Green Tea Extract Ameliorates Ethanol Induced Liver Injury in Albino Rats

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ABSTRACT
In the present study, it was tried to investigate the effects of green tea on some biochemical parameters of male albino rats with ethanol toxicity. All rats were divided into 4 groups, Group 1 (controls) and group 2 (ethanol control) remaining 2 groups were treated with ethanol and green tea extract for 30 days. The results showed significant elevation in the level of ACP, sugar (P<0.001), and Bilirubin (P<0.005) where as liver weight showed no significant elevation with ethanol as compared to normal. These changes in all parameters indicated liver injury and hepatomegaly due to the enhancement in the ROS which causes decrease in antioxidants of body defense system. The green tea extract with ethanol treatment was able to restore these changes at various levels of significance comparing with the control group of rats. These data suggested that the green tea exerts improvement in liver function by preventing the production of reactive oxygen species (ROS) and enhancing the antioxidant defense system capacity. Thus green tea extract has protective effects against ethanol toxicity.

Keywords: Ethanol, Green Tea Extract (GTE), Liver, ACP, Bilirubin, sugar.

INTRODUCTION

Ethanol is used for avoiding stress and in milder respiratory infections in winter season. Ethanol consumption causes various diseases of liver, other organ and affects many systems of the body. The liver is the target organ of ethanol toxicity and causes fatty change, hepatitis and cirrhosis in liver. The major toxic metabolites of ethanol are acetaldehyde and free radicals. Chronic ethanol ingestion induces changes in intestinal brush-border membrane, serum electrolytes and haematology. Deficiency in enzymes and non-enzyme activity is associated with alcoholic liver disease.
Oxidative stress is a key step in the pathogenesis of tissue injury by ethanol generating reactive oxygen species (ROS) in many tissues and decreasing in the endogenous antioxidants.

Medicinal plants play an important role in pharmacology and medicine for many years. Today, it is estimated that about 80% of the world population relies on botanical preparations as medicine to meet their health needs. The green tea belongs to family Theaceae. The green tea extract and its main catechin polyphenols have medicinal value for prevention and therapeutics in several diseases. Antioxidants play an important role in the protection of cells and tissues against free radical mediated tissue injury. In the present study, it was tried to find out the effects of green tea on biochemical parameters against ethanol toxicity.

MATERIALS AND METHODS

Preparation of extract

Green tea was procured from Tea State of Tata Group of Company, TALAT, Assam. The aqueous extract of green tea was prepared by following the method described by Dahiru et al. Two doses of extract were given orally to treat rats. One was 5mg/kg bw another 10mg/kg bw.

Experimental animals

All animals were (7-8 weeks old, Wistar strain albino rats) purchased from Animal Division of IVRI, Izatnagar, were acclimatized for laboratory conditions at room temperature with standard food pellets and tap water ad libitum. All animals were cared for according to guidelines of the Institutional Animal Ethics registered by IAEC (384/PO/a/01/CPCSEA 28-03-2001).

Experimental design

After 2 weeks, each rat received a dose of 0.25ml/100 g body weight ethanol by oral route for 30 days. All experimental animals were divided into following 4 groups. Each group had 6 animals:

- Group I: Normal rats.
- Group II: Ethanol control group.
- Group III: Ethanol+ Green tea aqueous extract (5mg/kg bw) dose.
- Group IV: Ethanol+ Green tea aqueous extract (10mg/kg bw) dose.

Haematological studies

After 30 days, all rats were sacrificed under light ether anesthesia. The blood was collected by retro-orbital pluxes in EDTA vials for biochemical analysis. All the chemicals used were of analytical grade. The kits for all biochemical estimations were purchased from Nice Pvt, Ltd. Banglore, India.

Statistical analysis

The significance value of all the data was analyzed using student’s t-test from Sigma Plot software (version 11). Results were presented as Mean ± SD and P value less than 0.05 was considered significant.

RESULTS

In the present study, a no significant increase was observed in the liver weight with 0.25 ml dose of alcohol whereas both doses of green tea extract reduced the liver weight after 30 days (Table 1). The levels of acid phosphatase, sugar, total and direct bilirubin showed significant increase with ethanol dose at different significance level (Figure 1). No significant decrease was observed in these all parameters with 5 mg dose of green tea extract whereas with 10 mg dose of extract was in normal range as compared to normal groups of rats (Table 2). The level of urea showed no change.
DISCUSSION

The increase in the weight of liver may be due to hepatomegaly or hepatotrophy. It is attributed to the fact that chronic alcohol consumption causes accumulation of lipids and proteins in hepatocytes with an impaired protein secretion by hepatocytes\textsuperscript{3,24}. Water is retained in the cytoplasm of hepatocytes leading to enlargement of liver cells resulting in increased total liver mass and volume\textsuperscript{5}. This alcohol induced increase in total liver weight was prevented by treatment with green tea extract. \textit{Tylophora indica} leaf extract and \textit{Solanum nigrum} fruit extract (SNFEt) indicating a hepatoprotective effect against ethanol\textsuperscript{9,1}. Chronic ethanol administration is known to enhance the protein and fat accumulation in the liver. Ethanol and acetaldehyde are known to induce cell injury and necrosis by enhancing the production of reactive oxygen species by the process of lipid peroxidation\textsuperscript{11}.

The level of acid phosphatase (ACP) increased with ethanol treatment\textsuperscript{21}. In tissues, acid phosphatase is associated with break down and catalytic activities. High level of acid phosphatase is observed in tissues with cell destruction and lytic activities. ACP is a lysosomal enzyme which hydrolyses the ester linkage in phosphate esters and help in the autolysis of the cell after death. Experimental evidences show that it is not only restricted to lysosomal fraction out has also been found in golgi cisternae and specialized region of endoplasmic reticulum. Acid phosphatase reaction thus reflects some impressions about the structure and function of these organelles or components. The damaged organs might produce an augmented quantity of the enzymes\textsuperscript{19}. Green tea extract restore the ACP level to normal\textsuperscript{8}. Normal level of acid phosphatase in blood clearly indicates that no tissue damage is taking place.

The level of blood sugar showed significant increase with ethanol dose compared to control rats\textsuperscript{2}. This increased level was almost in normal range with green tea extract. Our results are consistent with Mongi Saoudi et al\textsuperscript{14}. who reported \textit{Opuntia vulgaris} fruit extract (OE) treatment could significantly decrease the level of glucose because of a potential source of natural antioxidants. The protective effects of OE may be due to the modulation of antioxidant enzymes activities and inhibition of lipid per oxidation. Same mode of action can be suggested for green tea.

The level of total and direct bilirubin showed significant increase with ethanol when compared with control group\textsuperscript{9,6}. Green tea extract prevent these changes and our results are also consistent with Maruthi et al. and Wan-Guo Yu et al.\textsuperscript{13,25}. 2',4'-Dihydroxy-6'-methoxy-3',5'-dimethylchalcone has potential hepatoprotective effects against CCl\textsubscript{4} and decreased activity of total bilirubin and the aqueous extract of \textit{Ziziphus mauritiana} leaves with alcohol resulted in reduction of bilirubin level\textsuperscript{6,25}. Which cause attenuation of oxidative stress and inhibition of lipid peroxidation.

CONCLUSION

The liver can be injured by many chemicals and drugs. In the present study ethanol was selected as a hepatotoxicant to induce liver damage, since it is clinically relevant. These findings indicate that antioxidant or flavanols and polyphenols (catechins) present in \textit{C. sinensis} probably inhibit ethanol uptake by tissues and exert their protective effects. The green tea exerts improvement in liver function by preventing the production of reactive oxygen species and enhancing the antioxidant defence system capacity. In conclusion, the results of this study indicate that treatment of rat with green tea extract had a marked protective effect against ethanol toxicity.
ACKNOWLEDGEMENT

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REFERENCES


**Table 1.** Effect of GTE on liver weight of ethanol-induced liver injury in rats

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Controls</th>
<th>EtOH group 0.25ml / kg B wt.</th>
<th>EtOH + GTE group 0.25ml + 5mg/ kg B wt.</th>
<th>EtOH + GTE group 0.25ml + 10mg/ kg B wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver wt.gm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Days</td>
<td>1.65±0.14</td>
<td>1.81±0.40(^d)</td>
<td>1.72±0.09(^d)</td>
<td>1.62±0.12(^d)</td>
</tr>
<tr>
<td>30 Days+ reversibility</td>
<td>1.52±0.20</td>
<td>1.72±0.10(^d)</td>
<td>1.67±0.15(^d)</td>
<td>1.65±0.17(^d)</td>
</tr>
</tbody>
</table>

Values represent mean ± S.D.; n = 6; \(a = P<0.01\), \(b = P<0.005\), \(c = P<0.001\), \(d = \text{non significant}\), \(e = \text{no change}\)

**Table 2.** Effect of GTE on biochemical parameters in serum in ethanol-induced liver injury in rats

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Controls</th>
<th>EtOH group 0.25ml / kg B wt.</th>
<th>EtOH + GTE group 0.25ml + 5mg/ kg B wt.</th>
<th>EtOH + GTE group 0.25ml + 10mg/ kg B wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACP (KA unit)</td>
<td>1.17±0.39</td>
<td>1.55±0.15(^c)</td>
<td>1.15±0.18(^d)</td>
<td>0.93±0.12(^c)</td>
</tr>
<tr>
<td>Sugar (gm/dl)</td>
<td>94±14.79</td>
<td>128±9.89(^c)</td>
<td>125±9.58(^d)</td>
<td>98±19.08(^c)</td>
</tr>
<tr>
<td>Total Bilirubin (gm/dl)</td>
<td>0.65±0.18</td>
<td>1.43±0.18(^d)</td>
<td>1.15±0.25(^d)</td>
<td>0.66±0.21(^c)</td>
</tr>
<tr>
<td>Direct Bilirubin (gm/dl)</td>
<td>0.74 ± 0.16</td>
<td>1.1 ± 0.22(^b)</td>
<td>1.1 ± 0.29(^d)</td>
<td>0.91±0.24(^c)</td>
</tr>
<tr>
<td>Urea (mg/dl)</td>
<td>24.33±6.12</td>
<td>24.16± 5.15(^e)</td>
<td>23.5± 4.03</td>
<td>23.33± 3.44</td>
</tr>
</tbody>
</table>

Values represent mean ± S.D.; n = 6; \(a = P<0.01\), \(b = P<0.005\), \(c = P<0.001\), \(d = \text{non significant}\), \(e = \text{no change}\)
Figure 1. Histogram showing comparison of acid phosphatase level in blood of 0.25 ml ethanol treated and C. sinensis aqueous extract treated group.