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Effect of flumethrin on blood biochemical following oral administration in Wistar albino rats

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ABSTRACT

The effect of daily oral administration of flumethrin on the serum enzyme activity on albino rats was investigated. In the present study 12 male albino Wister rats were used and divided in to two groups. The first group served as the control group; the second group received flumethrin (1% pour on formulation) at the rate of 5 mg/kg bw orally daily for 14 days. On 15th day animals were sacrificed and blood samples were collected. Flumethrin did not alter the haemoglobin concentration neither the cell count that is TEC, TLC and DLC of rats. Flumethrin significantly altered the enzymatic level of serum which includes ALT and AST and also the serum protein. The present study suggests that flumethrin is having toxic effect, producing oxidative stress in animal's body.

Keywords: flumethrin, oral, biochemical, hemoglobin

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INTRODUCTION

Pesticides include insecticides, acaricides, rodenticides, fungicides herbicides and fumigants. Synthetic pyrethroids are most widely used ecto-paraciticides today as they found comparatively lesser toxic to animals than that of other insecticides. Synthetic pyrethroids are classified into two groups viz., non cyano (Type I) and cyano (Type II) groups containing pyrethroids. Type II pyrethroids includes flumethrin, cypermethrin, deltamethrin, fenvalerate etc. Flumethrin is a lipid soluble insecticide used to control of ecto-parasites on cattle, sheep, goats, horses and dogs. In veterinary medicine, it is applied topically as 1% w/v pour-on and 6% w/v as a plunge dip. Flumethrin is a neuro-poison for insects and its main target of action on nerve membrane sodium channel. It inactivates the Na^+ channel causing long lasting prolongation of transient increase in Na^+ ion permeability of nerve membrane producing a persistent depolarization and frequency dependent conduction block in sensory and motor neurons and long lasting repetitive firing of sensory nerves organ and muscle fibre producing killing effect on insects.

On the other hand, flumethrin was found to have toxic effects in a variety of experimental animals. The effects of repeated exposure to the pyrethroid insecticide flumethrin (40 mg/kg intraperitoneally once a day for 6 days) on the activity of cytochrome P_{450}-dependent monooxygenases and UDP-glucuronosyltransferase as well as on antipyrine disposition in male Wistar rats and concluded that flumethrin exposure diminishes hepatic enzyme levels and catalytic activities of monooxygenase systems as well as oxidative metabolism of antipyrine [1].

The present work was conducted to study the effect of flumethrin on the blood biochemical parameters of albino Wister rat. Keeping in view of above, the present research work has been undertaken with following objective:

To study the effect of Flumethrin on blood bio-chemistry following daily oral administration for 14 days in albino Wister rats.

MATERIALS AND METHODS

Test compound:

Flumethrin: Tikkil (1% pour on formulation)

EXPERIMENTAL ANIMAL

Adult Wistar albino male rats (100-150g) were obtained from a registered laboratory animal breeder. The animals were grouped and housed in polyacrylic cages and maintained in an air conditioned Lab Animal House attached to the Department of Pharmacology & Toxicology. All animals were fed with standard laboratory animal diet with free access to clean drinking water. The animals were acclimatized to the laboratory conditions for 10 days before

commencement of experiment. All the experimental protocol were approved by the Institutional Animal Ethical Committee (IAEA) and were in accordance to the guidelines of the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Ministry of` Forests and Environment, Government of India. Twelve male rats were divided into two groups (I and II) each consisting of six animals.

Dose and Mode of application

Group I (control) was treated with vehicle (Tween 80). In group II flumethrin (1% pour-on formulation) was given orally daily at a dose rate of 2 mg/kg bw for 14 days.

Collection of sample

Four ml of blood was collected from heart on 15th days after daily oral administration of flumethrin from both control group as well as test group in separate sterile vials for hematological and blood biochemical estimation.1 ml of blood was collected in sterile vial previously containing EDTA at 1 mg/ml of blood for hematological essays like hemoglobin (Hb), Packed cell volume (PCV), Total erythrocyte count (TEC),Total leukocyte count (TLC), Differential leukocyte count (DLC) and blood biochemical. 0.5 ml of blood in sodium fluoride was collected for glucose estimation. The remaining 2.5 ml of blood was collected without any anti coagulant was allowed to clot in a larger and bigger dimension test tube keeping in slanting position for sufficient times. After clotting, the serum was aspirated with the help of Pasteur pipette in a separate sterile glass vial and then centrifuged in Remi Centrifuge machine at 5000 r.p.m. for 15 minutes. The clear supernatant was thus obtained was pipetted out and collected in a separate sterile glass vial labeled properly, corked tightly and then preserved in a deep freezer (-20°C) for ALT, AST and Protein estimation.

Hematological parameters

Haemoglobin level was determined by indirect acid haematin method as described and expressed as g/dl [2]. Total erythrocyte count, total leucocyte count and differential count were done following standard method of Wintrobe as described [4] and expressed as SI unit.

Blood Biochemical parameters

Serum protein

Protein content of serum was estimated by Bi-Uret method described [7].

Serum aspartate and alanine transaminase

Serum protein was determined by SGOT and SGPT kit based on Reitman and Frankel's method manufactured by crest Biosystems [3].

STATISTICAL ANALYSIS

The results were expressed as Mean ± Standard error (S.E.). The data were analysed statistically using general linear model with univariate data in SPSS 10.0 version of software.

RESULTS AND DISCUSSION

Physical parameters

Significant changes were observed in the treated groups of rat. Little mortality was observed till the end of the dosing period in treated group of rats when compared to the control group. The most prominent clinical signs were manifestations of central nervous system toxicity, such as reduced motor activity and altered gait, that is animal showed circling movement. Skin lesions were ulcerative and scabbed patches and were seen on the head, neck, shoulder girdle, and front extremities. Immediately after the start of dosing, the animals at this dose showed aggressive behavior and frequent scratching movements.

Haematological parameters:-

Haemoglobin:-

Mean values with SE of haemoglobin level of blood in rats of groups I (control) and II on day 15 following daily oral administration of flumethrin have been shown in Table 1 and Figure 1. Table 1 describes that mean values of haemoglobin in rats of groups I and II on day 15 were 12.75±0.89 and 12.38±0.99 gm/ml of blood, respectively. No significant alteration was observed in the haemoglobin level in treated group of rats when compared to the control group.

Table 1: Effect of Flumethrin on haemoglobin on 15th day following daily oral administration for 14 days in rats

GROUPS	Haemoglobin (g/dl)
I	12.75 ± 0.89
II	12.38 ± 0.99

Group I (Control) rats received no flumethrin.
Mean value with dissimilar superscript vary significantly (P<0.05)

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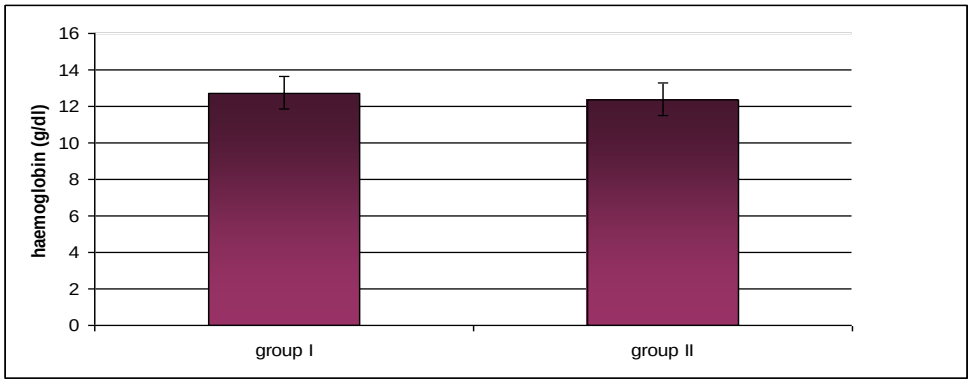
Figure 1: **Effect of Flumethrin on haemoglobin on 15th day following daily oral administration for 14 days in rats**



Total Erythrocyte Count:-

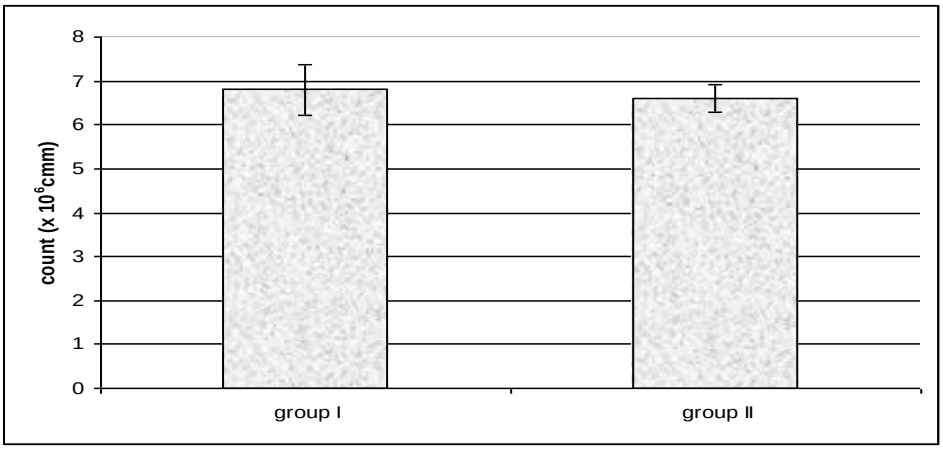
Mean values with SE of TEC of blood in rats of groups I (control) and II on day 15 following daily oral administration of flumethrin have been shown in Table 1 and Figure 1. No significant effects have been observed in the in TEC of the albino Wister rats after oral administration of flumethrin.

Table 2: Effect of Flumethrin on TEC on 15th day following daily oral administration for 14 days in rats

GROUPS	COUNT(×10^6cmm)
I	6.80±0.58
II	6.60±0.32

Group I (Control) rats received no flumethrin.
Mean value with dissimilar superscript vary significantly (P<0.05)

Figure 2: **Effect of Flumethrin on TEC on 15th day following daily oral administration for 14 days in rats**



Total Leucocyte Count (TLC):-

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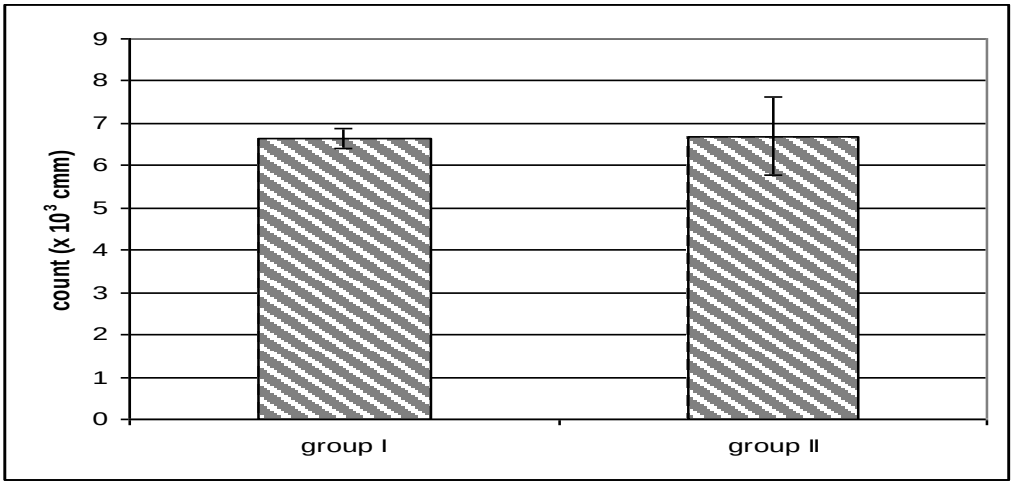
Mean values with SE of TEC of blood in rats of groups I (control) and II on day 15 following daily oral administration of flumethrin have been shown in Table 1 and Figure 1. Oral administration of flumethrin does not cause any significant alteration in TLC of the blood of albino Wister rats.

Table 3: **Effect of Flumethrin on Total Leucocyte Count (TLC) on 15th day following daily oral administration for 14 days in rats**

GROUPS	COUNT(×10^3cmm)
I	6.65±0.23
II	6.70±0.92

Group I (Control) rats received no flumethrin.
Mean value with dissimilar superscript vary significantly (P < 0.05)

Figure 3: **Effect of Flumethrin on Total Leucocyte Count (TLC) on 15th day following daily oral administration for 14 days in rats**



Differential Leucocyte Count (DLC):-

Table 4 depicts the Differential Leucocytic Count (DLC) of rat blood treated with flumethrin orally for 14 days. Oral administration flumethrin does not result in any significant alteration in Differential Leucocytic Count (DLC) of rat blood.

Table 4: **Effect of Flumethrin on Total Leucocyte Count (TLC) on 15th day following daily oral administration for 14 days in rats**

Parameters	GROUP I COUNT(X 10^3cmm)	GROUP II COUNT(X 10^3 cmm)
Neutrophil	1.66±0.05	1.65±0.12
Lymphocyte	4.45 ± 0.26	4.48±0.18
Monocyte	0.19±0.15	0.22±0.23
Esinophil	0.33±0.10	0.36±0.09

Group I (Control) rats received no flumethrin.
Mean value with dissimilar superscript vary significantly (P<0.05)

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Serum Protein Estimation:-

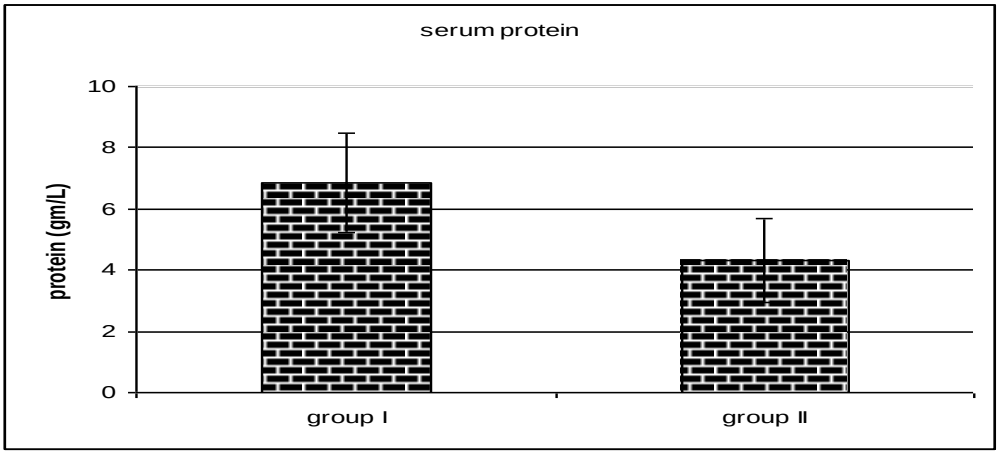
Table 5 and Figure 5 depict the serum protein of rat blood treated with flumethrin orally for 14 days. Oral administration of flumethrin resulted in significant reduction in serum protein level of rat blood.

Table 5: Effect of Flumethrin on Serum protein on 15th day following daily oral administration for 14 days in rats

GROUPS	Serum protein (gm/L)
I	6.87±1.63
II	4.32±1.39*

Group I (Control) rats received no flumethrin.
Mean value with dissimilar superscript vary significantly (P < 0.05)

Figure 5: Effect of Flumethrin on Serum protein on 15th day following daily oral administration for 14 days in rats



ALT Level:-

Mean values with SE of ALT level of blood in rats of groups I (control) and II on day 15 following daily oral administration of flumethrin have been shown in Table 6 and Figure 6. ALT level in the blood is found to be significantly increased following the oral administration of flumethrin for 14 days.

Table 6: Effect of Flumethrin on Serum ALT on 15th day following daily oral administration for 14 days in rats

GROUPS	ALT Level (U/ml)
GROUP I	3.01 ±1.36
GROUP II	12.69 ±2.63*

Group I (Control) rats received no flumethrin.
Mean value with dissimilar superscript vary significantly (P < 0.05)

Figure 6: Effect of Flumethrin on Serum ALT on 15th day following daily oral administration for 14 days in rats

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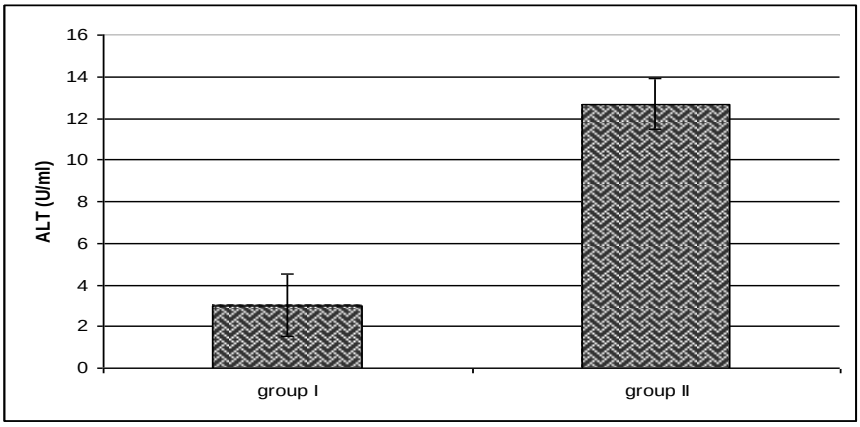


AST Level:-

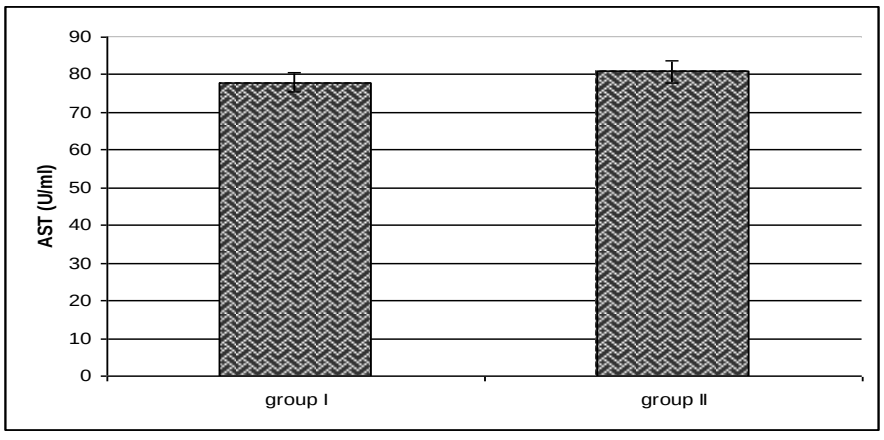
Mean values with SE of AST of blood in rats of groups I (control) and II on day 15 following daily oral administration of flumethrin have been shown in Table 7 and Figure 7. AST level significantly increased following oral administration by flumethrin.

Table 7: **Effect of Flumethrin on Serum AST on 15th day following daily oral administration for 14 days in rats**

GROUPS	AST Level (U/ml)
I	77.95 ±2.50
II	80.836 ±3.01*

Group I (Control) rats received no flumethrin.
Mean value with dissimilar superscript vary significantly (P < 0.05)

Figure 7: **Effect of Flumethrin on Serum AST on 15th day following daily oral administration for 14 days in rats**



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CONCLUSION

Thus, it can be concluded from the above findings that the oral administration of flumethrin in rats may produce mild central nervous symptom while, skin lesion indicates accumulation of flumethrin in subcutaneous fat. However, flumethrin could not produce significantly hematological changes. Inhibition of serum protein can be correlated with effect of immune system. Increased AST and ALT activities show liver damage.

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