



An investigation of the hepatoprotective effects of *Mollugo cervoviana* Linn on rats subjected to carbon trifluoride-induced liver damage

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Article Info

Received: 31-04-2025

Revised: 19-06-2025

Accepted: 30-06-2025

Abstract

There is no specific treatment regimen for liver damage induced by pathogens or chemical reagents, despite the fact that the two are quite comparable. The majority of substances that are harmful to the liver do so primarily by causing oxidative damages, such as lipid peroxidation. Because there was no effective allopathic treatment for hepatic damage, the researcher felt compelled to investigate herbal remedies. So, we have tried to determine how effective *Mollugo cerviana* is as a hepatoprotective agent. In this study, we looked at the effects of an alcoholic extract of *Mollugo cerviana* on CCl₄-induced liver damage. The findings showed that CCl₄-treated rats had considerably higher levels of all the enzymes compared to the control group. A positive control was used using silymarin at a dosage of 25 mg/kg. The antioxidant enzyme activities of rats treated with *Mollugo cerviana* were likewise significantly elevated. Lipid peroxidation is reduced and free radical scavenging is enhanced as a result of the antioxidant defenses provided by these enzymes. The substantial hepatoprotective effect may be due to the presence of flavonoids in the extract.

Introduction

Damage to the liver or a decrease in its ability to perform its detoxification and excretion functions may have far-reaching consequences for one's health¹. Liver disorders continue to be a problem for contemporary medicine as no reasonable treatment is now available for them. The most significant representatives of phyto components are those that alleviate hepatic disorders, whereas modern treatments have nothing to offer in this regard. Excessive alcohol use, hepatotoxins, microbiological infections, and certain treatments may all damage the liver. Lipid per oxidation products³ are the end result of free radical production, which mostly causes oxidative damage. Many liver problems may be effectively treated with traditional remedies. One such traditional remedy is *Mollugo cerviana*, which has long been utilized in rural India for its numerous health benefits. It has antibacterial, aperient, and stomachic properties. By monitoring biochemical parameters in blood and histological parameters in liver, our current research aims to assess the hepatoprotective potential of a crude methanol extract of the plant. The noteworthy aspects are discussed.

Material and Methods

Collection of Plant Material

The *Mollugo cerviana* plants were sourced from Tirunelveli in the Indian state of Tamil Nadu. The Department of Botany, Central Siddha Research Unit, Tirunelveli, headed by Dr. V. Chelladurai, verified their authenticity. We kept the sample voucher on file for future use.

Extract Preparation

The whole dried and powdered plant was subjected to a 48-hour methanol extraction using the soxhlet device. After filtering the extract, the remaining liquid was dried using a rotary evaporator operating at decreased pressure to provide a semisolid mass that may be used for more research.

Initial Screening for Phytochemicals in the Methanolic Extract

We used thin layer chromatography to undertake preliminary phytochemical screening on the crude methanolic extract, and we used qualitative chemical testing to look for tannins, saponins, triterpenoids, and flavonoids.

Chemicals

Both BDH Chemicals and Sigma Aldrich Chemical Co. supplied the chemicals, and they were all of excellent quality. The other solutions were made using deionized water that had been distilled twice.

Various creatures

For this research, we used adult male and female Wister albino rats weighing 200–250 gms. They remained in a controlled environment and given commercial rat pellets and water as needed. The experiment was conducted after the animals had fasted throughout the night. The Institutional Animal Ethics Committee got the go-ahead for the experiment. (No. 265/ CPCSEA)

Studying Acute Toxicities

The "up and down" or "star case" approach was used to conduct acute toxicity studies. Based on the findings, the highest non-lethal dosage is 2000 mg/kg body weight. Therefore, 200 mg/kg body weight, which is 1/10th of the dose, was considered an efficient dose.

CCl₄ Induced Hepato toxicity in Rats

Each group of rats in the experiment consisted of five individuals. As a control, the animals in Group I were used. Each of groups II–V got 0.5 ml/kg of CCl₄ intraperitoneally. The third group was given an aqueous extract (200 mg/kg, p.o.), whereas the fourth group was given a methanolic extract. Silymarin (25 mg/kg, p.o.) was administered to Group V. A total of fourteen days have passed since the beginning of the therapy. By the fifteenth day, all of the animals had been sacrificed. After drawing blood samples from the carotid artery, they were left to coagulate at 37 degrees Celsius for 30 minutes.

The total bilirubin, total protein, and marker enzymes (SGOT, SGPT, AST, and ALP) were estimated using the isolated clear serum. Histopathological examinations followed the meticulous isolation of the liver, removal of any foreign tissue, and preservation in 10% neutral formalin.

Estimation of Biochemical Parameters

In order to estimate biochemical parameters, blood samples were taken from the carotid artery and the serum was separated. The Biuret technique was used to determine total protein and bilirubin. The Reitman technique and the Bessey method⁷⁻⁸ were used to study the marker enzymes, Alp and Ast, respectively. Analysis of Histopathology

Following blood collection and washing with normal saline, the livers were removed from the animals in each group that participated in the experiment. Both bovine solution and 10% buffered neutral formalin were used to fix the items. The microtome procedure was used to prepare them for paraffin embedding. Haematoxylin and eosin were used to stain the sections after processing them in an alcohol xylene series. The histological alterations were assessed by microscopically examining the sections.

Data Analysis by Statistic

Mean $\pm$ SEM was used to represent the values. A one-way analysis of variance (ANOVA) and Dunnett's test¹⁰ were used to evaluate the data. A significant value was defined as $P < 0.01$.

Results

The preliminary phyto chemical screening showed the presence of essential phyto constituents such as flavonoids, saponins, terpenoids and tannins.

From the acute toxicity studies, the LD₅₀ dose was found to be 2000 mg / kg body weight. 1 / 10th of the LD₅₀ dose were taken as an effective dose (200 mg / kg body weight). CCl₄ intoxication in normal rats elevated the serum levels and bilirubin significantly. The rats treated with alcoholic and aqueous extracts of *Mollugo cerviana* Linn. showed a significant reduction in all biochemical parameters elevated by CCl₄ (Table 1).

Discussion

It was shown that the *Mollugo cerviana* plant significantly reduced the harmful effects of CCl₄ on the liver. The harmful effects of CCl₄-induced toxic hepatitis start with alterations to the endoplasmic reticulum, leading to the degradation of intracellular metabolic enzymes [1]. Adipose tissue lipid membranes are peroxidatively degraded when the harmful CCl₃ radical, which is generated by the microsomal oxidase system, bonds covalently to the macromolecule. Animals in the treatment group had significantly elevated levels of serum total bilirubin, SGOT, SGPT, AST, and ALP in their blood samples. The total protein level, in contrast, was lower than the control. The severity of liver injury is confirmed by the accumulation of a high bilirubin concentration and a low total protein level. Serum aspartate transaminase values rapidly increasing indicate the severity of liver necrosis.

Table 1 shows that the harmful effects of CCl₄ were mitigated after administering aqueous and methanolic *Mollugo cerviana* extracts. The hepatoprotective effects of the *Mollugo cerviana* methanolic extract were most pronounced in the group IV animals, while those of the aqueous extract were less pronounced.

The histopathological profile of the animals treated with methanolic extract showed improvement in their manual compact arrangement of hepatic cells as compared to the control group, suggesting a recovery from CCl₄-induced necrosis (Fig. 3). The animals who were given aqueous extracts exhibited a considerable buildup of fatty lobules around the vein (Fig.4), but they had less severe liver damage than the animals that were given CCl₄.

Conclusion

CCl₄ causes lipid peroxidation in the liver, which leads to dose-dependent hepatotoxicity. We still don't fully understand the intricate multi-factorial mechanism of action of CCl₄. After administration, CCl₄ builds up in the cells of the liver's parenchyma and is converted into CCl₃ free radicals via a process known as CCl₄ + $\text{e}^- \rightarrow \text{CCl}_3 + \text{Cl}^-$. The oxidative breakdown of polyunsaturated fatty acids is caused by peroxy radicals (H₂O₂, O₂, and $\cdot\text{OH}$) that are produced when the radicals react with molecular oxygen.

The biochemical investigations in albino rats showed that the alcoholic and watery extracts of the whole *Mollugo cerviana* plant considerably reduced CCl₄-induced liver damage ($P < 0.001$). All of the outcomes are consistent with those of the gold standard medicine silymarin (25 mg/kg body weight).

There is a considerable difference in the hepatoprotective efficacy between the water-based and alcohol-based extracts. The histopathology studies corroborated this finding, showing that liver cells may regenerate themselves.

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