Research Article

HEPATOPROTECTIVE EFFECT OF GOTU KOLA (CENTELLA ASIATICA LINN.) ON CARBON TETRA CHLORIDE INDUCED LIVER INJURY IN RATS

Smitha M. Xavier* and D. Umadevi
1Rubber Research Institute of India, Kottayam, Kerala, India
2Department of Zoology, University of Calicut, Kerala, India
*Corresponding Author Email: smitha.rri@yahoo.com

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ABSTRACT

Centella asiatica Linn. is a well known medicinal herb used in various types of diseases. The present study was conducted to evaluate the hepatoprotective effects of the Centella asiatica extract in carbon tetrachloride (CCl4) induced liver injury in rats. Biochemical parameters such as serum total protein, albumin and marker enzymes (aspartate aminotransferase, alanine aminotransferase and alkaline phosphatase) were estimated both before and after the experiment. The present investigation reports that Centella asiatica affords protection against CCl4 induced liver injury as it restored marker enzyme levels, total protein and albumin levels compared to that of untreated control.

Keywords: Centella asiatica Linn., hepatoprotective, ayurveda, carbon tetrachloride.

INTRODUCTION

Centella asiatica Linn. Belonging to family of Umbelliferae popularly known as “Brahmi”, is a very useful medicinal plant described by Charaka as an anti aging plant. In Ayurveda it has been used in the treatment of skin diseases, local wounds and also for improving general mental ability, jaundice and hepatitis. It is mainly used to treat neurological disturbances. Apart from its role as a brain tonic, it has been reported to have activities in wound healing, anti-inflammatory, antioxidant, antibacterial, antifungal and antidiabetic treatments. Chemical studies on Centella asiatica leaves showed that one of the major components is asiaticoside. The present investigation is an attempt to evaluate the short term protective effect of Centella asiatica in carbon tetrachloride induced hepatic damage.

MATERIALS AND METHODS

Preparation of the extract of Centella asiatica

The medicinal plant used in this experiment is Centella asiatica. The plant was collected from Angamaly, Ernakulam, Kerala, India. The plant is found in moist soil, especially along bunds and canals. The crude extract was prepared by grinding the whole plant. 1 g of crude extract was dissolved in 25 ml of purified water. It was given at a dosage of 200 mg/kg body weight.

Animal model of CCl4-induced liver injury

Animals were purchased from Small Animals Breeding Station (SABS), Vavathode, Manonudy, Thrissur, Kerala, India. The study was conducted at Little Flower Medical Research Centre, Angamaly, after obtaining clearance from Institutional Animal Ethics Committee. The animals were kept at room temperature of 26-28°C and humidity of 56-58%. They were fed with standard diet (prepared in the lab) and water ad libitum. The animals were kept for two weeks for acclimatization before starting the experiment. Female rats of Sprague dawley weighing 180-280 g were selected for the experiment. The animals were divided into three groups of six animals each. Experimental groups were induced hepatic damage, by intra peritoneal injection of 1:1 mixture of CCl4 and coconut oil, 1 mg/kg body weight, thrice in a week. Group A served as control (1 ml distilled water /100 g body weight), Group B served as Untreated control (1 ml CCl4 – coconut oil mixture/kg body weight intraperitoneally + 1 ml distilled water orally) and Group C served as Treated group (1 ml CCl4 – coconut oil mixture/kg body weight intraperitoneally + 200 mg/kg of extract orally). The treatment was given for a period of seven days.

Estimation of biochemical parameters

Blood samples were collected from caudal vein of rats under ether anesthesia for the estimation of biochemical parameters such as Alanine transaminase (ALT), Aspartate transaminase (AST), Alkaline Phosphatase (ALP), total protein and albumin. Estimation of serum aminotransferases were done by 2,4-DNPH method. Alkaline phosphatase was estimated by Kind and King method. Serum total protein was estimated by Biuret method and albumin estimation was done by Bromocresol green (BCG) method.

RESULTS

Effect of Centella asiatica on liver function tests

The level of serum ALP in the control group (A) was in the normal range. The serum ALP increased to a significant level (p < 0.001) in untreated control (B) compared to normal group. The percentage of increase observed in group (B) was 58 %, while there was only 16 % increase in the treatment group (C). A significant decrease (p < 0.001) in ALP (Table 1) was observed in the treated group compared to untreated control group. There was 36 % decrease in the treatment group (C). The amount of ALT showed a remarkable reduction in the extract treated group when compared untreated group. The level of serum in the AST in the control group (A) appeared in the normal range. The serum AST increased to a significant level (p < 0.001) in untreated control (B) compared to normal group. The percentage of
increase observed in group (B) was 96 %, while there was only 29 % increase in treatment group (C). A significant decrease (p < 0.001) in AST level (Table 1) was observed in the treated group compared to untreated control group. There was 52 % decrease in the treatment group (C). The level of serum albumin in the control group (A) was in the normal range. The serum albumin decreased to a significant level (P < 0.001) in untreated control (B) compared to normal group. The percentage of decrease observed in group (B) was 49 % while there was only 35 % decrease in the treatment group (C). A significant increase (p < 0.001) albumin level (Table 2) was observed in the treated group compared to untreated control group. There was 11 % increase in the treatment group (C). The level of serum total protein in the control group (A) was in the normal range. The serum total protein decreased to a significant level (p < 0.001) in untreated control (B) compared to normal group. The percentage of decrease observed in group (B) was 37 %, while there was only 18 % decrease in the treatment group (C). A significant increase (p < 0.001) increase in protein level (Table 2) was observed in the treated group compared to untreated control group. There was 16 % increase in the treatment group (C). The above effects on the total protein, albumin and liver marker enzymes revealed that crude extract of Centella asiatica restored liver functions to an almost normal level, compared to untreated control group.

Effect of Centella asiatica extract on liver

Microscopic study

Animals were sacrificed at the end of seven days study. Microscopic studies of the liver showed normal liver in reddish brown color in control group (A). The liver of untreated control animal, group (B) was in pale color. In the treatment group (C), liver appeared to be normal as in the control group (A).

### Table 1: Effect of Centella asiatica on ALP, ALT and AST in CCl4 induced hepatic damage

<table>
<thead>
<tr>
<th>No</th>
<th>Alkaline phosphatase (IU/L)</th>
<th>Alanine Transamiase (IU/L)</th>
<th>Aspartate Transamiase (IU/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control (A)</td>
<td>Untreated Control (B)</td>
<td>Treated animal (C)</td>
</tr>
<tr>
<td>1</td>
<td>38</td>
<td>59</td>
<td>42</td>
</tr>
<tr>
<td>2</td>
<td>37</td>
<td>58</td>
<td>46</td>
</tr>
<tr>
<td>3</td>
<td>39</td>
<td>59</td>
<td>41</td>
</tr>
<tr>
<td>4</td>
<td>36</td>
<td>62</td>
<td>47</td>
</tr>
<tr>
<td>5</td>
<td>38</td>
<td>61</td>
<td>43</td>
</tr>
<tr>
<td>6</td>
<td>39</td>
<td>60</td>
<td>45</td>
</tr>
<tr>
<td>Mean</td>
<td>37.83</td>
<td>59.8</td>
<td>44</td>
</tr>
</tbody>
</table>

### Table 2: Effect of Centella asiatica on albumin and total protein in CCl4 induced hepatic damage

<table>
<thead>
<tr>
<th>No</th>
<th>Albumin (g/dl)</th>
<th>Total protein (g/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control (A)</td>
<td>Untreated Control (B)</td>
</tr>
<tr>
<td>1</td>
<td>3.4</td>
<td>2.1</td>
</tr>
<tr>
<td>2</td>
<td>3.6</td>
<td>2.2</td>
</tr>
<tr>
<td>3</td>
<td>3.5</td>
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<tr>
<td>6</td>
<td>3.5</td>
<td>2.4</td>
</tr>
<tr>
<td>Mean</td>
<td>3.46</td>
<td>2.32</td>
</tr>
<tr>
<td>S.D</td>
<td>0.0817</td>
<td>0.1472</td>
</tr>
</tbody>
</table>

Figure 1: Effects of Centella asiatica pretreatment on acute liver damage induced by CCl4 treatment in the rats

Microscopic studies of the liver showed normal liver in reddish brown color in control group (A). The liver of untreated control animal was in pale color group (B). In the treatment group (C), liver appeared to be normal as in the control group.
DISCUSSION
Intra peritoneal injection of carbon tetrachloride induces toxicity in liver. CC14 is a simple molecule, which when administered, cause centrilobular hepatic necrosis and fatty liver. Low doses of CC14 produce only fatty liver and destruction of hepatic cytochrome P-450. However chronic administration or exposure leads to liver cirrhosis, in some instance liver cancer and kidney damage18. Hepatic cells are normally protected from injury with glutathione content of hepatocytes available for detoxification. When glutathione gets exhausted hepatocytes become vulnerable to noxious effects of metabolites resulting in necrosis of liver19 CC14 is metabolized in the liver to toxic free radical CC1 which affect cellular permeability of hepatocytes, leading to elevated levels of serum biochemical parameters like SGOT, SGPT and ALP20. The serum total protein and albumin levels were decreased and the serum marker enzyme levels were increased during CC14 induced hepatic damage. After seven days treatment with Centella asiatica extract, the level of total protein and albumin were increased and reached to almost normal values as in the control animals. The level of marker enzymes ALP, ALT and AST were decreased to normal levels as in the control animals. It is concluded that Centella asiatica affords protection against CC14 induced liver injury as it restored marker enzyme levels, total protein and albumin levels compared to that of untreated control. Earlier studies show that the extract of the plant prevented fatty infiltration of liver in rats and caused restoration of 40 % of damaged liver cells to the normal state. The present study examined the hepatoprotective activity of Centella asiatica using carbon tetrachloride induced liver injury in rats. The activities of amino transferases and alkaline phosphatase were elevated and level of total protein and albumin were reduced in carbon tetrachloride induced rats. Centella asiatica extract was administered orally at 200 mg/kg/day for seven days. After the treatment period, the level of aminotransferases and alkaline phosphatase were reduced. While that of the total protein and albumin were increased near to normal level as in the control animals. Hence the hepatoprotective effect produced by Centella asiatica in carbon tetrachloride induced liver injury is attributed to its potent antioxidant action, particularly to the asiaticoside present, which in turn inhibit the hepatic damage caused by carbon tetrachloride through free radical mediator reactions.

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REFERENCES


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