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"Hepatoprotective effect of ethanolic extract of *Curcuma longa*"

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Abstract
Liver cirrhosis is a significant health concern, prompting research into traditional remedies for liver protection. This study aims to elucidate the mechanisms by which the ethanolic extract of Curcuma longa (CLRE) exerts its hepatoprotective effects. The results indicated that treatment with CLRE significantly reduced histopathological damage and liver biochemistry markers compared to control groups. The extract promoted apoptosis in liver cells while inhibiting their proliferation, without affecting hepatic CYP2E1 levels. The findings assert that Curcuma longa's liver-protective properties benefits are due to its antioxidant and anti-inflammatory properties, potentially inhibiting the progression of liver cirrhosis and preserving liver function.
Keywords: hepatoprotective, proliferation, antioxidant, liver function.

Introduction:

Curcuma longa, another name for turmeric, is a perennial plant that is extensively grown across Asia. It is a member of the Zingiberaceae group of plants, which also contains ginger. The part of the plant called the rhizome, or stem, and these can be consumed for medical purposes as a yellow substance, is utilized both as flavoring in a wide variety of food styles and as medication to treat a wide range of illnesses. It is especially useful as an antibacterial and for treating colic, hematuria, jaundice, also indigestion, and menstrual cramps. The rhizome may also be used as a treatment for relieving a variety of skin conditions. Turmeric's therapeutic benefits are attributed to many volatile oils, including zingiberene, atlantes, and turmerone, as well as the chemical compound curcumin, often referred to as diferuloylmethane. Studies have shown the potent antioxidant effects of curcumin, or the active ingredient of the spice turmeric, that seems similar to the actions of the vitamins C and E, when extracted using water and fat-soluble extracts. Turmeric's hepatoprotective impact is mostly due to its antioxidant qualities, which result in increased cellular resistance to oxidative damage. Additionally, turmeric has the capacity to reduce the generation of proinflammatory cytokines, which is another reason why turmeric is beneficial for the liver.'

Materials and methods

"Ferric reducing anti-oxidant power of CLRE"

The ferric reducing antioxidant power "(FRAP) of CLRE" was measured using the method reported by Jing et al. (2010), with minor adjustments. In order to create the FRAP reagents, 300 mM buffered sodium a (3.1 mg/mL, pH 3.6) was combined with a 10 mM solution of "2,4,6-tripyridyl-S-triazine (TPTZ) (Merck, USA) and a 20 mM solution of FeCl3.H2O (5.4 mg/mL). 10 µL of a 1 mg/mL solution of CLRE (equivalent to a daily dose of 500 mg/kg in animals) and the standards gallic acid, quercetin, ascorbic acid, retin, trolox, and 2,6-di-tert-butyl-4 methyl phenyl (BHT) were each mixed with 10 µL of a 0.1 mg/mL solution of Silymarin (equivalent to a daily dose of 50 mg/kg in animals)". These mixtures were then added to "290 µL of TPTZ reagent in triplicate wells". At a length of wavelength, the quantity of absorption was taken into consideration. of "593 nm using an ELISA reader (Shimadzu, Japan) every 4 minutes for duration of 2 hours".

Experimental animals

A total of sixty-six Sprague Dawley rats, weighing between 180 and 250 grams, were utilized for the studies. All the rats were in good health. The rats were housed in cages with wire bottoms at a temperature of 25 ± 2°C. They were supplied with a typical pellet meal and tap water. The rats were also subjected to" a 12-hour day and 12-hour night characterized by day and night.", with a humidity level of 50-60%. These conditions were maintained "in an animal room". During the trials, all animals were provided with human care in accordance with the requirements specified in the "Guide for the Care and Use of Laboratory Animals" prepared by the "National Academy of Sciences and published by the National Institute of Health".

"Acute toxicity study"

A total of 36 healthy rats, consisting of 18 males and 18 females, were divided evenly into 3 groups of 6 rats each. The first group received a vehicle solution containing 10% Tween-20 w/v at a dosage of 5 mL/kg. The second and third groups were treated with CLRE preparation at dosages of "2 g/kg and "5 g/kg, respectively". The animals underwent an overnight fasting period without food but were allowed access to water before receiving the dose. After administration, food was not given for an additional 3-4 hours. The animals were monitored for a duration of 30 minutes, as well as at certain time intervals of "2, 4-, 8-, 24-, and 48-hours following injection", in order to detect any indications of toxicological or physical symptoms. On the fifteenth day, the living things were ceremoniously slain. Using recognized techniques, the blood biochemical measurements and histology indications were evaluated. (Mahmood A A et al., 2010).

"Induction of liver cirrhosis in rats"

Thioacetamide is a substance that is toxic to the liver and can cause liver cancer when given to animals in their diet. It is commonly used as a way to study both short-term and long-term liver diseases in laboratory animals (Ramaiah S K et al., 2000). Following the ingestion of TAA in the food, it undergoes conversion into "TAA-S-oxide (TASO) by the hepatic microsomal enzyme cytochrome P450 2E1 (CYP2E1)". Subsequently, it is further turned into the hazardous compound "thioacetamide S-dioxide (TASO2) (Chilakapati J et al., 2005)". TASO2 causes damage to biomolecules in the liver, resulting in the development of cirrhosis (Djordjevic V B et al., 2004).

Results and Discussion

"TPC and FRAP results"

"The total phenolic content (TPC) of the chlorogenic acid (CLRE)" was determined to be 517.54 ± 0.049 mg "gallic acid equivalents (GAE) per milligram of extract". The calibration curve equation used to determine this value was y = 0.15× + 0.0557, with an R-squared value of "0.9867". "The FRAP value" of a "1 mg/mL concentration of CLRE was measured to be 1736.7 ± 0.032 nM/1 mg, which is comparatively lower than the established standards for gallic acid, quercetin, ascorbic acid, rutin, trolox, and BHT. Nevertheless, the measured CLRE value was similar to that of the reference medication Silymarin, which is 600.56 ± 0.003 nM/ 0.1 mg".

Table: 1 CLRE possesses enough antioxidant effectiveness to preserve the current state of the liver.

S.no	Standard	FRAP Value
1.	Gallic acid	24831.9
2.	Quercetin	11201.10
3.	Ascorbic acid	4565.0
4.	Rutin	9227.87
5.	Trolox	687.2
6.	Silymarin	610.65
7.	Azadirachta indica	1636.76
8.	Curcuma longa	1560.7

"CLRE does not induce acute toxicity"

Following the injection of CLRE, every animal lived and showed no obvious symptoms of mortality at the prescribed dosages. Clinical evaluations and serum science did not reveal any noteworthy variations. comparing the individuals receiving treatment unit and the non-treatment group. The previously the versus and kidney the histopathology findings revealed no appreciable variations. comparing the different groups and that of the control group that received treatment.

Table: 2 "Impact of plant extract on renal function tests in rats"

Dose	Sodium	Potassium	Chloride	Urea	Creatinine
	(mM/L)				(µM/L)
Vehicle (10% Tween-20)	136.79 ± 1.34	4.85 ± 0.47	102.81 ± 1.42	4.71 ± 0.42	45.10 ± 2.63

Low dose CLRE (2 g/kg)	133.31 ± 2.11	5.04 ± 0.39	113.46 ± 2.04	4.90 ± 0.58	37.00 ± 2.71
High dose CLRE (5 g/kg)	160.67 ± 2.67	4.09 ± 0.40	100.70 ± 1.52	5.07 ± 0.52	38.62 ± 3.14

"CLRE refers to the ethanolic extract of C. longa rhizomes".

Table: 3 "The impact of CLRE on liver function tests in rats"

Dose	**Total protein (g/L)**	**Albumin (g/L)**	**TB (µM/L)**	**AP (IU/L)**	**ALT (IU/L)**	**AST (IU/L)**	**GGT (IU/L)**
Vehicle (10% Tween 20)	67.33 ± 1.71	11.74 ± 0.76	1.64 ± 0.13	72.85 ± 5.53	34.65 ± 2.66	53.08 ± 5.20	4.40 ± 0.19
Low dose CLRE (2 g/kg)	71.14 ± 1.28	12.66 ± 0.58	2.05 ± 0.16	66.70 ± 5.40	37.17 ± 3.16	62.28 ± 2.63	4.18 ± 0..45
High dose CLRE (5 g/kg)	70.17 ± 1.85	11.26 ± 0.64	1.81 ± 0.46	71.08 ± 11.12	35.50 ± 2.91	55.19 ± 4.83	4.77 ± 0.33

The data will be displayed as the average ± a standard deviation of the average (SEM). There is a lack of substantial disparities among the groupings. There is a statistically significant value at a significant level of $P<0.05$.

Conclusion

Our results suggest that using the extract made from ethanol of C. longa root systems may prevent or lessen the progression of liver cirrhosis caused by TAA. The adverse chain of events brought on by TAA overdose was inhibited by the herb's extract, demonstrating its liver-protective properties effect. The liver protection effectiveness of CLRE preserved the liver's existing state against toxins, including its features, activities, and structure. This justifies the need for additional research to investigate its pharmacological potential in the treatment of liver cirrhosis. Furthermore, it is possible that Curcumin is primarily accountable for the CLRE core extract's liver protection properties. These results would prompt further investigation into the pharmacology significance of using herbal remedies as substitute for standard therapy.

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