Haematotoxicity of Cybil on Rattus Norvegicus

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ABSTRACT

Acute and sub-acute toxicity of Cybil was studied on certain blood parameters of Rattus norvegicus by administering oral dose to Rattus norvegicus and observing them for one day for acute and 7, 14 and 21 days for sub-acute treatment. Doses were selected on the basis LD$_{50}$ values (i.e. LD$_{50}$ of Cybil is 643 mg/kg of body weight). In the investigation acute and sub-acute treatment dose of Cybil was 129 mg/kg and 6.14 mg/kg of body weight respectively. The pyrethroid (synthetic pyrethroid) showed dose dependent toxicity with slight tremor in whole body and caused significant alterations in blood parameters, i.e TEC (total erythrocyte count), Hb. Conc. (Haemoglobin concentration), TLC (total leucocyte count), PCV (Packed cell volume), ESR (erythrocyte sedimentation rate) of Rattus norvegicus.

Keeping this in view, toxicity of Cybil has been observed. Considering the paucity of information on the effect of pyrethroid on blood, it is necessary that blood pyrethroid interaction be exposed further.

Keywords--- Toxicity, Synthetic Pyrethroid, Cybil

I. INTRODUCTION

The indiscriminate use of insecticide posed potential health hazard to human beings. Synthetic pyrethroids have become one of the most important insecticide in wide scale use. Synthetic pyrethroids are chemical analogues of natural pyrethrins, which are derived from the flower, Chrysanthemum cinerariafolium. The most commonly used synthetic pyrethroids are Cybil, fenvalerate, deltamethrin, allethrin, λ-cyhalothrin, β-cyfluthrin etc.

For the purpose of creating awareness about the potential of poisoning by insecticides, the focus group of chemical in this paper are synthetic pyrethroids which are widely available in our home in the form of mosquito aerosol, mosquito vapour mats and mosquito coils.

Due to extensive use of these synthetic pyrethroid, human population can get the access of these pesticides through various trophic levels of food chains. A long term pesticide exposure may lead to a health hazard for the animal and human population.

In the present investigation the synthetic pyrethroid Cybil has been selected to investigate its haemotoxic potential in Rattus norvegicus after acute (1 day) and sub-acute (7, 14 and 21 days) treatment.

II. MATERIALS AND METHODS

Experimental Compounds

Cybil [α-cyano-3-phenoxbenzyl-3-(2,2, dichlorovinyl) 2, 2 – dimethyl cyclopropane carboxylate] was obtained from Bayer India Ltd., Bombay. The acute oral LD$_{50}$ of prethroid, i.e. Cybil was determined on Rattus norvegicus. The prethroid was dissolved in coconut oil of pharmaceutical quality and introduced by gavage tube. The data were analysed by probit analysis (Finney 1971) for LD$_{50}$ determination. (TABLE 1). Rats from the control set were given coconut oil alone.

Experimental Animal

Rattus norvegicus ranging in weight from 120-130 gm with an average of 125 ± 2.36 gm and body size ranging 15-16 cm with an average of 15.5 ± 0.24 cm from an inbred colony representing both the sexes were selected for experimentation. The rats were kept in polypropylene cages at the 20 ± 5°C temperature, 50 ± 5% relative humidity and 12 hrs/day photoperiod. Rats were fed on rat feed obtained from Hindustan Antibiotic Ltd., (Pune), and water was provided ad libitum.

Experimental Design

Sixty-four Rattus norvegicus were divided into two groups of 32 rats each. The first group of 32 Rattusnorvegicus included the treatment groups for acute (1 day) and sub-acute (7, 14 and 21 days) studies for Cybil with 16 rats in each. The second group of 32 rats served as control for Cybil with 16 rats in each for various time intervals. The doses were introduced orally through gavage for 1, 7, 14 and 21 days. The doses were selected on the basis of LD$_{50}$ (TABLE 1). The selected sublethal dose of 1/5 of LD$_{50}$ for Cybil was given to the rats. The acute and sub-acute doses for Cybil were 129 mg/kg and 6.14 mg/kg of body weight respectively.

Four rats were taken out after 1, 7, 14 and 21 days from control and treated sets and rats were anaesthetized by chloroform. The blood was collected directly from cardiac puncture by sterilized needles and stored in vials having anticoagulant (EDTA). Haemoglobin concentration (Hb.Conc.) was estimated by Sahli’s method and outlined by Wintrobe et al. (1981). Total erythrocyte count (TEC) and total leucocyte count (TLC) were conducted using the Improved Neubaur haemocytometer (Dacie and Lewis, 1975). Packed cell volume (PCV) and erythrocyte sedimentation rate (ESR) determined by Wintrobe’s method (Wintrobe and Landsberg, 1985).

Statistical significance between experimental and control values were calculated according to Fisher’s student ‘t’ test. (Fisher, 1950).
III. OBSERVATION AND DISCUSSION

Cybil showed dose-dependent toxicity. Parker et al. (1984) and Desi et al. (1986) also observed similar dose-dependent mortality in dogs and rabbits after Fenvalerate and cypermethrin intoxication, respectively.

On the basis of LD₅₀ values shown in (TABLE 1) Cybil has been found to be toxic. The findings in the present investigation gain support by the observations made by Qadir et al. (1987) and Institoris et al. (1999b)

<table>
<thead>
<tr>
<th>Experimental Rat</th>
<th>Test Compound</th>
<th>Regression Equation</th>
<th>LD₅₀ (mg/kg)</th>
<th>Variance</th>
<th>Fiducial limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rattus norvegicus</td>
<td>Cybil</td>
<td>y = 0.6741 + 1.543x</td>
<td>643</td>
<td>0.034</td>
<td>0.742 (+)</td>
</tr>
</tbody>
</table>

Haemoglobin concentration (Hb. Conc.) decreased in Cybil (Table 2) treated rats. This decrease in Hb. Conc. may be due to the decrease in RBC count because Hb is an integral part of the RBC and/or to hypohaemoglobinemia. Decreases in Hb. Conc. have also been observed by Qadir et al. (1987), Khan and Ali (1993) and Saxena and Saxena (1997) after cypermethrin, pesticides, and Cybil administration in chickens, factory workers and albino rats, respectively.

Caballo et al. (1992) reported that the cell cycle of the Chinese hamster ovary was effected by Fenvalerate administration.

Intoxication of Cybil (Table 2) induced leukocytosis after acute and sub-acute treatment.

Leukocytosis in some cases may be due to a protective reaction in which leukocytes protect the body when xenobiotic substances invade. Increased leukocyte count may also be found in leukaemia 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. Similar increase in total leukocyte count (TLC) were reported by Khan and Ali (1993) in factory workers, Siroki et al. (1994) in mice, respectively. Contrary to these findings, Institoris et al. (1999b) observed reduction in TLC after cypermethrin treatment in rats.

<table>
<thead>
<tr>
<th>PARAMETERS*</th>
<th>CONTROL</th>
<th>ACUTE</th>
<th>SUB ACUTE</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>1 day</td>
<td>7 days</td>
</tr>
<tr>
<td>TEC (million/mm³)</td>
<td>6.75 ± 0.04&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.55 ± 0.01&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.50 ± 0.05&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>Hb. Conc. (gm/l)</td>
<td>11.70 ± 0.05&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.87 ± 0.30&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10.60 ± 0.41&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>TLC (X10³/mm³)</td>
<td>7.10 ± 0.05&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.13 ± 0.05</td>
<td>8.90 ± 0.05&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>PCV (%)</td>
<td>43.00 ± 0.47&lt;sup&gt;a&lt;/sup&gt;</td>
<td>34.67 ± 1.44&lt;sup&gt;a&lt;/sup&gt;</td>
<td>36.33 ± 0.02&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>ESR (mm/hr)</td>
<td>3.00 ± 0.47&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.33 ± 0.27</td>
<td>4.66 ± 0.27&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

*Abbreviations used. TEC = Total erythrocyte count, Hb. Conc. = Haemoglobin Concentration, TLC = Total Leukocyte count, PCV = Packed Cell Volume, ESR = Erythrocyte Sedimentation rate, 1-Mean ±SEM, Student ‘t’ Test P<0.05<sup>a</sup> P<0.01<sup>b</sup> P<0.001<sup>c</sup>

The increased erythrocyte sedimentation rate (ESR) in Cybil (Table 2) treated rats may be due to decreased total erythrocyte count (TEC) because ESR depends on Rouleux formation of erythrocytes. When Rouleux is formed the density of it’s mass increases. Thus, with reduced erythrocyte count Rouleux formation decreases which in turn increases ESR. Saxena and Saxena (1997) also reported a significant increase in ESR after Cybil intoxication.

PCV decreased after acute and sub-acute treatment of Cybil administration (Table 2). Continuous decrease after acute and sub-acute treatment may be due to hypochromic microcytic anaemia. Reduction in PCV can also be correlated with reduced RBC count.
Qadri et al. (1987) and Institoris et al. (1999a & b) reported reduction in PVC after cypermethrin intoxication in chicken and rats respectively. Sirkori et al. (1994) revealed enhancement in PCV of rats following treatment by super cypermethrin.

IV. CONCLUSION

In the light of the present findings it can be concluded that thepyrethroid, i.e. Cybil is capable of inducing changes in blood and blood-forming organs. There is considerable evidence that all pyrethroids do not act the same way in mammals but poisoning induced by the major kinds of pyrethroids are very similar.

REFERENCES