HEPATOPROTECTION BY ELEPHANTOPUS SCABER LINN.
IN CCl₄-INDUCED LIVER INJURY

M. G. RAJESH AND M. S. LATHA*

School of Biosciences,
Mahatma Gandhi University,
PD Hills P. O., Kottayam - 686 560

(Received on February 25, 2000)

Abstract: The efficacy of the medicinal plant Elephantopus scaber Linn. (Asteraceae), to prevent carbon tetrachloride (CCl₄)-induced chronic liver dysfunction in the rats was examined by determining different biochemical markers in serum and tissues. In serum, liver function marker enzymes like aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP) and also protein were evaluated. The concentrations of total lipid, cholesterol and phospholipids were studied in serum and the different tissues. The concentration of serum triglycerides was also studied. The biochemical changes induced by CCl₄ in different tissues particularly in the liver tissue improved following treatment with E. scaber Linn. The results suggest the hepatoprotective effect of this medicinal plant.

Key words: Elephantopus scaber hepatoprotective effect carbon tetrachloride medicinal plant

INTRODUCTION

The liver, which occupies the pivotal position in body, plays an essential role in drug and xenobiotic metabolism and in maintaining the biological equilibrium of the organism. The role played by this organ in the removal of substances from the portal circulation makes it susceptible to first and persistent attack by offending foreign (xenobiotic) compounds culminating in liver dysfunction. Despite the tremendous strides in modern medicine, there is hardly any drug that stimulates liver function, offers protection to the liver from damage or helps regeneration of hepatic cells. However, many herbal formulations are available for liver disorders on the Indian market based on Ayurvedic principles (1, 2). Polyherbal drugs are frequently considered to be less toxic and free from side effects than synthetic drugs. Medicinal plants like Andrographis paniculata, Boerhaavia diffusa, Eclipta alba, Hibiscus rosasinensis, Phyllanthus amarus, Phyllanthus debilis, Vitex negundo etc. are well-known for their hepatoprotective effects (3-8).

Elephantopus scaber Linn. of the family Asteraceae, is a perennial herb. It is light,
cooling, astringent, diuretic and good for the heart (9). It is used in the treatment of wound, chapped lips, gonorrhoea, rheumatism, tetanus, arthritis, dysentery, filariasis, heart trouble, liver ailments, colic pain and diarrhoea (9, 10). Recently it has also been used to cure hepatitis (11). *E. scaber* is reported to possess anti-inflammatory and anti-bacterial properties (12-13). The plant part used varies depending upon the disease to be treated (i. e. entire plant, bark, leaf and root) (10). The root of this plant is used in the treatment of liver disorders (14). In the present study, we have attempted to investigate the antihepatotoxic potential of the roots of *E. scaber* Linn. on liver damage induced by CCl₄ in albino rats.

**METHODS**

*E. scaber* Linn. was collected from Kottayam district, Kerala. The roots of the plants were cut, washed and dried at 45°C for two days and powdered. This powdered plant part was used for the experiment.

Male albino rats of Sprague Dawley strain weighing between 120 g to 150 g were used for the experimental purpose. They were housed in polypropylene cages and given standard pellet diet (M/s Hindustan Lever Ltd., Bombay, India). Water was given ad libitum. The animals were divided into three groups of six rats each. Group I rats served as normal control. Group II rats received a dose of 0.1 ml of CCl₄ in groundnut oil (1:1v/v) per 100 g body weight through an intragastric tube twice a week (i. e. every first day and fourth day) for a period of two months. Group III consisting of rats, which in addition to CCl₄, received a dose of 1000 mg/kg body weight of *E. scaber* root powder suspended in water daily in the morning for 60 days. The dose of the plant was ascertained by a pilot study over a range of doses varying from 250 mg/kg body weight to 1500 mg/kg body weight.

At the end of the experimental period, rats were deprived of food overnight and sacrificed by decapitation. Blood was collected by excising the jugular vein. It was allowed to clot and then centrifuged at 3000 rpm for 20 min. The serum samples were collected and left standing on ice until required. The tissues (liver, kidney, heart and lungs) were excised and transferred into ice-cold containers for biochemical estimations.

Activities of serum enzymes such as aspartate aminotransferase (AST), alanine aminotransferase (ALT) (15) and alkaline phosphatase (ALP) (16) were assayed. The protein content of serum was also estimated (17). The concentrations of total lipid (18), phospholipids (19), cholesterol (20) and triglycerides (21) were estimated in serum and tissues.

The protective effect of *E. scaber* roots was evaluated by comparing the above-mentioned biochemical parameters of group II with group I and group III with group II. Results were expressed as the mean ± SEM. Student's 't'-test was used to assess statistical significance.
RESULTS

The activities of serum enzymes and the concentrations of total protein, total lipid, cholesterol, phospholipids and triglycerides are presented in Table I. A marked elevation in the activities if the enzymes AST, ALT, ALP and in the concentrations of total lipid, cholesterol, phospholipids, triglycerides and decrease in protein content was observed in the CCl₄-treated group II rats compared to normal control. In rats, which received both E. scaber and CCl₄, the activities of the liver function marker enzymes and the concentrations of total protein, total lipid, phospholipids, triglycerides and cholesterol were maintained at near normal levels.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group I-Normal control</th>
<th>Group II-CCl₄ treated</th>
<th>Group III-CCl₄ + E. scaber</th>
</tr>
</thead>
<tbody>
<tr>
<td>AST</td>
<td>16.66±0.42</td>
<td>29.17±1.02*</td>
<td>16.66±0.86t</td>
</tr>
<tr>
<td>ALT</td>
<td>27.78±0.70</td>
<td>69.44±2.45*</td>
<td>43.33±2.21*</td>
</tr>
<tr>
<td>ALP</td>
<td>88.75±2.24</td>
<td>390.50±13.73*</td>
<td>159.75±8.00</td>
</tr>
<tr>
<td>Total protein</td>
<td>5.16±0.13</td>
<td>4.02±0.14*</td>
<td>4.68±0.24*</td>
</tr>
<tr>
<td>Total lipid</td>
<td>256.76±6.45</td>
<td>342.95±12.00*</td>
<td>249.18±12.46*</td>
</tr>
<tr>
<td>Phospholipids</td>
<td>150.00±3.77</td>
<td>187.50±6.58*</td>
<td>150.00±7.67</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>5.70±0.14</td>
<td>8.70±0.31*</td>
<td>5.90±0.30*</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>50.00±1.26</td>
<td>66.67±2.33*</td>
<td>53.33±2.72*</td>
</tr>
</tbody>
</table>

Group II has been compared with Group I
Group III has been compared with Group II
*P<0.01
tP<0.01

Table II shows the concentration of total lipid, cholesterol and phospholipids in tissues such as liver, kidney, heart and lungs. Significant increase in the concentration of total lipid and cholesterol was observed in the tissues of group II rats. Remarkable increase in the concentration of phospholipids was noticed in all the tissues studied except liver and lungs of the group II rats. In liver and lungs, the level of phospholipids was found to decrease. Co-administration of E. scaber root powder to group III rats significantly (P<0.01) prevented the CCl₄-induced alterations in the lipid profile. However, no significant change in the concentration of phospholipids in the liver of the above group was observed.
TABLE II: Effect of *E. scaber* on various biochemical parameters in different tissues.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group</th>
<th>Liver</th>
<th>Kidney</th>
<th>Heart</th>
<th>Lungs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I: Pairfed control</td>
<td>6012.90±149.84</td>
<td>2153.84±53.42</td>
<td>1846.15±46.15</td>
<td>1969.22±49.23</td>
</tr>
<tr>
<td>Total lipid</td>
<td>II: CCl₄ treated</td>
<td>8017.20±280.60*</td>
<td>2769.23±97.20*</td>
<td>2153.84±75.39*</td>
<td>2297.43±80.18*</td>
</tr>
<tr>
<td></td>
<td>III: CCl₄ + <em>E. scaber</em></td>
<td>6347.14±222.15</td>
<td>1846.15±92.31*</td>
<td>1350.77±67.54*</td>
<td>2461.53±123.08*</td>
</tr>
<tr>
<td></td>
<td>I: Pairfed control</td>
<td>2230.50±55.76</td>
<td>2240.91±56.02</td>
<td>2018.80±50.29</td>
<td>1066.50±26.66</td>
</tr>
<tr>
<td>Phospholipids</td>
<td>II: CCl₄ treated</td>
<td>1584.82±55.47*</td>
<td>5890.26±206.16*</td>
<td>1210.80±419.91*</td>
<td>986.50±34.53*</td>
</tr>
<tr>
<td></td>
<td>III: CCl₄ + <em>E. scaber</em></td>
<td>1526.28±76.32NS</td>
<td>2667.79±133.39*</td>
<td>3027.00±30.27*</td>
<td>1279.75±63.99*</td>
</tr>
<tr>
<td></td>
<td>II: CCl₄ treated</td>
<td>719.72±7.20*</td>
<td>666.66±23.33*</td>
<td>602.94±21.10*</td>
<td>266.66±9.33*</td>
</tr>
<tr>
<td></td>
<td>III: CCl₄ + <em>E. scaber</em></td>
<td>533.33±27.20*</td>
<td>466.66±23.33*</td>
<td>324.90±16.25*</td>
<td>359.99±18.00*</td>
</tr>
</tbody>
</table>

Group II has been compared with Group I
Group III has been compared with Group II
*P<0.01
**P<0.001
NS - Not significant
(Values expressed as mg/100 g tissue)
(Values are mean ± SEM of 6 animals in each group)

**DISCUSSION**

Carbon tetrachloride is a commonly used standard hepatotoxin (22). It is converted by the liver drug metabolizing enzyme system into CCl₄ radical which attacks unsaturated fatty acids of membranes in the presence of oxygen to give lipid peroxides. Consequently, the functional integrity of hepatic mitochondria is altered. All these events ultimately lead to liver damage (23). The enzymes AST, ALT and ALP are found in higher concentration in the cytoplasm (24). In hepatic dysfunction, these enzymes leak into the bloodstream. So the extent of liver injury can be assessed by estimating the level of these cytoplasmic enzymes released into the circulation (25).

Hepatotoxins impair the capacity of the liver to synthesize albumin (26). So the protein content of serum decreases in such cases. In the medicinal herb treated group, the protein level of serum was almost normal. This is a clear indication of the improvement of the functional integrity of the liver cells. In the CCl₄ treated rats, there was a significant increase in the activities of AST, ALT and ALP. In our study, *E. Scaber* root powder administration to the rats with the hepatotoxin caused a decrease in the activities of these enzymes. This elucidates the protective efficacy of *E. scaber* on CCl₄ induced liver damage.

Treatment of rats with CCl₄ also causes
centrilobular necrosis which results in the accumulation of fat in liver and kidney. Fat from the peripheral adipose tissue is translocated to the liver and kidney leading to its accumulation during toxicity. Hepatotoxins like CCl\(_4\) and ethyl alcohol interfere with hepatic phospholipid synthesis (27, 28). This is also evident from the decreased concentration of phospholipids in the liver of the CCl\(_4\)-treated group as seen in this study. The changes in the lipid profile caused by CCl\(_4\) were almost completely restored with E. scaber treatment.

From the results, it can be concluded that the root powder of E. scaber prevents hepatic injury induced by CCl\(_4\) in rats by neutralizing the oxidative stress. Further studies are required for its potential use as a hepatoprotective drug in clinical practice.

REFERENCES


