EVALUATION OF TOXIC POTENTIAL OF SHORT TERM EXPOSURE TO

CYPERMETHRIN IN SWISS ALBINO MICE

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ABSTRACT

Alpha cypermethrin (α-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 7th, 14th, 21st and 28th day of the experiment and blood was collected for the estimation of serum transaminases and phosphatase activity and complete hematological profile. α-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 α-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 α–isomer of cypermethrin which is believed to be the most active isomer, and is known as α-cypermethrin (World health organization, Geneva, 1992). α-cypermethrin (α-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 α–CP have been reported earlier (WHO, Geneva, 1992). The present study has been undertaken to examine effect of short term exposure to αcypermethrin on transaminase (AST & ALT),

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

**MATERIALS AND METHODS**

**Pesticide**

Technical grade á-cypermethrin (á-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±1.0°C and humidity:60±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, 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 1/10th of the LD$_{50}$ value of á-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 7th, 14th, 21st and 28th 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 ±SE. Statistical analysis was done using Student’s ‘t’ test. A difference of $P<0.05$ was considered statistically significant.

**RESULTS**

Short term á-CP exposure in Swiss albino mice did not cause any significant change in the body weights of the treated group compared to control group. á-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 Jhongson, 1977). á-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 posses 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 á-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).

α-CP undergoes metabolism in the liver via esoteric and oxidative pathways by the cytochrome P$_{450}$ 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


Giray,B,Gurbay, A. and Hineal,


TABLE: 1

Effect of α-Cypermethrin on hematological parameters after oral administration @ 250mg/kg in mice

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th>α-Cypermethrin treated group</th>
<th>Day 7</th>
<th>Day 14</th>
<th>Day 21</th>
<th>Day 28</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEC (m/Cmm)</td>
<td>22.42±0.25</td>
<td>28.5±0.04</td>
<td>25.25±0.04</td>
<td>29.5±0.12</td>
<td>27.5±0.05</td>
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<tr>
<td>TLC (Thousands/Cm)</td>
<td>11.2±0.13</td>
<td>11.4±0.03</td>
<td>11.1±0.03</td>
<td>10.8±0.09</td>
<td>10.3±0.02</td>
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</tr>
<tr>
<td>PCV (%)</td>
<td>46.0±0.22</td>
<td>48.0±0.04</td>
<td>42.0±0.02</td>
<td>47.0±0.08</td>
<td>43.0±0.08</td>
<td></td>
</tr>
<tr>
<td>Hb (mg%)</td>
<td>16.0±0.04</td>
<td>15.0±0.08</td>
<td>14.0±0.06</td>
<td>15.0±0.15</td>
<td>16.0±0.03</td>
<td></td>
</tr>
</tbody>
</table>

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