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ORIGNAL ARTICLE

Pulmonotoxicity assessment in pesticide and insecticide applicators in the vicinity of Lahore

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ABSTRACT

UN-protective work practices followed by insecticide and pesticide applicators during application results to pesticide exposure among worker. The aim of this study is formulated to explore the pulmonary health of labor occupationally UN-protected to insecticides. In study include the health impact of sprays practices and PPE usage among labor,duration & timimg in mediating respiratory health problems, and studies investigating the link between exposure and risk of lung diseases. A cross-sectional study compared insecticide and pesticide applicators (n= 100) working in urban in the vicinity of Lahore with controls (n=50). The assessment of lung functions and questionnaire-based survey on lung health was conducted among study individuals. Results showed the symptoms for a lung disease like a cough without sputum, cough with sputum, irritation of the throat & wheezing were found to be greater ($P \leq 0.05$) among insecticide applicator than controls. Pulmonary Function tests standards like. PER, FVC,FEV1/FVC & FEV were found to be remarkably decreased ($P \leq 0.05$) among labor in comparison to controls. It is concluded from the study that unsafe occupational exposure to pesticides and insecticide causes lung illness, significant decreasing of lung functions.

1. Introduction

The large scale use of insecticide shows a threat to the environment and human health, especially those called as chemical herbicides,pesticides, insecticides, and fungicides (Vašíčková et al., 2019). Insecticides have been linked to some illnesses such as asthma and cancer, and frequent usage can affect biodiversity & ecosystem since greater than 95% of insecticides affect non-target organisms (Tian et al., 2018). Therefore, insecticide are important to contaminate the surface water, groundwater, sediments, and soils (Hazra et al., 2017; Kranawetvogl et al., 2018; Sun et al., 2019).

insecticides are chemicals of huge effect on human health and labor represent a population that is greatly affected to the ill-health hazards of insecticide exposure since they are in direct exposure with the different types of insecticides, fungicides, and herbicides (Milhome et al., 2018). Agriculture is the largest consumer of pesticides, where almost 85% of whole world production i formulated to control insects on agri production. Moreover, insecticides are also used in the elimination of pests in envornmental, public health and house hold activities for insects'elemination & eradication (Kim et al., 2017).

Studies have found increase potential for asthma, wheezing, and other Chronic Bronchitis among agricultural labor (Hoppin ., 2006; Fareed ., 2013; Raherison ., 2019). The channeling of pesticides through normal gaseous circulation via the process of inhalation and absorption costs health to the lung tissues (Zhang et al., 2018). A recent study reported certain epidemiological studies that concluded pesticides inhalation through occupational exposures enhances the probability of respiratory diseases among respective laborers. (Hutter&Moshammer, 2018).In addition to respiratory symptomatology study, several researchers have assessed clinical pesticide chronic

exposure with the help of spirometry to evaluate the working status of pulmonary functions. Similarly, a higher prevalence of throat irritation and lung problems were observed among agriculture workers as per reduced lung functioning tests due to occupational pesticide exposure (Fareed et al., 2013; Nordgren & Charavaryamath, 2018). It has been observed and documented that respiratory illness and asthma among many other lung problems are caused by occupational factors. About 15% of the population is suffering from either adult asthma or occupational asthma out of their occupational pesticides Exposures. This study aims to asses whether agricultural occupational exposure to insecticides is linked with lung problems & impaired lung functioning in Lahore and its peripheral areas.

2. Methodology & Study

A cross-sectional study is done in the vicinity of Lahore with hundreds of insecticides and pesticide applicators (n= 100) for 50 control areas (n=50). The duration of pesticide exposure was set to be for five years. A structured questionnaire is established with a yes or no format to examine respective questions. At least three work hours per day are scheduled throughout the year for the inclusion criteria. As per the exclusion criteria is concerned we have gathered the Medical and family history of workers for liver, kidney, neurological, and metabolical, and hematological disorders.

Moreover, a condition of no history of any sort of toxic chemical exposure, excessive consumption of meat, and constant or routine smoking of alcohol cigarettes, or any sort of drug consumption is set for this study. We have gathered this pesticide exposure information through a structured questionnaire survey in which we have gathered data for exposure of pesticides, time period of pesticide exposure,the usage of PPE(personal protective equipment), and class of toxic chemical either pesticide or insecticide used by workers for spraying activities.

2.1 Pulmonary function tests

Lung functioning data is collected through spirometry in which we have used disposable mouthpiece filters and nose clips for both pesticide-exposed and unexposed agriculture labor. A spirometry test is scheduled twice: once before the work shift and once after 2 days away from the workspace. In this lung functioning test, we have added Vital Capacity (VC), Forced Vital Capacity (FVC), and Forced Expiratory Volume in one second (FEV1), FEV1/FVC ratio, and Peak Expiratory Flow (PEF). After this, we have compared the respiratory capacity of the exposed population with the control groups.

3. Metric BMI

BMI = (Weight in Kilograms / (Height in Meters x Height in Meters)

4. Data Analysis

The student's T-test is used to have a comparison of mean values and frequency values and also to have a comparative analysis of samples of control and exposed groups.

The P-value is considered statistically important.

5. Results

Table Number 1 exhibits certain characteristics of the sample population. As per the demographic variables are concerned, there were no particular different statistical value were observed among the two groups. Table Number 2 is showing data about the population that used PPE. Most of the agricultural laborers preferred to use respiratory PPE. However, only 16% of the population used hand-based PPE.

A comparatively higher FVC ratio ($P \leq 0.05$) was observed in control groups (5.8±0.1) as compared to the workers that have ok 4.9±0.6. In addition to this, a comparatively higher FV1 ratio ($P \leq 0.05$) was also observed in control groups 4.8±0.05, and workers were found with 4.2±0.5.

FEV1/FVC ratio (%) was drastically higher ($P \leq 0.05$) in control groups 83±1 and workers were found with 87±2. Similarly, PEF was alsoobserved drastically higher ($P \leq 0.05$) in control groups that was 10.1±0.1, and workers were found with 9.5±0.3 as exhibited in figure number 1.

The most common pesticides that were sprayed by laborers are known as Glyphosate with a percentage of 77% and 23% respectively. In non-glyphosate organosulfur, the trend observed was about 5% in which <Organonitrogen 8% <Organophosphorus 12% <Pyrethroid 52%.

Similarly, the Pyrethroidgroup showed the trend of Deltamethrin 45%> Permethrin 4%> Alpha-cypermethrin 3% as exhibited in figure number 2.

Table 1. General characteristics of the population under study(mean ± SD).

	Referent	Exposed	P-value
Age (yr) (Mean±S.D)	25±7	28±8	0.686
Weight (kg) (Mean±S.D)	78±12	79±20	0.925
Height (cm) (Mean±S.D)	171±12.9	167±10.6	0.556
IBM (kg/m2) (mean ± SD)	26+4	28+3	0.526

Table 2: The frequency distribution of wearing personal protective equipment among pesticide spray workers.

PPE variables	Percentage
Use of respiratory PPE (mask)	98%
Use of eyes PPE (visor)	45%
Use of hand PPE (gloves)	16%
Use of shoes PPE (boots)	87%

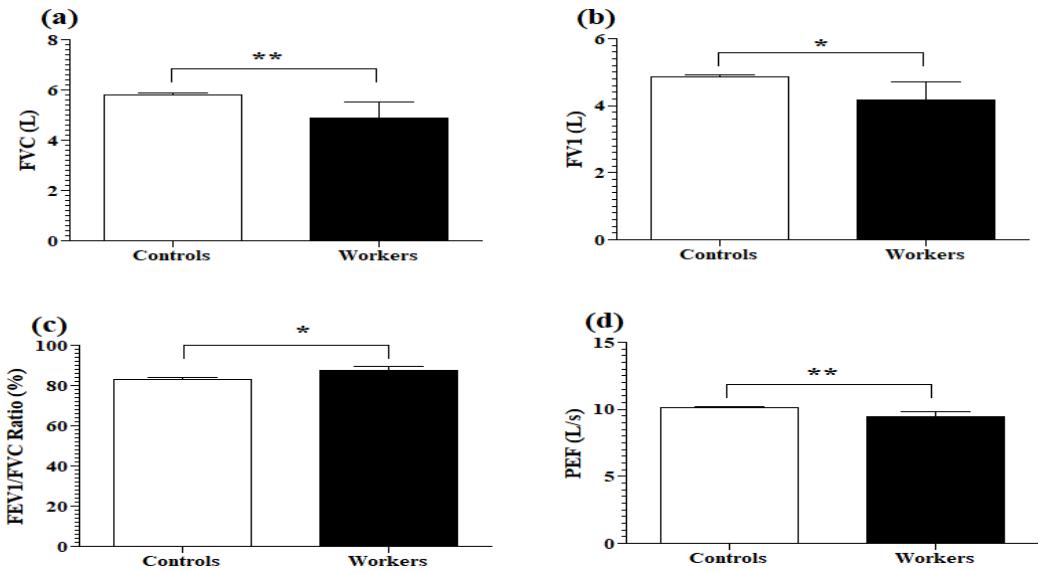

Fig.1. (a) FVC(forced vital capacity), (b) FEV1(forced expiratory volume per second), (c) FVC% (forced vital capacity in percentage) to FEV1(forced expiatory volume per second) ratio, (d) PEF (Peak expiatory flow).

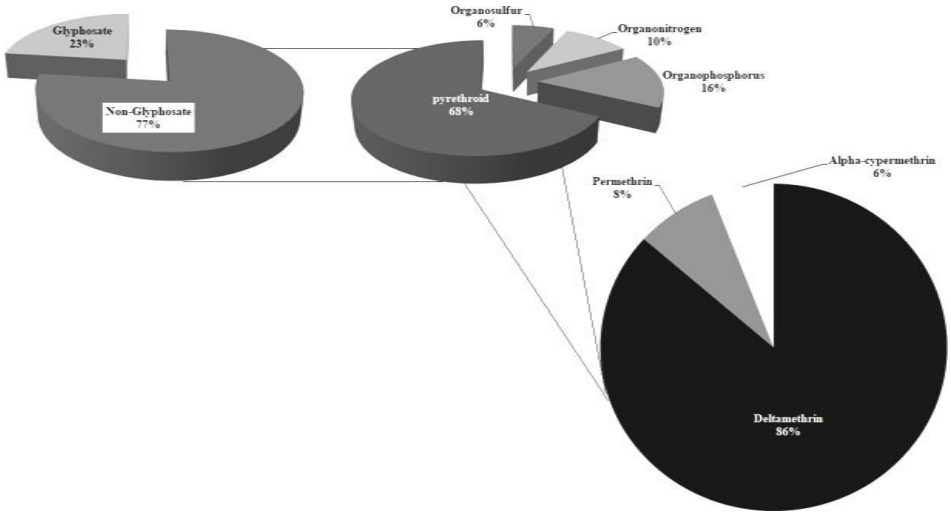

Fig. 2 The percentage distribution of the most common pesticides sprayed by workers.

6. Discussion

Agriculture labor exposed to pesticides and related airborne chemicals have been observed with adverse health effects. This study examined the link of occupational insecticide exposure with lung problems and lung functioning status as per the excessive use of insecticides in agriculture activities in Lahoreanditsperipheralareas.Theresultshowedthattheuse ofinsectcides in agriculture activities and lung problems with reduced pulmonary health is directly associated because the chemicals inhaled by agriculture labor negatively impact their lung functioning and caused diseases like asthma wheezing and coughing.

This way the results agreed with the study conducted by Fareed and Coworkers in 2013 (Fareed et al., 2013). The Cha and co-researchers studied similar patterns in Korean farms where they have established an exposure-response relation between respective defects of ventilators and duration of pesticide applicators (Cha et al., 2012). This also adds value to the study where the exposure-response trend between pesticide exposure and risk of FEV1/FVC was reported to affect health status of the exposed sample group. Moreover, the result of this study concluded a higher exposure effect comparable to the Korean farm impacts.

In 2014, DeJong and colleagues also conducted an exposure study in Netherland where they have observed a reduction in the FEV1among sample group (De Jong, et al., 2014).Similarly, Negatu and researchers conducted a study in Ethiopiain 2017 where they have observed similar results within a short period due to poor agriculture practices with excessive pesticide exposure (Negatu et al., 2017). The study shows a direct link of respiratory symptoms with exposure to organophosphate pesticides as Roberts and colleagues reported in 2014 that low levels of organophosphate-containing pesticides have the potential to produce pulmonary dysfunctioning (Roberts et al., 2014; Suarez-Lopez et al., 2018). Similarly, anticholinesterase pesticides are also reported to produce a higher level of lung problems in agriculture workers (Lermen et al., 2018). Moreover, a study conducted in Southern Ghana showed the prevalence of respiratory diseases among agriculture workers out of excessive fungicide exposure associated with wheezing and coughing problems (Quansah et al., 2016; Bruce et al., 2018).

In 2016, Neghab and colleagues conducted a similar study in which they concluded a direct relation of pesticide exposure with pulmonary toxicity in human beings (Neghab et al., 2016).

In 2015, Hanssen and fellows conducted a similar study in which they compared and concluded that the group who was exposed to pesticides developed more respiratory problems as compared to the unexposed group. In 2018, Lermen reported that the pulmonary dysfunctioning situation becomes even worse whenagriculturallaborareuneducatedabouttheproperusag eofpesticidesor Personal Protective Equipment (PPE) (Lermen et al., 2018). Health problems associated with pesticide exposure are common in developing countries where people don't have enough awareness about risks of pesticides, misuse of personal protective equipment, and misuse of chemical applicators, highly toxic pesticides usage, or lack of proper health services availability.

7. Conclusion

This study provides a detailed analysis of pesticide exposure, their level of toxicity, and the development of pulmonary toxicity in agriculture laborers. The parameters covered to collect data includes spray practices, the status of education, uses of Personal Protective Equipment (PPE), timing and duration of chemical exposure, health status, and associated lung problems. Results showed an alarming situation as respiratory symptoms started to appear in such a short duration of exposure with highly negative health consequences. The population group observed rarely uses Personal Protective Equipment (PPE) that increases their risk of anomaly development. In addition to this, the lack of education about the toxicity level of pesticides and their proper usage is exacerbating the situation. Most of the farm labor is uneducated and untrained and started spraying pesticides without any previous knowledge that resulted in serious lung functioning at such an early age. So, this study concluded a direct relation of pulmonary toxicity with pesticide exposure complemented with lack of chemical awareness and poor agriculture practices. With this, it is suggested that agricultural labor should be properly trained, provided with knowledge of chemical toxicity, and usage of Personal Protective Equipment (PPE) in this richly emerging agriculture sector of Lahore.

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