Protective effect of aqueous extract of Curcuma longa on ethanol induced Hepatotoxicity in Rat

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ABSTRACT
In ethnomedicinal practices, the traditional healers use the genus Curcuma for the treatment of various ailments. Turmeric is a spice derived from the rhizomes of Curcuma longa, which is a member of the ginger family (Zingiberaceae). The aqueous extract of the Curcuma longa, was investigated for hepatoprotective activity in rats with liver damage induced by carbon tetrachloride. The extract at an oral dose of 500 mg/kg exhibited a significant protective effect by lowering the serum levels of aspartate aminotransferase (AST), alanine aminotransferase (ALT) alkaline phosphatase (ALP), total serum bilirubin, total cholesterol and triglycerides. These biochemical observations were supplemented by histopathological examination of liver sections. The activity of extract was also comparable to that of Silymarin, standard known hepatoprotective reference drug.

Key words: Curcuma longa, Hepatoprotective, ethanol

INTRODUCTION
Liver, one of the most important organs of body, plays a pivotal role in regulating various physiological process. It is involved in several vital functions such as metabolism, secretion, storage and excretion of many endogenous and exogenous compounds causing its injury or impairment. It has great capacity to detoxify toxic substance and synthesize of useful material. Its typical positions and function make it not only the most essential organ but also prone to number of toxicant – targets leading to liver diseases (Ghosh, 2013). Liver diseases remain one of the serious health problems and our Indian traditional system of medicine, particularly Ayurveda have put forward a number of medicinal plants and their formulations for liver disorders. In this modern age it is very important to provide scientific proof to justify the various medicinal uses of herbs. Herbal drugs are prescribed widely even when their biologically active components are unknown because of their effectiveness, fewer side effects and relatively low cost (Valiathan, 1998). In south Asia, number of medicinal plants and their formulations are used as medicine for serious liver disease; most of them speed up the natural healing process of liver. Therefore the research for the effective hepatoprotective drug is still continued (Kumar, 2012).

The rhizomes of the plant are used in various ailments, burning sensation cough, leprosy, and bleeding disorder and in treatment of inflammations. The rhizomes contain various chemical constituents like glycosoids, alkaloida and proteins. In view of the reported hepatoprotective activity of other Zingiberaceae and traditional claims, the c of Calamus Rotang was evaluated against carbon tetrachloride induced hepatic damage in rats with the aim of developing a natural hepatoprotective drug.

MATERIALS AND METHODS

Plant material: Curcuma longa rhizomes were collected from Kodad, Andhra Pradesh, India and authenticated by Dr. Vishnuvardhan, Taxonomist, Botany department, ANU University, GUNTUR. A voucher specimen (UCPSC/ANU/27) is deposited in the laboratory of Pharmacognosy.

Preparation of extract: Dried Rhizome powder (200 g) was extracted with distilled water by maceration for five days. The concentrated aqueous extract (15.0 g) was tested for qualitative phytoconstituents and indicated the presence of glycosoids, alkaloida and proteins.

Animals: Male Wistar rats (200-220 g) procured from the Mahaveer enterprises, Hyderabad. The animals were maintained under standard environmental conditions (relative humidity 55-65%, room temperature 23.0 ± 2.0C. Animals had free access to feed (Hindustan Liver, Bangalore) and tap water ad libitum during the quarantine period. All procedures compiled with the norms of the Institutional animal ethics committee (IAEC) of our college.

Hepatoprotective effect against ethanol induced hepatotoxicity in rats: Animals were divided into four groups of six rats each. Group I and II served as normal and intoxicated control, respectively and received only the vehicle (5% gum acacia; 1 ml/kg; p.o). Group III animals were treated with standard Silymarin at an oral dose of 100 mg/kg. Group IV received the aqueous extract of at an oral dose of 500 mg/kg, with a fine suspension of 5% aqueous gum acacia. The treatment was continued for 7 days, once daily. On the day of 7 for groups II-IV, 30 min post-dose...
of extract administration animals received Ethanol (95%) at the dose of 1.5 ml/kg (1:1 of Ethanol (95%) in olive oil) orally. The animals were sacrificed after 36 hour administration of acute dose of Ethanol (95%). The blood was collected by carotid artery. The serum was separated out and used for estimation of aspartate aminotransferase (AST) (Reitman, 1957), alanine aminotransferase (ALT) (7), alkaline phosphatase (ALP) (Ohkawa, 1979) and total serum bilirubin using Span diagnostic kits. The liver was immediately removed and a section of liver was processed for histological studies.

Histopathological studies: Immediately after the sacrifice, a portion of liver were fixed in 10% formalin, then washed, dehydrated in ascending grades of alcohol and finally rinsed with xylene. The tissue was then embedded in paraffin wax. Sections of 4-5 microns thickness were made using rotary microtome and stained with haematoxylin-eosin and histological observations were made under light microscope (Galighor, 1976; Luna, 1968).

Statistical analysis: The results are expressed as means ± S.D. The difference between experimental groups were compared by one way ANOVA (toxic control versus treatment, followed by post hoc Dunnet S test using Statistical Package for Social science(SPSS software, Version 18.0).Values with p<0.05 were considered as statistically significant

RESULTS AND DISCUSSION

Hepatoprotective effects: The animals treated with toxic doses of carbon tetrachloride had markedly elevated values of the serum ALT, AST, ALP and total bilirubin compared to normal rats, indicating acute hepato-cellular damage (Table-1). Serum enzyme values in the animals pretreated with aqueous extract of Curcuma longa (500 mg/kg; p.o) were significantly (p< 0.001) lower than those of toxic control values and except for ALP. ALT, AST, total bilirubin serum enzyme values in treated animals were similar to the normal control values. The effects of the aqueous extract of Curcuma longa were comparable to that of standard silymarin activity. Histopathological examination of liver sections of control group showed normal cellular architecture with distinct hepatic cells, sinusoidal spaces and central vein (Fig.1). Disarrangement of normal hepatic cells with centrilobular necrosis, vacuolization of cytoplasm and fatty degeneration were observed in Ethanol (95%) intoxicated animals (Fig. 2). The liver sections of the rats treated with aqueous extract of Curcuma longa and silymarin followed by Ethanol (95%) intoxication showed a sign of protection as it was evident by the less disarrangement and degeneration of hepatocytes (Fig. 3 and 4).

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment, p.o</th>
<th>ALT (U/L)</th>
<th>AST (U/L)</th>
<th>ALP (U/L)</th>
<th>Total Bilirubin (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control</td>
<td>20±2.3</td>
<td>121.7±4.0</td>
<td>112.4±7.5</td>
<td>0.40±0.04</td>
</tr>
<tr>
<td>2</td>
<td>Ethanol (95%)</td>
<td>37.5±1.5</td>
<td>125.5±3.6</td>
<td>195.5±6.5</td>
<td>11.80±1.7</td>
</tr>
<tr>
<td>3</td>
<td>Silymarin+ Ethanol (95%)</td>
<td>20.2±1.2</td>
<td>114±2.7</td>
<td>185.6±3.5</td>
<td>0.54±0.2</td>
</tr>
<tr>
<td>4</td>
<td>Test extract +Ethanol (95%)</td>
<td>21.5±3.2</td>
<td>118.6±3.2</td>
<td>186±4.4</td>
<td>0.5±1.4</td>
</tr>
</tbody>
</table>

Table.1.Effect of pretreatment with aqueous extract of Curcuma longa on Ethanol (95%)-induced rats

Figure.1.Microphotograph of normal rat liver section H&E staining x200
Figure.2.Microphotograph of rat liver section treated with Ethanol (95%) H&E staining (x200)
DISCUSSION

The present studies were performed to assess the hepatoprotective activity in rats, against ethanol as hepatotoxic to prove its claim in folklore practice against liver disorder. The changes associated with Carbon tetrachloride induced liver damage of the present study appeared similar to the acute viral hepatitis (Venukumar, 2002). Animals of Group II (received Ethanol (95%) significantly lost their body weight and showed reduced food consumption as compared to control group. Animals of Group III and IV (received Carbon tetrachloride plus Standard drug100mg/kg body weight of sillymarin and test extract 500mg/kg body weight) showed a significant increase in body weight and food consumption when compared to Carbon tetra chloride group animals. These findings suggested the extract administered has significantly neutralized the toxic effects of ethanol and helped in regeneration of hepatocytes (Farooq, 1997).

Estimating the activities of serum marker enzymes, like ALT, AST, ALP can make the assessment of liver function when liver cell plasma membrane is damaged, a variety of enzyme normally located in the cytosol are released into the blood stream. Their estimation in the serum is a useful quantitative marker of the extent and type of hepato cellular damage (Mc Comb, 1972). The tendency of these enzymes to return to near normally in extract administered group is a clear manifestation of anti-hepatotoxic effects of the extract. Reduction in ALP levels with concurrent depletion of raised bilirubin levels suggests the stability of the biliary function during injury with Carbon tetra chloride. The protein albumin levels were also raised suggesting the stabilization of endoplasmic reticulum leading to protein synthesis. This hepatoprotective effect exhibited by the aqueous extract of Curcuma longa at the dose level of 500mg/kg body weight was comparable with the standard drug, Silymarin. Histopathological liver sections also revealed that the normal liver architecture was disturbed by hepatotoxin in Ethanol, whereas in the liver sections of the rat treated with the aqueous extract and intoxicated with Ethanol (95%) the normal cellular architecture was retained and it is comparable with the standard Silymarin group, hence confirming the significant hepatoprotective effect of extract of Curcuma longa at the dose of 500mg/kg body weight. In accordance with these results, it may be confirmed due to the presence of phytoconstituents such as flavonoids, alkaloids and glycosides which are present in the aqueous extract could be considered as, responsible for the significant hepatoprotective activity.

CONCLUSION

It can be said that the aqueous extract of Curcuma longa exhibited a hepatoprotective effect against Carbon tetrachloride induced hepatotoxicity. Efforts are in progress to isolate and characterize the active principle, which is responsible for the hepatoprotective efficacy of this valuable medicinal plant.

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REFERENCES


