



Farmers' Use of Personal Protection Equipment in Jeshore and Rajshahi Districts of Bangladesh

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Authors' contributions

This work was carried out in collaboration among all authors. Author MSA designed the study, prepared the interview schedule, actively co-operated the collection of both quantitative data and qualitative information, wrote the protocol and guided the statistical analysis and modified the draft article based on reviewers' comments and suggestions. Authors AAB and MEH managed the analyses of the study and wrote the first draft of the manuscript. Author MH managed the literature searches and supported the data collection activities. All authors read and approved the final manuscript.

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ABSTRACT

Personal protection equipment (PPE) is used by farmers when dealing with crop protection products. Owing to its relevance, this survey assessed the status of PPE use by the farmers. The survey focused on two districts (Jeshore and Rajshahi) of Bangladesh. Descriptive research design was used to achieve the survey objective including both quantitative and qualitative techniques. Findings revealed that the mean age of respondents was 39.5 years with an average annual income of BDT 194,540.0 (USD 2,434.8), having very poor training exposure, but expressed

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positive perception on PPE use. Upon exposure to any crop protection product, the farmers wash it off immediately, and mostly clean with soap and water within one hour of spray completion. Frequently experienced difficulty was skin burn, and whenever contamination or poisoning occurs local domestic first aid methods were adopted or contact was made to village quacks. Qualitative findings revealed similar information, however, in addition, farmers especially, youth were found to have adopted "traditional PPE," which involves wearing of trousers, long sleeve shirts, polythene in place of hand gloves and cotton napkin to cover their faces. It was suggested that organized campaigns and effective information dissemination would encourage adequate and proper application of PPE. Use of PPE becomes inevitable for farmers' safety with advancement in science and technology and its consequential effects. It is, therefore, obvious that the all stakeholders in agriculture and agri-allied industries take awareness creation and training on PPE use as part of their core agenda to avert hazard and ensure safety.

Keywords: Difficulties; farmers; use; poisoning; PPE.

1. INTRODUCTION

Every day, 243 agricultural workers suffer a serious lost-work time injury. Five percent of these injuries result in permanent impairment. In 2010, the injury rate for agricultural workers was 20.0 percent higher than the rate for all workers. This is a conservative estimate as countless other accidents are never reported and many accidents occur to family members that are also under-reported. Many farm and ranch injuries could be prevented or their impacts reduced if farmers and ranchers wore proper personal protective equipment [1].

Personal Protection Equipment (PPE) refers to any equipment or clothing worn for protection against health and safety hazards. PPE is designed to protect many parts of the body. These include; eyes, head, face, hands, feet, ears or chest. PPE prevents or reduces injury when used. Amongst the users of PPE are farmers, and all other people involved in work(s) that require safety measures or are hazardous. Tasks on the farm expose farmers to hazards, this, therefore, require wearing of personal protective clothing and/or specialized safety equipment in order to be safe. Wearing of PPE is common with hazardous tasks involving agricultural chemicals or pesticides.

Outdoor work and work inside many agricultural workers may expose their eyes, lungs and skin to a potentially hostile environment and work-related health problems. Eyes may be irritated by dust, sawdust, animal dander, or ammonia and other fumes and gases. Tiny particles of mold spores or toxic gases can get into your lungs, nose and throat. These problems may not manifest themselves for many years, but once they reach advanced stages they may become

chronic. Skin irritations may result from handling various animals or plant materials. Also, cuts or open-skin sores may become infected from contact with air-borne contaminants, soil, animals or animal waste [2].

In general, farmers can be affected by pesticides during trans-port of pesticides and grounding of spray solution as well as before, during or after pesticide application [3]. In particular, farmers can be affected by pesticides in three various ways during pesticide application. These mainly comprise oral contact, dermal contact, and contact via inhalation. Especially, during spraying with fog (10 e 30 mm) or aerosol (30 e 50 mm) small droplets, which are suspended in the air, farmers have to use a mask [4]. If farmers do not use mask, pesticide droplets about 1e5mm in diameter are accumulated in the lungs and the breathing tube. Furthermore, small droplets (< 1 mm) are spread in the lower part of the lungs [5].

In words of suggestion, wearing long pants and a long-sleeved shirt can help protect the body. Worn gloves when appropriate to protect the hands. Open wounds, cuts and scratches should be bandaged when necessary to protect against exposure to dirt or bacteria that can infect the wound. Excessive exposure to the sun can also cause problems for farmers. Skin cancer risks can be reduced by wearing a full-brimmed hat, a long sleeved shirt, and by applying sunscreen to exposed areas. Eyes are best protected from splashing chemicals or foreign materials by wearing goggles. Eye shields on safety glasses may be sufficient in some instances. Face shields work well when handling certain chemicals, grinding or when working in situations where full face protection is needed to prevent particles from being splashed or flung into the

face. Respiratory hazards are generally avoidable by wearing a dust mask designed to filter the particulate before it reaches your respiratory system. A dust mask rated for screening out non-toxic particulates provide basic protection for pollens, animal dander, fiberglass, or alfalfa dust. A dust mask designed for toxic substances provides a broader range of protection against inhaling grain molds and fungal spores [2].

However, given limited or no available empirical work on PPE use by farmers in Bangladesh, the present study was undertaken to establish the status of PPE use by farmers; their selected socioeconomic characteristics; and problems encountered while using PPE in two districts of Bangladesh, namely; Jeshore and Rajshahi.

2. METHODOLOGY

Jeshore is a district in the southwestern region of Bangladesh. It has a landmass of 2,606.98 square km with a population of 2,764,547 according to the 2011 Bangladesh Census. It is located on 23.17°N 89.20°E. Annual average temperature range from 9 to 41°C (48 to 106°F). The annual rainfall is 1,537 millimeters (60.5 inch). The main occupation of the inhabitants of the area is agriculture, as such they produce a number of crops year-round. These include rice and varieties of vegetable [6]. On the other hand, Rajshahi is a metropolitan city in Bangladesh and a major urban, commercial and educational centre of northern Bangladesh. It is geographically situated 23 m (75 ft.) above sea level and lies at 24°22'26"N 88°36'04"E. The maximum mean temperature is between 32 to 36°C (90 to 97 °F). The annual rainfall in Rajshahi is around 1,448 millimeters (57.0 in). The major occupation of the inhabitants is also agriculture. Apart from the usual agricultural products of Bangladesh, such as rice, wheat, potatoes and lentils, Rajshahi and its neighboring regions are specially known for various crops such as Mango, Litchi, Sugarcane, Potato, Tomato and Watermelon [7].

This study used descriptive research design to achieve its objective [8,9]. Four hundred (400) respondents including 200 farmers were selected using simple random sampling from both locations from the list provided by the Department of Agricultural Extension (DAE), Bangladesh [8]. Four data enumerators were selected based on competence and experience in the field. The selected data enumerators were

trained on procedure of data collection with respect to the intended survey. The trained enumerators collected quantitative data from the selected respondents by face-to-face interview using the designed interview schedule. Similarly, two focus group discussions (FGD) were conducted involving 15 farmers in each of the locations for generating qualitative information. Direct observations were also made regarding non-verbal expressions and the farmers' surrounding environment as well. Generated data were coded (conversion to numerical values by assigning number for identification), compiled and analyzed (Statistical Package for Social Sciences) in accordance with the objectives of the study.

3. RESULTS AND DISCUSSION

Results shown in Table 1 hint that most of the respondents in the study area were 35.0 years or less (47.0%) with mean around 39.5 years across young, middle and old age categories.

Having less number in the middle and old age categories signals a positive future. Because the younger the farmers are the more active years they are likely to spend using PPE when they adopt it. In a study, it is reported that almost all (96.1%) of the building construction workers in Kampala, Uganda within age range of 18-45 years use of Personal Protective Equipment [11].

Majority of the respondents attained secondary education downward. Results in Fig. 1 indicate that 29.6 percent attended secondary school, 21.2 percent attended primary school, while 11.6 percent and 11.1 percent attended tertiary institution and college, respectively. However, a reasonable number (26.5%) were illiterate.

Those obtained to be illiterate was not caused by their inability to afford the cost, but due to their early engagement in farm activities by the family which ultimately hinders their enrollment or lead to stoppage of school at levels below tertiary. Farming is generally considered as a traditional activity in local areas and cost of education is quiet affordable in Bangladesh.

It is clear from Table 2 that most of the respondents were low income earners (48.3%), earning BDT 120,000.0 (USD 1500.0) or less per annum. However, their mean annual income was BDT 194,540.0 (USD 2431.8).

Table 1. Arrangement of the respondents based on their age

Categories	Respondents		Mean	SD
	Number	Percent		
Young aged (up to 35 years)	188	47.0	39.28	12.12
Middle aged (36 to 45 years)	97	24.3		
Old (> 45 years)	115	28.7		
Total	400	100.0		

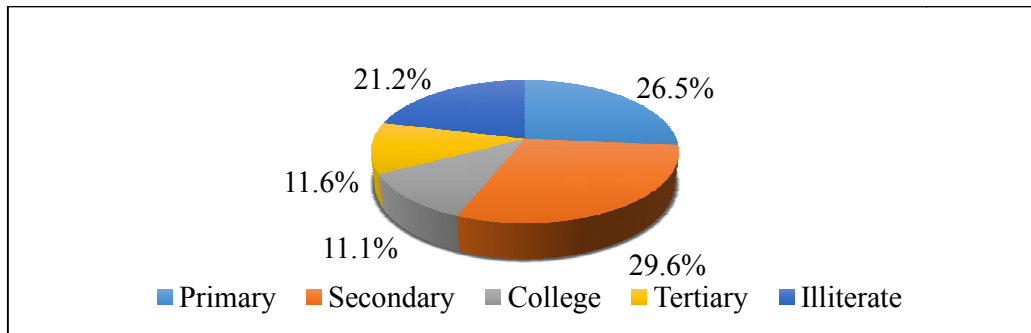


Fig. 1. Distribution of the respondents based on educational attainment

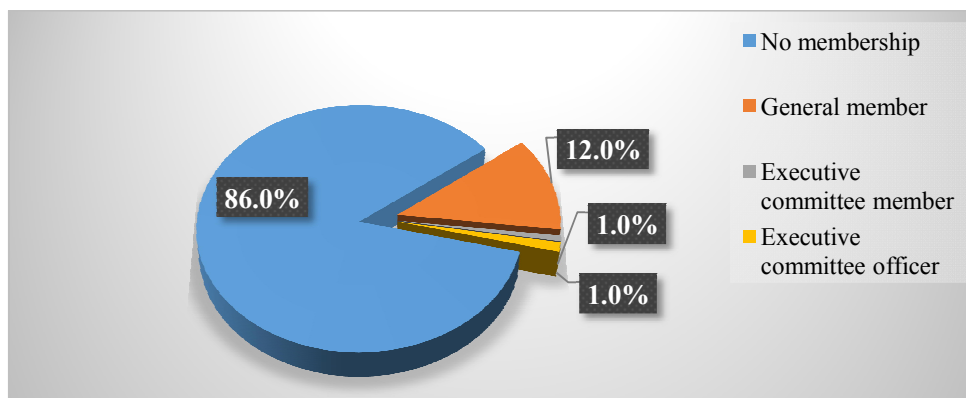


Fig. 2. Distribution of the respondents based on their membership of association

Income determines financial worth of a family and its ability to incur certain cost. To a farmer, it determines his ability to buy inputs and cater for his family needs.

Fig. 2 presents membership of various associations the respondents belonged to. Highest number of the respondents (86.0%) did not belong to any type of association. A few (12.0%) that were members of association (farmer based associations) were mostly general members, while 1.0 percent of each were executive committee members and executive committee officers.

Membership of association usually provides greater access to information and new

technologies. This is because through interactions farmers exchange ideas and learn from one another.

Majority (78.7%) of the respondents did not have any training exposure in PPE use. Those that received the training was either short term (10.0%) or medium term (9.0%). Nevertheless, 2.3 percent received a long term training of more than 10 days (Fig. 3).

Training in PPE use enhances efficiency, minimizes waste and risk. The result implies that most the respondents that did not have any training exposure on PPE use were more prone to risks associated with improper handling and utilization of PPE than those who had the training [12].

According to the information on Fig. 4, out of the respondents that were exposed to training, 78.7 percent did not utilize the training. Those that utilized the training were 21.3 percent and in the categories viz. high application (12.0%), medium application (6.8%) and low application (2.5%).

High non-use of training was observed to be related to irregular use of PPE amongst the respondents.

The major source of information on crop protection advice and PPE use was retailers of crop protection products (39.7%), followed by friends/relatives (22.6%), media (12.0%) and farmers' meeting (12.2%), government agency (9.7%). Although, 3.1 had no any source of information, 0.7 got information from other sources that include campaign and local shows (Fig. 5).

In essence, retailers of crop protection products were the major source of information on crop protection advice and PPE use. Even though, friends/relatives follow retailer in percent, retailer is still the primary source while, friends/relatives are a secondary source.

Result on Fig. 6 shows that majority (63.4%) of the respondents did not purchase PPE from any source, while most of those that purchased got it from open market (32.9%). Only 1.2 percent

purchased from crop protection products retailers shop and 2.5 percent from other nearby shops.

Having large proportion not purchased PPE could be a function of being newly introduced product or inadequate information and awareness.

Majority of the respondents (45.3%) reported that they learnt how to use PPE through personal practice. This was followed 21.2 percent who learnt from retailers. A low distribution of 10.1, 7.9, 6.1, 3.7, 2.4, 2.0 and 1.3 percent learnt how to use PPE from manual, fellow farmer, other source, farm meetings, government agent, posters and leaflets, respectively (Fig. 7).

There exists a common belief that PPE is meant to be used during application of pesticides, thus it is an issue of just putting it on. As a result, large proportion of the respondents assumed to have known how to use it. Perhaps, why majority learnt through self-practice.

Most of the respondents as shown on Fig. 8 used PPE when applying pesticides or any crop protection product (35.0%), 3.0 percent use PPE during mixing, while 23.0 percent use it during both mixing and application. Nearly 1/3 (31.0%) never used PPE in all circumstances, but 8.0 percent used it occasionally.

Table 2. Distribution of the respondents based on annual income

Categories	Respondents		Mean	SD
	Number	Percent		
Low income (up to BDT 120,000)	193	48.3	194,540.0	1.95
Medium income (BDT 120,001 to 200,000)	112	28.0		
High income (> BDT 200,000)	95	23.7		
Total	400	100.0		

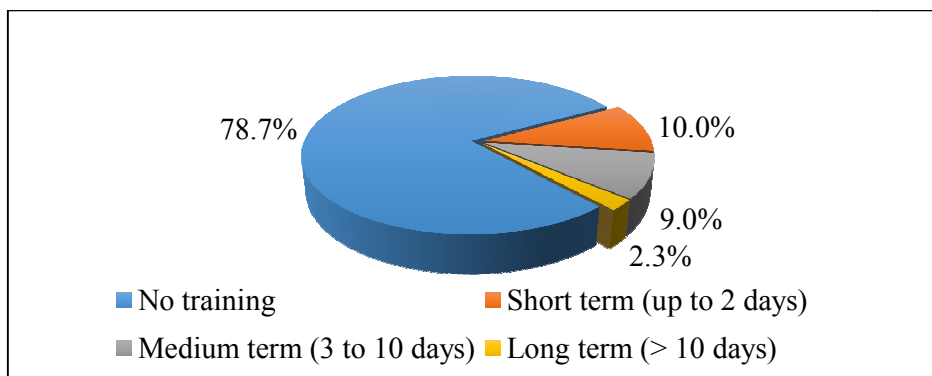


Fig. 3. Distribution of the respondents based on their training exposure in PPE use

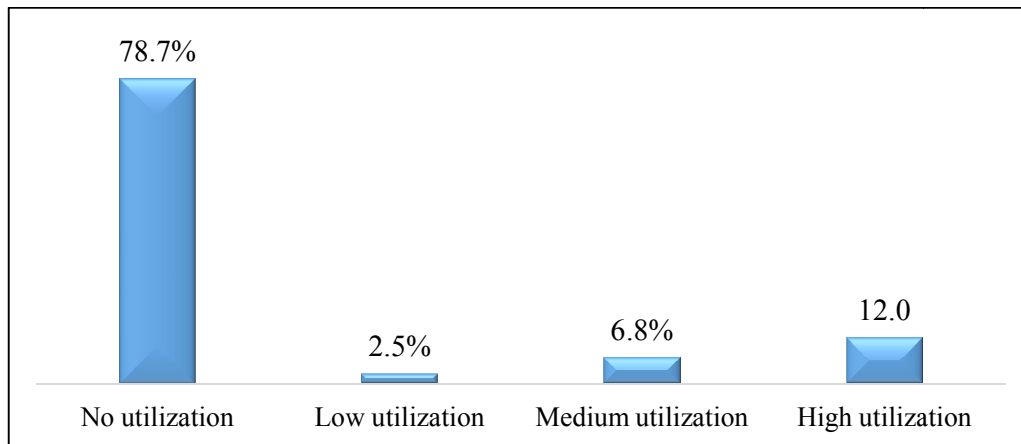


Fig. 4. Distribution of the respondents based on their application of training experience

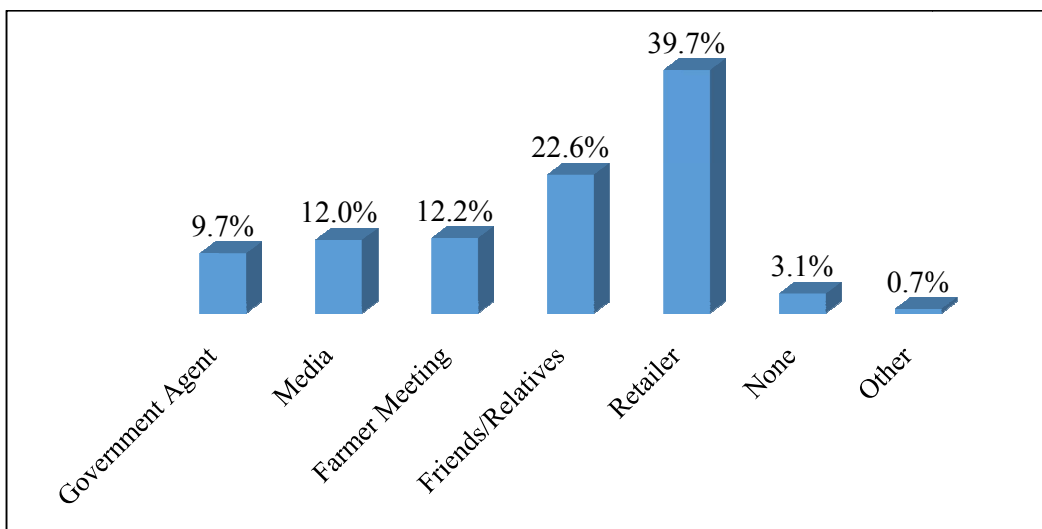


Fig. 5. Distribution of the respondents based on their source of crop protection advice

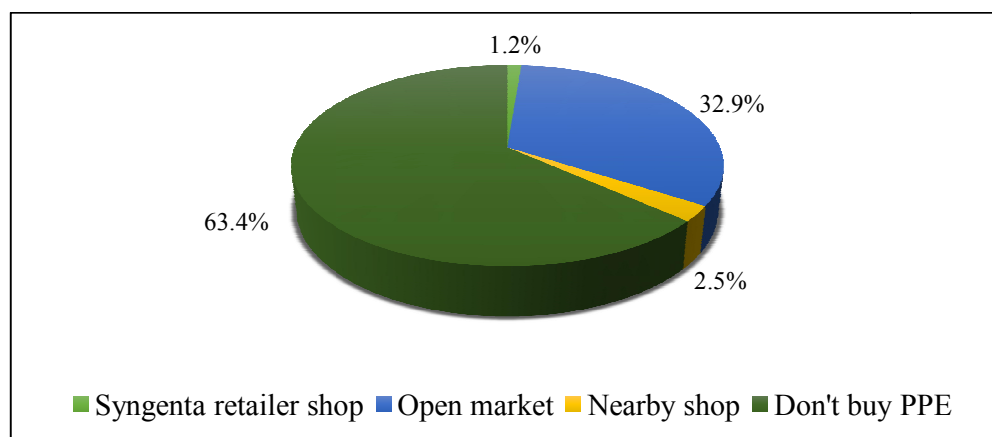


Fig. 6. Distribution of the respondents based on their source of PPE purchase

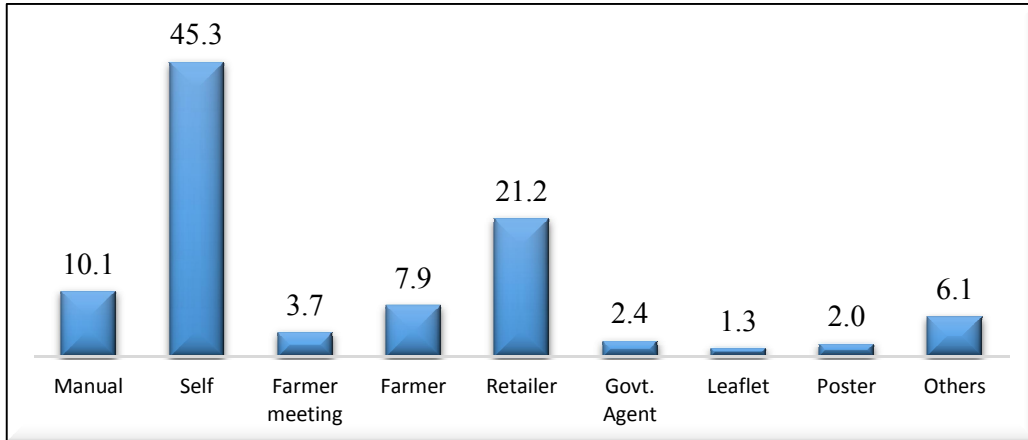


Fig. 7. Distribution of the respondents based on their source of learning about PPE

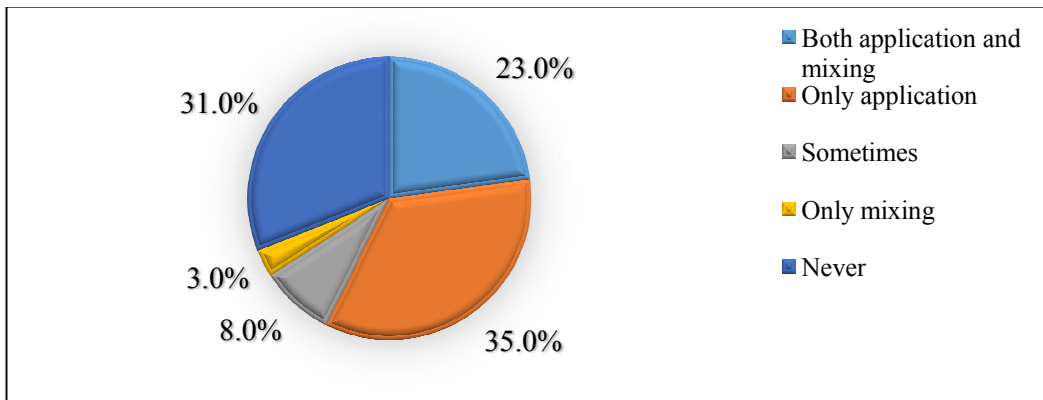


Fig. 8. Distribution of the respondents based on their frequency of PPE use

The occurrence of considerable number of respondents never used PPE could be due to lack of adequate information and proper awareness on its appropriate use. In a study, it is reported that most of the farmers (49.3%) showed potentially unsafe behavior with respect to PPE use [13].

Results presented on Fig. 9 indicate that majority of the respondents perceived the usefulness of PPE when dealing with pesticides or any crop protection product as either highly encouraging (58.0%) or encouraging (40.0%), while only 2.0 percent had a less encouraging perception.

The respondents have been confirmed by the findings to have a positive perception on the usefulness of PPE while handling pesticides or any crop protection product.

Positively obtained as presented in Fig. 10, majority (70.8%) of the respondents wash their

PPE after every usage. Those that wash it anytime deemed fit were 2.5 percent, but a negligible number (2.0%) wash it seasonally. However, nearly ¼ (24.7%) do not wash their PPE at all.

Despite that some do not wash their PPE at all, more than 3/4 wash it after every use. This implies a good practice in the maintenance of PPE.

Findings contained in Fig. 11 reveal that more than four-fifth (84.0%) of the respondents' shower with water and soap immediately after using PPE. Those that do not clean themselves at all after PPE use were 2.9 percent whereas 1.1 percent don't wash just after using pesticides. Less than 1.0 percent (0.7%) wash their limbs and face with water only immediately after PPE use. On the other hand, 5.3 percent shower immediately after spraying with water while more

or less the same portion (6.0%). wash their limb and faces with water and soap immediately.

Findings affirmed the results obtained in Fig. 10. In addition, the finding highlights certain idea on the benefits of self-cleanliness after PPE use.

Information presented in Table 3 reveal result on experienced difficulties due to non-use of PPE. In terms of extent of difficulties, majority (76.1%) rarely experienced any difficulty due to non-use

of PPE, 59.7 percent experienced difficulty often, while 19.1 experienced difficulties very often.

In order of importance, respondents experienced the difficulties viz. skin burn, irregular illness, respiratory difficulties, rashes and poisoning. Findings revealed that in spite of the dominance of rare occurrence of difficulties, skin burn and poisoning were major and least experienced difficulties due to no-use of PPE, respectively.

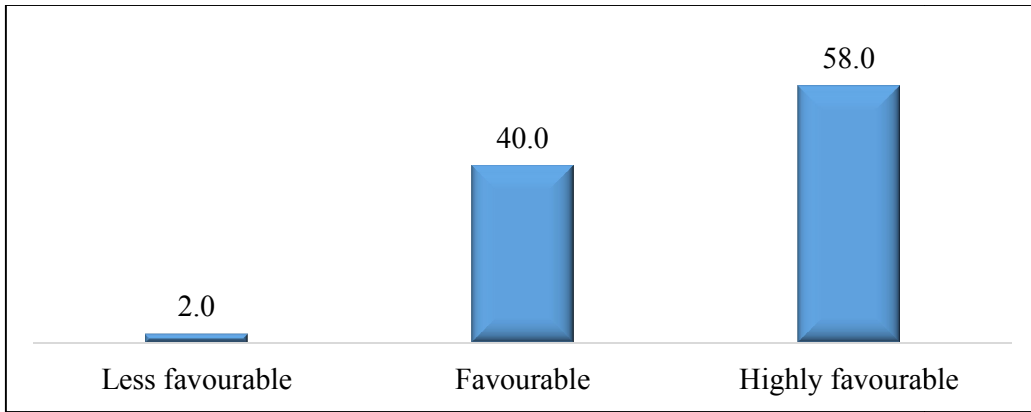


Fig. 9. Percent distribution of the respondents based on their perception on PPE use

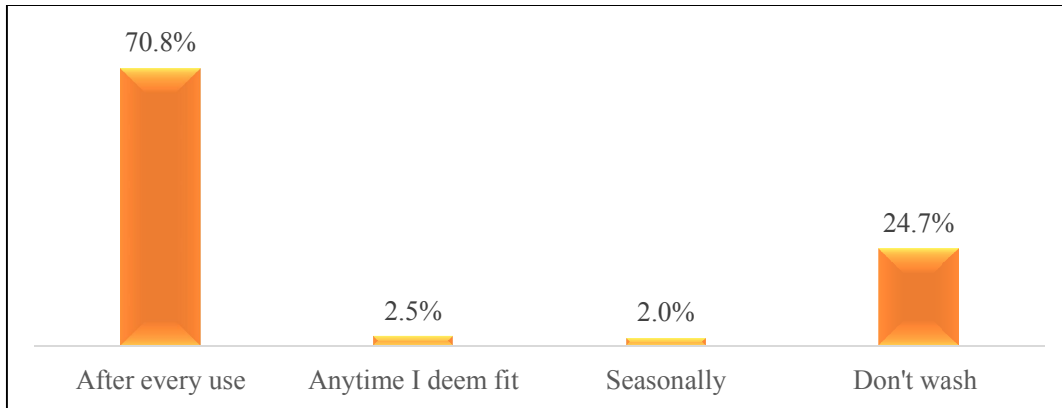


Fig. 10. Percent distribution of the respondents based on washing of their PPE after use

Table 3. Distribution of the respondents based on their perceived difficulties experienced due to non-use of PPE

SN.	Difficulties	Percent		
		Rare	Often	Very often
1.	Skin burn	21.4	16.7	5.7
2.	Rashes	10.7	9.7	2.7
3.	Respiratory difficulties	11.9	13.9	5.7
4.	Poisoning	14.2	6.2	2.0
5.	Irregular illness	17.9	13.2	3.0

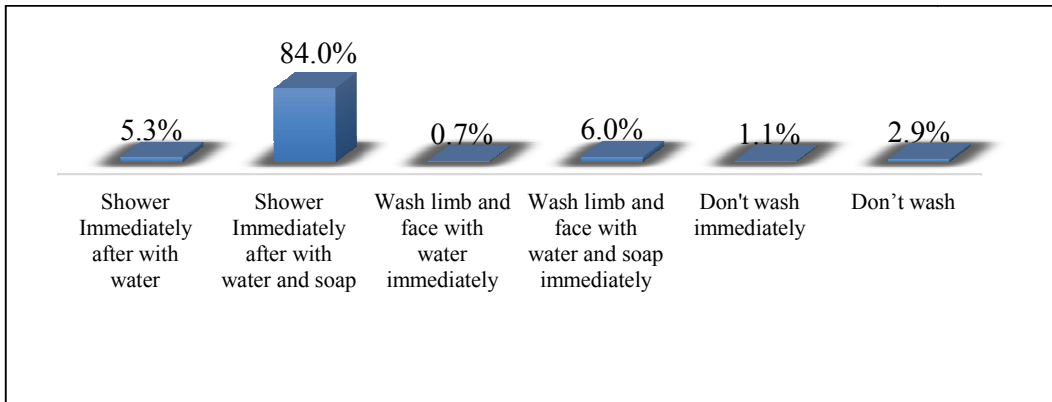


Fig. 11. Percent distribution of the respondents based on their self-cleanliness after PPE use

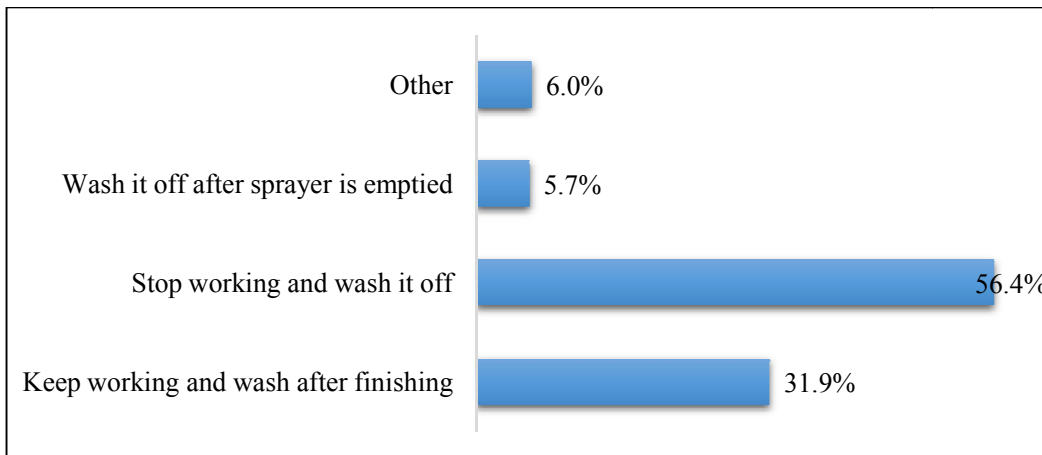


Fig. 12. Distribution of the respondents based on their responses after exposure to pesticides or any other crop protection product

Findings presented in Fig. 12 reveal that more than half (56.4%) of the respondents stop working and wash off immediately exposed to pesticide or any other crop protection product, 31.9 percent keep working and wash after finishing their work. Nearly 6.0 percent (5.7%) wash the exposed part of their body after the content in the sprayer must have finished. Other (6.0%) actions taken include; using cloth to clean up the exposed body part, mopping and shake-off.

Findings shown in Fig. 13 show that several actions were taken by the respondents to avoid consequences that might occur due exposure to pesticide or any other crop protection product. Even so, some were not appropriate. Alternative ways (56.4%) that include local methods of curing poisoning or contamination constitute major source for seeking help by the

respondents whenever poisoning or contamination occurred. Those that consult local doctor were 35.1 percent, while 8.5 percent consult local hospital. But, nobody consulted any local nurse for help.

The result implies that majority lack contact with proper source for taking right measures when exposed to either contamination or poisoning.

Many extra activities were carried out by the respondents during spraying (Fig. 14). More than half (56.1%) of the respondents focused on the spraying alone. But then, intermittently 17.00 percent smoke, 15.7 percent make a phone call, 7.2 percent drink, while the least (4.0%) eat during the spraying activity.

Findings reveal some of the ways through which contamination and poisoning occur during spraying activity.

About one-third of the respondents (31.5%) abandon emptied container on the field. Others of nearly 20.0 percent (19.7%) used the empty container for domestic purposes, 18.5 percent

bury, 14.4 percent sell to collectors, 7.7 percent throw them in waterways, 7.5 percent burn, while only 0.7 percent return the containers to seller (Fig. 15).

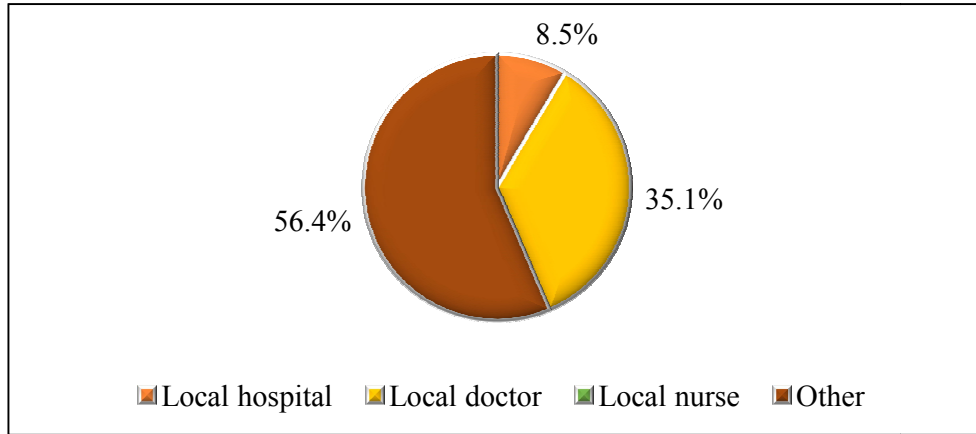


Fig. 13. Distribution of the respondents based on their source of assistance in case of contamination or poisoning

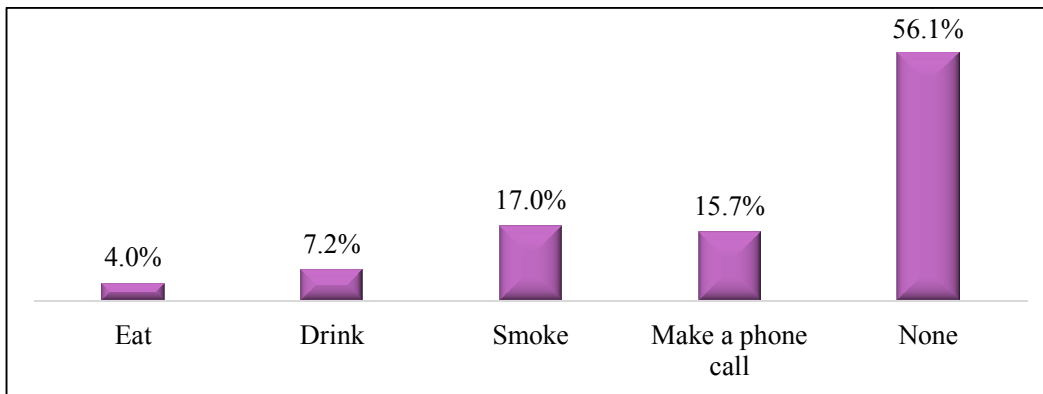


Fig. 14. Distribution of the respondents based on their activities done while spraying

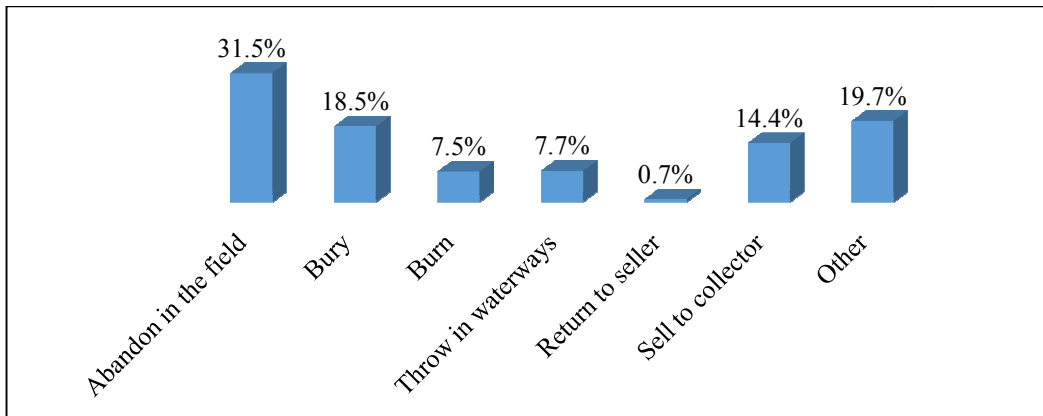


Fig. 15. Distribution of the respondents based on how empty container is disposed

Therefore, result reveals that majority of the respondent dispose of the empty containers in ways that could have adverse effects on self and environment.

Results shown in Fig. 16 reveal that almost four-fifth (79.5%) of the respondent rinse the empty container before any other action is taken on it. Those that do not rinse were 20.5 percent. The number of times an empty container is rinsed determines the extent of residual effect likely to be contacted.

These findings denote that majority of the respondents were less likely to be exposed to high degree of pesticides or any other crop protection product residual effect owing to none rinsing of the empty container.

According to the demonstrated results in Fig. 17, majority of the respondents (81.2%) felt safe, normal or comfortable using PPE but 13.7 percent felt uncomfortable wearing PPE, while 4.1 percent felt uneasy either when carrying out farm operations or when nobody from the

neighbors was using it. Feeling professional using PPE was least reported (1.0%) by the respondents.

Most of the respondents seems to have positive feeling about using PPE. Others that felt uneasy or uncomfortable could be due to none adaptation to its usage.

Information displayed in Table 4 present results of problems encountered by respondents in the course of using PPE. Majority of the respondents did not encounter any problem (ranked 1). In order of hierarchy, incompatibility with condition was reported second, followed by handling complexities and safety management difficulties. The least (5th) reported was encountering handling complexities, incompatibility with condition and safety management difficulties altogether.

This result expresses that most of the respondents have encountered one problem or the other, with a considerable number having encountered none.

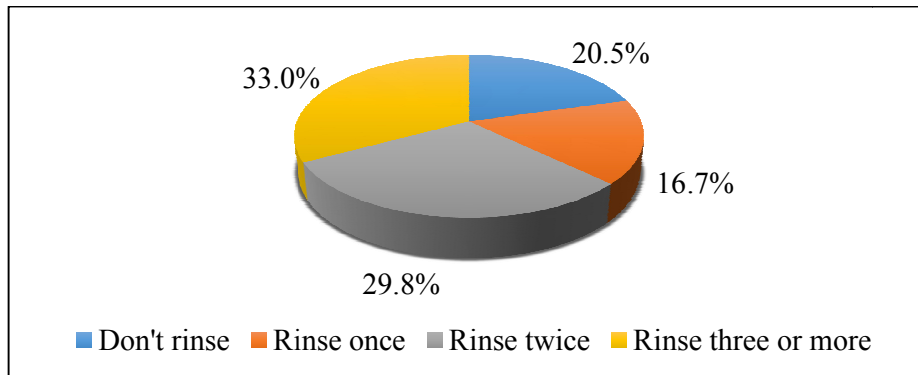


Fig. 16. Distribution of the respondents based on their cleaning of empty container

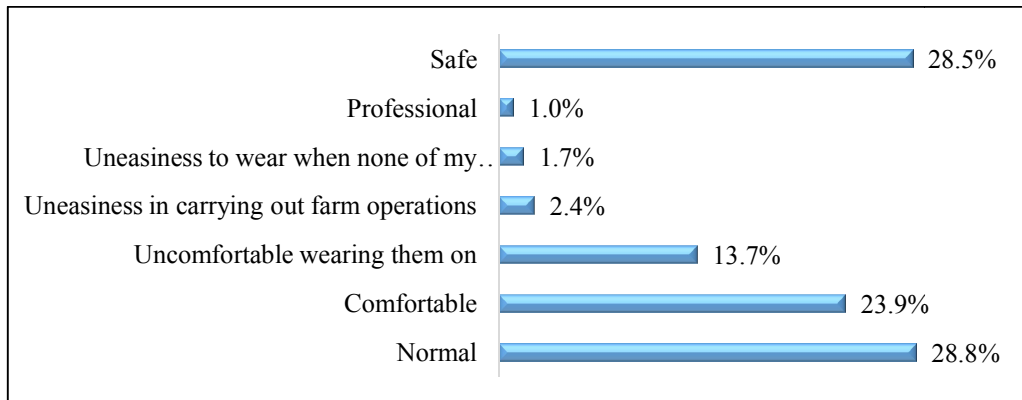


Fig. 17. Distribution of the respondents based on their feelings about using PPE

Table 4. Rank order of the problems encountered in using PPE

SN.	Problems	Score	Rank
1.	Handling complexities	120	3 rd
2.	Incompatibility with condition	133	2 nd
3.	Safety management difficulties	117	4 th
4.	All of the above	41	5 th
5.	None of the above	280	1 st

3.1 Qualitative Findings

Qualitative investigation was carried out using two tools that included FGD and direct observation. The result is therefore presented as follows:

To assess the status of PPE use by the Farmers, an in depth interview was conducted on some purposively selected key informants in Muktadah, Chowgacha, Jeshore district, and Krishnapur, Tanore, Rajshahi district. Results obtained are presented below:

The usual source of accessing information was retailers because governmental agents hardly visit. Farmers poorly partake in farmer based associations, as a result membership of association was low due to lack of concrete benefits because most of what is needed was obtained from retailers. Only a few purchased PPE, due to cost and most of the time it was purchased from open market since it was readily available there whenever needed.

Training exposure on PPE use was very low amongst farmers. Mostly, all information and trainings were obtained from retailers of crop protection products which never lasted for more than one hour in a contact. As regards utilization of the training exposure, participants were indifferent, but reported that they used traditionally devised way; especially the youth. This involved wearing trousers, long sleeve shirts, polythene in place of hand gloves and napkin to cover their faces.

Because most of the farmers do not use PPE as obtained during the discussions, they failed to make clear-cut utterances concerning extent and perception on PPE use. However, they expressed feeling of safety in using PPE, although they complained of discomfort wearing and getting it off due to its impermeability for air penetration. On the other hand, they dominantly clean themselves after completion of spraying and other farm activities. The cleaning takes place within one hour of total farm work

completion, reason being that it is preferred to get all work done for avoidance of interruptions.

Emptied containers were washed several times before put to domestic use. Disposal of emptied containers was mostly by burying, burning or given out to collectors in exchange for children fast foods and snacks.

The commonly experienced difficulties were skin and eye burns, and poisoning. In case of any difficulties, village quacks were contacted for help, whereas for contamination the procedure adopted was washing and usually practiced first aids at household level. The farmers mostly concentrate when carrying out spraying activities, but sometimes use mobile, smoke, drink or even eat.

In order to encourage adequate and proper utilization of PPE the following recommendations were suggested during the discussions:

- a) Promotion of PPE use through organized campaigns and other local means of information dissemination.
- b) Making PPE readily available whenever needed and selling it at affordable price.
- c) Use of mass media for creation of awareness in all locales of the farmers.
- d) Farmer trainings and capacity building.
- e) Adequate circulation of posters.
- f) Pricing strategy and special offers.
- g) Government initiatives in line with the use of PPE.

The direct observation was done through physical instant noticing of happenings, close monitoring of body language and respondents' side talks. After this, information was compiled relative to the objectives of the survey.

Farmers in Jeshore were observed to be more cosmopolite, unprejudiced and open to changes compared to those of Rajshahi. This was obtained to be influenced by factors such as Polyculture practices, civilization and better standard of living in terms of income.

4. CONCLUSIONS AND RECOMMENDATIONS

Majority of the farmers were 35.0 years or less with mean age around 39.5 years and mostly were literate. They are generally low income earners of averagely BDT 194,540.0 (USD 2431.8) per annum and lack training exposure on PPE use. They usually obtained all information from retailers and use "traditional PPE" (trousers, long sleeve shirts, polythene in place of hand gloves and napkin to cover their faces) mainly when applying pesticides. The farmers in Jeshore were found more advanced in using modern agricultural practices including PPE. Most of the farmers learnt how to use PPE through self-efforts and have positive perception about its use. Majority wash their PPE after every use, clean themselves with soap and water immediately after work, and when exposed to pesticide or any other crop protection product the usual practice was to stop working and wash. Emptied containers were abandoned in the field by majority of the farmers, but before put to any form of use they are rinsed several times. Most experienced difficulty was skin burn, and in the event of contamination or poisoning locally domestic alternative methods were adopted or village quacks were consulted.

Promotion of PPE use may be operated through organized campaigns and other local means of information dissemination. PPE may be made readily available whenever needed and selling it at affordable price. Mass media may be employed for creation of awareness in all locales of the farmers. In this connection, adequate circulation of posters may be suitable. Farmers may be trained for their capacity building. Government may undertake initiatives in line with the use of PPE including affordable pricing strategy and special offers.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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