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Pesticides toxicity assessment in occupational workers in Dir Lower, Khyber Pakhtunkhwa, Pakistan

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Key words: Pesticides; Farmers; Dealers; Biochemical Markers; Blood Profiling.

Abstract

Pesticides are chemical compounds used to control insects and weeds to enhance food and crops productivity. The present study was aimed to evaluate the effects of pesticides on health status of dealers and farmers in district Dir Lower, Khyber Pakhtunkhwa, Pakistan. Blood samples were collected from different groups viz: farmers, dealers (exposed to pesticides), and control (not exposed to pesticides) and the history was recorded on a questioner. For Blood Profiling and Serum Biomarkers analysis, Sysmex Kx-21 (Japan) and Shiamadzu Double Beam Spectrophotometer 1700 Pharma (Japan) were used. Upon pesticides exposure the blood cholesterol, Triglyceride, Serum glutamate pyruvate transaminase, Uric Acid, Total Lipid, Low density lipoprotein, High density lipoprotein, Mean Corpuscular Hemoglobin Concentration, Platelets and White Blood Cells count were increased in dealers and farmers as compared to control group. While, Hemoglobin, Red Blood Cells, hematocrit, Mean Corpuscular Volume, Mean Corpuscular Hemoglobin, Lymphocytes and Neutrophils counts decreased in farmers and dealers as compared to control. The present findings suggest that pesticides exposure adversely affect dealers and farmers health status by significantly altering their liver and kidney functions as well as blood biochemistry and hematology.

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Introduction

Pesticides are widely used to improve food and crop productivity in order to cope with the rapidly growing population throughout the World (AL-Shinnawy, 2008). These area heterogeneous group of chemicals used to control, kill and eradicate weeds, insects, pests, fungi and rodents (Kamel *et al*., 2004, Mnif *et al*., 2011). They include a variety of compounds like nematicides, plant growth regulators, molluscicides, herbicides, rodenticides, fungicides and insecticides (Aktar *et al*., 2009). Due to exposure these pesticides results mortality and morbidity in most of the less developed countries of the World such as Pakistan, India and Bangladesh (Saxena, 2010).

The ruthless use of these pesticides has not only adversely affected domestic animals but, also wild animals including human beings (Alpalan *et al*., 2006). Pesticides exposure disrupts sperm production which ultimately leads to male sterility and reduced sperm quantity as well as poor quality (Falck *et al*., 1992). The widespread use of the pesticides for agricultural purposes have caused multiple ailments and problems of respiratory system, nervous system, endocrine system, reproductive system, cardiovascular and immune system such as blood coagulation, arthrosclerosis, fluid as well as electrolyte imbalance. They are potent mutagenic as well as carcinogenic for multiple body parts but, liver and kidney are among the most vulnerable organs (Kumar, 2008, Patil *et al*., 2009).

Its exposure predominantly takes place through eyes, human skin, ingestion and breathing (Patil *et al*., 2009). Exposure in occupational workers including farmers, gardeners and dealers occurs while handling, processing, using and spraying of the pesticides (Wolfe *et al*., 1967). The current research was undertaken to evaluate the adverse effects of insecticides on health status of the farmers and dealers exposed to these toxic chemicals by analyzing their hematological and biochemical markers.

Materials and methods

Sampling Area and Population

For the current research, three villages (Asbanr, Tazagram and Ouch) of district Dir Lower, Khyber Pakhtunkhwa, Pakistan were selected, where vegetables like tomato and onions and crops such as wheat and maize are commonly grown and sprayed with pesticides to protect them from different diseases as well as pest and weeds. A total of 200 workers including both farmers and dealers exposed to pesticides and 200 controls (not exposed to pesticides) were randomly selected and the informed consent letter was signed from all the participants and the history was recorded on questioner.

Blood sampling and analysis

A 5 ml blood sample was taken from the brachial vein of each of pesticides exposed workers (farmers and dealers) and control group (unexposed to pesticides) using sterile syringes. The 3 ml blood sample was taken in vacutainer tube having heparin for complete blood profiling via Sysmex KX-21(Japan).For serum isolation, 2 mLblood was transferred to sterile falcon tubes containing no anticoagulant and stored at -20 °C for analysis. The serum samples were analyzed for estimation of various biochemical markers (Triglycerides, Cholesterol and SGPT etc.) by using Shiamadzu Double Beam Spectrophotometer 1700 Pharma (Japan).

Statistical Analysis

The results were expressed as mean ± standard deviation**.** Data was statistically analyzed by one way analysis of variance (ANOVA) and the mean values were compared by using Tukey's comparison test at $p<0.05$. The online available software Graph pad prism, Demo version 5.0 was used for statistical analysis.

Results and discussions

Despite the widespread use of pesticides in Agriculture and livestock improvement. Its role in diseases development in human beings is still debatable and not clear. To provide a comprehensive report regarding the adverse effects of pesticides on

vital organs such as liver, kidney and heart of occupational workers the current research work was undertaken. The present study was designed to investigate the toxic effects of pesticides on human health by analyzing blood hematology and biochemistry of the occupational workers including farmers and dealers of Dir Lower, Pakistan.

Biochemical Parameters

The blood biochemical parameters like cholesterol (Fig.1A.), triglyceride (Fig.2A.), serum glutamate pyruvate transaminase (SGPT) (Fig.3A.), uric acid (Fig.4A.), total lipid (Fig. 5A.), low density lipoprotein (LDL) (Fig.6A.) and high density lipoprotein (HDL) (Fig.7A.) levels increased upon exposure to pesticides in both dealers and farmers as compared to control (not exposed to pesticides), but the effects of pesticides were more severe in farmers than dealers which may be due to prolonged exposure time and unawareness while handlings these toxic compounds by the farmers. High SGPT and Uric acid levels in the farmers and dealers than control indicate pesticides stress and toxicity on Liver and kidney.

These results are in close agreement with the findings of Salih, (1995), who assessed the toxic effects of Diazinon and Dimethoate on liver and kidney functions, and reported elevated concentrations of Aspartate Aminotransferase (AST), Alkaline phosphatase (ALP), Alanine Aminotransferase (ALT), glucose, creatinine and uric acid in the serum of the exposed rabbits in comparison to control. It is concluded that pesticides significantly alter liver and kidney functions and also badly affects various blood biomarkers. Similarly, Muthuviveganandavel *et al.*, (2010) reported that carbendazim fungicide result in increased levels of uric acid, creatinine, glucose and cholesterol in rats. Our findings are also in harmony with the results of Nabi *et al.*, (2014).

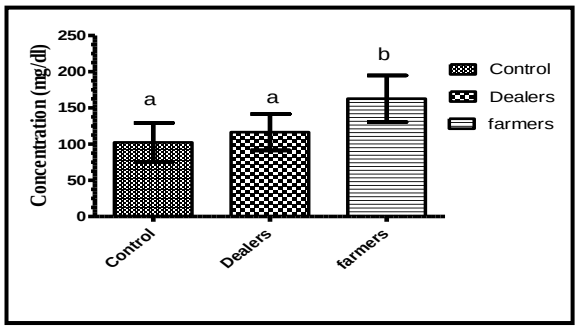

Fig. 1A. Blood Cholesterol Level of Control, Dealers and Farmers.

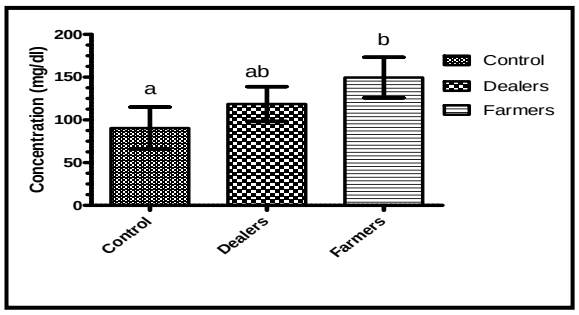

Fig. 2A. Blood Triglyceride Level of Control, Dealers and Farmers.

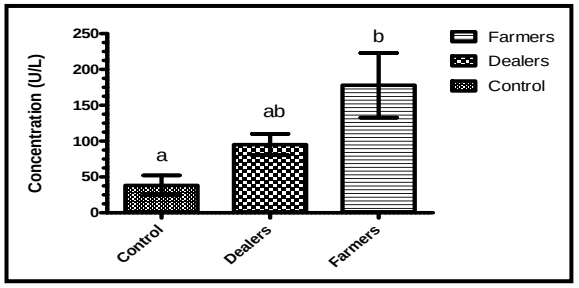

Fig. 3A. Serum glutamate pyruvate transaminase level of control, dealers and farmers.

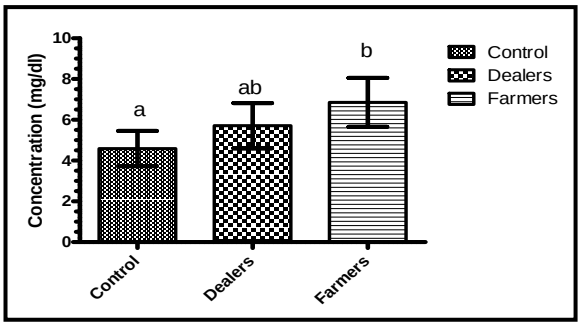

Fig. 4A. Blood uric acid level of control, dealers and farmers.

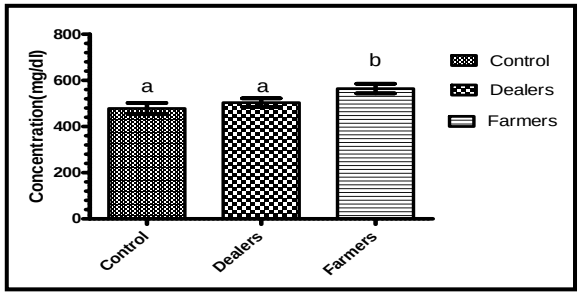

Fig. 5A. Blood total lipid level of control, dealers and farmers.

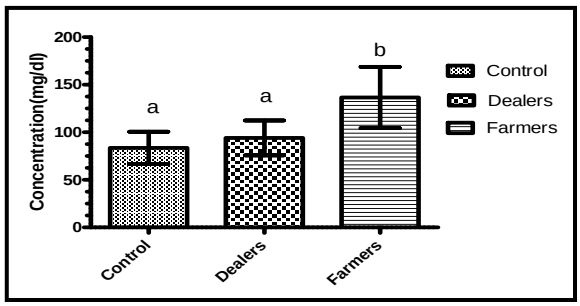

Fig. 6A. Blood LDL level of control, dealers and farmers.

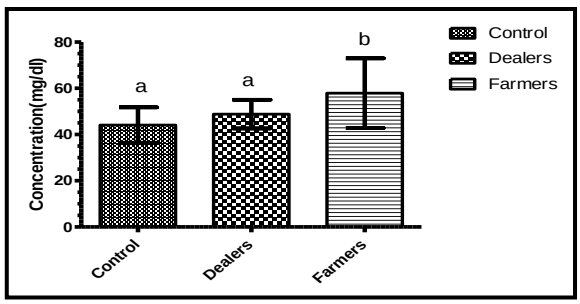

Fig. 7A. Blood HDL level of control, dealers and farmers.

Hematological Parameters

The hematological parameters such as Hemoglobin (HB) (Fig.1B.), Red Blood Cells (RBC) count (Fig.2B.), hematocrit (HCT) (Fig.3B.), Mean Corpuscular Volume (MCV) (Fig.4B.), lymphocytes count (Fig.5B.), neutrophils count (Fig.6B.) and Mean Corpuscular Hemoglobin(MCH) (Fig.7B.) of dealers and farmers decreased upon exposure to pesticides when compared to control (not exposed to pesticides), while Mean Corpuscular Hemoglobin Concentration (MCHC) (Fig.8B.), Platelets count (Fig.9B.) and White Blood Cells (WBC.) count (Fig.10B.) of dealers and farmers were increased in comparison to control group and the adverse effects of pesticides were more prominent in farmers than dealers. High WBC count in the exposed workers shows that they are at higher risk to contract various pathological conditions. Similar results were also reported by Muralidharan, (2012), who observed a decline in RBC, Erythrocyte Sedimentation Rate (ESR), hemoglobin and clotting time, while platelet and WBC levels were increased in *Cyprinus carpio*fish treated with different concentrations of fenthion. These results indicate that pesticides exposure significantly alter the blood biochemical as well as hematological parameters. Similar findings were also reported by Jasper *et al.*, (2012).These results are correlated with the findings ofNabi *et al.*, (2014),who observed elevatedPlatelets, Neutrophiland white blood cells count in Tandoor Occupants.

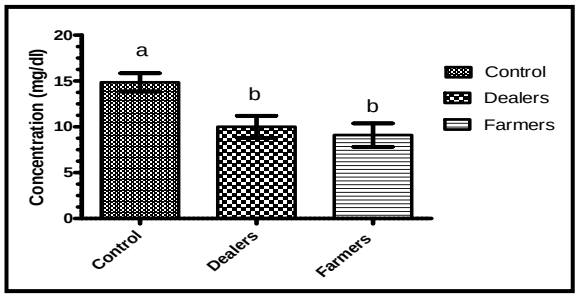

Fig. 1B. Haemoglobin level of control, Dealers and farmers.

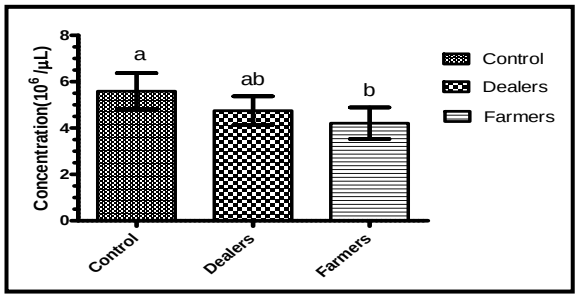

Fig. 2B. RBC level of control, dealers and farmers.

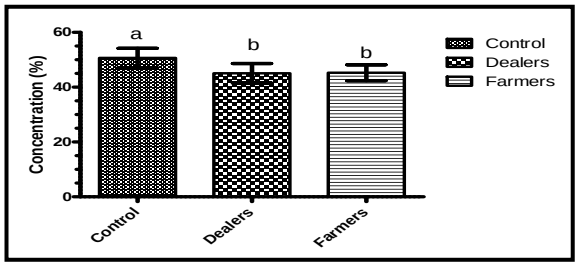

Fig. 3B. Hematocrit level of control, dealers and farmers.

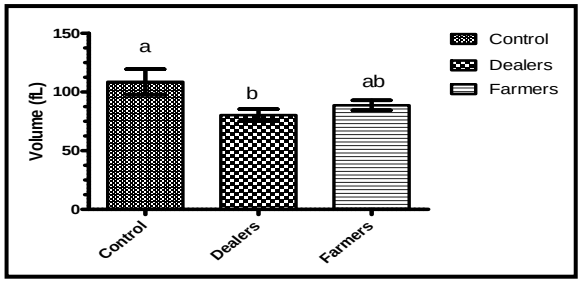

Fig. 4B. Mean Corpuscular Volume of control, dealers and farmers.

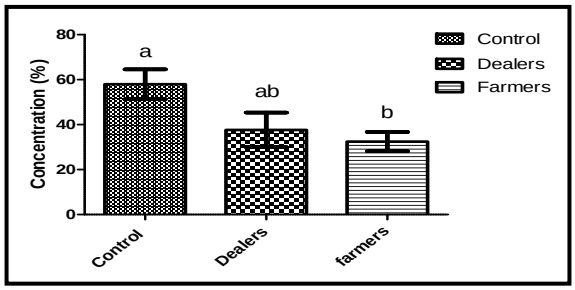

Fig. 5B. Lymphocytes level of control, dealers and farmers.

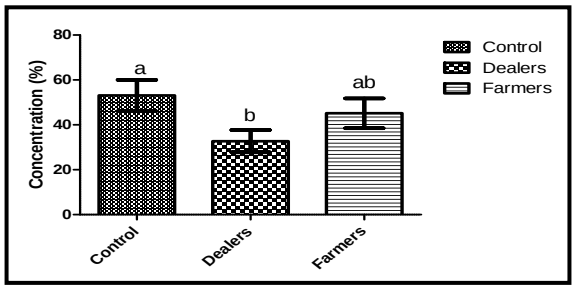

Fig. 6B. Neutrophil level of control, dealers and farmers.

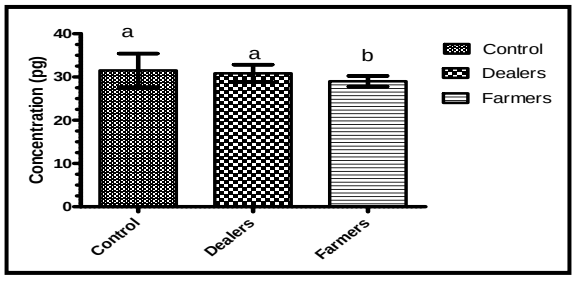

Fig. 7B. Mean Corpuscular Haemoglobin of control, dealers and farmers.

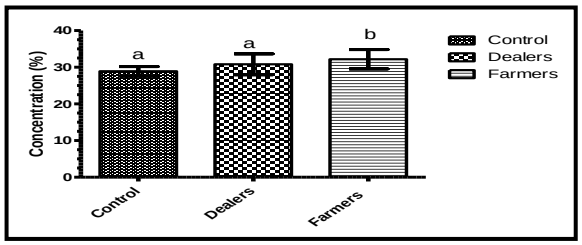

Fig. 8B. MCHC level of control, dealers and farmers.

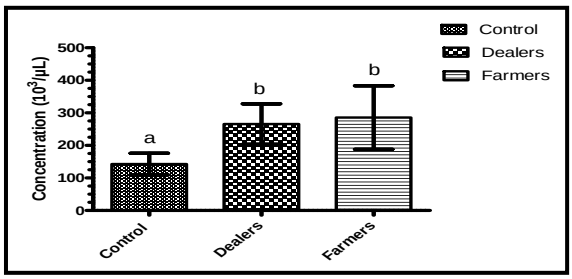

Fig. 9B. Platelets level of control, dealers and farmers.

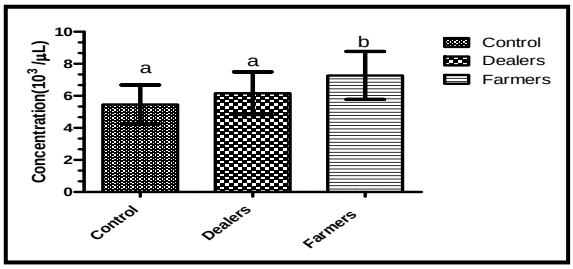

Fig. 10B. WBC level of control, dealers and farmers.

Conclusions

It is concluded from these findings that pesticides exposure adversely affect dealers and farmers health status by significantly altering their liver and kidney functions as well as blood biochemical markers and blood profiling. Further study is to be needed to identify more risk factors of pesticides exposure considering large population.

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