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# ACUTE EFFECT OF ALPHA-CYPERMETHRIN ON CHANGES OF PHOSPHATASE IN MALE ALBINO RAT TESTIS

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## ABSTRACT

Alpha-cypermethrin (α-CYP) a synthetic pyrethroid (type-II) pesticide. Pyrethroid insecticides have been used in agricultural and home formulations for more than 30 years. Despite their extensive worldwide use, there are relatively few reports of the kinetic profile. Dissolved in alcohol was given to male albino rat for 24hr individual groups at 5, 10, 25 and 50mM dose for each group. The animals were sacrificed after 24hr duration. Biochemical studies were observed in testis. Increased the activity of alkaline phosphatase(ALP) at 24hr duration, while decreased acid phosphatase(ACP) at respective duration. Therefore low doses of alpha-cypermethrin altered testicular biomarker enzyme activities. This may interfere in the functioning of the reproductive system of albino rat.

**Keywords:** Alpha-cypermethrin; Albino rats; ALP; ACP

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## INTRODUCTION:

Pyrethroid insecticides have been used in agricultural and home formulations for more than 30 years. Despite their extensive worldwide use, there are relatively few reports of the kinetic profile. Alfa-cypermethrin (α-CP) is a synthetic type-II pyrethroid and a α-isomer of cypermethrin. α-CP is extensively used not only as an ectoparasiticide in animals, but also used in agricultural crop production and public health program. This chemical has been considered potentially toxic to mammals[1] and the toxic actions of α-cypermethrin have been reported[2]. Testis is a complex organ containing three important cell types such as germ cells, Sertoli cells and Leydig cells in close proximity with unique autonomic and vascular features regulated by endocrine, paracrine and autocrine mechanisms. Spermatogenesis and steroidogenesis are the major functions of testis.[3,4] The present studies ware undertaken to investigate the acute toxic effect on rat testis biochemical parameters, nucleic acids and antioxidant status.

## MATERIALS AND METHODS

α-Cypermethrin was obtained from Gharda Chemicals Ltd., Mumbai, India. All chemicals used in this study were of analytical grade. Male albino rats were obtained from animal house JIPMER, Puducherry. All the experiments are carried out according to International Ethical Committee Regulations. The animals were housed in propylene cages under controlled temperature and hygiene conditions with 12 hours of light and dark cycle throughout the experimental period. The animals were provided free access to drinking water *ad libitum.* Rats were grouped into six for control and test animals.

Rats were segregated into control and treated groups containing six animals each. Dose levels were 5, 10, 25 and 50mM of α-cp and correspond to 60.45, 120.9, 302.25 and 604.5 µg/kg.b.wt doses respectively. This compound was dissolved in 0.1 ml ethanol and administered intradermally. The time intervals were 6, 12 and 24 hrs the all form of studies. Specific tissue of the rat testis was surgically removed, immediately rinsed in ice cold 1.15% KCL solution, pre-cut into small pieces and taken for homogenization employing several strokes in a potter-Elvejham homogenizer using a Teflon pestle, in the appropriate buffer, to obtain 10% (w/v) tissue homogenate. Throughout the homogenization process, the tissue homogenate was maintained on crushed ice in an ice bucket. The tissue homogenate was then centrifuged in a refrigerated high-speed centrifuged at 4$^{o}$C and at 10,000 x g for 30 minute. The clear supernatant obtained from each tissue homogenate was used an enzyme source for the investigations. Acid phosphatase[5], Alkaline Phosphatase estimation by the method of Bessey et.al, 1946[6].

**Statistical analysis**

All the values were expressed as mean ± SEM. Statistical analysis was done using SPSS 11. The statistical significance of differences between the means was assessed by ANOVA. A difference at $P<0.05$ was considered statistically significant.

## RESULT AND DISCUSSION

This study used α-Cypermethrin at lower doses (5, 10, 25 and 50mM) treatment after 24hr to determine their metabolic impact in male albino wistar strain rat testis tissue as a mammalian model. The study estimated selected marker enzyme activities of phosphatase in the testis tissue of the rat to determine specific activity changes due to α-Cypermethrin pesticide. Results of these studies were as follows. ACP specific activity significantly decreased in all concentrations. The inhibited percentages of ACP activity by α -cypermethrin 5mM dose at 43.7%, 10mM dose at 58%, 25mM dose at 65.2% and 50mM dose at 55.3% respectively. ALP specific activity significantly increased at 10, 25 and 50mM concentrations, whereas slightly decreased at lower dose. Percentage changes of ALP activity increased by 10mM dose at 117.5%, 25mM dose at 118.3%, 50mM dose at 106.9% respectively, compared to control (Figure 1, 2).

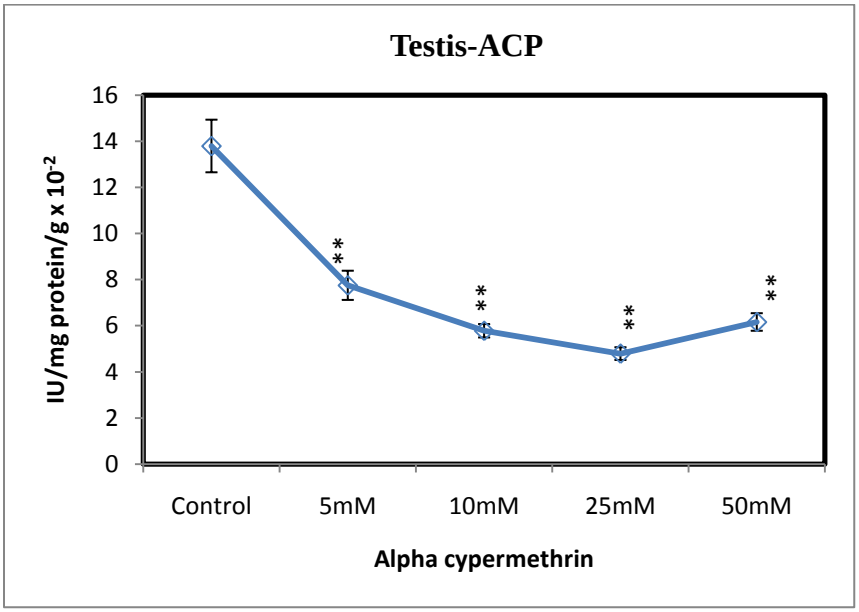


**Figure 1a: Rat Testicular ACP specific activity (IU/mg protein/g x10$^{-2}$) in control and treated groups with Alpha cypermethrin after 24 hr duration**

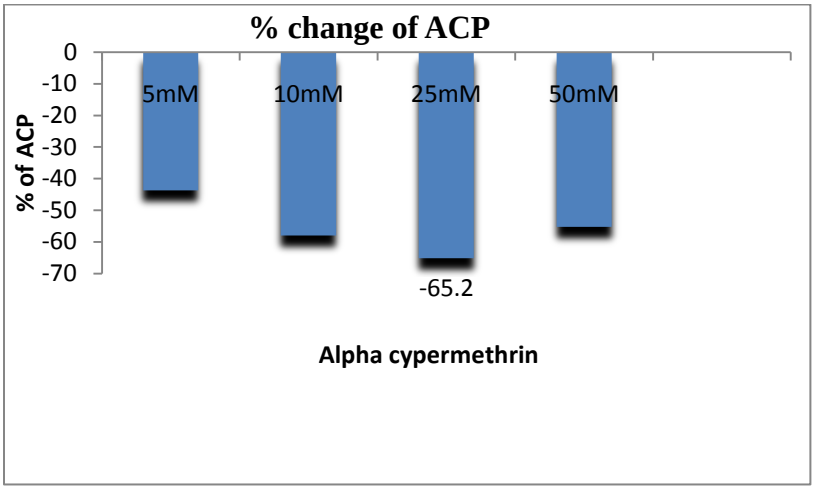


**Figure 1b: Percentage change of Rat Testicular ACP specific activity (IU/mg protein/g x10⁻²) in control and treated groups with Alpha cypermethrin after 24 hr duration.**

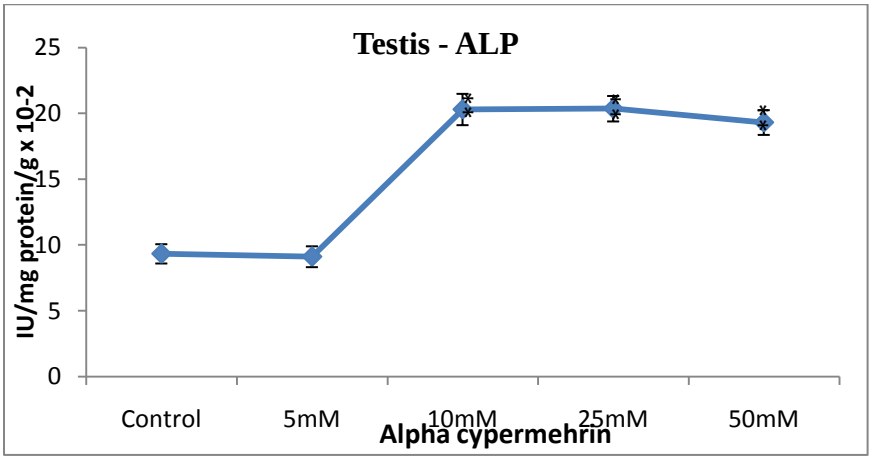


**Figure 2a: Rat Testicular ALP specific activity (IU/mg protein/g x10⁻²) in control and treated groups with Alpha cypermethrin after 24 hr duration.**

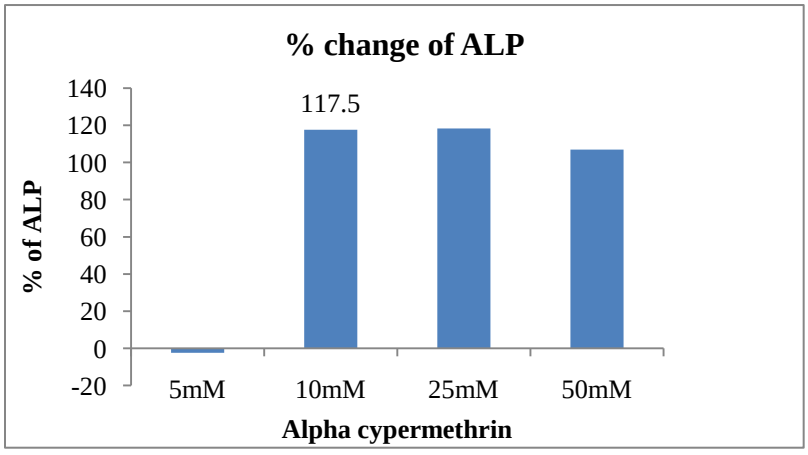


**Figure 2b: Percentage change of Rat Testicular ALP specific activity (IU/mg protein/g x10⁻²) in control and treated groups with alpha cypermethrin after 24 hr duration.**

In the present study, it has been found that prolonged exposure of α-cypermethrin caused decrease in the activity of ACP and increase in the activity of ALP in testis of albino rat. The activity of ACP and ALP are essential in the formation of ATP. The alteration in the activity of phosphatase enzymes may be due to cellular leakage caused by chemical induced injury of the tissue. Synthetic pyrethroids are used preferentially in place of organophosphates and organochlorines since they are highly effective for a wide range of insects, exhibit low toxicity to mammals and birds, and undergo rapid biodegradability. Several studies report that reactive oxygen species have been implicated in the toxicology of organochlorine[7, 8], organophosphate and pyrethroids[9]. The increase in ALP activity suggests that a-cypermethrin caused testicular damage in rat and that damage occurred probably through a free radical mechanism.

This suggests that the toxicity of α-CP in rats, oral LD50 of α-CP dissolved in DMSO was determined as 145 mg/kg in rats. In repeated short-term toxicity study at 1/10 LD50 dose for 30 days increased was observed in liver MDA, serum AST, ALT, ALP, LDH, and glucose but the activities of SOD and CAT, glycogen level and cytochrome P450 content decreased. Residue levels of α-CP were observed in different tissues. It produced moderate cytotoxic effects in lungs, liver, stomach and testis, and least effect in cerebellum. The pathological changes correlated with the altered enzyme activities[10]. These results suggest that α-CYP toxicity to the male reproductive system was associated with the activities of testicular enzymes which are the sensitive biochemical endpoints reflecting α-CYP toxicity to the male reproductive system. Low dose level of α-CYP has toxicity to the reproductive system in male rats. The increased use of α-cypermethrin increased the risk of environmental contamination and the ensuing intoxication of non-target organisms in different ecosystems[11]. This pyrethroid is therefore a potent toxin in a rat model, and confirms that its use in agriculture, animal husbandry and home formulations needs to be restricted.

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