ANALYTICAL DIAGNOSTICS OF NON-OPTIMAL USE OF PESTICIDES AND HEALTH HAZARDS FOR VEGETABLE PICKERS

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ABSTRACT:- Economically pesticides are meant to control pests in the fields. Up to certain optimal use of a typical pesticide, it enhances the yield of crops and vegetables. But, eventually amplified use of pesticides results in contamination of environment (water, soil, and air) and increase the health cost of vegetable pickers. The purpose of this study is to estimate the excessive use of pesticides and economic cost of health hazards for the vegetable pickers in district Vehari. Data from 90 respondents were collected and analyzed. The most common health problems identified during the survey were headache, eye irritation, skin infection, cough and shortness of breath. Health cost consists of costs related to precautionary measure, medication, traveling, the opportunity cost of attended persons and productivity loss. The mean health cost of vegetable pickers in the study area was about Rs. 385 per picker per year. Health cost model was used to measure the health cost of vegetable pickers. The regression results showed that pesticides were being applied non-optimally in the study area i.e., number of pesticide applications for vegetables (7-31) were substantially higher than the recommended dose. Health cost function was significantly different from zero as indicated by F-stat (32.18) and it is also supported by R^2 that about 70% variation in health cost is explained by medication accompanied by productivity loss (Rs. 223), precautionary measure (Rs. 134), attended person cost (Rs. 14) and traveling expenditures (Rs. 16). Hence, strict legislation is required to overcome the availability of hazardous pesticides and to keep the vegetable pickers aware of the optimal use of pesticides through appropriate extension services.

Key Words: Pesticides; Vegetable Pickers; Health Problems; Health Cost; Pakistan.

INTRODUCTION

The foremost intention of introducing the pesticides was to prevent an outbreak of pests and pest related diseases in the crop fields. The use of pesticides initially, reduced pest assault and paved the way for increasing the crop yield as expected. Simultaneously, excessive use of chemical pesticides has resulted in contamination of the environment and the long-term implications on the society are reflected in multidimensional perspective. Globally there are a lot of cases about pesticide poising (Richter, 2002). Pesticide residues found in the environment are much higher than the maximum permissible limit. Pesticide residues present in the environment affect the soil, water, agricultural products, animals, and

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plants. Continuous applications of pesticides have caused diseases like cancer and epilepsy (Rajendran, 2003).

Excessive use of pesticides is causing many environmental problems including pollution, risk to human health, non-target organisms, wildlife, agitation to natural balance and increase in the pest resistance. Pesticide residues control programs are often prevalent in developing countries due to the limited of resources and strict legislation (EU Commission, 2006). Use of Pesticides are released into the environment and human get contact directly or indirectly. Humans are exposed to pesticides found in environmental media (soil, water, air and food) by different routes of exposure such as inhalation, ingestion and dermal contact. Exposure to pesticides results in acute and chronic health problems. These range from temporary acute effects like irritation of eyes, excessive salivation to chronic diseases like cancer, reproductive and developmental disorders etc.

Kishi et al. (1995) analyzed before and after observations of Indonesian shallot farmers established that over one fifth (21%) of pesticide sprayings produced three or more neurobehavioral, gastrointestinal, and respiratory symptoms of pesticide poisoning. Research on farmers in Iowa State, USA exposed to an unusually high amount of pesticide reveals an array of symptoms. These include headaches, skin irritation, nausea or vomiting, dizziness and feeling excessively tired, chest discomfort, breathing difficulties, nervousness or depression, eye irritation, jerking or involuntary movement of the arm and legs (Alavanja et al., 2001). Toxicity is simply the inborn ability of a chemical to be fatal (US EPA, 1992). A complete understanding of the health problems resulting from pesticide exposure requires additional consideration of the toxicity type, involves agrochemicals, frequency and exposure pathways the quantities used per given parcel and individuals physical characteristics such as size and weight.

The present study aims to add more understanding consequence of the pesticide relating hazards, identify various health problems of the vegetable pickers, estimating the health costs and determine the factors affecting the health cost due to pesticide exposure.

MATERIALS AND METHOD

A farm level survey was conducted in January 2014 in Vehari district, which lies between 29°36′ and 30°22′ north latitudes and 71°44′ and 72°53′ east longitude. From Burewala, Mailsi and Vehari tehsils, vegetable pickers were selected randomly as respondents of this study. Thus, 90 respondents were picked for collecting information. Data was gathered through interviews by employing a well-structured questionnaire. Some sophisticated econometric techniques and descriptive analysis were applied to estimate different aspects of the study.

Health Cost Model

The present study employs the same technique to evaluate the cost on the health of vegetable pickers as that of Dasgupta et al. (2001). They estimated the health cost of people of Delhi due to the sickness from diarrhoea. Pesticide related specific studies of similar kind have been done by Dung and Dung (2000), Pingali et al. (1994) and Wilson (1998).

Pesticide contact in Vehari affected peoples' health due to sickness, salary cut and checkup cost. In the present study, illness, travel, opportunity cost of accompanied person and aversive action technique to get pesticide related health expenses were used.

Health costs associated to vegetable pickers from short-term pesticide contact are mainly determined by age, education, hospitalization, pesticides application and distance from health centers. On the basis of existing literature in environmental economics and health cost model, following log regression model was used (Dung and Dung, 2000) which linearized as:

$$LnY_i = a + \beta_i LnX_i + \mu_i$$

where,

a = Intercept
β = Co efficient
Y_i = Dependent Variable
X_i = Vector of independent Variables
μ_i = Disturbance Term

According to above model, the dependent variable is health cost(Y) while explainatory variables include age, education, precautionary measures use, etc.(Table 1).

Table 1. Variables' description

Variable	Description
Health Cost (Y)	Vegetable picker's Health Cost (Rupees)
	Work days opportunity cost*
	Traveling cost to the hospital
	Opportunity cost* of sick attendant
	Medication cost
	Costs of protecting equipment or precautionary measures.
Age	Vegetable picker's age (years)
Edu	Education of the respondents (years)
Pmuse	Dummy for precautionary measure use (1 for use of PM and 0 otherwise)
Dist	Distance of health center from respondent's home (km)
Pesticide	Number of pesticide sprays applied in the field for vegetables
Exp	Experience of the vegetable picker (years)

0pportunity cost = wage off days due to illness.

RESULTS AND DISCUSSION

This study has a variety of inter-related components, such as role, participation, personal, socioeconomic characteristics of vegetable pickers and their health problems due to exposure to pesticides possibly. In this analysis, the respondents were taken of above 16 years of age and below 72 years so that mature information from the respondents could be collected (Table 2). The majority of the vegetable growers and pickers are 16-30 years which constitutes about 43.3%. It indicates that most of the vegetables pickers were mature. The literacy rate (0-14 years of schooling) among them is much frustrating (20%). Only few respondents (19%) have completed their matriculation. These results are inconsistent with GoP (2013) that literacy rate in urban is higher than rural areas and higher gap for men than women. They are involved in the vegetable picking since their teenage (51%). It indicates that lack of

Table 2. Socio-economic characteristics of the study area

Characteristics	Frequency (%)
Age (years)	
16-30	39 (43.3)
31-40	30 (33.3)
41 and above	21 (23.4)
Education (years)	
Illiterate	18 (20.0)
Primary	28 (31.1)
Up to middle	19 (21.1)
Matric	17 (18.9)
Above matric	08 (8.9)
Experience (year)	
Up to 10	46 (51.1)
11-20	27 (30.0)
21-30	05 (5.6)
Above 30	12 (13.3)

employment compels them to take part in activities in the lethal environment, such as vegetable fields.

Pesticide application ranging from 0-10 constitute about 11%, 11-20 number of pesticide sprayed constitute 61%, 21-30 number of pesticide application constitutes about 27% and the rest (1%) of the pesticide application were above 30 indicating a very high applications than recommended dose (Table 3). These results were inconsistent with Choudhary and Gaur (2009) that up to 15 sprays were recommended in Brinjal.

Table 3. Pesticides sprays

No. of sprays per acre	Frequency (%)
0-10	10 (11.1)
11-20	55 (61.1)
21-30	24 (26.7)
Above 30	01 (1.1)
Total	90 (100.0)

Due to intensified and non-optimal applications of pesticide, the vegetable pickers are exposed to the remnants of pesticides sprays during picking (Proper and Mechelen, 2007). While these remnants results in large number of diseases among vegetable growers and pickers. They were asked about the common health problems related to pesticide chemicals and their responses depicted that most frequently occurring health problems in vegetable pickers were skin infection (57%) and the respondents were complaining less about vomiting (7%) in the study area (Table 4).

Table 4. Prevailed diseases in the study

Disease	Frequency (%)
Eye irritation	13 (14.4)
Headache	20 (22.2)
Skin infection	51 (56.7)
Vomiting	06 (6.7)
Total	90 (100.0)

In the present study, a very few respondents were following precautionary measures (PM). The estimated costs of these PM were Rs. 134 only per picker. The prices of PM have been rising steadily due to inflation in the country. Respondents who fell due to pesticide exposure only incurred Rs. 223 as medication costs including cost on medicine and fee paid to doctors, if any. This cost also includes productivity loss due to disease. Since health centers are located away from residential areas in rural localities and people have to travel for medical advice/treatment. The travel cost was low (Rs. 16) because respondents had medical dispensaries in their locality.

Due to illness, vegetable pickers failed to go picking and other farm activities and work day's loss incurred is called productivity loss, which was on an average Rs. 86 incurred in medication. Finally, all of these costs to estimate the ultimate health cost (HC) of the vegetable picker which was Rs. 386 only per person per season were calculated (Table 5). The estimated cost in the study on hand is same as HC studies conducted by different scientists in Nepal (Atreya, 2005) and Tanzania (Ngowi, 2002). Results vary from some studies in which the estimated HC is too high or too low. It is due to the fact that vegetable pickers

Table 5. Health cost components of vegetable pickers' health cost model

Cost items	Mean ± S.D	Range
PM (Rs.)	133.56 ± 107.21	0-500
Medication & Prod. Loss (Rs.)	222.61 ± 339.52	0-2000
Traveling (Rs.)	15.78 ± 39.033	0-200
Attended Person (Rs.)	13.89 ± 38.967	0-200
HC (Rs.)	385.84	0-2250

exposed to vegetable picking but not at the time of spraying as that of farmers. So, when the vegetable pickers are exposed to the vegetable field, the intensity of the pesticide hazards is reduced.

Education had positive and statistically highly significant impact on the health cost (Table 6). This shows that one percent change in schooling year brought corresponding change in health cost upto two percent. Higher education intends individual to buy PM for his safety. As compared to the other variables, although, HC increases but at a lower rate. Age of the respondent also had the positive and statistically significant impact on dependent variable which explains that one percent increase in the age of the respondent resulted in two percent increase in HC. Khan (2012) research finding were also in line with education and age has positive relation with HC using willing to pay method.

The distance from hospital is positively related to health cost and is statistically significant. One percent increase in the distance, increased HC by 0.92%. Study was consistent with Nicholl et al. (2007) who concluded that increased distance can increase health risk. The experience of vegetable pickers is negatively related to the health cost which is interpreted as one percent increase in experience leads to 0.41% decrease in HC. Experienced person will pick vegetables when intensity of the pesticide hazard will be low.

Table 6. Estimated health cost function of vegetable pickers

Variables	Coefficients	t-value	Significance
Constant	-6.826	-2.880	0.005**
ln AGE	2.069	2.823	0.006*
ln EDU	0.697	3.464	0.001***
PMUSE	4.619	12.965	0.000***
ln Distance	0.923	3.098	0.003**
ln EXP	0.414	-1.458	0.149
ln Pesticide	0.100	0.213	0.83
R^2	0.700		
Adjusted R^2	0.670		
Value	32.181		

****,** and * =Significant at 1%, 5% and 10% level, respectively*

Precautionary measures and pesticides application (number of application of the pesticides on the farm) are positively related to the health. It showed that one percent increase in PM and number of pesticides in the vegetable field resulted in 4% and 0.10% increase in HC of the vegetable picker. Sekiyama et al. (2007) also suggested PM have some positive sign on human health. Higher numbers of applications of pesticides by farmers to get high yield cause increase in health cost of the pickers.

Overall, HC function is significantly different from zero as indicated by value of F-Test (32.21). Value of R^2 shows that explanatory variables included in the model substantially contribute in dependent variable (HC). Results shown that health cost increased significantly with the increase in the age of the vegetable picker, which are similar to Dung and Dung (2000). It clearly indicates that as the vegetable picker gets older, the resistance to the pesticide effect decreases and they fall sick.

CONCLUSION AND RECOMMENDATIONS

Use of higher concentration pesticide results in serious health issues that draws the attention of policy makers towards this alarming situation. The pesticides applications in the study area and similar kind of other regions are very high which is consistently associated to substantial health cost of vegetable pickers. Results showed that their average health cost in the study area was about Rs. 386. In addition to

unawareness regarding the health risks of pesticides, the poor farmers cannot afford to buy proper equipment for spraying and protection. Inspite of sufficient financial resources, farmers do not wear protective clothes. Due to lack of enforcement of legislation, a lot of low quality or banned pesticides are available in the markets. Strict legislation is required which can control the availability of hazardous pesticides and also make the farmers to use the PM. The network of extension services and farmers' field schools can play a pivotal role if diffusion and dissemination process is enhanced through good governance system and institutional reforms in the agricultural departments operated under provincial governments.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

S. No	Author Name	Contribution to the paper
1.	Mr. Muneeb Zafar	Conceived the idea,Wrote abstract, Introduction, Data collection and entry, Methodology,References
2.	Mr. Tahir Mehmood	Methodology, Did SPSS analysis, Results and discussion
3.	Dr. Irfan Ahmad Baig	Technical input at every step, Overall the management of the article
4.	Prof. Dr. Abdul Saboor	Technical input at every step, Overall the management of the article
5.	Mr. Mazher Abbas	Overall management of the article
6.	Ms. Shumaila Sadiq	Results and discussion
7.	Dr. Khalid Mahmood	Conclusion

(Received March 2015 and Accepted November 2015)