Research Article

Farmers' Perception of Plant Protection Practices and Management of Insect Pests of Rice in Lahore Division, Pakistan

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Abstract | In Pakistan, pesticides are abundantly used in agriculture sector for increasing high yield of crops and for controlling pests of different crops. The excessive use of pesticides with poor knowledge about pesticide handling, disposal, storage and Personal Protection Equipment (PPE) during operation leads to health problems of human, increase resistance against pests with negative effects on the environment. The purpose of this survey was to check the knowledge about pesticide uses, risks and storage among farmers in Lahore division of Punjab, Pakistan. And, to get knowledge from farmers regarding local knowledge system (LKS) and Integrated Pest Management (IPM). Most of respondents 97% (out of total 250) were male and 28% were between the ages of 26-45 years. Thirteen percent respondents had acquired education up to secondary level, and 92% respondents got knowledge about pesticide usage from pesticide retailers. Most of the respondents (85%) visited doctor after any exposure and 96% took showering after application. Most of the respondents (96%) did not use any protection during mixing of pesticide solution and 94% respondents did not during applying. Forty-nine percent respondents disposed left over pesticide solution on ground and 67% used for different purposes until finished. This study revealed lack of knowledge about pesticide use, storage, disposal, LKS, IPM and PPE. Farmers training regarding pesticide usage are necessary to ensure safe use of pesticides, and to save the environment.

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1. Introduction

Pakistan's economy is dependent on agriculture because it is an agricultural country with heavy reliance on pesticide to increase productivity of crops and controlling different pests (Hanif *et al.*, 2022; Khan *et al.*, 2022). Local Knowledge Systems (LKS) are comprised of indigenous and local groups' information, attitudes, customs, behaviors, organizations, and views of the world, and are thought to constitute an adaptation strategy to the environment in which they exist (Khan *et al.*, 2013). A few scholars have questioned the value of LKS, claiming that it is limited to local problems (Briggs, 2005) and persons

having local knowledge labeled like caretakers of the earth, conservation groups, or subsistence consumers who are not to be able to coexist in a sustainable way with the environment as their population rises and as there should be more assimilated in economic systems (Lu, 2007). LKS have been labeled conventional in the past, with the implication of being older or archaic, and hence ineffective in solving modern-day problems (Beckford and Barker, 2007). Others have argued that LKS's adaptability, applicability, and utility should be objectively evaluated and proven by science (de Albuquerque and Hanazaki, 2009).

Farmers have been seen to depend primarily on pesticides to protect their crops from pest attacks, despite being ignorant of the adverse effects of pesticides. Health issues, environmental pollution and spread of secondary pest are reduced and not only caused by pest resistance by this method (Abbas *et al*., 2015; Khan, 2020a; Khan *et al*., 2022). Mostly chemicals like organophosphate, pyrethroids and other classes and their types of pesticides such as acaricides, rodenticides, herbicides and insecticides, are used against pests in Pakistan (Khan, 2022).

Working with chemical pesticides exposes farmers, agricultural workers, and pesticide operators to a high risk of poisoning and health risks in most regions of the world (Damalas, 2009). Long-term exposure to agrochemicals has been linked to injuries and health issues among workers and farmers and other non-target (Khan, 2020b; 2022). Pesticide overuse in agricultural farms has been linked to various of health problems, such as headaches, skin irritation, eye irritation, respiratory and throat discomfort, and many more (Devi, 2009). Furthermore, these issues have resulted in financial losses due to medical expenses among sick persons, poor farmers and agriculture labor (Maumbe and Swinton, 2003). These direct expenditures might be overwhelmed by hidden and indirect costs.

In the Punjab province, the major crops including, maize, rice, cotton, sugarcane and wheat are growing on large areas. Crops damages are observed at all stages by sucking and chewing pests. Pest control with pesticides is preferred by farmers in this region (Basit *et al*., 2013). These farmers were unaware of the chemical nature of pesticides (Ibitayo, 2006; Khan *et al*., 2013). They also receive no help or guidance from the extension department of agriculture about pesticide application (Rodrigues *et al*., 2013). Disposal of empty bottles were not properly disposed of which contain a significant amount of pesticides that ultimately cause pollution and resistance development in non - target species. However, even when farmers are aware of the health concerns of pesticides, they continue to apply them to avoid a decreased crop output, leading to the perception that agrochemical use is inevitable (Enserink *et al*., 2013).

The purpose of the survey in farming lands located in Lahore division, Punjab province was to analyses farmers' knowledge about pesticide usage, storage, disposal procedure and PPE during mixing and application of pesticide. And, also to evaluate the problems of exposure and treatments after pesticide exposure.

2. Materials and Methods

Using questionnaire-based interviews with farmers, cross-sectional survey was undertaken from December 2021 to May 2022. A questionnaire prepared according to the guidelines of Frary (1998) and included the closed ended questions. After preparation of questionnaire, to assess suitability of the questions, firstly 20-25 questionnaires were filled by students and these questionnaires were not included in research. After that, few questions had changed in Questionnaire. Farmers were interviewed face to face for this survey. The study's goal was first stated in easy language, and then questions about their willingness were addressed verbally and their responses recorded on a questionnaire.

The questionnaire had four main parts such as demographic characteristics, knowledge about pesticide use, knowledge about Personal Protection Equipment (PPE) of pesticide use and knowledge about storage and disposal of pesticides. Questionnaires were filled only from those farmers who showed consent to participate this research verbally. During research got information about local knowledge system (LKS). The survey was consisted of 250 respondents, and the respondents were selected based on convenient random sampling. This research was conducted in five sites of Lahore division. These respondents were from villages of Kasur district (31.1179° N, 74.4408° E), Sheikhupura district (31.7167° N, 73.9850° E) and few respondents from University of the Punjab, Lahore (31.5204° N,

74.3587° E). These areas selected due to massive use of pesticides and operational convenience to protect their crops from pest attack. Most of respondents were not able to read and understand the questionnaire then explained the questions face to face conservation in Urdu/Punjabi language and told to the purposes of this survey.

The data from the surveys was extracted and recorded for each farmer in a Microsoft Excel spreadsheet file. To avoid the possibility of a mistake, the file was double-checked and compared to the questionnaires of surveys. The data of knowledge about pesticide use, storage, disposal and its Personal Protection equipment (PPE) were inserted in Microsoft Excel Spreadsheet and given the score 1 for selected option of any question by following the methodology of (Koenraadt *et al.*, 2006). And the unselected options of questions left the blank in Microsoft Excel spreadsheet and not filled with 0.

3. Results and Discussion

3.1 Respondents

Two hundred and fifty respondents from three sites in Kasur and one site in Sheikhupura took part in this research survey. From Tolu Wala (TW) Kasur, Sheikh Amad Kasur (SAK), Sanda Chistana Kasur (SC), Wandala Sheikhupura (WNK), and University of the Punjab, Lahore (PU Lahore), 102, 37, 34, 48 and 29 respondents, respectively, took part in the survey. According to the results, there were 12% respondents from Punjab University Lahore and 41% respondents from Tolu Wala Kasur, 15% respondents from Sheikh Amad Kasur, 14% respondents from Sanda Chistana Kasur, 19% respondents from Wandala Sheikhupura, and 15% respondents from Sheikh Amad Kasur (Figure 1).

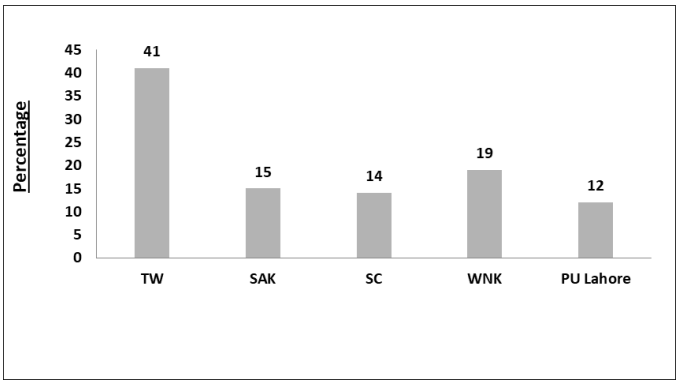

Figure 1: Participation of respondents per site.

3.2 Age

None of the people that contributed were under the age of fifteen (15 years). Twenty eight percent of respondents in the two age groups 16 to 25 and 26 to 35 were among the total participants. Maximum age of 59% of respondents in PU Lahore, 6% in TW, 2% in WNK, and 10% of all participants who participated to the study survey were between the ages of 16 and 25. A minimum of 7% respondents in PU Lahore and almost 47% of the oldest respondents in SAK were over 55 and farming at the time of the study. In PU Lahore, 28% of responders were women, compared to over 97% of participants who were males. More than 90% of respondents were farm owners, and many of them worked as both owners and contractors in SAK. In WNK, 96% of respondents were owners, while no respondents identified as contractors. Only 4% of responders were WAK employees (Figure 2).

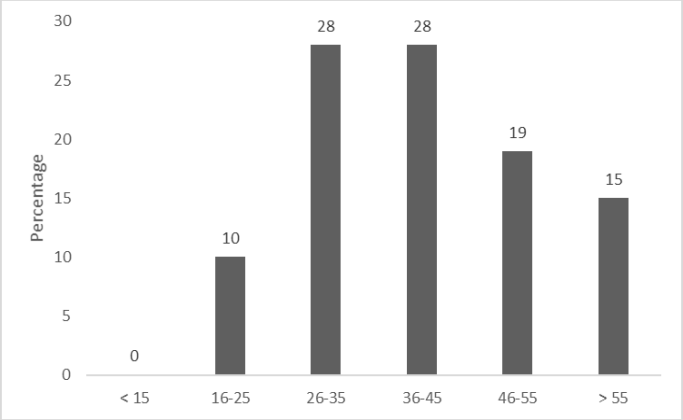

Figure 2: Age distribution of the respondents.

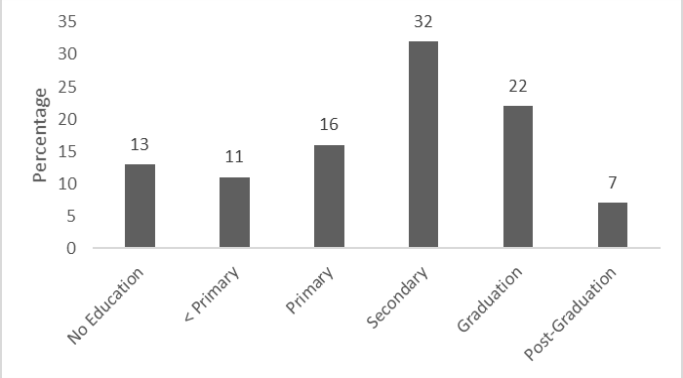

Figure 3: Education level of the respondents.

3.3 Education level

The bulk of respondents (51%) had their secondary school in SAK, whereas those with the least education were concentrated in TW. Of all responders, 32% claimed to have completed their secondary schooling. While just 13% of respondents overall indicated that they did not attend school for education, 7% of those

who participated in the survey as a whole had post-graduate degrees (Figure 3). Regarding knowledge of pesticide usage, only 7% of respondents indicated that they acquired information from the extension department, while 92% of respondents said they got knowledge from pesticide dealers. Out of all respondents, 83% said they could choose the optimal time to apply, while 17% said they couldn't. 92% of the respondents who participated in this study stated that while others cannot accurately measure rate, they can measure the rate of application.

3.4 Type of sprayer

The electric knapsack sprayer was used by mostly 92% respondents of total participants which contributed and only 24% respondents said that they used manual knapsack sprayer and 31% responded that they used compression/pump sprayer. A large number of farmers said that they used either the manual knapsack sprayer or electric knapsack sprayer, and either electric knapsack sprayer or compression/pump sprayer. The majority (39%) of farmers in SAK said that they used compression/pump sprayer and the least number (10%) of farmers in WNK responsed that they used. Small farmers mostly used electric knapsack sprayer and larger farmers used compression/pump sprayer (Figure 4).

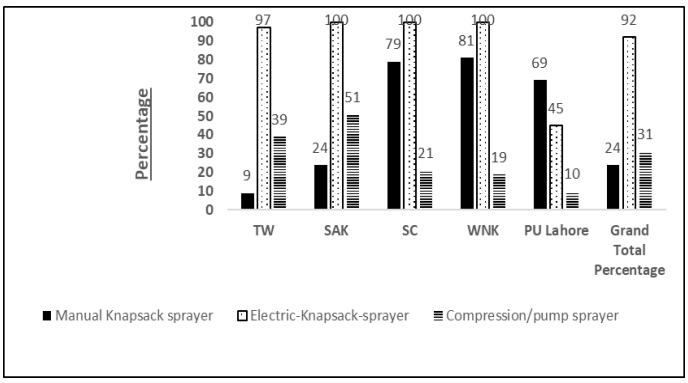

Figure 4: Types of sprayers used by the respondents.

Most of the respondents (92%) said that they cleaned their all tools and equipment after pesticide application but only 10% told that they did not clean the equipment. Few of them said that they stored tools and equipment and washed next time before reuse. 29% respondents in SC said that they did not wash tools and equipment and nobody in SAK said that they did not wash. Different crops might be harmed by the same sprayer if the spray liquid is not washed away after application. This is a major issue when they herbicides applied (Figure 5).

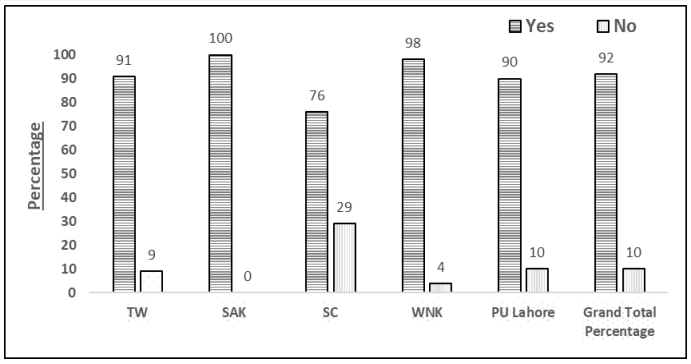

Figure 5: Cleaning after application

3.5 Transport

Seventy percent of respondents said they did indeed transfer pesticides to farms at the same time as they transported food items, and 32% of participants indicated they did it by car or van. Only 2% of respondents indicated they transported chemicals to their farms using public transportation. Few of TW and PU Lahore participants reported using public transportation to deliver pesticides. In SC, 85% of pesticides were transported alongside food goods, but 51% of respondents in SAK stated they transported pesticides in a special pick-up van or car. No one who responded said that they utilized public transportation in SAK, SC, or WNK (Figure 6).

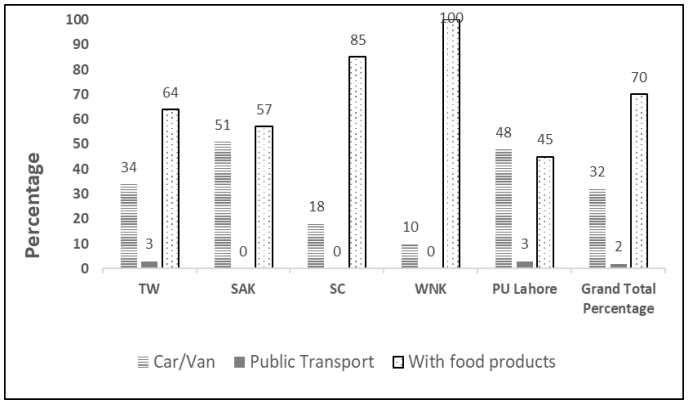

Figure 6: How to carry pesticide to farm?

3.6 Storage

Seventy percent of respondents admitted that they did not have a dedicated warehouse for the storage of pesticides. The identical response was given by 94% of WNK participants, who believed that the safest place to store pesticides was in a bedroom or a corner of a house. Only 2% of participants overall responded, compared to 10% of respondents at PU Lahore and 1% in TW who reported buying before using. 51% of respondents were from SAK, and the majority of them were farmers working big tracts of land, according to 34% of those polled. But most people concurred

that keeping pesticides locked up in a store was the safest choice. In PU Lahore, 3% of respondents said they kept insecticides in open air (Figure 7). A total of 85% of participants stated to have purchased the proper number of pesticides; whereas, 27% stated that they had the opposite. Few of them admitted to making unnecessary and excessive purchases. In WNK, 100% of respondents said they purchased the proper quantity of pesticides, compared to just 15% and 30% of respondents in SC and TW and 24% in PU Lahore who said they purchased huge numbers.

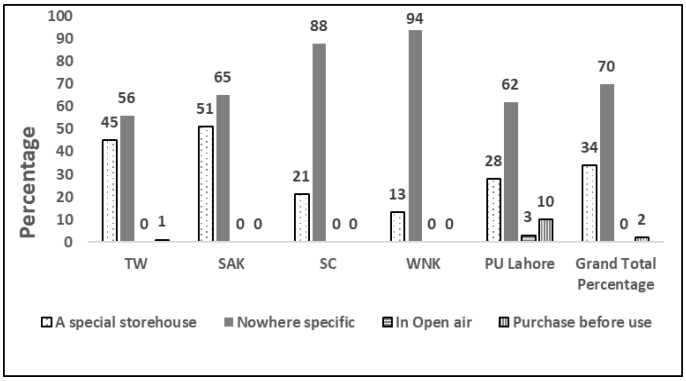

Figure 7: Storage of pesticide by the respondents.

3.7 Disposal

All of respondents in WNK said they used sprayers until they were completed; however, just 31% of respondents in PU Lahore did the same. The overall proportion of respondents who said they used sprayers until they were finished was 67%. In PU Lahore, 10% of respondents claimed to have purchased what was necessary, although this only amounted to 1% of all participants overall. In PU Lahore, 7% of respondents said they spilled water into a stream, while 14% said they released it down a drain or into a sink. The greatest response rate was 76% in SAK about what they disclosed on the ground, while the lowest response rate in WNK was 19%. Because the huge farmer released most, 49% of the participants as a whole were released on the ground (Figure 8). The overall proportion of people that participated was as follows: 89% responded NO, which indicates they did not adhere to the safety procedures given, and just 12% replied YES, which indicates they did. 34% of respondents at PU Lahore indicated they followed, compared to 66% who claimed they did not. The highest proportion of respondents 100% in SC and WNK indicated they did not adhere to the recommended safety of disposal, while just 16% and 14% of respondents in TW and SAK, respectively, stated they did.

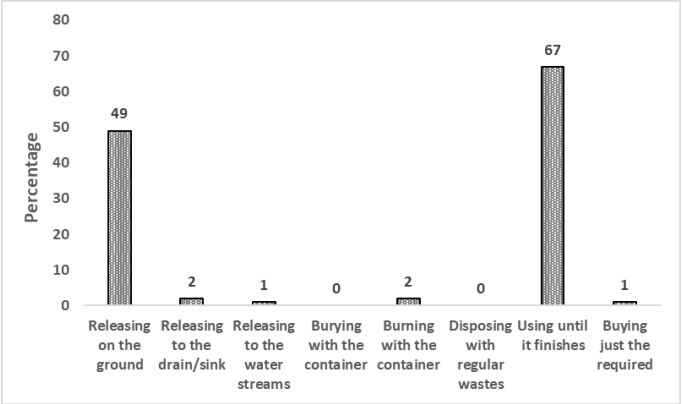

Figure 8: Disposal of remaining solution of pesticide.

3.8 Preparation of spray

The majority of the farmers mixed pesticides in separate containers for making dilutions and then transfer to sprayer for application. Most of respondents (95%) of total participants said that they stirred pesticide solution in container with stick, 4% said that they used gloved hand for stirring the solution and 3% told that they stirred with sprayer lance. 62% respondents in PU Lahore reported that they used gloved hand for stirring the pesticide solution and only 1% respondents in TW stirred with hands without protection and sprayer lances. The percentage of response indicated in graph such as 100% mixing of pesticide with stick in SAK, SC and WNK. The percentage of response maximum 34% with gloved hand mixing of pesticide and become 4% of total participants which contributed in this research survey. Mix with gloved in TW, SAK, SC and WNK could not answer anyone in these sites (Figure 9).

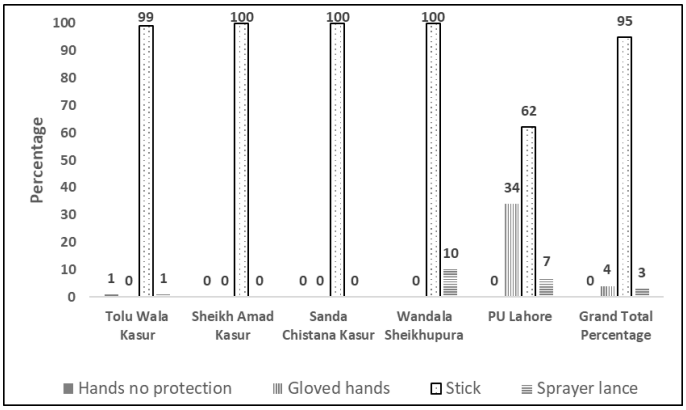

Figure 9: How to mix pesticides?

3.9 Protective clothing during mixing

This research surveyed reported that only one percent pesticide users used long sleeved shirt and trouser during mixing and loading but only 2% users used hand gloves during mixing, irrespective of the age,

wore the recommended fives key items of PPE such as long-sleeved shirt and trouser, gloves, face shield and boots. It is safest way to protect them by wearing five items. In this way, the low level of risks perceived during mixing. 96% respondents of total participants who contributed said that they did not use any item during mixing and 19% used face shield during mixing. The maximum 38% respondents in SAK reported they wore face shield. The low level of incidents reported during mixing if used PPE recommendation used (Figure 10). Overall, 99% respondents reported that they had availability of clean water during mixing any incident occurred and only one percent said that they had often availability of clean water. In PU Lahore, 7% respondents reported often availability of clean water.

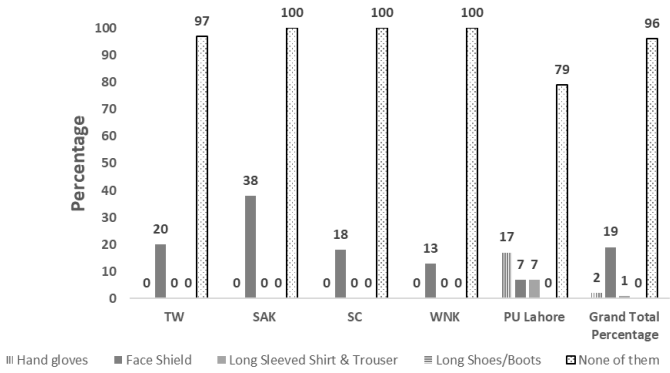

Figure 10: PPE during mixing.

3.10 Protective clothing during applying

Respondents asked that they did not wear PPE items such as long-sleeved shirt and trouser, face protection and long shoes. 94% participants said that they did not use any protection during applying pesticides and this may reduce droplets depositing directly on face but may form reservoir of product which may cause irritation around the mouth. Few of them reported that sometime they used face protection but as usually they did not wear any PPE items. 30% respondents reported that they wore face protection during applying and 46% respondents in SAK said that they used face protection. Hand protection used only 6% of total participants; this PPE item mostly reported respondents were 8% in SAK and 6% in TW. These PPE items reduce the risks of applicators (Figure 11). The highest percentages of respondents who stated they could not resist eating or drinking while applying were 88% in SC and 56% in TW, while the highest percentages who said they prevented doing so were 79% in PU Lahore and 51% in SAK. In SC, 18% of responders must check the agree option as a minimum. 55% of respondents out of the total participants that contributed answered "NO" whereas 48% said "YES." Few of them reported drinking water while applying.

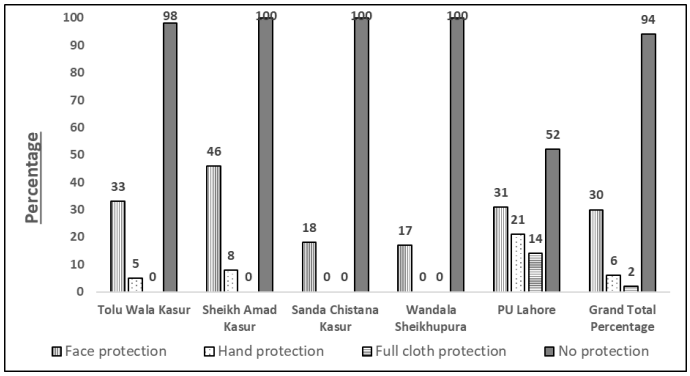

Figure 11: PPE during applying.

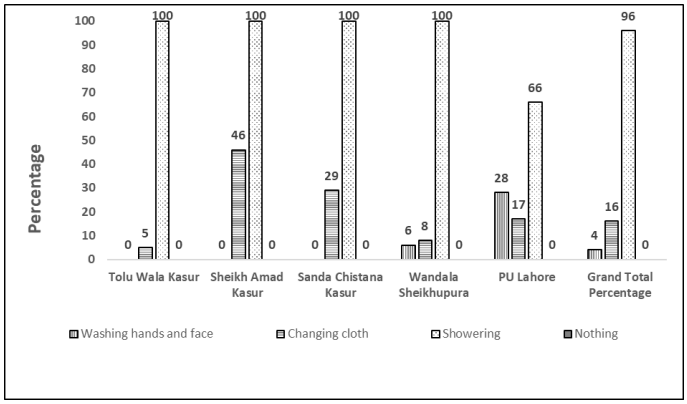

Figure 12: After spraying habits of the respondents.

3.11 After spraying habits

The overall proportion of participants was 96% who participated said that they get showers after spraying. A small number of them stated that they also changed their clothes after applying and 16% of respondents reported that they changed their clothes. Only 4% of all participants stated they only wash their hands and faces with soap if it is available. In PU Lahore, 66% of respondents claimed to take a shower, 28% claimed to merely wash their hands and faces, and only 17% claimed to change their clothing. In TW, SAK, SC, and WNK, 100% of respondents per site claimed they showered. However, just 5% of respondents in TW and 46% of respondents in SAK admitted to changing clothing (Figure 12). A remarkable 87% of all individuals who responded indicated they experienced illnesses, the majority of which were allergies brought on by repeated chemical applications. And, only 13% of respondents indicated they had never been sickened by pesticides. Pesticide exposure has a negative influence on the health of farmers and staff. The highest percentage of respondents each location for particular, 97% in SAK

reported sickness, while 79% in PU Lahore reported the lowest rate. The highest percentage of respondents who stated they had no diseases to report was 21% in PU Lahore, while the lowest number was 3% in SAK.

3.12 Treatment after exposure to pesticides

Regarding treatment after exposure to pesticide, following responses were noted: 85% sought medical attention after exposure, 10% lacked experience, 5% employed natural antidotes, and just 2% used first aid, including inducing vomiting. In SAK, the highest proportion of respondents who sought a doctor after exposure was 97%, while in PU Lahore, the lowest number of respondents, it was 62%. Other percentages of responses at PU Lahore included 17% using first aid as directed and 7% using inducing vomiting as a remedy. No comment has been given on mouth to mouth breathing. Ghee+Milk was also utilized as a natural antidote (Figure 13).

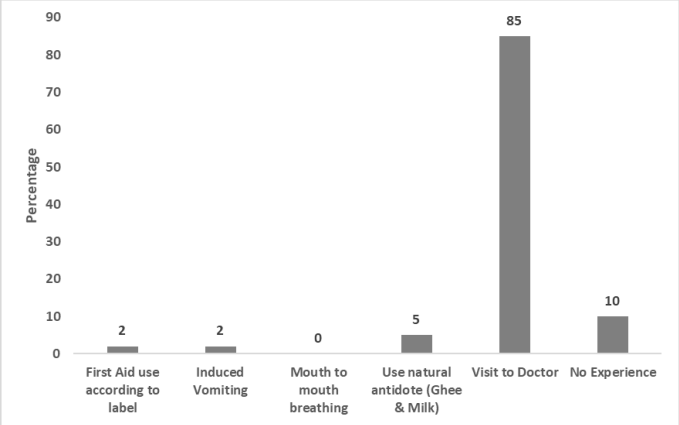

Figure 13: Treatment after pesticide exposure by the respondents.

This paper reports of farmers' knowledge about pesticide usage, storage, disposal procedure and PPE during mixing and applying of pesticide. The survey was also focused to get response of farmers about treatment after pesticide exposure. These studies are supplemented by observational surveys of what individuals do, but they frequently lack the specificity needed to characterize what someone does since people tend to act differently when they are being observed. This study's power provides it a unique perspective on the attitudes and behaviors of hand-held pesticide applicators, which are often thought to be among the agricultural workers who may be exposed to pesticides in the greatest amounts.

Most of the respondents were men, while 3 percent were women. Mostly in Pakistan, men are farming on agriculture land but women are working as labor in field. In research done in Turkey, all of the farmers were men. According to Oluwole and Cheke (2009) 93 percent of farmers were men in Nigeria.

The age bracket of the respondent's maximum 28 percent varied from 26 to 45 years. In SC, majority of farmers were oldest and greater than 55 years. The average age of farmers in Turkey was 18–51 years old in their study of farmers' understanding, attitude, and conduct against pesticides. Tanzanian farmers were on average 37.5 years old, according to (Lekei *et al.*, 2014). The average age of farmers in Pakistan was 30–50 years old in a study on pesticide and biodefense knowledge. Farmers aged 18–50 in northern Sindh, Pakistan, followed a similar pattern in 2020, according to (Khuhro *et al.*, 2020).

Respondents educational attainment is linked to their activities. Insecticide instructions for dosage formulation and precautionary actions can be read and understood by educated farmers. According to the current survey, 13% of farmers were illiterate, 32 percent had secondary education. In research by (Yassin *et al.*, 2002) on knowledge, attitude, habits, and harmful symptoms connected to pesticide usage in Philistine, it was discovered that 8.5 percent of the population was illiterate. 12.2% of the population in Northern Sindh was uneducated, with 40.9 percent having a basic school and 27.7% having a higher schooling. A similar trend was observed in Pakistan's Lodhran and Vehari, where 26.4 percent of the population is uneducated. These findings back with Khan and Iqbal's conclusions that the majority of Pakistani farmers had a low educational level, with only 6% having graduated from university.

According to the current study, 92% of farmers were asked from retailer about method of application and 92% had knowledge about application rate. There was a robust link between farmer knowledge and understanding of pesticide product label information. As a result of the increased emission rate, there is a higher level of exposure. According to (Damalas and Khan, 2016), 73% of farmers couldn't understand the label instructions on pesticide containers (Mubushar *et al.*, 2019). Found a similar tendency, with 48.2 percent of people unable to comprehend pesticide label instructions. It is important to follow the instructions on the products for preparing the right dose in order to avoid misuse and the release of

residues into the environment, which can contribute to the development of insect resistance. According to (Afsheen, 2021) 79.5 percent of farmers did not obtain any pesticide instruction from extension officers, whereas 12.3 percent, 5.1 percent, and 3.1 percent got two to four, and more than four, respectively. Similarly, (Aslam *et al*., 2007) discovered that Pakistani farmers lacked knowledge about pesticide use, implying that extension officer education might be an effective method to reduce risk factors (Negatu *et al*., 2016). Observed that 85 percent of Ethiopian farmers lacked pesticide application education, while (Ibitayo, 2006) discovered a similar pattern among farmers

Most of the respondents who participated in the survey indicated they used an electric knapsack sprayer; just 24% said they used a manual knapsack sprayer, and 31% said they used a compression/pump sprayer. 3% of TW and PU Lahore participants said they delivered pesticides using public transit. A large number of farmers said that they used either the manual knapsack sprayer or electric knapsack sprayer and either electric knapsack sprayer or compression/ pump sprayer. Mostly, a small-scale farmers used the manual knapsack sprayer because the others sprayer is expensive. A large-scale farmer mostly used compression/pump sprayer for large area application and electric knapsack sprayer used for small area farm. Few of them said that they used different sprayer for herbicide otherwise same equipment used for application of fungicide or insecticide.

When asked if they delivered pesticides to farms along with food, 70% of respondents claimed they did, and 32% of respondents stated they did it by car or van. Only 2% of respondents said they used public transit to deliver chemicals to their farms. Farmers said that they also brought pesticides when they purchased food items but the farmers are farming on large scale farming, they brought through dealer their farms. Sometimes, they carry pesticides to their farm by cars/vans.

Seventy percent of respondents admitted that they did not have a dedicated warehouse for the storage of pesticides. The identical response was given by 94% of WNK participants, who believed that the safest place to store pesticides was in a bedroom or a corner of a house because they had feared of theft. Only 2% of participants overall responded, compared to 10% of respondents at PU Lahore and 1% in TW who reported buying before using. Fifty one percent of respondents were from SAK, and the majority of them were farmers working big tracts of land, according to 34% of those polled. But most people concurred that keeping pesticides locked up in a store was the safest choice. In PU Lahore, 3% of respondents said they kept insecticides in open air. The pesticides should remain away from children these are poisons and very dangerous to human health. Large farmers were safe because they kept their pesticides at farm in locked warehouses.

A total of 85% of participants stated to have purchased the proper number of pesticides, whereas 27% stated that they had the opposite. Few of them admitted to making unnecessary and excessive purchases. In WNK, 100% of respondents said they purchased the proper quantity of pesticides, compared to just 15% and 30% of respondents in SC and TW and 24% in PU Lahore who said they purchased huge numbers. A small farmer purchased those amounts which he applied but mostly, a large farmer purchased complete pesticides of crop.

All of respondents in WNK said they used sprayers until they were completed, however just 31% of respondents in PU Lahore did the same. The overall proportion of respondents who said they used sprayers until they were finished was 67%. In PU Lahore, 10% of respondents claimed to have purchased what was necessary, although this only amounted to 1% of all participants overall. In PU Lahore, 7% of respondents said they spilled water into a stream, while 14% said they released it down a drain or into a sink. Farmers failed to take preventive precautions due to a lack of information about the hazardous effects of pesticides. The overall proportion of people that participated was as follows: 89% responded NO, which indicates they did not adhere to the safety procedures given, and just 12% replied YES, which indicates they did. The important part of pesticide usage is the effective disposal of pesticide wastage. Equipment, contaminated empty bottles and expired products, excess of spray stock solution and others items are included in pesticide wastes (Nesheim and Whitney, 1989). Pesticide waste released accidentally or without control cause hazard to humans and the environment. If not properly cleaned, then empty pesticide containers might release unbearable quantity of hazardous chemicals. Understanding how farmers feel about pesticide waste disposal is essential

for developing intervention or preventative strategies (Damalas *et al.*, 2008).

The majority of the farmers mixed pesticides in separate containers for dilutions and then transfer to sprayer for application. 95% respondents of total participants said that they stirred pesticide solution in container with stick, 4% said that they used gloved hand for stirring the solution and 3% told that they stirred with sprayer lance. 62% respondents in PU Lahore reported that they used gloved hand for stirring the pesticide solution and only 1% respondents in TW stirred with hands without protection and sprayer lances. According to the USDA, education will help farmers use pesticides properly by increasing their knowledge and understanding of proper equipment usage and workplace circumstances (Perry *et al.*, 2000). In one India study, the recommended practice rating of understanding, attitude, and behavior concerning safe pesticide handling increased after an education program (Sam *et al.*, 2008).

In the present study, 96% respondents did not use any PPE item during mixing of pesticide solution and 94% respondents reported that they did not wear any protection during application pesticides. In this survey 95% respondents said that they observed resistance in field while 5% did not observe. Another issue related to the dangerous impact was the failure to apply precautionary measures the impact of pesticides on the environment. According to a study done in North Greece and India, there is a strong link between knowledge and the application of precautionary measures (Clarke *et al.*, 1997), shared their findings. Due to the hot and humid climate in the tropics, there has been a decline in the usage of preventive measures by farmers. Farmers are uncomfortable while using protective measures in humid climatic circumstances. During the spray, the usage of a respirator was overlooked, with just 1.7 percent reporting it. It's worth noting that (Hashemi *et al.*, 2012) found that 40% of Iranian farmers do not utilize any safety equipment when spraying.

In this survey, 67% respondents said that they used pesticide mixture remaining until finished it while 49% said that they released remaining solution on ground. Farmers stated that if herbicides then not repeat and when insecticides or fungicide repetition until end.

Respondents asked that they did not wear PPE items such as long-sleeved shirt and trouser, face protection and long shoes. 94% participants said that they did not use any protection during applying pesticides and this may reduce droplets depositing directly on face but may form reservoir of product which may cause irritation around the mouth. Few of them reported that sometime they used face protection but as usually they did not wear any PPE items. Farmers claimed that they did not wear because these are expensive. In SC, 18% of responders must check the agree option as a minimum. 55% of respondents out of the total participants that made a contribution answered NO whereas 48% said YES. Few of them reported drinking water while applying.

The overall proportion of participants was 96% who participated said that they had showering after spraying. A small number of them stated that they also changed their clothes after applying and 16% of respondents reported that they changed their clothes. Only 4% of all participants stated they only wash their hands and faces with soap if it is available. A remarkable 87% of all individuals who responded indicated they experienced illnesses, the majority of which were allergies brought on by repeated chemical applications. And only 13% of respondents indicated they had never been sickened by pesticides. Pesticide exposure has a negative influence on the health of farmers and staff.

The resulting in greater of replies among all participants was as follows: 85% sought medical attention after exposure, 10% lacked experience, 5% employed natural antidotes, and just 2% used first aid, including inducing vomiting. Many sections of the globe, especially developing countries, agricultural chemicals are handled with the great caution and the chances of improving farmer safety are limited by wearing PPE. Levesque *et al.* (2012) reported as use of personal protection equipment (PPE), and avoidance of pesticide dangers, hygienic procedures, and correct dose usage are acknowledged as preventative measures that might help to reduce the severity of health issues among farmers and pesticide users (Sharifzadeh *et al.*, 2019). We concentrate on LKS's potential and existing value in addressing local and global issues. It's been a motto encouraging local activity to improve general well-being on the planet for a few decades. What are the lessons that LKS can teach us in an increasing globalized world with numerous social,

economic, and environmental uncertainties? One of the advantages of LKS is that it is based on the principles of interconnectivity and involvement, in which persons and their actions are viewed as part of a larger environmental, social, and spiritually context. Pesticide prohibitions, particularly their names and justifications, as well as the possible environmental and health consequences, should be communicated to farmers (Yang *et al*., 2014). The effects of pesticides on farmers' health and environment were largely unknown.

Reyes-García *et al*. (2010) have previously claimed that adopting culturally representative modes of teaching about knowledge of the area, such as field visits, inspection, and informally instruction, is a key issue in introducing LKS into official school curriculum. Taking into consideration all of these aspects, the current research was created to assess farmers' awareness of pesticide use. This will help the agricultural sector in developing a comprehensive plan to educate farmers to resist insect attacks and maintain the sustainability. Over time, several approaches with a specific topic matter and collaborative learning methodology were created. A successful example of such a strategy is the IPM/ FFS initiatives taken in different countries of world. Now a days, farmers teach by new concepts and technology to enhance social learning among them such as ICTs, smart phones, tablets and TV programs (Fu and Akter, 2016).

Conclusions and Recommendations

In conclusion, this study revealed that farmers had poor knowledge about pesticide use, storage, disposal, LKS, IPM and PPE. Farmers training regarding pesticide usage are necessary to ensure public health and to safe environment.

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Novelty Statement

Local knowledge system about plant protection practices helps to design an effective insect management program with safety to farmers. The present survey explored farmers' behavior towards insect management and use of pesticides in rice crop. The data will help to fill the gap in prevailing knowledge of farmers regarding plant protection practices.

Author's Contribution

MUS, HAAK and TK designed and performed the study; WA, AA and MZ helped in field survey; MUS, HAAK and TK analyzed data and wrote the manuscript. All authors approved final version of the manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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