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# Alteration in white blood cells after cypermethrin and cyhalothrin toxicity in albino rats

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**Abstract :** Pesticides have been widely used to control pest and pest-related diseases in agriculture, fishery, forestry and the food industry. The aim of this study was to assess the effect of cypermethrin and cyhalothrin in the albino rats. The effect was based on results of acute (1 day) & sub-chronic (7, 14, 21 days) toxicity tests and on a comparison of results of hematological examination of a control and an experimental group exposed to cypermethrin and cyhalothrin. The experimental groups of the albino rats showed significantly higher values ($p < 0.05$) of total leukocyte and neutrophils count while lymphocytes count showed significantly lower values ($p < 0.05$) after acute and sub-chronic treatments compared to the control group. Changes in the values of the leucocyte profile after exposure of cypermethrin and cyhalothrin may be referred to disruption of haematopoiesis in the albino rats can serve as an indicator for similar effects on other allied and higher mammalian species.

**Keywords: Albino rats, synthetic pyrethroid Cypermethrin, Cyhalothrin , Leukocyte, Neutrophils, Lymphocytes**.

## INTRODUCTION

Agriculture is a basic source of income and subsistence among many Indians. Despite the rise of industrialization, agriculture remains a highly significant contributor to the country's Gross Domestic Product.Pesticides are widely used in large quantities throughout the world to protect crops and to increase productivity. Occupational exposures to pesticides occur during the production, transportation, preparation and application of pesticides in the workplace [1-2]. Generally, it is known that these pesticides possess high activity against broad spectrum insect pests[3-4] and also affect potential hazard to human being[5]. Pesticide related health problems usually manifest as a series of symptoms depending on the severity of the exposure.The harmful effects of many pesticides, such as organochlorines, organophosphates and carbamates, have led to the use of pyrethroids as alternatives[6]. Pyrethriods are synthetic analogues of pyrethrins, the active substances in the flowers of Chrysanthemum, *Cineraria folium*. Pyrethroids can be classified into two large groups. Type I pyrethroids do not contain a cyano group in their molecules and include allethrin, tetramethrin, permethrin, and phenothrin. Type II pyrethroids contain a cyano group and include newer compounds, such as deltamethrin, cyhalothrin, cypermethrin, and fenvalerate[7].

With the steadily increasing use of pyrethroid insecticides, there is an urgent need to identify their possible effects on living organisms. In the present investigation the synthetic pyrethroid cypermethrin and cyhalothrin have been selected to investigate their haematotoxic potential in albino rats. Hematological values are widely used to determine the systemic relationship and physiological adaptation including the assessment of the general health condition of the animals. The aim of the study was the evaluation of the effect of cypermethrin and cyhalothrin on the selected blood parameters in albino rats after acute (1 day) and sub-chronic (7, 14, 21 days) treatments.

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## MATERIALS AND METHODS

The adult individuals of albino rats *Rattus norvegicus* of almost equal size and weight representing both the sexes were selected randomly from inbred colony and maintained in the laboratory conditions. They were housed in well ventilated cages. The animals were fed a standard pellet diet (Gold Mohar lab animal feeds) and given water *ad libitum*. Insecticide cypermethrin (α-cyno-3 phenoxybenzyl-3-2,2 dichlorovinyl 2,2-dimethylcyclopropane carboxylate ) and cyhalothrin (RS)-α-cyno-3phenoxybenzyl(Z)-(1RS)-cis,-3-(2chloro-3,3,3-trifluoropropenyl 2,2-dimethylcyclopropanecarboxylate)

**Table- 1 Dose selection of test compounds**

| Test compound | $LD_{50}$mg/kg b.wt. | Acute dose mg/kg b.wt. | Sub-chronic dose mg/kgb.wt. |
|---|---|---|---|
| **Cypermethrin** | 620 | 310 | 14.76 |
| **Cyhalothrin** | 1514 | 757 | 38.00 |

were used in present investigation. The rats were kept in four sets one acute, one sub-chronic and two control sets consisting of 5,15,5 and 15 rats respectively for both the synthetic pyrethroids separately for testing different parameters. The oral doses of cypermethrin and cyhalothrin for acute and sub-chronic studies were selected on the basis of $LD_{50}$ [8] are given in table -1.

All the albino rats of acute group were given sub-lethal doses of cypermethrin and cyhalothrin separately and the blood samples were collected for the hematological examination after 24 hours treatment. The fifteen rats of sub-chronic group for each pyrethroid were divided into three subsets of five rats each and given fractioned sub lethal doses of cypermethrin and cyhalothrin separately till the experimental duration of 21 days. The blood samples were collected on the 7th day after each sub-chronic treatment i.e. 7th, 14th and 21st day after the treatment, one subset of rats were examined for each sub chronic treatment. The rats of control set were given vehicle treatment only using a similar amount of diluents orally. The blood was collected by sterilized needles and stored in a vial having anticoagulant (EDTA) for the estimation of Leukocyte Indices.The total leukocyte count (TLC) was counted using the improved Standard Neubaur Haemocytometer [9]. Differential leukocyte count (DLC) was also performed manually by making a blood smear stained with Leishman's stain for each individual [10]. The percentage of each type of leukocytes was calculated under oil immersion objective lens. The statistical significance difference between experimental and control values were calculated according to Fisher's student't' test [11].

## RESULTS AND DISCUSSION

In the present study blood has been used to assess the toxic effect of cypermethrin and cyhalothrin on albino rats. Blood can easily be obtained from the intoxicated rats and status of toxicity can rapidly be evaluated. The results of this study provide necessary baseline data on leukocyte indices in experimental rats under control and treated condition. Both cypermethrin and cyhalothrin showed dose dependent toxicity. Similar dose dependent toxicity in animals after cypermethrin and cyhalothrin intoxication was recorded in different studies [12-14]. A significant increase in total leukocyte count (TLC) after acute toxicity has been recorded after cypermethrin treatment while the increase in TLC after cyhalothrin is non significant with respect to the control rats (Table-2).

The increase has been observed after seven day treatment with both the pyrethroids as compared to the control rats. A significant increase in TLC is observed after 14 &21 days sub-chronic treatments due to cypermethrin toxicity, however, the increase is nonsignificant after cyhalothrin treatment. There is significant increase in the number of neutrophils, however, the number of lymphocytes decline significantly after acute and sub chronic treatment in the cypermethrin treated rats as compared to control rats. Similarly a significant fall in the number of neutrophils and increase in lymphocytes has been recorded in cyhalothrin treated rats after acute and sub-chronic treatment as compared to the control rats (Table-2). This is in accordance with the earlier finding [15-16], who reported a significant and non significant rise in total leukocyte count in rats after fenvalerate and cypermethrin treatment respectively.

**Table 2 Comparative Effect of Cypermethrin and Cyhalothrin on Leukocyte Indices in the blood of Albino rats**

| Parameters | SP | Control$^{o}$ Mean±SE | Post Treatments Days | | | |
|---|---|---|---|---|---|---|
| | | | 1$^{st}$ Day(acute) Mean±SE | 7$^{th}$ Day (sub chronic) Mean±SE | 14$^{th}$ Day (sub chronic) Mean±SE | 21$^{st}$Day (sub chronic) Mean±SE |
| Total leukocyte count((X10$^{3}$/µl)) | Cy | 6.76±0.14 | 8.33± 0.44* | 8.50±0.86 | 8.50±0.29** | 9.00±0.29*** |
| | Ch | 7.1±0.66 | 8.03±0.14 | 7.50±0.50 | 7.73±0.37 | 8.16±0.44 |
| Neutrophils(%) | Cy | 30.00±1.53 | 41.00±0.58** | 32.00±1.15 | 38.00±0.58** | 40.00±1.15** |
| | Ch | 29.67±0.88 | 25.00±0.58* | 27.33±0.67 | 24.00±0.58** | 24.33±0.33** |
| Lymphocytes (%) | Cy | 70.00±1.53 | 59.00±0.58** | 68.00±1.15 | 62.00±0.58** | 60.00±1.15** |
| | Ch | 69.00±0.58 | 75.00±0.58** | 72.67±0.67* | 76.00±0.58** | 75.67±0.33*** |

SP=Synthetic pyrethroid, Cy=Cypermethrin, Ch=Cyhalothrin, O=controls were given the same quantity of diluents, *=Significant p<0.05, **=Highly Significant <0.01, ***=Very Highly Significant<0.001

The observed leukocytosis may be the body's answer to the entry of toxic substance, the leukocytes are the body's soldiers when a foreign substance invades the body, the bone marrow becomes hyperplastic and intern produces an increased amount of granulocytic leukocytes. Increased leukocyte counts may also be found in leukemia in which uncontrolled abnormal proliferation of haemopoietic cells leads to progressive infiltration of the bone marrow in which a large number of immature forms are produced. These immature forms ultimately escape into the peripheral blood leading to very high leukocyte count.

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