

Occupational exposure to pesticides among farmers

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ABSTRACT

Objective: Agricultural workers are at risk of exposure to occupational hazardous such as pesticides. Exposure to pesticides may result in some health problems. Aim of this study was evaluation of pesticides effect on hematological parameters among farm workers of Southwest Iran.

Methodology: In this case control study, 54 male farmers exposed to pesticides and 54 healthy male were enrolled. Blood parameters (Hemoglobin, Hematocrit, MCV, MCH, MCHC, and ESR), cell counts (Erythrocyte, Leukocyte, and Platelet) and coagulation factors (PT, PTT) were measured among case and control groups.

Results: Subjects were in the age between of 17 - 65 years of age (35±8). Data showed that all the hematological parameters which assayed were in normal range. The values of Hb, Hct, RBC, Platelet and PT in case group were more than control.

Conclusion: In this study, hematological indexes were changed in case group but these were not meaningful compared to normal range ($p > 0.005$). It was concluded that RBC, Hb, platelet and PT are useful indexes as warning signals for quick diagnosis of poisoning due to pesticides.

KEY WORDS: Pesticide, Occupational Exposure, Hematological indices, Farm-workers.

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INTRODUCTION

Pesticide is any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest.^{1,2} It is estimated that almost three million people are poisoned

annually with organophosphate globally. Out of this number three hundred thousand individuals either die or are severely hurt.³ The increasing use of synthetic pesticides is intensifying worldwide pollution risks. Pesticides are toxic and designed to repel or kill unwanted organisms, and when applied to the land they may be washed into surface waters and kill or, at least adversely influence, the life of aquatic organisms.^{4,5} While pesticides have been and continue to be useful against agricultural pests, the risk they pose is a major focus of the global interest because their use has led to numerous health risk effects on non-target species, especially humans.⁶ The widespread use of these pesticides consequently leads to the exposure of manufacturing workers, field applicators, the ecosystem and finally the public to the possible toxic effects of these pesticides.^{7,8} Occupational exposure to pesticides in farm-related activities has been regularly associated with an increased risk of developing some chronic diseases.^{9,10}

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Many studies have reported associations between exposure to agricultural chemicals and various health outcomes, including different kinds of cancer and degenerative diseases.¹¹⁻¹³ Effects in immune, hematological, nervous, endocrine and reproductive systems have been reported, and these compounds have also been associated with DNA damage in human.¹⁴⁻¹⁸ Biomarkers such as hematological parameters may be used to detect the hazardous effects of pesticides before adverse clinical health problems occur. To the best of our knowledge there was no study among Iranian farm workers to find out their hematological parameters. The aim of this study was to explore the effect of pesticides on hematological changes among farmers. Results of this study might have important application for helping the medical group in quick diagnosis and treatment of persons who have been poisoned and thus decreasing the risk of the mortality.

METHODOLOGY

This cross-sectional case-control study was conducted in rural areas of Ahvaz city (southwest of Iran), which was recently reported as the most polluted city in the world by WHO. Study involved 108 persons aged 17–65 years and were divided in case and control group. Case group consisted of 54 farmers that were exposed to pesticides in their farmlands, and control group was chosen from the general population that did not have exposure to any pesticides. These two groups were matched by age.

Table-I: Pesticides used by case group.

General name	Trade name	Type	LD ₅₀
Endosulfan	Thiodan	organoclorate	30
Paraquat	Gramoxone	herbicide	150
Permethrin	Ambush	insecticide	500
Propargite	Omite	insecticide	2200
Profenofos	Curacron	organophosphate	358
Propionic acid	Poumasooper	herbicide	
Thiodicarb	Larvin	carbamat	166
Tribenuron methyl	Granstar	herbicide	<5000
2,4-D	U46	herbicide	699
Diazinon	Basudin	organophosphate	300
Diclofop methyl	Illuxan	herbicide	563
Fenvalerae	Sumicidin	insecticide	141
Mancozeb	Dithane M-45	fungicide	11200
Haloxypop etoxy-ethyl	Gallant	herbicide	518

In order to assay and analysis of hematological indices, 2ml fresh blood samples were collected using anticoagulant EDTA. Red Blood Cells (RBCs) count ($\times 10^6 \text{ mm}^{-3}$), number of Withe Blood Cells(WBCs) and platelet ($\times 10^3 \text{ mm}^{-3}$) and also, Hemoglobin (Hb) g/ dL^{-1} , Hematocrit values (HCT%), Mean Corpuscular Volume (MCV)fl, Mean Corpuscular Hemoglobin (MCH) pg, Mean Corpuscular Hemoglobin Concentration (MCHC) (g dL^{-1}) were made by cell counter (Koobas micros 60). Similarly 2ml blood was collected into citrate tubes for the detection of Erythrocyte Sedimentation Rate (ESR), with the help of a Wintrobe pipette. At the same time, two ml blood was collected into citrated tubes and was immediately used for assaying of prothrombin Time (PT) (Thermo. CO. No: V 40528) and partial prothrombin (PTT) (Thermo. CO. No: V 36665).

This study was approved by Ethical Committee of Ahvaz Jundishapur University of Medical Sciences. Data analysis was conducted by using the Statistical Package for Social Science (SPSS 17). Descriptive analysis was carried out to obtain mean and standard deviation for all continuous data. For between-group comparisons, Independent T-test was used to determine differences in mean among the intervention and control groups. P value less than 0.05 was used as significant point.

RESULTS

The mean of age of subjects was 35 ± 8 years. Table-I shows the pesticides were being used by the workers who were identified as cases. Data showed that all the hematological parameters which were assayed were in normal range, while statical analysis of Hb, Hct, RBC, Platelet and PT demonstrated significant differences between two group, respectively (Table II, III and IV). On the other hand, the values of Hb, Hct, RBC, Platelet and PT in case group were more than control. Although ESR was less in control

Table-II: Blood parameters in exposed and control groups (means \pm SD).

Parameter	Exposed	Control	P value
Hemoglobin (g/100ml)	15.783 \pm 1.55*	14.898 \pm 1.24	0.002
Hematocrit (%)	46.21 \pm 4.08*	43.40 \pm 3.51	0.001
MCV (μm^3)	89.33 \pm 5.19	89.53 \pm 9.66	0.898
MCH (pg)	30.55 \pm 2.62	31.07 \pm 2.36	0.287
MCHC (%)	33.98 \pm 2.13	34.32 \pm 1.27	0.330
ESR	14.6 \pm 10.52	15.86 \pm 11.01	0.578

* Values are statistically significant when compared to control, by Student's t-test.

Table-III: Cell count of exposed and control groups (means \pm SD).

Cells	Exposed workers	Controls	P value
Erythrocyte (106)	5.199 \pm 0.535*	4.813 \pm 0.461	0.001
Leukocyte (104)	7.605 \pm 0.2	7.859 \pm 0.23	0.555
Platelet (103)	2.938 \pm 0.7*	2.55 \pm 0.68	0.014

* Values are statistically significant when compared to control. By Student's t-test.

group, but it was not significant (Table-II). The values of Erythrocyte and Platelet have increased among farmers, significantly (Table-III). Although PT and PTT have been elevated among exposed farmers, but only changes in PTT was statistically significant (Table-IV).

DISCUSSION

In this study, hematological indices were changed in case group but it was not meaningful compared to normal range ($p > 0.005$). Hb, Hct, RBC and platelet levels increased, but other indices were decreased. This data demonstrated that pesticides have effects on blood cells as well as RBC indices. The reduction in MCV and increases in RBC and Hct in this study are similar to the effect of toxification of heavy metals. It is indicating that there is probably a similar mechanism of toxification between the pesticide and heavy metal on the blood indices.^{19,20}

In an experimental research the subchronic effect of a new phosphorothionate was studied on Wistar rats. After 90 days Hb, Hct and RBC level showed a significant reduction, but on the other hand MCV, MCH and MCHC levels were increased.²¹ In another study on the effect of sulphur mustard on war victims it was showed that the level of RBC and Hct was increased when it was compared to the control group.²² The effect of actellic showed that the rate of RBC, Hct and Hb was significantly reduced by this insecticide in a case-control study.²³ In other study it was found that cypermethrin caused a meaningful reduction in Hb and RBC in rabbit.²⁴ These results are in contrast to our study. This contradiction is probably attributed to the kind of pesticides used and exposure conditions.

Jamil and colleagues have reported that count of WBC was increased in agricultural worker who were exposed to pesticide but in our study count of leukocytes were decreased.²⁵ El-Sadek et al found that the level of WBC and platelet in exposed to pesticides group were more than normal in non-exposed group.²⁶

Table-IV: Coagulation tests of exposed and control groups (means \pm SD).

Test	Exposed	Control	P value
PT	13.5 \pm 0.61*	12.9 \pm 0.50	0.001
PTT	42.3 \pm 7.81	41.5 \pm 1.35	0.489

* Values are statistically significant when compared to control, by Student's t-test.

World Health Organization (WHO) has reported that some pesticides such as Bentazone caused increase in platelet that is similar to our study.²⁷ Increase in prothrombin time (PT) may be due to dysfunction of liver to synthesis of proteins (prothrombin) that has been reported in some studies.^{28,29}

We concluded that not only RBC and Hb but also platelet and PT are useful indices as warning signals for quick diagnosis of poisoning due to pesticides. Hence application of appropriate treatment protocol is possible. A more in depth study is needed to find out which type of pesticides were used regularly among these subjects. It could help us to look into specific hematopoietic effects of pesticides.

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