

# EVALUATION OF TOXIC POTENTIAL OF SHORT TERM EXPOSURE TO

## CYPERMETHRIN IN SWISS ALBINO MICE

**N.Prakash\*, M.Vijay Kumar, Shrikant Kulkarni<sup>1</sup>, U. Sunilchandra and  
B.H.Pavithra**

Department of Veterinary Pharmacology and Toxicology  
Veterinary College,  
Karnataka Veterinary Animal & Fisheries Sciences University  
Post box No:6;Bidar-585 401, India

### ABSTRACT

*Alfa cypermethrin ( $\alpha$ -CP) is a synthetic pyrethroid with potent insecticidal property and is extensively used not only as an ectoparasiticide in animals, but also in agriculture and public health programs. Cypermethrin was dissolved in arachis oil and administered to the mice orally at the dose rate of 250mg/kg body weight, once a day for 28 days. The animals were sacrificed on 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>st</sup> and 28<sup>th</sup> day of the experiment and blood was collected for the estimation of serum transaminases and phosphatase activity and complete hematological profile.  $\alpha$ -CP significantly ( $P < 0.05$ ) increased the activities of serum AST, ALT and decreased ALP activity. The hematological profile has not shown any significant changes. The study demonstrated the effect of short term  $\alpha$ -CP exposure on serum biochemical profile only without producing any effect on hematological profile.*

### INTRODUCTION

Synthetic pyrethroids represent one quarter of the insecticides used in the agriculture all over the world. These belongs to diverse class of potent, broad spectrum insecticides used to control insect pests in animals, agriculture, households, and stored products (Hutson *et al.*, 1981). While the agricultural utilization of pyrethroids derived from natural pyrethrins is limited due to their low photostability, synthetic pyrethroids of the second and third generations are photostable (Casida *et al.*, 1983) and highly effective against broad spectrum of insects (Bhunya and Pati, 1990). Cypermethrin is a synthetic pyrethroid with potent insecticidal

property. The technical grade cypermethrin is the racemic mixture of eight isomers ( four *cis* and four *trans* isomers; Crawford and Croucher, 1981). Two stereo isomers are termed as  $\alpha$ -isomer of cypermethrin which is believed to be the most active isomer, and is known as  $\alpha$ -cypermethrin (World health organization, Geneva, 1992).  $\alpha$ -cypermethrin ( $\alpha$ -CP) is a synthetic pyrethroid used not only as ectoparasiticide in animals but also employed as insecticide extensively in agriculture and public health programmes. Some of the toxic actions of  $\alpha$ -CP have been reported earlier (WHO, Geneva, 1992). The present study has been undertaken to examine effect of short term exposure to  $\alpha$ -cypermethrin on transaminase (AST & ALT),

---

<sup>1</sup> Department of Veterinary Physiology

phosphatase (ALP) activity and hematological profile in albino mice.

## MATERIALS AND METHODS

### Pesticide

Technical grade  $\alpha$ -cypermethrin ( $\alpha$ -CP w/v 99%, Gharda Chemicals Ltd. Mumbai)

### Animals and Experimental design

Twenty four healthy swiss albino mice of either sex weighing (30-40g) were divided into two equal groups consisting of 12 animals each. All mice were kept under laboratory conditions (temperature:  $24 \pm 1.0^\circ\text{C}$  and humidity:  $60 \pm 5\%$ ) for acclimatization for a week. They were given pesticide free pellet feed (National Institute of Nutrition, Hyderabad, India) and drinking water *ad libitum*. The experimental protocol met the national guidelines on the proper care and use of animals in laboratory research and the study was approved by the institutional animal ethics committee. Group II animals were administered cypermethrin dissolved in arachis oil (1:9) (Himedia<sup>R</sup>, Mumbai, India) orally at the dose rate of 250mg/kg body weight once a day till 28 days whereas group I received arachis oil only. Body weights of individual animals were recorded at weekly intervals. The dose employed was  $1/10^{\text{th}}$  of the  $\text{LD}_{50}$  value of  $\alpha$ -cypermethrin which was calculated (250mg/kg, PO) by pilot study conducted in the department according to Miller and Tainter (1944) method.

Out of twenty four animals of control and treated groups, three in each group were sacrificed on 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>st</sup> and 28<sup>th</sup> day of administration of cypermethrin. The animals were fasted overnight, sacrificed by decapitation and trunk blood was collected from the heart and serum was used for the estimation of Aspartate transaminase (AST), Alanine transaminase (ALT) by calorimetric method (Reitman *et al.*, 1957), and Alkaline phosphatase (ALP) (IFCC, 1983). Blood was used for the

hematological profile ( Benjamin, 1985). All the values were expressed as Mean  $\pm$  SE. Statistical analysis was done using Student's 't' test. A difference of  $P < 0.05$  was considered statistically significant.

## RESULTS

Short term  $\alpha$ -CP exposure in Swiss albino mice did not cause any significant change in the body weights of the treated group compared to control group.  $\alpha$ -CP significantly ( $P < 0.05$ ) increased the serum levels of AST, ALT (Fig. 1). On the contrary it significantly ( $P < 0.05$ ) decreased the serum ALP activity ( $P < 0.05$ ; Fig. 2). No significant changes in hematological profiles were found between treatment group and untreated control groups.

## DISCUSSION

Widespread use of insecticides in animal husbandry and agriculture for many years can lead to their contamination in the food chain and the environment (Manske and Jhonson, 1977).  $\alpha$ -CP is a synthetic pyrethroid used not only as ectoparasiticide in animals but also employed extensively as insecticide in agriculture and public health programmes. Although pyrethroids possess wide mammalian : insect toxicity ratio they are capable of exerting toxicopathological changes upon sub-acute or chronic exposure. AST is normally found in a diversity of tissues including liver, heart, muscle, kidney, and brain. It is released into serum when any one of these tissues is damaged. ALT is, by contrast, normally found largely concentrated in liver and is released into the bloodstream as the result of liver injury. Increase of transaminase activity (AST & ALT) along with decrease in the ALP activity may be the consequences of  $\alpha$ -CP induced pathological changes in tissues. The increase in serum AST and ALT accompanied by decrease of ALP enzyme activity is related to the intensity of cellular damage due to chemical-induced cellular alteration varying

from simple increase of metabolism to death of cell (Giray *et al.*,2001).

$\alpha$ -CP undergoes metabolism in the liver via esoteric and oxidative pathways by the cytochrome P<sub>450</sub> microsomal enzyme system which results in oxidative stress by producing the depletion of the activity of free radical scavengers and increased level of malonaldehyde (Floodstrom *et al.*,1988) causing hepatic necrosis leading to pathological changes on liver and other tissues which was in agreement with Manna *et al.*, 2004. The hematological studies revealed no significant changes.

### REFERENCES

- Benjamin,M.M(1985):Outline of veterinary clinical pathology,3<sup>rd</sup> edition, kalyani publishers, New Delhi.
- Bhunya,S.P. and Pati,P.C.(1990): Effect of deltamethrin, a synthetic pyrethoid on the induction of chromosome aberrations, micronuclei and sperm abnormalities in mice.Mutagenesis.,5:229-232.
- Casida,J.E.,Gammon,D.W., Glickmann,A.H and Larovence,L.J.(1983): Mechanism of selective action of pyrethroid insecticides. Annu.Rev.Pharmacol.Toxicol., 23:413-438.
- Crawford,M.J., Croucher,A. and, Hutson D. H.(1981): Metabolism of cis- and trans-cypermethrin in rats. Balance and tissue retention study. J.Agril.Food Chem., 29: 63-66.
- Floodstrom, S., Warngard, L., Lijunquist, S. and Ahlborg,U.G.( 1988):Inhibition of metabolic cooperation *in vitro* and enhanced enzyme altered foci incidence in rat liver by the pyrethroid insecticide fenvelerate. Arch Toxicol;61:218-23.
- Giray, B, Gurbay, A. and Hineal, F.(2001):Cypermethrin induced oxidative stress in rat brain and liver is prevented by Vit -E or allopurinol. Toxicol Lett., 118; 139-46.
- Hutson, D.H., Gaughan, L.C.and Casida,J.E. (1981):Metabolism of the cis- and trans-isomers of cypermethrin in mice.Pesticide Sci., 12: 385-398.
- IFCC (International Federation of Clinical Chemistry) (1983): Methods for Alkaline phosphatase. Clin.Chem.Acta, 135:339-367.
- Manna, S.,Bhattacharya, D.,Basak, D.K. and Mandal, T.K.(2004):Single oral dose toxicity study of  $\alpha$ -Cypermethrin in rats.Indian. J. Pharmacol.,36;25-28.
- Manske,D.D. and Jhonson ,R.D.(1977): Pesticide and other chemical residues in total diet samples(X).Pestic Monit J ., 10:134-148.
- Miller, L.C. and Tainter M.L.(1944):Estimation of the LD50 end its error by means of logarithmic-probit graph paper. Prjc. Soc. Exp. Biol. Med., 57: 261-269.
- Reitman, S. and Frankel, S.A.(1957): Colorimetric method for determination of glutamic oxaloacetic and glutamic pyruvic transminase .Am. J. Clin. Patho.,28;56-63.
- World health organization (Geneva) (1992): Alfa cypermethrin.In:Environmental Health criteria-142,WHO,Geneva: Library cataloguing in publishing data..pp.20-43.

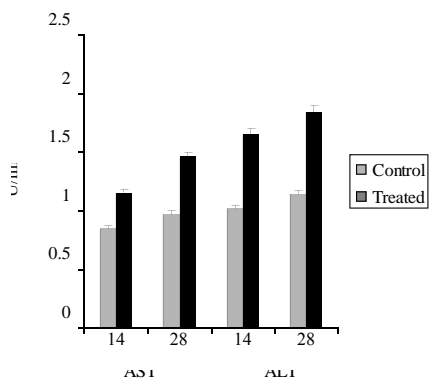
**TABLE: 1**

**Effect of  $\alpha$ -Cypermethrin on hematological parameters after oral administration @ 250mg/kg in mice**

Parameter	Control Day '0'	$\alpha$ -Cypermethrin treated group			
		Day 7	Day 14	Day 21	Day 28
TEC (m/Cmm)	22.42±0.25	28.5±0.04	25.25±0.04	29.5±0.12	27.5±0.05
TLC (Thousands/Cm m)	11.2±0.13	11.4±0.03	11.1±0.03	10.8±0.09	10.3±0.02
PCV (%)	46.0±0.22	48.0±0.04	42.0±0.02	47.0±0.08	43.0±0.08
Hb (mg%)	16.0±0.04	15.0±0.08	14.0±0.06	15.0±0.15	16.0±0.03

Values are Mean±SE; NS (P,0.5) between control and treated at various time intervals

**Fig.1** Serum transaminase activity (AST and ALT) levels on day 14 and day 28 of the experiment



**Fig.2** Serum alkaline phosphatase activity (ALP) levels on day 14 and day 28 of the experiment

