pesticides in your fields? (n=180)		
1-5 years	23	12.78
5- 10 years	68	37.78
10 years and above	89	49.44
Receive any special training on pesticides? (n=227)		
Yes	8	3.5
No	219	96.5
How Long Have you been engaged in this occupation(n=227)		
1-5 years	23	10.1
5-10 years	87	38.3
10 years and above	117	51.5
Storage of the pesticides before and after use(n=190)		
open shed just for pesticides	19	5.00
In the open field	17	9.44
Locked chemical store	29	16.11
living area	47	26.11
Animal house	78	43.33
What do you do with the unused leftover (mixed, dilut-ed) pesticides(n=180)		
Dispose in the field	9	5.00
Mix only needed pesticides	106	58.88
Apply on other crops	65	36.11
What do you do with empty pesticide containers(n=180)		
Discard on-farm	34	18.88
Place in trash or dumpster	39	21.66
Incinerate on-farm	86	47.77
Hazardous waste collection sites	21	11.6
Route of entry of pesticides (multiple response)		
Dermal	95	41.9
By inhalation	209	92.1
Oral	110	48.5
Eye contract	54	23.8
Don't know	33	48.5

Table 2 presents the knowledge and experiences of respondents regarding pesticide use and its effects. All 227 respondents had heard of pesticides (100%), with various sources of information: 22.5% (51) learned from health workers, 45.8% (104) from teachers/friends, 100% (227) from media (TV, radio, internet), and 49.3% (112) from neighbors. When asked about the meaning of pesticides, 40% (9) didn't know, 52% (118) said pesticides control pests, 44.1% (100) mentioned their use in controlling weeds, insects, diseases, and improving agricultural productivity. Regarding health effects, all respondents (100%) reported experiencing health issues related to pesticides. The most common symptoms included headaches (100%), nausea/vomiting (45.8%), skin irritation (43.2%), blurred vision (23.3%), shortness of breath (19.8%), dizziness (42.7%), cough (19.4%), itchy eyes (9.3%), slow heartbeats (29.1%), and stomach cramps (23.3%). In terms of pesticide use, 79.30% (180) reported using pesticides on their crops, while 20.70% (47) did not. The duration of pesticide use varied: 12.77% (23) for 1-5 years, 37.77% (68) for 5- 10 years, and 49.44% (89) for 10 years or more. However, only 3.5% (8) received special training on pesticide use, while 96.5% (219) did not. The respondents› experience in agriculture varied: 10.1% (23) had 1-5 years of experience, 38.3% (87) had 5-10 years, and 51.5% (117) had 10 years or more. When asked about pesticide storage, 5% (19) stored pesticides in an open shed, 9.44% (17) in the open field, 16.11% (29) in locked chemical stores, 26.11% (47) in living areas, and 43.33% (78) in animal houses. Regarding disposal of unused pesticides, 5% (9) disposed of them in the field, 58.88% (106) mixed only the necessary amount, and 36.11% (65) applied leftovers to other crops. As for empty containers, 18.88% (34) discarded them on the farm, 21.66% (39) placed them in the trash, 47.77% (86) incinerated them on-farm, and 11.6% (21) used hazardous waste collection sites. Lastly, respondents identified the ways pesticides enter the human body. The most common entry routes were inhalation (92.1%, 209), dermal exposure (41.9%, 95), ingestion (48.5%, 110), eye contact (23.8%, 54), and 14.5% (33) didn't know how pesticides entered the body.

Table 3: Distribution of the respondent question regarding safety practices

Characteristics	Number	Percent`
Preventive practice immediately after handling pesticides? (n=180)		
Yes	180	100
If yes, which preventive practice do You use? (n=180)		
Hand washing	103	57.22
Showering whole body	43	23.88
Changing clothes	34	18.88
Protective equipment During pesticides uses(n=180)		
Yes	**180**	**100**
Types of protective Equipment is used (multiple response)		
face Mask	180	100
Hand Gloves	48	26.66
Boots	97	53.88
Hats	180	100
Eye Googles	37	20.55
Sleepers	83	46.11
Eating and drinking during spray of pesticides (n=180)		
Never	180	100
Always	0	0
Do you wash your clothes separately (n=180)		
Always	102	56.98
Sometimes	78	43.02

Table 3 Reveals that perception of the respondents considering the practices of safety. Among the respondent enquired on how you observe any preventive measures a moment after exposure to pesticides i.e. One hundred percent (100) Yes was the answer of all the respondent. Yes, and which preventive measures do you practice I.e. (31.11) d/o h 56 declared showery total body, (72.22) percent 130 did changing clothes and (100) percent 227 in said hand washing. Among the respondent asked about do you use some precautionary material when using pesticides i.e.

Yes (100) % 180. Among which inquired about the use of protective equipment i.e. (100) % 180 use Face mask, The percentage of users of Hand gloves stands at (26.66) % 48, the percentage of users of boots at (53.88) % 97 and Hats at (100) % 180. The use of Slippers is (46.11) and eye goggles is (20.55) %. Among the and eating and drinking habit during spray i.e. (100) % was asked by respondent 180 Never eat and drink. Of the respondent questioned on washing the clothes that they are working in singularly i.e. (56.66) % 102 answered always and (43.33) % said sometimes 78.

Figure 1 Distribution of the level of respondent's safety practices

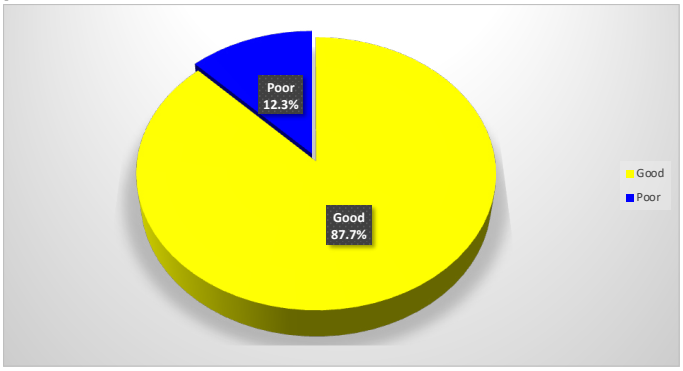

Figure 1 shows that 87.7% of the respondent had good practices and 12.3% had poor practices during pesticides use. The majority of respondents demonstrated good safety practices indicating a positive trend towards safe pesticide handling behavior.

DISCUSSIONS

This study aimed at analyzing safety measures on pesticides and their consequences on the health of the farmers. The study population selected was 227 farming households located in wards 7, 8 and 10 of Rampur Municipality in the district of Palapa. There was no exclusion of participants in regard to their age, marital status, religion, ethnicity, or socio-economic status. The analysis established the practices of pesticide use as well as the health consequences of these practices in this group of people. The present study found that nearly all respondents (99.6%) were literate and had attended formal education. This finding is consistent with a study conducted in Kapilvastu, where literacy was reported at 99.1%. However, it contrasts sharply with results from a similar study in Dhading, where only 50% of respondents were literate. These differences highlight substantial variation in educational status across districts. [12,13] This means people are still learning thing by themselves.

In the present study, 87.7% of respondents demonstrated good safety practices while handling pesticides, whereas 12.3% exhibited poor practices. More than half of the participants (57.22%) reported washing their hands after pesticide use, 23.88% took a full-body shower, and 18.88% changed their clothes. These findings are comparable to those reported by Mustapha, who observed that 53.88% of participants washed their hands, 25.22% showered their entire body, and 20.9% changed their clothes following pesticide application. Similar results were also noted in a study conducted in Bhaktapur, indicating a consistent pattern of post-exposure hygiene behaviors across different settings.[13]

When handling pesticides, all participants (100%) wore masks and hats, 26.66% wore gloves, and 20.55% of respondents said they wore safety glasses. Furthermore, 46.11% wore slippers and 53.88% wore boots. A similar study (15) found that while boots (15.6%) and other protective clothing (29.6%) were used less frequently, protective gloves (73.2%) and masks (78.8%) were used more frequently. These variations point to significant variances in the use of PPE in various research environments.[16] Just 12% of farmers in four areas of Nepal did not utilize any kind of personal protective equipment (PPE), according to a prior survey. Present study, on the other hand, had a significantly larger share. In comparison to more centrally placed places where supplies are more easily accessible, the district's physical remoteness and restricted access to protective gear may be the cause of this disparity. [15]

This study demonstrates how farmers' use of pesticides affects their health. 100% of the farmers reported having headaches, 42.7% reported dizziness, 45.8% reported nausea and vomiting, 19.8% reported respiratory distress (SOB), 43.2% reported skin irritation, 23.3% reported blurred vision, 42.7% reported coughing, 9.3% reported itchy eyes, 29.1% reported slow heartbeats, and 023.3% reported diarrhea. The weather makes protective gear uncomfortable, and essential supplies like soap and gloves are scarce. Previous study which was conducted in Nepal shows that the most commonly self-reported symptoms of pesticide toxicity were skin rash 72.5%, headache 70, nausea 46.7%, and dizziness 31.6%. This is similar to a study done among farm workers in the West Bank, Palestine, where self-reported symptoms of pesticide toxicity included skin rash 37.5%, headache 37%, excessive sweating 24.9%, and diarrhea 21.3% (15). It may be due to the lack of safety precautions. Pesticide poisoning results in health problems like headaches, lightheadedness, and skin irritation in poor nations like Nepal. Farmers have inadequate hygiene and pesticide disposal procedures.

CONCLUSION

According to this study, although most farmers in this study were aware of the harmful effects of pesticides, their actual safety practices remained inadequate. Commonly reported health problems including headaches, dizziness, and skin irritation were closely linked to improper handling, unsafe storage, and poor disposal practices. Despite relatively high literacy levels, the absence of formal training and the limited availability or use of personal protective equipment significantly increased exposure risks. These findings emphasize that awareness alone is not sufficient to ensure safe behavior. Strengthening pesticide safety education, enforcing regulatory standards, and promoting environmentally sustainable pest-management approaches are essential to reducing health risks and protecting farmers' well-being.

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ACKNOWLEDGEMENT

I would like to thank the respondent who gave genuine response as well as my supervisor of Shree college of technology.

COMPETING INTERESTS

All the authors declare no competing interest.

AUTHOR CONTRIBUTIONS

All authors contributed significantly to the development of this manuscript. Asmita Khanal was involved in editing, conducting the literature review, writing, finalizing the manuscript, and performing data analysis and drafting. Jamuna Poudel contributed through data analysis, editing, literature review, methodology development, and writing. Kamal Poudel played a key role in the literature review, original drafting, data coding and editing, reviewing, article writing, and supervising the overall work. Roshani Sharma supported the study by contributing to article writing, data coding and analysis, editing, conducting the literature review, and writing the results. Suresh Lamsal was responsible for conceptualization, data collection, writing the introduction, and contributing to the literature review. Vidya Sharma provided guidance and contributed to data interpretation, editing, literature review, writing, and coding.