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Research Paper

Evaluation of Hepatoprotective Effect of *Pluchea Wallichiana* Linn on Carbon Tetrachloride induced Hepatotoxicity in Experimental Rats

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ABSTRACT

Liver plays a vital role in the metabolism, detoxification, and excretion of various endogenous and exogenous substances. However, several pathological conditions such as viral hepatitis, non-alcoholic fatty liver disease (NAFLD), chronic alcohol consumption, genetic disorders, autoimmune diseases, and prolonged use of hepatotoxic drugs can impair liver function and lead to severe hepatic injury. *Pluchea wallichiana* has traditionally been used in Ayurvedic medicine for the treatment of inflammation, fever, respiratory disorders, and pain. Experimental animals were divided into five groups: normal control, disease control, standard-treated group (Silymarin 50 mg/kg), and two test groups receiving methanolic extract at doses of 200 mg/kg and 400 mg/kg orally for 14 days. Hepatotoxicity was induced using CCl_4 (1 ml/kg, i.p.) mixed with olive oil. Evaluation parameters included liver function markers such as SGOT/AST, SGPT/ALT, ALP, bilirubin, total protein, and antioxidant parameters including GSH and catalase activity. The study concludes that *Pluchea wallichiana* possesses promising hepatoprotective activity and may serve as a potential natural therapeutic agent for the management of liver disorders. Further studies are required to isolate and characterize the active constituents responsible for its pharmacological activity

INTRODUCTION

Human liver is the most essential visceral organ in body concerned with synthesis, excretion, metabolism and detoxification of diverse exogenous and endogenous substance.^{1,2} However, multiple conditions, including viral hepatitis, non-alcoholic fatty liver disease, long

term alcohol abuse and chronic use of medications can cause injury in which regenerative capacity becomes dysfunctional resulting in liver damage.³ Despite the recent therapeutic advances and significant development of modern medicine, hepatic diseases remain a health problem worldwide. Thus, the search for the new

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therapeutic agents to treat liver disease is still in demand.⁴

Cause of hepatotoxicity are Infection – Hepatitis-A, Hepatitis-B & Hepatitis-C, Alcohol abuse.^{5,6} Genetic disorder – Alpha-1 antitrypsin deficiency, Hereditary hemochromatosis & Wilson disease, Other chronic disease – High cholesterol, Diabetes & Hypertension Autoimmune cause – Primary biliary cirrhosis, Primary sclerosing cholangitis & Autoimmune hepatitis, Other causes - Chronic use of drug or over dose of drug – NSAID, Anti TB drug, Anticancer drug, Antipsychotic drug. *Pluchea wallichiana* has been traditionally used in Ayurvedic and other traditional medicine systems for various ailments, including respiratory problems, fever, inflammation, and pain Plant has been reported for its Anti-microbial activity.⁷⁻⁹

Hepatoprotection, or the protection of the liver damage, is increasingly important today due to several modern lifestyle and environmental factors (Alcohol Consumption, Environmental

Toxins, Increased Use of Processed Foods and Additives) that put the liver under constant stress. *Pluchea* species such as *P. indica*, *P. lanceolate*, and *P. quitoc* have been shown to have anti-inflammatory and analgesic properties due to their chemical components, which include flavonoids, alkaloids, phenolics, and tannins.¹⁰ The plant is known to have good antioxidant potential might be attributed to presence of flavonoids. Antioxidant potential can exert good hepatoprotection. And hence, the proposed work is planned to evaluation effect of leaf methanolic extract of the plant on CCl₄ induced hepatotoxicity.¹¹

Therefore, investigate the effect of *Pluchea wallichiana* on carbon tetrachloride induced hepatotoxicity in rats and evaluate the Pharmacological screening for hepatoprotective activity of prepared leaf extract.

MATERIAL AND METHODS

Table 1: Experimental design

Sr. No.	Animal Group (n=6)	Induction	Treatment schedule
1.	Normal	CCl ₄ 1ml/kg Mixed with 1:1 olive oil i.p. (1 st and 4 th day)	Distilled water
2.	Disease		Distilled water
3.	Standard		Silymarin 50mg/kg for 14 days orally
4.	Test-1		200mg/kg Methanolic extract of plant for 14 days orally
5.	Test-2		400mg/kg Methanolic extract of plant for 14 days orally

Fresh leaves of *Pluchea wallichiana* was collected, clean properly, dried at 50-60° C for 1.5 hours, and grind into powder format. Weigh the powdered plant material (80gm), and place it in a clean glass container. Load the powdered plant material into the thimble of the Soxhlet apparatus. Add sufficient methanol to the round-bottom flask. Heat the setup to allow the solvent to continuously circulate through the plant material for 24 hours.

After 24 hours collect the methanolic extract in the flask.

Experimental method:

All the animals used in the experiment were approved by the Institutional Animal Ethics Committee (IAEC). The disease was induced by carbon tetrachloride to the animals. Carbon tetrachloride (CCl₄) is used to induce



hepatotoxicity because it causes liver damage similar to that seen in human liver diseases. After administration, CCl₄ is metabolized in the liver by cytochrome P450 enzymes to form a reactive trichloromethyl radical (CCl₃•). In the presence of oxygen, this radical forms trichloromethyl peroxy radicals, which initiate lipid peroxidation and damage the cell membranes. This leads to

oxidative stress, inflammation, and necrosis of liver cells. Continuous exposure results in fibrosis, cirrhosis, and even hepatocellular carcinoma, making it a suitable agent for experimental liver injury models.

Evaluation Parameter:

Sr. No.	EVALUATION PARAMETER
2.	Liver function test : SGOT (Serum glutamic-oxaloacetic transaminase) or AST (Aspartate transaminase), SGPT (Serum glutamic – pyruvic Transaminase) or ALT (Alanine Transaminase), ALP (Alkaline Phosphate), total bilirubin , total protein
3.	Antioxidant Assay – GSH, Cat assay

RESULTS AND DISCUSSION:

1. Effect of MPW of liver enzyme levels of animals:

Parameter	Normal	Disease	Standard	Test-1	Test-2
ALT	63.15±4.23	160.32±4.56	85.65±3.65	130.2±2.356	120.3±3.16
AST	90.36±2.65	185.32±7.56	119±3.565	167.0±3.632	150.36±4.23
ALP	120.0±2.67	290.0±3.521	185±4.32	260.0±3.56	225.0±8.21
Total bilirubin	0.210±0.035	0.856±0.0361	0.4120±0.050	0.651±0.035	0.512±0.046
Total protein	5.231±0.215	2.321±0.35	4.51±0.185	3.32±0.27	4.0±0.36

The levels of ALP, ALT, AST and Total bilirubin were significantly increased in the disease group compared to the normal group and it is decreased in standard and test group compared to the disease group. While the levels of total protein was significantly decreased in the disease group

compared to the normal group and it is increased in standard and test group compared to the disease group.

2. Effect of MPW of lipid profile of animals:

Parameter	Normal	Disease	Standard	Test-1	Test-2
HDL	40.0±1.32	15.0±1.65	38.0±2.56	25.0±2.045	32.00±1.45
LDL	15.45±2.45	72.0±4.21	30±1.54	42±1.32	37.0±1.65
Triglycerides	52.0±2.354	140±6.84	80.0±2.65	110±3.65	92.32±3.65
Total cholesterol	80.32±2.15	200±10.23	130.0±2.00	170±2.32	150±3.62

The levels of lipid profile, LDL, Triglycerides and Total Cholesterol was significantly increased in the

disease group showing in the compared to the normal group and it is decreased in standard and

test group compared to the disease group. Statistical significance denoted as (*- $p < 0.05$, **- $p < 0.01$ and ***- $p < 0.001$ compared to the disease control group.

Parameter	Normal	Disease	Standard	Test-1	Test-2
GSH	20.32±0.23	10.00±0.65	17.23±0.24	14.0 ± 0.84	16.0±0.31
CAT	0.765±0.008	0.295±0.001	0.690±0.021	0.456±0.012	0.545±0.035

The levels of antioxidant GSH and CAT was significantly decreased in the disease group showing in the compared to the normal group and it is increased in standard and test group compared to the disease group. Statistical significance denoted as (*- $p < 0.05$, **- $p < 0.01$ and ***- $p < 0.001$ compared to the disease control group.

CONCLUSION

It is concluded that the methanolic leaf extract of *Pluchea wallichiana* exhibits significant hepatoprotective activity against carbon tetrachloride-induced liver damage in rats. The extract effectively normalized elevated liver enzyme levels, improved antioxidant status, corrected lipid abnormalities, and restored normal hepatic architecture. The hepatoprotective effect of *Pluchea wallichiana* may be attributed to the presence of flavonoids, phenolic compounds, and other phytoconstituents possessing strong antioxidant and free radical scavenging properties. The protective effect was found to be dose-dependent, with the higher dose (400 mg/kg) showing greater efficacy. These results scientifically validate the traditional use of *Pluchea wallichiana* in the management of liver disorders and suggest that the plant may serve as a promising source for the development of safe and effective hepatoprotective agents.

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