Effect of Curcuma longa on Growth Factors and Liver Enzymes in Male Wistar Rats

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Abstract: The objective of this study was to investigate the effect of Curcuma Longa on growth and liver enzymes in male Wistar rats. Experiment was carried out on 15 Wistar albino rats, divided into 3 groups. First group was fed with a standard diet and water (control group), second group was fed with a standard diet and received turmeric dissolved in 50 ml water at 100 mg/kg body weight and third group was fed with a standard diet and received turmeric dissolved in 50 ml water at 200 mg/kg body weight. Statistically insignificant difference was observed between control and experimental groups for change in weight, growth rate, total food consumption and food efficiency. It has been found that administration of Curcuma Longa decreased the AST and ALT activities in serum so it can be concluded from this study that Curcuma Longa may protect against liver damage.

Key words: Curcuma longa • AST • Liver enzymes • Liver damage • ALT

INTRODUCTION

Curcuma longa, commonly known as turmeric is a perennial herb with short and thick rhizomes and belongs to the family Zingeberaceae (ginger). It has been used widely in Ayurvedic and traditional Chinese medicinal system [1] and is commonly used as a spice and as an active ingredient in curries in India, China and other Asian and Middle Eastern countries [2]. Curcuma longa rhizomes contain approximately 2% volatile oils [3], 5% curcuminoids [4], vitamin C, carotene and minerals [1]. It possess anti-inflammatory [5, 6], anti-microbial activity [7, 8], gastro protective activities [9], antiparasitic and antipasmodic [10], protective effect against diabetes mellitus [11], cystic fibrosis [12], atherosclerosis [13], antitumor [14, 15] etc.

Liver plays very important role in carrying various functions such as clearing damaged RBC and bacteria by phagocytosis, synthesizing plasma proteins and removing and excreting body wastes and other foreign substances [16]. Liver disorders are one of the foremost health concerns in human due to chemical and environmental toxins [17]. An imbalance between oxidants and the antioxidant system is the reason behind hepatic damage caused by oxidative stress [18] and to prevent oxidative stress, many molecules play an important role in decreasing reactive oxygen species (ROS) levels called endogenous and exogenous antioxidants. Reactive oxygen species can damage biological molecule and major cellular components and it can enhance membrane lipid peroxidation [19]. Curcumin works as an exogenous antioxidant; it provides protection against hepatic damage caused by free radicals and reduces hepatic lipid peroxidation [20, 21]. This study focuses on the effect of Curcuma longa on growth factors and liver enzyme in healthy Wistar rats.

MATERIALS AND METHODS

This experiment was carried out on 15 healthy Wistar albino rats weighing 128±5 gm. Rats were obtained from Experimental Animal Care and Experimental Surgery Center at the Faculty of Medicine, King Saud University, Saudi Arabia. All animals were housed individually in stainless steel cages at 25 ± 2°C, given standard pellet diet, exposed to 12:12 h light and dark cycle at 50±5 % relative humidity in animal room. This study is in accordance with the Animal Ethics Committee of the College of Science, King Saud University.
**Diets Formulation and Preparation:** Basal diet was obtained from the General Organization for Grain Silos and Flour Mills, Saudi Arabia. Group 1 was fed with a standard diet (20gm) and water (control group), group 2 was fed with a standard diet (20gm) and received turmeric dissolved in 50 ml water at 100 mg/kg body weight and group 3 was fed with a standard diet (20gm) and received turmeric dissolved in 50 ml water at 200 mg/kg body weight. Food and liquid intakes were monitored daily in all groups.

**Assessment of Body Weight and Food Consumption Growth:** Body weight was recorded in the non-fed state at the beginning of study (initial weight) and at time before slaughter (final weight).

\[
\text{Weight gain} = \text{final body weight (g)} - \text{initial body weight (g)}
\]

\[
\text{Growth rate} = \frac{\text{total weight gain (g)}}{\text{duration}}
\]

**Food Consumption:** Food consumption was analyzed daily in all experiments by calculating the difference between the diets provided (before consumption) and the diet consumed using a calibrated scale with 0.01mg precision.

\[
\text{Food consumption per day (g)} = \text{diet provided (g)} - \text{diet consumed (g)}.
\]

**Food efficiency:** Food efficiency was calculated using the following formula:

\[
\text{Food efficiency} = \frac{\text{Gain weight}}{\text{total food consumption}}.
\]

**Collection of Blood:** At the end of experiment on 27th day, animals were food deprived over-night and anaesthetized under chloroform. Blood was collected from retro orbital plexus in heparinized tube and centrifuged at 3500 rpm for 15 minutes for plasma separation and stored at 5-7°C for further analysis [22].

**Plasma Liver Function Test:** The parameters measured include alanine transaminase (ALT) and aspartate transaminase (AST). ALT and aspartate AST levels were determined using UV kinetic method following the instructions of manufacturer (United Diagnostic Industry, Dammam, Saudi Arabia).

**Statistical Analysis:** Data were expressed as mean ± standard deviation and it was analyzed using SPSS statistical software package (version 22) and the differences among treatment groups were analyzed by ANOVA at a significance level of P < 0.05; if significant differences were found, Post-hoc analysis using Duncan’s multiple range tests was performed.

**RESULTS AND DISCUSSION**

**Effect of Turmeric on Dietary Intake and Growth Rate:** In this study the effect of *Curcuma longa* on food intake, food efficiency, weight gain and growth rate has been investigated. Statistically insignificant difference was observed between control and experiments groups for food efficiency, food intake and all growth parameters. Gutierres *et al.* [23] and Ejaj *et al.* [24] also didn’t found any significant difference in food intake, however, Sarker *et al.* [25] and Wisberg *et al.* [26] used very high concentration of turmeric (1g/kg and 30 g/kg respectively) and reported significant effect of turmeric on food intake. *Curcuma longa* did not significantly affected weight gain or growth rate. Gutierres *et al.* [23] and Bastaki *et al.* [27] also reported similar findings; however Kim *et al.* [28] investigated the effect of high dose of turmeric on weight gain, body fat deposition and lipid profile and reported that turmeric (10% of diet) led to weight loss significantly. Kuo *et al.* [29] also reported that higher dose of turmeric (10% of diet) affects weight.

**Effect of Turmeric on Liver Enzymes Activity:** Rise in free radical levels and decrease in endogenous antioxidants leads to alter AST and ALT. AST and ALT levels remains the most useful test for the detection of hepatic cell damage, because both are present in high concentrations in hepatocytes. ALT is more specific to liver as it catalyses the conversion of alanine to pyruvate and glutamate and is released in similar manner [30]. In liver high levels of serum enzymes observed are indicative of loss of functional integrity and cellular leakage of cell membrane [31]. No significant alterations were detected in AST in the animal groups treated with *Curcuma longa* when compared to the control group but the result was slight significant for ALT (Table 1). ALT level decreased significantly in treated groups. In this respect, Baxia *et al.* [32] reported significant decrease in ALT and AST level against lead induced toxicity in rats. Similar was the findings of Singh *et al.* [16] in ethanol induced hepatotoxicity in albino Wistar rats. Hepatic injury leads to death of hepatocytes and can be identified when there is an increase of more than three times of normal serum transaminase enzymes [17].
Table 1: Growth indicators of males Wister rats fed with *Curcuma Longa*

<table>
<thead>
<tr>
<th></th>
<th>Control (n=5)</th>
<th><em>Curcuma Longa</em> (100 mg/kg) (n=5)</th>
<th><em>Curcuma Longa</em> (200 mg/kg) (n=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial weight (gm)</td>
<td>114.8±7.26*</td>
<td>126.2±1.73*</td>
<td>132.8±2.17*</td>
</tr>
<tr>
<td>Final weight (gm)</td>
<td>203.8±9.68*</td>
<td>224.6±11.52*</td>
<td>227.8±19.52*</td>
</tr>
<tr>
<td>Change in weight(gm)</td>
<td>89±9.38*</td>
<td>98.6±10.48*</td>
<td>95±18.35*</td>
</tr>
<tr>
<td>Growth rate</td>
<td>3.42±0.34*</td>
<td>3.79±0.35*</td>
<td>3.66±0.68*</td>
</tr>
<tr>
<td>TFC (gm)</td>
<td>464.30±30.64*</td>
<td>486.18±17.19*</td>
<td>484.38±37.13*</td>
</tr>
<tr>
<td>Food intake (g/d)</td>
<td>17.86±1.18*</td>
<td>18.70±0.66*</td>
<td>18.63±1.43*</td>
</tr>
<tr>
<td>FE (%)</td>
<td>0.192±0.01*</td>
<td>0.203±0.03*</td>
<td>0.19±0.03*</td>
</tr>
</tbody>
</table>

Small alphabet letters in each row indicates significant difference among dietary treatment groups separately as indicated by ANOVA followed by Duncan’s multiple range tests.

Table 2: Liver enzymes of males Wister rats fed with *Curcuma Longa*

<table>
<thead>
<tr>
<th>Enzymes</th>
<th>Control (n=5)</th>
<th><em>Curcuma Longa</em> (100 mg/kg) (n=5)</th>
<th><em>Curcuma Longa</em> (200 mg/kg) (n=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALT (U/L)</td>
<td>11.60±1.89*</td>
<td>5.02±4.71*</td>
<td>1.52±0.66*</td>
</tr>
<tr>
<td>AST (U/L)</td>
<td>3.35±1.45*</td>
<td>4.60±2.02*</td>
<td>3.89±1.01*</td>
</tr>
</tbody>
</table>

Small alphabet letters in each row indicates significant difference among dietary treatment groups separately as indicated by ANOVA followed by Duncan’s multiple range tests.

**CONCLUSION**

To summarize, in this study; the *Curcuma longa* does not significantly lowered the liver enzyme AST but significantly lowered the ALT activity. It also didn’t exhibit any major effect on weight. This might be due to short study period. From this study it can be concluded that *Curcuma Longa* may protect liver damage.

**REFERENCES**


