

Original Article

KNOWLEDGE OF PESTICIDE USE AND TOXICITY SYMPTOMS AMONG
HORTICULTURE WORKERS

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ABSTRACT

Background: Pesticide toxicity is a major concern in Bangladesh, where agriculture is the backbone of the economy. Horticulture, a rapidly growing subsector, exposes workers to pesticides, making knowledge of usage and toxicity symptoms crucial. Pesticides adversely affect human health, animals, and the environment. The increasing demand for food production has led to greater pesticide use, raising concerns about exposure and adverse effects.

Methods: This was a cross-sectional study which was conducted on the population of 236 rural horticulture workers of Munshiganj district, Dhaka, Bangladesh from January to December 2021. The study place was selected purposively and respondents were selected conveniently. Data collection was done by face to face interview with semi-structured questionnaire.

Results: Among the 236 respondents, 56.8% were aged >45 years, 89% were male, all were Muslim, and 40.7% had primary-level education. Most (87.3%) were married, 34.3% earned ≤15,000 BDT, and horticulture was their primary income source. About 42.4% had lived in their current residence for 41–60 years, 39.4% had used pesticides for 10–20 years, and 71.2% had not received training from government institutions. Knowledge, assessed using Bloom's cut-off, revealed 61% had moderate, 6.8% had low, and 32.2% had good knowledge. Self-reported toxicity symptoms malaise 89.4%, skin itching 84.7%, headache 83.1%, skin rash 74.2%, epigastric discomfort 62.7% and Abdominal pain 54.7% subsequently. Significant associations ($p < 0.05$) were found between age, gender, marital status, pesticide use duration, and government training with some symptoms.

Conclusion: The study highlights workers' knowledge levels and common toxicity symptoms, emphasizing the need for better pesticide-use education and safety measures. Findings can inform policies to enhance safe pesticide practices and reduce toxicity, supporting sustainable horticulture development.

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INTRODUCTION

Bangladesh, an agro-based country, has 16.5 million farming families, with nearly 40% of the labour force engaged in agriculture^{1-4,11}. Horticulture, a rapidly growing subsector, significantly contributes to the national economy⁵. However, extensive pesticide use in horticulture raises concerns about occupational health risks⁶⁻⁷. Farmers and horticulture workers frequently use pesticides without adequate protective

measures, leading to increased exposure and associated health risks⁸. Studies indicate that pesticide exposure causes both acute and chronic health effects, including neurological, respiratory, dermatological, and gastrointestinal issues⁹⁻¹³. Despite regulations on pesticide use, their improper handling remains a public health concern, particularly in developing countries like Bangladesh^{11,14}. Inadequate training, lack of personal protective

equipment (PPE), and insufficient knowledge further exacerbate the risks¹⁵. Previous research highlights a strong correlation between pesticide exposure and various health problems among agricultural workers worldwide¹⁶⁻²¹. This study aims to assess the knowledge of pesticide use among horticulture workers in Bangladesh, identify common toxicity symptoms, and explore associations between pesticide exposure and sociodemographic factors. Findings will inform policies and interventions to promote safe pesticide use, reducing occupational health risks and ensuring sustainable agricultural development.

METHODS

This cross-sectional study was conducted among 236 rural horticulture workers in Munshiganj district, Bangladesh, from January to December 2021. Participants were selected using a convenient sampling method. Data were collected through face-to-face interviews using a semi-structured questionnaire. The questionnaire covered sociodemographic characteristics, pesticide knowledge, usage patterns, and self-reported toxicity symptoms. Knowledge levels were classified using Bloom's cut-off points into low, moderate, and good categories. Statistical analysis was performed to identify associations between pesticide exposure and various sociodemographic factors. Data were entered into SPSS version 26 for analysis. Each questionnaire was checked daily for completeness, and data clean-up was performed to ensure accuracy.

RESULTS

The study included 236 horticulture workers from Munshiganj district, Bangladesh. The age of participants ranged from 22 to 72 years, with a mean of 46.69 years (SD ±11.52). The largest proportion of respondents (28.4%) belonged to the 45–54 and ≥55-year age groups, followed by 26.7% in the 35–44-year range, and 16.5% in the ≤34-year group. The majority (89%) of the respondents were male, and all participants identified as Muslim. Regarding education, 40.7% had primary-level education, 25.4% completed secondary education, and 21.6% had higher education. A notable 12.3% had no formal education. The vast majority (87.3%) were married, while 12.7% were single. Income distribution showed that 34.3% earned ≤15,000 BDT per month, 33.5% earned 15,001–25,000 BDT, 23.7% earned 25,001–35,000 BDT, and 8.5% earned >35,000 BDT. Among them, 63.1% relied solely on horticulture for income, while 36.9% had additional sources of earnings. In terms of residence, 42.4% had been living in their

current location for 41–60 years, followed by 33.9% for 21–40 years, 18.2% for ≤20 years, and 5.5% for more than 60 years. Pesticide usage varied among respondents, with 39.4% using pesticides for 10–20 years, 33.5% for <10 years, and 27.1% for more than 20 years. Alarming, 71.2% of respondents had not received any training from government organizations on pesticide safety. Distribution of the respondents according to their socio-demographic characteristics are presented in Table 1.

Regarding pesticide awareness, 78.8% of respondents knew the names of pesticides they used, while 70.8% were aware of the instructions on pesticide containers. However, only 65.7% knew the recommended pesticide concentration, and 72% stored empty pesticide bottles on the farm rather than disposing of them properly. The most commonly known pesticide was Carbofuran (Furadan/Fana 5G), recognized by 70.8% of respondents. Other frequently identified pesticides included Azoxystrobin+Difenoconazole (65.3%), Cypermethrin+Chlorpyrifos (46.2%), and Metribuzin (33.5%). The majority (63.6%) applied pesticides through spraying, while 36.4% used hand scattering methods.

About 78.8% of respondents knew the names of pesticides they used, while 70.8% were aware of the instructions written on pesticide bottles. However, only 65.7% knew the recommended concentration for application. Alarming, 72% of respondents reported storing empty pesticide bottles on farm sites, while 99.2% did not store them at home. Most (83.5%) disposed of bottles in garbage, whereas 64.8% burned or dumped them. Proper hygiene practices were noted, with 97.5% taking showers after pesticide application. However, only 65.7% took showers immediately after use. A strong awareness of pesticide health risks was observed, with 92.8% acknowledging their adverse effects. Alternative pest control methods were poorly known, as only 36% of respondents were aware of them. Regarding exposure routes, 86.4% identified inhalation as a risk, while 78.8% noted skin absorption and 64.8% recognized oral ingestion. Activities such as smoking (77.5%), drinking (86.4%), and eating (91.9%) while handling pesticides were cited as risk factors. Regarding knowledge about PPE usage for pesticide protection, most respondents (84.7%) recognized the protective benefits of gloves, 92.8% understood the importance of masks, only 55.5% acknowledged the need for special boots, 47% mentioned wide-brimmed hats, and 29.2% recognized the protective role of goggles.

Knowledge of pesticide use was categorized based on Bloom's cut-off points, revealing that 61% had

moderate knowledge, 6.8% had low knowledge, and 32.2% had good knowledge.

Self-reported toxicity symptoms were highly prevalent among participants. Malaise was the most common, affecting 89.4% of respondents. Skin irritation was reported by 84.7%, while 83.1% experienced headaches. Skin rashes affected 74.2% of participants, and gastrointestinal symptoms such as epigastric discomfort (62.7%) and abdominal pain (54.7%) were also prevalent. Cardiovascular symptoms, including palpitations and chest pain, were experienced by 11.9%, 4.2%, while 38.1% suffered from feverish feeling (Table 2).

Regarding medical consultations due to pesticide-related health issues, 52.1% of respondents had sought medical advice, while 47.9% had not. Only 6.4% required hospital admission due to pesticide

exposure, while 12.7% had knowledge of pesticide poisoning-related deaths.

Statistical analysis revealed significant associations ($p < 0.05$) between various sociodemographic factors and toxicity symptoms. Older workers and those with longer pesticide use duration exhibited higher symptom prevalence. Gender differences were also notable, with male respondents reporting more severe symptoms. Workers who had received pesticide training showed a lower incidence of self-reported toxicity symptoms compared to untrained workers. However, the majority had never attended training, highlighting a crucial gap in education and awareness programs. Significant association of Socio-Demographic and Training Factors with Knowledge of Pesticide Use are presented in table 3.

Table 1. Distribution of the respondents according to their socio-demographic characteristics

Variables	Class difference	Frequency	Percentage	Remarks
Age group (years)	≤34	39	16.5	Min. age: 22, Max. age: 72 Mean SD: 46.69 ±11.522
	35-44	63	26.7	
	45-54	67	28.4	
	≥55	67	28.4	
	Total	236	100.0	
Educational qualification	No formal education	29	12.3	
	Primary	96	40.7	
	Secondary	60	25.4	
	Above	51	21.6	
	Total	236	100.0	
Marital status	Single	29	12.7	
	Married	207	87.3	
	Total	236	100.0	
Monthly Income	≤15000	81	34.3	Min: 5,000tk, Max: 50,000tk Mean SD: 22233.05 ± 9697.155
	15001-25000	79	33.5	
	25001-35000	56	23.7	
	>35000	20	8.5	
	Total	236	100.0	
Income solely from horticulture	Yes	149	63.1	
	No	87	36.9	
	Total	236	100.0	
Period of residence	≤20	43	18.2	
	21-40	80	33.9	
	41-60	100	42.4	
	>60	13	5.5	
	Total	236	100.0	
Duration of using pesticide	<10	79	33.5	
	10-20	93	39.4	
	>20	64	27.1	
	Total	236	100.0	
Training from govt. agency	Yes	68	28.8	
	No	168	71.2	
	Total	236	100.0	

Table 2. Distribution of the respondents according to their self- reported toxicity symptoms

Self-reported toxicity symptoms	Yes Freq.(%)	No Freq.(%)	Total Freq.(%)
Malaise	211(89.4)	25(10.6)	236(100)
Headache	196(83.1)	40(16.9)	236(100)
Fits and loss of senses	9(3.8)	227(96.2)	236(100)
Palpitations	28(11.9)	208(88.1)	236(100)
Chest pain	10(4.2)	226(95.8)	236(100)
Feverish feeling	90(38.1)	146(61.9)	236(100)
Sneezing	24(10.2)	212(89.8)	236(100)
Cough	51(21.6)	185(78.4)	236(100)
Dyspnea	18(7.6)	218(92.4)	236(100)
Epigastric discomfort	148(62.7)	88(37.3)	236(100)
Abdominal pain	129(54.7)	107(45.3)	236(100)
Vomiting	55(23.3)	181(76.7)	236(100)
Diarrhea	24(10.2)	212(89.8)	236(100)
Itchy painful nose	28(11.9)	208(88.1)	236(100)
Itchy painful ear	13(5.5)	223(94.5)	236(100)
Itchy painful throat	16(6.8)	220(93.2)	236(100)
Skin itching	200(84.7)	36(15.3)	236(100)
Skin rash	175(74.2)	61(25.8)	236(100)
Itchy painful eyes	67(28.4)	169(71.6)	236(100)
Tearing eyes	50(21.2)	186(78.8)	236(100)

Table 3. Association of Socio-Demographic and Training Factors with Knowledge of Pesticide Use

Variable	Category	Low Knowledge (%)	Average Knowledge (%)	Good Knowledge (%)	Significance (p-value)
Age Category	≤34	23.1	59.0	17.9	0.001
	35-44	4.8	65.1	30.2	
	45-54	4.5	61.2	34.3	
	≥55	1.5	58.2	40.3	
Gender	Male	4.8	59.0	36.2	0.000
	Female	23.1	76.9	0.0	
Marital Status	Single	24.1	58.6	17.2	0.000
	Married	4.3	61.4	34.3	
Monthly Income (BDT)	≤15,000	16.0	75.3	8.6	0.000
	15,001-25,000	1.3	62.0	36.7	
	25,001-35,000	0.0	58.9	41.1	
	>35,000	0.0	50.0	50.0	
Duration of Pesticide Use (Years)	<10	13.9	70.9	15.2	0.000
	10-20	5.4	57.0	37.6	
	>20	0.0	54.7	45.3	
Training in Pesticide Use	No	9.3	69.8	21.0	0.000
	Yes	1.4	41.9	56.8	

DISCUSSION

Pesticides and its related toxicity symptoms should be considered as one of the major issue of Bangladesh as our country depends on agriculture for

both economy and living purposes. This study assessed knowledge, practices, and self-reported symptoms among horticulture workers in Bangladesh. The findings reveal that while a significant proportion of workers had moderate

knowledge about pesticide use, many still experienced adverse health effects, suggesting gaps in safety implementation. Similar studies from other countries support these findings. A study in Nepal reported that 65% of pesticide applications were classified as "unlikely to present acute hazards," yet improper storage and lack of PPE use contributed to pesticide-related symptoms². Similarly, research in Kenya found that over 40% of horticultural workers experienced pesticide-related symptoms, with respiratory issues being a common complaint¹³. In Ghana, despite high levels of knowledge regarding pesticide names, nearly 95% of farmers lacked awareness of their environmental and health impacts, with most failing to use protective equipment. Differences in pesticide regulation and training accessibility may explain the variation in health impacts observed across studies¹. European Union regulations mandate comprehensive risk assessment and management practices, reducing occupational risks compared to developing countries where such measures are inconsistently enforced. Additionally, a study in Malaysia indicated that education level significantly influences pesticide knowledge and safety practices, with secondary school graduates exhibiting higher compliance with protective measures²¹. This contrasts with findings in Bangladesh, where training in pesticide safety was minimal among respondents

CONCLUSION

The study highlights significant knowledge gaps and health risks associated with pesticide use among horticulture workers in Bangladesh. The high prevalence of self-reported toxicity symptoms underscores the urgent need for improved training and safer pesticide practices. Addressing these issues through policy changes and educational interventions can reduce occupational health risks and promote sustainable agriculture.

Limitations

This study relied on self-reported data, which may be subject to recall bias. The convenient sampling method limits generalizability to a broader population. Additionally, the study did not include direct biological assessments of pesticide exposure.

Recommendations

- Implement mandatory training programs on safe pesticide use.
- Increase accessibility and affordability of PPE for horticulture workers.
- Strengthen regulations and enforcement on pesticide handling and application.
- Promote integrated pest management (IPM) strategies to reduce pesticide reliance.

- Conduct further research on long-term health effects of pesticide exposure.
- Improve healthcare services for agricultural workers, including screening and treatment for pesticide-related health issues.

Ethical considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of the National Institute of Preventive and Social Medicine (NIPSOM). The code of approval was: NIPSOM/IRB/2017/09.

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