

AN ANALYSIS OF VEGETABLE GROWERS' PERCEPTION REGARDING HEALTH HAZARDS ASSOCIATED WITH PESTICIDE USE IN DISTRICT VEHARI, PUNJAB-PAKISTAN

Ahmed Faiz Akbar¹ and Abdulmalek Naji Alsanhani²

¹Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan

²Department of Agricultural Extension and Rural Society, College of Food and Agriculture Sciences, King Saud University, P. O. Box 2460, Riyadh 11451, Saudi Arabia

*Corresponding author: faizi9066@gmail.com

ABSTRACT

The extensive use of pesticides in Pakistan's vegetable sector poses significant health risks for farmers who are often directly exposed during handling and application. This study analyzed vegetable growers' perceptions regarding health hazards of pesticide use in District Vehari, Punjab, Pakistan. Using a cross-sectional survey of 200 respondents, data were collected through a questionnaire and analyzed using descriptive and inferential statistics. Results indicated that farmers were more aware of acute health effects, such as skin irritation (M = 4.12, SD = 0.88) and dizziness/headache (M = 3.95, SD = 0.92), than chronic risks like cancer (M = 2.88, SD = 1.10) or reproductive problems (M = 2.95, SD = 1.08). Among hygiene-related practices, washing hands and bathing after spraying (M = 2.55, SD = 0.61) ranked highest, while use of goggles (M = 1.52, SD = 0.70) and gloves (M = 1.68, SD = 0.74) ranked lowest. Major constraints included high PPE cost (M = 2.48, SD = 0.69) and limited availability (M = 2.40, SD = 0.73). Chi-square analysis revealed significant associations of education ($p < 0.01$), income ($p < 0.05$), and extension contact ($p < 0.001$) with pesticide-related perceptions. Logistic regression showed that education (OR = 2.32), income (OR = 2.00), and extension contact (OR = 3.06) significantly increased the likelihood of perceiving pesticides as hazardous (Nagelkerke $R^2 = 0.31$). The study underscores the importance of affordable PPE accessibility, targeted awareness programs, and strengthened extension services to enhance safe pesticide practices in Pakistan.

Keywords: pesticide hazards, vegetable growers, perception, safety practices, extension contact, and District Vehar

Article History (2025-016) || Received: 08 Nov 2024 || Revised: 13 Jan 2025 || Accepted: 08 Feb 2025 || Published Online: 2025

This is an open-access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. INTRODUCTION

Vegetable production is among the most intensive and input-demanding sub-sectors of Pakistan's agriculture, and Punjab province is its main hub. Punjab has emerged as a notable center for fresh vegetable supply, producing onion, okra, bitter melon, tomato, cauliflower, and many other high-value crops that are marketed across the province and beyond (SMEDA, 2024). Intensive vegetable cultivation is closely linked to frequent application of pesticides and weedicides to manage a broad spectrum of insect pests, diseases, and weeds. While these inputs can stabilize yields and marketable quality, they also elevate occupational and public-health risks, especially where knowledge of safe handling is uneven, personal protective equipment (PPE) is inconsistently used, and regulatory oversight is difficult to enforce (Gurung et al., 2020; Punjab Agriculture Department, 2025).

A growing empirical literature from Pakistan documents acute and chronic health effects among farmers exposed to pesticides. Reported acute symptoms range from headaches, dizziness, skin and eye irritation, and nausea to more severe neurological manifestations; long-term exposure has been associated with respiratory, endocrine, reproductive, and neurobehavioral outcomes (Anonymous, 2020; Iqbal et al., 2021). Reviews underscore that risk is amplified in horticultural systems such as vegetable production due to shorter spray intervals, tank-mixing, and the use of multiple active ingredients across a season (Iqbal et al., 2021). Although national legislation (e.g., the Agricultural Pesticides Ordinance 1971 and the Punjab Agricultural Pesticides Rules 2018) sets standards for registration, labeling, sale, and use, on-farm practices often diverge from recommended guidelines due to limited training, economic constraints, and risk perceptions shaped by immediate pest pressure and market pressure (Punjab Agriculture Department, 2025).

Risk perception, the way growers understand the likelihood and severity of pesticide-related hazards, matters because it strongly influences behaviors toward sustainable use of pesticide application practices, adoption of recommended intervals, storage and disposal, and adoption of PPE as well as integrated pest management (IPM). Studies of vegetable growers report gaps in hazard recognition, underestimation of chronic risks, and inconsistent adherence to safety protocols (Jhansi et al., 2022; Hachem et al., 2020). Empirical studies show that perceived efficacy of pesticides, social norms, and experiential learning (e.g., no immediate harm observed) can also positively influence behavior, reinforced by targeted extension and practical, low-cost protective options (Kumar et al., 2024). Moreover, the public-health implications extend beyond applicators. Residue left on perishable vegetables affects the health of labor, farm families and end users (Kumar et al., 2024). Recent syntheses stress that without addressing perceptions and the structural constraints behind them, technical guidance alone may not translate into safer behavior (Mubushar et al., 2019).

In such contexts, understanding how growers perceive health hazards, what information they trust, and which constraints limit the adoption of safer practices is foundational for designing effective interventions. This study was designed as a district-specific analysis in Vehari to generate granular evidence on knowledge, attitudes, and practices (KAP), identify misconceptions or information gaps, and map the socioeconomic and institutional factors that shape the decision-making of farmers regarding safe use of pesticides under pest pressure. The district's cropping pattern includes major field crops (cotton, wheat, sugarcane) alongside significant and growing areas under vegetables; local value chains are supported by an active network of traders, contract buyers, and extension services (SMEDA, 2024).

Specifically, it explores: (i) growers' awareness of acute and chronic health risks associated with pesticides; (ii) constraints to adopting recommended measures; and (iii) associations between socioeconomic characteristics, extension contact and perceived risk of pesticides. The findings aimed to inform policymakers with empirical evidence on designing policy frameworks for locally tailored risk-communication strategies, more responsive extension programming, and sustainable vegetable production systems in Punjab.

2. MATERIALS AND METHODS

2.1. Research design

This study adopted a quantitative survey research design to analyze vegetable growers' perceptions of pesticide-related health hazards. A cross-sectional approach was used, as data were collected at a single point in time to address the research objectives. Cross-sectional design was employed due to its features of being less expensive to conduct compared to longitudinal studies, as they require fewer resources and time (Ziauddin et al., 2023).

2.2. Study population

The research was carried out in District Vehari, Punjab, Pakistan, which was purposively selected because of its intensive vegetable production, reliance on pesticide applications, and predominance of smallholder farming. The study population comprised vegetable growers actively involved in pesticide application or pest management decision-making on their farms. A multi-stage sampling procedure was applied. In the first stage, two tehsils, Burewala and Mailsi, were selected. In the second stage, 10 villages were selected from each tehsil, randomly. Next, it was decided to select 10 farmers from each village from the list of vegetable-growing households collected from local extension staff. Thus, a sample of 200 respondents was taken for the study.

2.3. Data collection

Primary data were collected using a structured questionnaire that was developed after reviewing relevant literature and pre-tested with 20 non-sampled growers to improve clarity and reliability. The questionnaire was divided into four sections: socioeconomic characteristics (age, education, household size, farm size, income, and extension contact), awareness and perceived severity of pesticide-related acute and chronic health effects, self-reported safety practices and constraints such as the use of personal protective equipment (PPE), pesticide storage and disposal, and overall perceived risk measured on Likert-type scales. Data were gathered through face-to-face interactions conducted in the local languages (Saraiki and Punjabi) by trained enumerators to reduce literacy barriers and enhance accuracy.

2.4. Data analysis

Data analysis was performed using SPSS version 26, employing both descriptive and inferential statistical techniques. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize growers' characteristics, awareness, perceptions, and practices. Composite indices were developed for awareness and safety practices using Likert-scale scores. Inferential tests included Chi-square to assess relationships

between socioeconomic characteristics and pesticide-related perceptions, while binary logistic regression was applied to model the likelihood of perceiving pesticides as a serious health hazard based on predictors such as age, education, farm size, income, and extension contact. Constraints were further analyzed through frequency distributions and mean weighted scores to identify and rank barriers limiting safe pesticide use. Ethical standards were carefully maintained throughout the study.

2.5. Ethical considerations:

Informed consent was obtained from all participants prior to data collection, and respondents were assured of confidentiality and anonymity. Data were used strictly for academic and research purposes, and ethical approval was secured from the relevant institutional review committee.

3. RESULTS

3.1. Demographic Characteristics

Table 1 gives the demographic information and shows that 31% of the respondents were in the age bracket of 31-40 years, 29% in the age category of 41-50 years, and, 23% in the age bracket of 50 years and above. It indicates that most of the vegetable farmers were middle-aged to relatively young, which is a common trend in other studies as well (Iqbal et al., 2021). About education, 26 percent of the respondents were illiterate, 22 percent had a primary schooling, and 19 percent had a middle schooling. Only 15 percent of respondents had an intermediate or higher education. This means that not all farmers in the district are well-educated, and their awareness and ability to read labels and warning signs of pesticide safety were limited. Low literacy rates of Pakistani farmers as an obstacle to the adoption of safer pesticide handling practices and integrated pest management solutions was also indicated by Iqbal et al. (2021) and Kumar et al. (2024).

Table 1: Demographic Characteristics of Vegetable Growers in District Vehari (n = 200)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	20–30	34	17.0
	31–40	62	31.0
	41–50	58	29.0
	Above 50	46	23.0
Education level	Illiterate	52	26.0
	Primary (1–5 years)	44	22.0
	Middle (6–8 years)	38	19.0
	Secondary (9–10 years)	36	18.0
	Intermediate and above	30	15.0
Household size	1–5 members	68	34.0
	6–10 members	94	47.0
	Above 10 members	38	19.0
Farm size	Small (<5 acres)	76	38.0
	Medium (5–10 acres)	84	42.0
	Large (>10 acres)	40	20.0
Monthly farm income	< 25,000 PKR	54	27.0
	25,001–50,000 PKR	78	39.0
	50,001–75,000 PKR	40	20.0
	Above 75,000 PKR	28	14.0
Extension contact	Regular (monthly or more)	48	24.0
	Occasional (seasonal)	76	38.0
	Rare/Never	76	38.0

Almost half (47 percent) of respondents had a large family (6-10). While 19 percent had a family size of above 10 people. This form of extended family could be common in the rural Punjab and indicates that women and children may be indirectly exposed to pesticides through storage, the washing of infected clothes, or fieldwork (Iqbal et al., 2021; Kumar et al., 2024). Regarding farm size, 38 percent of respondents were small land owners, 42 percent were medium, and 20% were large (>10 acres) farmers. Smaller farms are more intensive in their production and use more pesticides per hectare, which can lead to exposure to pesticide risk (Iqbal et al., 2021).

The monthly earnings profile shows that 39 percent of the respondent indicated their monthly earnings to be between PKR 25001-50000 and 27 percent indicated their monthly earnings to be below 25000 PKR. Forty percent of them earned more than PKR 75,000. This indicates that the majority of farmers might not be able to afford expensive control measures, nor invest in less risky pest control measures. Other past studies have found these financial constraints to be a significant obstacle to the adoption of safety measures (Kumar, 2020). Finally, there

were also very poor extension contacts. Only 24 percent said they encountered extension agents regularly, 38 percent seasonally and 38 percent rarely or not at all. This has been one of the consequences of the long-standing institutional vacuum in the Punjab's agricultural advisory services: a lack of access to extension officers (Kumari et al., 2021). Concerning pesticides specifically, low extension contact will reduce the likelihood that farmers receive training on risk awareness and the risks associated with pesticides and pesticide alternatives (Patel et al., 2018).

3.2. Awareness and Perceived Severity of Health Hazards

Table 2 presents vegetable growers' awareness and perceived severity of acute and chronic health effects associated with pesticide exposure.

Table 2: Awareness and Perceived Severity of Health Hazards of Pesticide Exposure among Vegetable Growers (n = 200)

Health Effect	Awareness Mean (\pm SD)	Perceived Severity Mean (\pm SD)	Rank (Severity)
Acute Health Effects			
Skin irritation/rashes	4.12 \pm 0.88	4.05 \pm 0.91	1
Dizziness/headache	3.95 \pm 0.92	3.88 \pm 0.95	2
Nausea/vomiting	3.82 \pm 0.94	3.70 \pm 0.96	3
Eye irritation / blurred vision	3.65 \pm 0.98	3.62 \pm 0.93	4
Breathing difficulty (short-term)	3.50 \pm 1.02	3.40 \pm 1.05	5
Chronic Health Effects			
Respiratory diseases (asthma, cough)	3.45 \pm 1.00	3.85 \pm 0.97	1
Neurological issues (memory loss, tremors)	3.10 \pm 1.05	3.60 \pm 1.01	2
Reproductive health problems	2.95 \pm 1.08	3.50 \pm 1.04	3
Cancer risk (long-term exposure)	2.88 \pm 1.10	3.45 \pm 1.02	4
Kidney/liver damage	2.75 \pm 1.12	3.30 \pm 1.09	5

Note: 5-Likert-scale items (1 = Not aware / Not severe, 5 = Fully aware / Very severe)

According to the respondents, skin irritation and rashes (M = 4.12, SD = 0.88), dizziness/headache (M = 3.95, SD = 0.92), and nausea/vomiting (M = 3.82, SD = 0.94) were the most frequently reported and perceived health effects. These results suggest that cultivators may be better equipped to recognize and monitor the short-term, noticeable outcomes of exposure to pesticides. The same tendency was noted in other research studies conducted in Pakistan, where acute effects (including skin and eye irritation, dizziness, and nausea) have been identified due to their frequent occurrence during or soon after spraying (Kumar et al., 2024; Iqbal et al., 2021). Perceived severity and awareness of the long-term health effects, in turn, were much lower. Since respiratory diseases were rated with a relatively higher severity level (M = 3.85, SD = 0.97), e.g., persistent cough or asthma, growers knew very little about the long-term consequences (e.g., the risk of cancer, M = 2.88, SD = 1.10; or kidney or liver damage, M = 2.75, SD = 1.12). The neurological problems and reproductive health problems were regarded as less severe when compared to the acute symptoms. This acute and chronic risk awareness reflects a broader trend in the literature, in which farmers are depicted as underestimating or failing to consider the insidious and long-term consequences of pesticide exposure on their health (Khuhro et al., 2020; Sharma et al., 2019).

The lack of knowledge about chronic conditions could be attributed to a long list of factors, including low levels of education, limited extension services, and the inability to link chronic diseases to pesticide exposures without a medical diagnosis. Other researchers have highlighted that farmers in developing nations, particularly those with low levels of literacy, make their judgements of the dangers posed by pesticides more on their own experiences and networks than on scientific evidence (Kumari et al., 2021; Sharma et al., 2019). Consequently, acute symptoms that occur immediately after the process of pesticide application are easier to identify than chronic diseases, which occur with the course of time. The results indicate that growers in Vehari are generally sensitive to the short term risks of exposure to pesticides, but have little understanding of the long term health issues related to pesticides. Promoting knowledge of acute and chronic outcomes among farmers can contribute to safer handling practices and, in the long term, reduce health risks, as evidenced by previous studies in Pakistan and other agricultural settings.

3.3. Safety Practices

Table 3 presents the self-reported safety practices of vegetable growers in District Vehari regarding pesticide use.

The findings indicate that the most frequently mentioned practices were related to fundamental hygiene, as they did not require the use of special protective equipment by the growers. Washing hands and bathing after spraying (Mean = 2.55, SD = 0.61), then changing clothes after spraying (Mean = 2.38, SD = 0.72) attained highest mean

score in the Table. These findings also coincided with those of Iqbal et al. (2021) and Kumar et al. (2024), who discovered that personal hygiene practices were more common than wearing protective equipment on a regular basis among pesticide applicants in developing countries. The middle positions with moderately low adoption level were taken by protective clothing (long sleeves) (Mean = 2.00, SD = 0.79) and safe storage of pesticides (Mean = 2.08, SD = 0.81). However, the application of the most relevant preventive measures, such as wearing masks/respirators (Mean = 1.74, SD = 0.83), disposing of empty containers properly (Mean = 1.82, SD = 0.77) and wearing gloves (Mean = 1.68, SD = 0.74) was low. The least practiced measure was goggles/eye protection (Mean = 1.52, SD = 0.70). The same findings are indicated by other studies that farmers frequently do not use the specialized PPE due to its discomfort, high cost and lack of awareness (Sai et al., 2019; Raghunandan et al., 2020). The results show that there is a disconnect between what growers already know about the risks of pesticide use and how they are really safeguarding themselves. Despite hygiene-related practices being prioritized, uptake of the recommended PPE is low. This lack of connection shows how essential it is to strengthen agricultural extension activities and farmer education to increase compliance with safety standards. The prior study indicates that training and extension contacts play a significant role in influencing the adoption of the safety measures related to pesticides (Mengistie et al., 2015; Jallow et al., 2017).

Table 3: Safety Practices Adopted among Vegetable Growers (n = 200)

Safety Practices	Mean	SD	Rank
Washing hands and bathing after spraying	2.55	0.61	1
Changing clothes after spraying	2.38	0.72	2
Wearing protective clothing (long sleeves)	2.00	0.79	3
Safe storage of pesticides	2.08	0.81	4
Wearing masks/respirators	1.74	0.83	5
Proper disposal of empty containers	1.82	0.77	6
Wearing gloves during spraying	1.68	0.74	7
Using goggles/eye protection	1.52	0.70	8

Note: 3-point Likert scale (1 = Never, 2 = Sometimes, 3 = Always)

3.4. Constraints to Adopting Recommended Practices

According to Table 4, the largest barrier to adopt the proposed pesticide safety measures (Mean = 2.48, SD = 0.69) was the high price of personal protective equipment (PPE), which received the first position among all restrictions. This finding is consistent with prior studies that identified cost as one of the most critical issues that smallholder farmers in low-income settings may encounter when purchasing and wearing safety equipment regularly (Shinde, 2017; Sharma, 2019). Second on the ranking chart was the limitation of the safety equipment (Mean = 2.40, SD = 0.73). In most instances, farmers reported that they did not find appropriate protective gear in the domestic markets, which is consistent with the study in Ethiopia and Nepal, where PPE is absent in the rural areas and, therefore, cannot easily manage pesticides in a safe manner (Mengistie et al., 2015). Awareness or training of how to apply pesticides safely was the third most ranked factor (Mean = 2.32, SD = 0.71) and it was an indication of the importance of educating farmers on safe agricultural practices. Some evidence exists that farmers are more likely to take protective measures than those who have not been approached in training or extension (Jallow et al., 2017; Kumari et al., 2021).

Table 4: Constraints to Adopting Recommended Practices among Vegetable Growers (n = 200)

Constraints to Adopting Recommended Practices	Mean	SD	Rank
High cost of PPE	2.48	0.69	1
Limited availability of safety equipment	2.40	0.73	2
Lack of awareness/training on safe use	2.32	0.71	3
Discomfort/inconvenience during fieldwork	2.26	0.75	4
Limited extension contact and guidance	2.16	0.77	5
Perception that PPE is unnecessary	2.15	0.72	6

Note: 3-Likert severity scale (1 = Low, 2 = Moderate, 3 = High).

The other limitation was that many farmers reported discomfort and inconvenience during fieldwork (Mean = 2.26, SD = 0.75) when wearing PPE, especially masks and gloves, which restrict movement and make working in hot, humid environments uncomfortable. This has been widely reported in South Asia and other parts of Africa, where weather has made the wearing of PPE a discouraged practice (Shinde et al., 2021; Kori et al., 2018). The constraints that got the lowest rank were limited extension contact and guidance (Mean = 2.16, SD = 0.77) and the perception that PPE is not necessary (Mean = 2.15, SD = 0.72). The findings demonstrate that there is still no knowledge transfer and that risk underestimation continues to persist among growers as observed in similar studies

carried out in Pakistan and other developing countries (Shinde et al., 2021). The results point to the existence of structural barriers (cost, extension support, availability) and behavioral barriers (perceptions, comfort) to the implementation of the recommended safety practices. To address the above problems, the state should implement solutions encompassing subsidizing PPE, improving service delivery, and practicing behavior change communication, which will lead to greater compliance with safety measures among farmers.

3.5. Inferential analysis

3.5.1. Chi-square Tests

The Chi-square analysis (Table 5) revealed significant associations between socioeconomic characteristics and growers' pesticide-related perceptions.

According to Table 5, awareness of health hazards, uptake of safety practices, and perceived risk were highly significantly associated with education ($p < 0.01$). This indicates that literate farmers had a better understanding of pesticide hazards, were more inclined to take precautionary measures and were more conscious of the long-term risks. We have seen the same evidence in Pakistan and other developing nations where education has been shown to improve the knowledge of farmers on the safety of pesticides and the perception of risk (Jallow et al., 2017; Riccò et al., 2018). Another highly significant determinant ($p < 0.001$) in all three outcomes was extension contact. Farmers who had frequent contact with agricultural extension officers were more aware, more protective, and more realistic in their perceptions of pesticide risks. The finding concurs with that of Jallow et al. (2017), who found that extension services are central to the spread of knowledge about integrated pest management (IPM) and safe pesticide handling. The limited outreach of extension has been pointed out as a hindrance to the safe application of pesticides in South Asia, and Pakistan is not an exception (Iqbal et al., 2021).

Table 5: Chi-square Tests of Associations between Socioeconomic Variables and Pesticide-Related Perceptions (n = 200)

Socioeconomic Variable	Awareness of Health Hazards (χ^2 , p)	Adoption of Safety Practices (χ^2 , p)	Perceived Risk of Exposure (χ^2 , p)
Age	4.82, 0.090ns	3.76, 0.152ns	6.24, 0.044*
Education	14.35, 0.001**	11.62, 0.003**	12.36, 0.002**
Farm size	2.91, 0.212ns	5.40, 0.144ns	3.82, 0.148ns
Income level	7.42, 0.024*	8.13, 0.017*	9.14, 0.010*
Extension contact	18.26, 0.000***	14.95, 0.001**	15.27, 0.000***

Note: * $p < 0.05$ = significant; ** $p < 0.01$ = highly significant; *** $p < 0.001$ = very highly significant; ns = not significant

All three outcomes were significantly associated with income level ($p < 0.05$), and it appears that more affluent farmers are better equipped to buy personal protective equipment (PPE) and implement safer practices. This confirms the previous evidence provided by Shinde et al. (2021), who stated that the adoption of safety measures is constrained by financial constraints, even though smallholders are aware of the risks associated with pesticides. Conversely, only age had a significant effect on perceived risk ($p < 0.05$); older farmers had higher perceived risks than younger ones, perhaps because of the experience they had with exposure to pesticides. Nevertheless, there was no significant effect of age on awareness or adoption of safety practices, which is consistent with the results of Kumar et al. (2024).

Interestingly, there were no significant correlations between farm size and awareness, safety practices, or perceived risk. This means that smallholders and big farmers are at the same level of vulnerability to health risks and have equal problems in the use of pesticides. Other studies in Punjab and Sindh provinces have also found that farm size does not play a role in determining the behavior of pesticide safety (Hachem et al., 2020). These findings highlight the significant importance of education, income, and extension contact in developing vegetable growers' awareness, their adoption of precautionary measures, and their perception of health risks associated with pesticide use.

3.5.2. Binary Logistic Regression

According to table 6, the overall model was significant (Nagelkerke $R^2 = 0.31$). In other words, approximately 31 percent of the risk perception was explained by the predictors used. The classification accuracy of the model is 72.5%, which further indicates the model's reliability in predicting the outcome. The most significant predictors identified as having a statistically significant effect on the perception of growers were education, income and extension contact. The farmers with literacy skills more frequently recognized pesticides as a serious health risk (OR = 2.321, $p < 0.01$) twice as often as illiterate farmers did, which supports the role of education in raising risk awareness. This outcome aligns with previous studies examining the role of education about the risks of pesticide use and protective working environments among farmers (Kori et al., 2018; Kumar et al., 2024).

Similarly, growers with higher monthly incomes (above Rs. 30,000) were about twice as likely to report a perception of health risks associated with pesticide use compared to their low-income counterparts (OR = 2.002, $p <$

0.05). Higher income levels will also enhance access to information, training, and safety devices, thereby raising awareness and perceptions. Prior studies in Pakistan and other developing countries confirm this association, as well as the assumption that financial capacity enhances the adoption of health-protective behaviors (Shinde et al., 2021; Sharma et al., 2019).

Table 6: Binary Logistic Regression of Factors Influencing the Likelihood of Perceiving Pesticides as a Serious Health Hazard (n = 200)

Predictor Variable	B	SE	Wald	p-value	Odds Ratio (Exp(B))	95% CI for Exp(B)
Age (years)	-0.012	0.018	0.44	0.507	0.988	0.953 – 1.024
Education	0.842	0.310	7.36	0.007**	2.321	1.254 – 4.296
Farm Size (acres)	0.056	0.029	3.73	0.054	1.058	0.999 – 1.121
Income (≥ Rs. 30,000)	0.694	0.280	6.13	0.013*	2.002	1.155 – 3.472
Extension Contact	1.120	0.333	11.29	0.001**	3.064	1.594 – 5.889
Constant	-1.527	0.492	9.63	0.002	0.217	—

Model Statistics:

-2 Log likelihood = 221.64

Nagelkerke R² = 0.31

Overall classification accuracy = 72.5%

*Significant at p < 0.05

*Significant at p < 0.01

The most meaningful predictor in the model was contact with extension agents (OR = 3.064, p < 0.01); growers who had contact with extension agents were more likely to have a negative perception of pesticides. This highlights the importance of agricultural extension services in sensitizing farmers on the acute and chronic health issues that are associated with exposure to pesticides. It has also been suggested by previous studies that an extension contact is a significant factor in the adoption of awareness and protection practices (Kumari et al., 2021; Jallow et al., 2017).

Farm size was marginally significantly related (p = 0.054) and larger scale farmers may be more aware of the risks associated with pesticides, as they are more exposed and reliant on chemical-intensive production. However, the impact was not so strong that we could make certain conclusions. It was not age predictive, however, and it is observable that growers did not vary greatly in their perceptions of the dangers of using pesticides across different age groups. This observation reinforces a small number of studies that suggest older farmers may be more conservative due to experience over time (Jhansi et al., 2022), although it aligns with a small number of studies that did not find age to affect this (Gurung et al., 2020). Overall, the results suggest that education, income and extension services are the strongest predictors of the perceptions of growers as to the health risk of pesticides.

4. CONCLUSION

The findings suggest that, despite growers demonstrating a high degree of awareness of acute health effects associated with pesticide use, such as skin irritation, dizziness, and nausea, awareness of chronic risks, including cancer, neurological disorders, and reproductive health issues, was low. A preference for simple hygiene practices (bathing or changing clothes after spraying) over the use of recommended personal protective equipment (PPE) due to financial concerns, availability, and inconvenience was also reported. Statistical tests indicated that education, income, and extension contact significantly affected perceptions of risk and the adoption of safety practices, whereas age and farm size did not play a critical role. More specifically, the extension services emerged as a critical variable, underscoring the role of institutional support in addressing the information gap. Logistic regression results showed that literate and more prosperous farmers who had often received extension were far more likely to report pesticides as a critical health hazard. Overall, the paper demonstrates the importance of targeted farmer training, low-cost, accessible PPE, and behaviorally based extension methods. Addressing structural and perceptual barriers to safer pesticide practices and saving lives in Pakistan's vegetable industry will matter.

Declarations

Funding: This study didn't receive any funding from any agencies in the public, commercial, or non-profit sector.

Conflicts of Interest: Authors have no conflicts of interest.

Data Availability: Data will be available from the corresponding author upon request.

Ethics Statement: The studies involving humans were approved by the Institute of Horticultural Sciences, University of Agriculture, Faisalabad. The studies were conducted in accordance with the local legislation and

institutional requirements. The participants provided their written informed consent to participate in this study.

Authors' Contribution: Ahmed Faiz Akbar; Conceptualization, Data Curation, Methodology, Data Original draft, Formal Data Analysis, Writing, Abdulmalek Naji Alsanhani; Review and Editing, Data Analysis and Data Collection

Generative AI Statements: The authors declare that no Gen AI/DeepSeek was used in the writing/creation of this manuscript.

Publisher's Note: This article's assertions are solely the authors' own and do not necessarily reflect those of the publisher, editors, reviewers, or their related organizations. The publisher and editors do not guarantee or promote any product that may be reviewed, evaluated, or claimed by its manufacturer in this article

REFERENCES

- Anonymous. (2020). *Agricultural & Processed Food Products Export Development Authority (APEDA)*. http://apeda.gov.in/apedaw_ebsite/six_head_product
- Ziauddin, L., Krivicich, L. M., & Nho, S. J. (2023). *Cross-section study* (pp. 191–193). Elsevier BV. <https://doi.org/10.1016/b978-0-323-91259-4.00081-3>
- Gurung, S., Shrestha, K. K., & Jha, P. K. (2020). Knowledge and practice of pesticide use among vegetable farmers in Nepal. *Environment and Ecology Research*, 8(3), 57–64. <https://doi.org/10.13189/eer.2020.080301>
- Hachem, M., Sharma, B. K., Naggar, A. E., Pilankar, I., & Anwar, A. (2020). Systematic approaches for soil analysis in forensic investigation. *2020 Advances in Science and Engineering Technology International Conferences (ASET)*, 1–5. <https://doi.org/10.1109/ASET48392.2020.9118299>
- Iqbal, M. F., Khan, M. I., Ahmad, I., & Khan, Z. H. (2021). Pesticide residues, health risks, and vegetable farmers' risk perceptions in Punjab, Pakistan. *Human and Ecological Risk Assessment: An International Journal*, 27(3), 846–866. <https://doi.org/10.1080/10807039.2020.1845640>
- Jallow, M. F., Awadh, D. G., Albaho, M. S., Devi, V. Y., & Thomas, B. M. (2017). Pesticide knowledge and safety practices among farm workers in Kuwait: Results of a survey. *International Journal of Environmental Research and Public Health*, 14(4), 340. <https://doi.org/10.3390/ijerph14040340>
- Jhansi, B., Kalal, & Annapurna, N. (2022). Socio personal profile of APMC women involved in postharvest activities of dry chili and their constraints – A comparative study. *Indian Research Journal of Extension Education*, 22(4), 13–21.
- Khuhro, S. N., Junejo, I. A., Hullio, M. H., Hassan, M. F., Maitlo, S. A., & Shaikh, M. A. (2020). Knowledge attitude practice regarding pesticide application among vegetable growers of Dadu Canal irrigated areas of Northern Sindh Pakistan. *Pakistan Journal of Agricultural Sciences*, 33(2), 331–336. <https://doi.org/10.17582/journal.pjar/2020/33.2.331.336>
- Kori, R. K., Thakur, R. S., Kumar, R., & Yadav, R. S. (2018). Assessment of adverse health effects among chronic pesticide-exposed farm workers in Sagar District of Madhya Pradesh, India. *International Journal of Nutrition, Pharmacology, Neurological Diseases*, 8(4), 153. https://doi.org/10.4103/ijnpnd.ijnpnd_38_18
- Kumar, R. (2020). *Awareness and attitude of farmers and traders towards electronic national agriculture market (e-NAM) in Sriganganagar District (Rajasthan)* (Doctoral dissertation, Swami Keshwanand Rajasthan Agricultural University, Bikaner).
- Kumar, R., Jhajharia, A. K., Rohila, A. K., Rajpurohit, T. S., Shubham, Kumar, S., & Choudhary, N. (2024). Awareness and challenges faced by farmers in marketing agricultural produce through the e-national agriculture market (e-NAM). *Asian Journal of Agricultural Extension, Economics & Sociology*, 42(6), 276–283. <https://doi.org/10.9734/ajaees/2024/v42i62013>
- Kumari, R., & John, R. (2021). Training needs and effectiveness of pesticide safety interventions among rural farmers. *International Journal of Agricultural Sciences*, 13(3), 153–159.
- Mengistie, B. T., Mol, A. P., & Oosterveer, P. (2015). Pesticide use practices among smallholder vegetable farmers in Ethiopian Central Rift Valley. *Environment, Development and Sustainability*, 17(3), 887–906. <https://doi.org/10.1007/s10668-014-9575-1>
- Mubushar, M., Aldosari, F. O., Baig, M. B., Alotaibi, B. M., & Khan, A. Q. (2019). Assessment of farmers on their knowledge regarding pesticide usage and biosafety. *Saudi Journal of Biological Sciences*, 26(7), 1903–1910. <https://doi.org/10.1016/j.sjbs.2019.03.001>
- Patel, H. M., Solanki, J. D., & Bhatt, V. D. (2018). Knowledge and practices of pesticide use among vegetable farmers. *Indian Journal of Extension Education*, 54(2), 78–81.
- Punjab Agriculture Department. (2025). *The Punjab Agricultural Pesticides Rules 2025*. Government of Punjab.
- Raghunandan, G., Deshmukh, S. N., & Patil, S. L. (2020). Perception of vegetable growers towards harmful effects of pesticides. *Journal of Agricultural Extension*, 24(1), 48–52. <https://doi.org/10.4314/jae.v24i1.5>
- Riccó, M., Vezzosi, L., & Gualerzi, G. (2018). Health and safety of pesticide applicators in a high-income agricultural setting: A knowledge, attitude, practice, and toxicity study from North-Eastern Italy. *Journal of Preventive Medicine and Hygiene*, 59(3), E200–E210. <https://doi.org/10.15167/2421-4248/jpmh2018.59.3.1030>
- Sai, S. M. V., Revati, G. D., Ramya, R., Swaroop, A. M., Maheswari, E., & Kumar, M. M. (2019). Knowledge and perception of farmers regarding pesticide usage in a rural farming village, Southern India. *Indian Journal of Occupational and Environmental Medicine*, 23(1), 32–36. https://doi.org/10.4103/ijoom.IJOEM_121_18

Citation: Akbar, AF & Alsanhani AN, 2026. An analysis of vegetable growers' perception regarding health hazards associated with pesticide use in district Vehari, Punjab-Pakistan. *Scientific Records* 2(1): 45-53. <https://doi.org/10.62324/SR/2025.019>



- Sharma, S., Singh, A., & Meena, B. S. (2019). Perception and awareness regarding pesticide use among farmers in Haryana. *Indian Research Journal of Extension Education*, 19(1), 43–47.
- Shinde, A. H. (2017). *Technological gap in green gram production practices among growers* (Master's thesis, VNMKV, Parbhani).
- Shinde, P. Y., Bhange, S. B., & Ban, S. H. (2021). Assessment of food and nutritional security status of farm women. *Gujarat Journal of Extension Education*, 32(1), 130–134.
- SMEDA—Small and Medium Enterprise Development Authority. (2024). *Cluster profile: Bitter gourd (Vehari, South Punjab)*. Government of Pakistan.