PERSONAL PROTECTION ACCESSORIES (PPA) AS A PRIMARY HEALTH SAFETY MEASURES IN PESTICIDE USE

Muhammad Aslam*, Sumaira Kanwal**, Tanvir Ali***, Ajaz Akhtar* and Muhammad Iqbal Zafar****

*Department of Agri. Extension, University of Agriculture, Faisalabad
**Department of Math and Stat, University of Agriculture, Faisalabad
***Department of Agri. Extension, University of Agriculture, Faisalabad
****Department of Rural Sociology, University of Agriculture, Faisalabad

Fruit growers from three districts of the Punjab took part in this study whereas their knowledge, attitude, skill and practices were evaluated regarding the use of pesticides. The hygiene and sanitation practices of the respondents were also related with proper use of PPA during pesticide spray which needs attitudinal changes along with the provision of better facilities and infrastructure. Demographic features of the fruit growers were evaluated regarding their age, qualification, marital status, source of income, smoking habits, farming size, fruit production and pesticide spraying experience. The ordinal regression model determined the significant relation among the qualification, spraying experience and land holding size with their level of knowledge and skill of using personal protection accessories (PPA). It is recommended that pesticide safety education and better skill be given to pesticide sprayers for the appropriate use of PPA.

Keywords: Punjab province; personal hygiene and sanitation; personal protection accessories; pesticides.

INTRODUCTION

Agriculture is the hub of economic activity in Pakistan which lays down the foundation for development and growth of the national economy. The province of Punjab is a major contributor in agricultural economy of the country and more than 70% population is dependent for its dietary requirements on the agro-based activities. Agriculture directly contributes 23.3 per cent to Gross Domestic Product (GDP) and provides employment to 42.1 percent of the total labour force of the country (Govt. of Pakistan, 2007).

Pakistan's climatic condition is much favorable for pest population build up. Therefore the use of agro chemicals particularly pesticides has become almost vital to fruit production and other agricultural activities. Increasing pest resistance makes growers to apply more and more of pesticide in hopes of overcoming the resistance. Pesticides are poison, being used globally to enhance the productivity of different crops and fruits. The high incidence of pesticide poisonings among farmers and adverse condition of environmental health in country like Pakistan was related to faulty pesticide practices and the use of highly toxic pesticides in agricultural practices (WHO, 1998). Pesticides of various kinds had been widely used on fruits and fruit orchards in the Punjab for the last 30 years. These pesticides were usually organophosphates, carbamates and to much extent organochlorides. Some restricted and banned pesticides in industrialized countries were used in many third-world countries (Wessling *et al.,* 1997).

The health hazards associated with pesticide handling are little understood by the sprayers. However, it is known that extensive use of pesticides on fruits had adverse effects on health (Lakew and Mekonnen, 1998; Wolf *et al.,* 1999) and gradually contaminates the soil, water and surrounding environment (WHO, 1984; Clarke *et al*., 1997). The use of personal protection accessories (PPA) can potentially reduce the acute and chronic health hazards of pesticides to the sprayers. In this paper, data is presented about knowledge, attitude and practice of the respondents regarding the use of PPA during pesticide spray.

MATERIAL AND METHODS

The study was conducted in Punjab Province which has 14 top fruit growing districts out of 35 districts (PHDEB, 2005). These districts were divided into three production zones viz. Southern Zone, Central Zone and Northern Zone (PARC, 2004). The Southern Zone was famous for mangoes production; consist of fruit producing districts Multan, Muzafargarh, Bahawalpur, RahimYar Khan, Dera Ghazi Khan. The Central Zone was important for guava production and consists of districts Toba Tek Singh, Faisalabad, Sheikhupura, Kasur and Northern Zone was prominent for citrus production and consists of districts Gujranwala, Sargodha, Mianwali, Khushab, and Chakwal (PHDEB, 2005). The fruit growers were spread in three fruit production zones of the Punjab province and due to prevailing limitations, this study was conducted in three

randomly selected districts i.e., one district from each fruit growing zones of the Punjab. The randomly selected three districts were Multan from Southern Zone, Sheikhupura from Central Zone and Sargodha from Northern Zone.

The population of the fruit growers in the Punjab was 0.141 million (Govt. of Pakistan, 2004) and by using Fitzggibbon, *et al.,* (1987) table technique, 384 respondents were taken as an appropriate sample size for this study. The population of this study consisted of all types of fruit growers in the research area. Lists of all rural union councils for selected districts were obtained from concerned district office. All three randomly selected districts, Multan, Sheikhupura and Sargodha were comprised of 74, 89 and 122 number of rural union councils respectively. From districts Multan, Sheikhupura and Sargodha, 6, 8 and 10 numbers of union councils were randomly selected respectively, comprising the total numbers of 24 union councils. All fruit growers in each selected union council were enlisted and 16 of them were randomly selected for interview. A total number of 384 respondents from 24 union councils of 3 randomly selected districts of the Punjab were interviewed for this study.

In this study Ordinal Regression Model introduced by Mc Cullagh (1980) were used for analysis of data having ordinal scale. The relationship between model parameters which appeared in the linear predictor and the original ordinal scale were obscured. The Ordinal Regression Model was used because it allows choosing a link function based on the problem under consideration to optimize the analysis results. According to the nature of data in this study the model does fairly well with the complementary log-log link function (c log log).

RESULTS AND DISCUSSIONS

Personal protection accessories (PPA) include clothing protect farmers from exposure when working with pesticides. PPA consists of equipments used to protect hands, body, respiratory system, head, feet and eyes. Use of PPA can significantly reduce pesticide contact with the skin, eyes, mouth and absorption through the lungs. PPA not only important for dealing with acute toxic pesticides but they are also important when dealing with some products identify as potentially causing chronic health problems (Perry, 1995).

Table-1 described the socio-economic and demographic features of respondents. As regarding the demographic characteristics of the respondents in this table, majority of them (68.2 %) were in the age of 31-50 years, 37.0 % were illiterate and most of them (82.3%) were married. There were 79.4 % respondents who had source of income as farming only and majority of them (71.9 %) involved in smoking habits. Most of the fruit growers (41.7 %) had farming size less than 12.5 acres, 44.0 % had fruit production experience less than 5 years whereas 40.9 % respondents who had spraying experience 1- 5 years.

Table 1. Demographic characteristics of the respondents

Demographic features	n	%
Age (Years)		
Up to 20	23	6.0
21-30	60	15.6
31-40	146	38.0
41-50	116	30.2
51-60	21	5.5
Above 60	18	4.7
Qualification		
Illiterate	142	37.0
Primary	88	22.9
Matric	67	17.4
Intermediate	48	12.5
Graduate and above	39	10.2
Marital Status		
Single	45	11.7
Married	316	82.3
Widowed	23	6.0
Source of income		
Farming	305	79.4
Farming + Employment	48	12.5
Farming + Private business	31	8.1
Smoking habit		
Smokers	276	71.9
Non smokers	108	28.1
Farming size / Land holding (in acre)		
Less than 12.5	160	41.7
12.5-25	130	33.9
Above 25	94	10.2
Fruit production experience (in years)		
Less than 5	169	44.0
5-10	144	37.5
Above 10	71	18.5
Experience as a sprayer (in years)		
Less than 1	136	35.4
1-5	157	40.9
Above 5	91	23.7

Table-2 represents the knowledge of personal protection accessories needed to be worn while spraying pesticides. The number of respondents having knowledge about use of boots and long shoes were found in 41.4 %, trouser suit by 43.0 %, gloves by 45.1 %, mask by 40.1 %, cap by 50.0 % and glasses were known by 35.4 % respondents.

Table 2. Distribution of the respondents according to their knowledge of personal protection accessories which are needed to wear while spraying pesticides

Personal protection accessories	Yes		No	
	n	%	n	%
Boots/Long shoes	159	41.4	225	58.6
Trouser suit	165	43.0	219	57.0
Gloves	173	45.1	211	54.9
Mask	154	40.1	230	59.9
Cap	192	50.0	192	50.0
Glasses	136	35.4	248	64.6

Table-3 represents respondents' level of knowledge regarding the use of personal protection accessories (PPA) while spraying pesticides. The analyzed results of the Table-3 predicted that 20.3 % respondents had satisfactory level of knowledge about the personal protection accessories which were needed to be worn while spraying pesticides, 26.0 % respondents were having poor and 29.4 % had very poor level of knowledge. There were only 14.6 % respondents having good and 9.6 % had excellent level of knowledge for personal protection accessories (PPA). The mean was estimated ($\overline{X}$ =2.49 with SD. =1.31) indicating that majority of the respondents (55.4 %) had knowledge below satisfactory level. The importance regarding the knowledge of PPA was also reported by Mekonnen and Agonafir (2002) that pesticide safety education be given to the sprayers and appropriate PPA should be used with regular maintenance and timely replacement of worn-out parts. The results of the study revealed that for better protection from pesticide hazards the knowledge of using PPA should be improved.

Table-4 represents the attitude of the respondents towards the statement that protective clothing should be worn when mixing or applying pesticides. The statement was dis-agreed by 4.2 % respondents and it was agreed by 95.8 % respondents. The mean estimated ($\overline{X}$ =3.92 with SD= 0.40) presented that a large no. of the respondents (95.8 %) had strong attitude towards the statement that protective clothing should be worn when mixing or applying pesticides.

Table-5 reveals practices of fruit growers regarding regularity of using personal protection accessories (PPA) at the time of spraying pesticides. There were 77.9 % growers who use personal protection accessories (PPA) sometimes whereas 22.1 % never used it at the time of spraying pesticides. There was no respondent who claimed to use personal protection accessories (PPA) regularly for spraying pesticides. The data analyzed revealed that majority of the respondents sometimes used the personal protection equipments during pesticide spray. These practices of the respondents were found similar as reported by Gomes, *et al.,* (1999) that farm workers in developing countries tended not to use protective measures while handling pesticides.

Table 3. Distribution of the respondents according to their level of knowledge for personal protection accessories (PPA) needed to wear while spraying pesticides

Knowledge of personal protection accessories	V. Poor n (%)	Poor n (%)	Satisfactory n (%)	Good n (%)	Excellent n (%)	$\overline{X}$	SD
	113(29.4)	100(26.0)	78(20.3)	56(14.6)	37(9.6)	2.49	1.31

Table 4. Distribution of the respondents according to their attitude towards the statement that protective clothing should be worn when mixing or applying pesticides

Statement	SDA n (%)	DA n (%)	Nil n (%)	A n (%)	SA n (%)	$\overline{X}$	SD
Protective clothing should be worn when mixing or applying pesticides.	0(0.0)	16(4.2)	0(0.0)	368(95.8)	0(0.0)	3.92	0.40

SDA: Strongly Dis-agreed DA: Dis-agreed A: Agreed SA: Strongly Agreed

Table 5. Distribution of the respondents regarding their regular practices for wearing of the personal protection accessories (PPA) during pesticides spraying

Wearing of the personal protection accessories	Respondents	Percentage
Regularly	0	00.0
Sometime	299	77.9
Never	85	22.1
Total	384	100.0

Table-6 represents the level of skill for wearing personal protection accessories (PPA) in the respondents. The table presented that skill in 28.4 % respondents was found very poor for wearing personal

Table 6. Distribution of the respondents regarding their skill of wearing the personal protection accessories (PPA)

Assessment of the skill regarding:	V. Poor n (%)	Poor n (%)	Average n (%)	Good n (%)	Excellent n (%)	$\overline{X}$	SD
Wearing the personal protection accessories (PPA)	109(28.4)	100(26.0)	87(22.7)	47(12.2)	41(10.7)	2.51	1.31

protection accessories (PPA). Poor level of skill was determined in 26.0 % of the respondents and 22.7 % had average level of skill. The respondents having good level of skill were12.2 % and 10.7 % had excellent level of skill in wearing the personal protection accessories. The mean calculated 2.51 with SD 1.31 represented that a large number of the respondents (54.4 %) were having the skill below average level for wearing the personal protection accessories.

The importance of PPA wearing skill in pesticide use was also described by Yassin *et al.,* (2002) that most farm workers were aware of the protective measures to be used during applying pesticides. Mekonnen and Agonafir, **(**2002) recommended that pesticide safety education be given to the sprayers; appropriate PPA should be used with regular maintenance and timely replacement of worn-out parts.

respondents have higher level of for safe methods to dispose of empty pesticides containers but the second and third explanatory variables (land size and spraying experience) considered in the model have negative regression coefficient showing that it had no effect on level of knowledge for safe methods to dispose of empty pesticides containers. The significance of Wald statistic also indicates that the parameters were useful to the model. The confidence intervals (C.I) are presenting the results more comprehensively.

The pseudo R^2 for McFadden (0.89), Cox and Snell (0.74), and Nagelkerke (0.91) in the complete model with the clog log link were larger. The additional model fitting statistic, the Pearson's chi-square, (χ^2 =314.77 with df = 185, and P = 0.52) for the complete model with the clog log link indicated that the observed data were consistent with the estimated values in the fitted

Table 7. Ordinal Regression Model for the respondent's knowledge of personal protection accessories (PPA)

		β	S.E.	Wald	df	P-value	95% C-I	
							Lower Bound	Upper Bound
Threshold	K_ppa (1)	-.132	.170	.601	1	.438	-.465	.201
	K_ppa(2)	.803	.162	24.493	1	.000*	.485	1.122
	K_ppa (3)	1.470	.168	76.325	1	.000*	1.140	1.800
	K_ppa (4)	2.060	.185	124.412	1	.000*	1.698	2.422
Location	Qualif	.490	.085	33.416	1	.000*	.324	.656
	L_sz	-.142	.142	1.005	1	.316	-.419	.136
	S_exp	-.060	.089	.457	1	.499	-.114	.233

Table-7 represents the relationship between qualification, land size and spraying experience of the respondents with their level of knowledge for personal protection accessories. The level of knowledge of personal protection accessories (PPA) needed to wear while spraying pesticides was found to be significantly associated with the qualification of the respondents by using the complete model with the complementary log-log (clog log) which shows that three thresholds of the model equation were significantly different from zero and substantially contributed to the values of the response probability in different categories. The significant explanatory variable (qualification) exhibited positive regression coefficients, indicating that

model which shows that the complete model with the clog log link is a better fit model. The chi-square parallel lines test (χ^2 = 42.96 with df = 30, and P = 0.20) indicated that there was no significant difference for the corresponding regression coefficients across the response categories, suggesting that the model assumption of parallel lines was not violated in the complete model with the clog log link.

Table-8 represents the relationship between qualification, land size and spraying experience of respondents with their level of skill for wearing personal protection equipments. The level of skill for wearing the personal protection equipment was found

Table 8. Ordinal Regression Model for the respondent's level of skill for wearing the personal protection accessories

		β	S.E.	Wald	df	P-value	95% C-I	
							Lower Bound	Upper Bound
Threshold	S_ppa (1)	-.264	.171	2.380	1	.123	-.599	.071
	S_ppa(2)	.655	.162	16.378	1	.000*	.338	.973
	S_ppa (3)	1.363	.167	66.973	1	.000*	1.037	1.690
	S_ppa (4)	1.842	.177	107.846	1	.000*	1.494	2.190
Location	qualif	.369	.083	19.711	1	.000*	.206	.532
	L_sz	-.041	.141	.085	1	.770	-.318	.236
	S_exp	-.057	.088	.424	1	.515	-.116	.231

to be significantly associated with the qualification of the respondents by using the complete model with the complementary log-log (clog log) which shows that three thresholds of the model equation were significantly different from zero and substantially contributed to the values of the response probability in different categories. The significant explanatory variable (qualification) exhibited positive regression coefficients, indicating that respondents have higher level of skill for mixing, loading and handling the pesticide into a spraying machines but the second and third explanatory variables (land size and spraying experience) considered in the model have negative regression coefficient showing that it had no effect on level of skill for mixing, loading and handling the pesticide into a spraying machines. The significance of Wald statistic also indicates that the parameters were useful to the model. The confidence interval (C.I) is presenting the results more comprehensively.

The pseudo R^2 for McFadden (0.94), Cox and Snell (0.79), and Nagelkerke (0.88) in the complete model with the clog log link were larger. The additional model fitting statistic, the Pearson's chi-square, (χ^2 =152.29 with df = 114 and P = 0.07) for the complete model with the clog log link indicated that the observed data were consistent with the estimated values in the fitted model which shows that the complete model with the clog log link is a better fit model. The chi-square parallel lines test (χ^2 = 28.41 with df = 19, and P = 0.09) indicated that there was no significant difference for the corresponding regression coefficients across the response categories, suggesting that the model assumption of parallel lines was not violated in the complete model with the clog log link.

CONCLUSIONS

The use of pesticide is very common in the Punjab, Pakistan. To provide regular coordination between researchers and farmers and to find out the structural constraints inhibiting safe practices, it is essential to quantify the extant of public health impact of environmental health hazards of pesticides for proper intervention. On the basis of the findings of the research, following recommendations are proposed. The proposed strategies provide a framework that could be used for future initiatives to address the problem of harmful pesticide exposures to the environmental health in Pakistan. The sprayers must be trained and facilitated to protect themselves during pesticide spray by using the necessary precautionary equipments. Health organizations at district and provincial levels should arrange the health protecting training program especially concerned pesticide hazardous management. They must be given knowledge of pesticide health hazards and proper awareness of emergency measures in case of poisoning.

REFERENCES

Clarke, E.E.K., L.S. Levy and A. Spurgeon. 1997. The problems associated with pesticide use by irrigation workers in Ghana. Occup. Med. 47: 301–308.

Fitzggibbon, C.T. and L.L. Morris. 1987. How to design a programme evaluation. Newbury Park, C.A. Sage. J. Gomes, O.L. Lloyd and D.M. Revitt. 1999. The influence of personal protection, environmental hygiene and exposure to pesticides on the health of immigrant farm workers in a desert country. In: Arch Occup. Environ. Health. J. 72(1): 40-45.

Govt. of Pakistan. 2004. Economic Survey Report, Finance Division, Economics Wing, Islamabad.

Govt. of Pakistan. 2007. Economic Survey Report, Ministry of Education, Islamabad.

Lakew, K. and Y. Mekonnen. 1998. The health status of Northern Omo state farm workers exposed to chloropyrifos and profenifol. Ethiop. Med. J. 36**:** 175–184.

Mc Cullagh. 1980. Generalized Linear Models. Journal of the Royal Statistics Society, Series B 42, 109-142.

Mekonnen. Y. and T. Agonafir. 2002. Pesticide sprayers' knowledge, attitude and practice of pesticide use on agricultural farms of Ethiopia Department of Biology, Faculty of Science, Addis Ababa University, Addis Ababa, Occup. Med. 52(6): 311–315. Society of Occupational Medicine. UK.

PARC (Pakistan Agricultural Research Council). 2004. Report; Sub group on cropping pattern of working group on agriculture. PARC, Islamabad.

Perry, R. 1995. Sensor Controlled Orchard Sprayers; Proceedings of the National Conference on Pesticide Application Technology August 1995, Guelph/Canada: 164-171

PHDEB (Pakistan Horticulture Development & Export Board). 2005. Fruit Events Overview: December 16, http://www.phdeb.org/sec_overview/php

Wessling, C., R. McConnell, T. Partanen and C. Hogstedt. 1997. Agricultural pesticide use in developing countries: health effects and research needs. Int. J. Health Serv: 27**:** 273–308.

WHO. 1984. Guidelines for Drinking Water Quality. Geneva: World Health Organization (1): 68–76.

WHO (World Health Organization). 1998. Primary prevention of mental, neurological and psychosocial disorders. World Health Organization: 75-90. Geneva.

Wolf, T.M., K.S. Gallander, R.A. Downer, F.R. Hall, R.W. Fraley and M.P. Pompeo. 1999. Contribution of aerosols generated during mixing and loading of pesticides to operator inhalation exposure. Toxicol. Lett. 105**:** 31–38.

Yassin, M.M., T.A.A. Mourad and J.M. Safi. 2002. Knowledge, attitude, practice, and toxicity symptoms associated with pesticide use among farm workers in the Gaza Strip Occupational and Environmental Medicine J. 59(6): 387-393.