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In-Vivo Hepatoprotective Activity of Aqueous and Ethanolic Extract of Achyranthens Aspera L. In Paracetamol Induced Hepatotoxicity in Rats

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Abstract

The present investigation was carried out to evaluate the in-vivo hepatoprotective potential of aqueous and ethanolic extracts of Achyranthes aspera *L. against paracetamol-induced hepatotoxicity in Wistar albino rats. Acute liver damage was induced by a single oral administration of paracetamol (2 g/kg body weight), followed by treatment with aqueous and ethanolic extracts of* A. aspera *at graded doses 100 and 200 mg/kg) for seven consecutive days. Silymarin (50 mg/kg) served as the standard reference drug. Hepatoprotective activity was assessed by estimating serum biochemical markers, including serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), alkaline phosphatase (ALP), total bilirubin, and total protein levels, along with histopathological examination of liver tissues. Paracetamol administration significantly elevated SGOT, SGPT, ALP, and bilirubin levels while reducing total protein, indicating hepatic injury. Treatment with both extracts, particularly the ethanolic extract, produced a dose-dependent and significant ($p < 0.05$) reversal of these biochemical alterations towards normal values, comparable to the silymarin-treated group. Histological analysis corroborated the biochemical findings, revealing reduced necrosis, inflammation, and restoration of normal hepatic architecture in extract-treated groups. The results suggest that* A. aspera *possesses potent hepatoprotective activity, which may be attributed to its phytoconstituents with antioxidant and membrane-stabilizing properties. This study supports the traditional use of* A. aspera *in liver disorders and warrants further investigation for isolation and characterization of its active principles*

Key-words: Achyranthes aspera, Plant Extract, *Hepatotoxicity*

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INTRODUCTION

Liver disorders remain a major health concern worldwide due to the liver's central role in metabolism, detoxification, and homeostasis, and hepatotoxicity caused by drugs such as paracetamol is one of the leading causes of acute liver damage. Paracetamol, although widely used as an analgesic and antipyretic, produces hepatotoxic metabolites in overdose conditions, resulting in oxidative stress, necrosis, and severe impairment of liver function [1]. In this context, medicinal plants with antioxidant and protective phytoconstituents have gained significant attention as safer alternatives for the management of hepatic disorders [2]. Achyranthes aspera L., a well-known ethnomedicinal plant of the Amaranthaceae family, has been traditionally used in Ayurveda and folk medicine for the treatment of liver ailments, inflammation, and metabolic disturbances. Phytochemical studies reveal that the plant is rich in bioactive compounds such as saponins, flavonoids, alkaloids, and glycosides, many of which are known for their antioxidant and hepatoprotective properties [3]. Therefore, the present study was undertaken to evaluate the in-vivo hepatoprotective potential of aqueous and ethanolic extracts of Achyranthes aspera L. in paracetamol-induced hepatotoxicity in rats, with the aim of providing scientific evidence to support its traditional claims and to explore its potential role in developing effective natural hepatoprotective agents

MATERIAL AND METHODS

Test Compounds

The extracts Achyranthes aspera leaves and standard drug silymarin (50 mg/kg body weight) were used.

Chemicals and Reagents

Paracetamol, Silymarin.

Experimental Animal

Albino rats (200-250 g) used in the present studies was procured. The animals were fed with standard pellet diet (Hindustan lever Ltd. Bangalore) and water ad libitum. All the animals were acclimatized for a week before use.

Paracetamol Induced Model

The rats were divided into 11 groups of 6 animals in each [4-5].

Group I (Normal): Received vehicle gum acacia (5mg/kg p.o) for 7days

Group II (Control): Received vehicle gum acacia (5 mg/kg p.o) for 7 days once daily and paracetamol 500mg/kg once daily

Group III (Standard): Received silymarin as standard (50 mg/kg) for 7 days once daily and paracetamol 500mg/kg once daily

Group IV, V, VI, VII (Test): Received AEASL, EEASL, AEASS & EEASS (100 & 200 mg/kg) once daily and paracetamol 500mg/kg once daily

On the seventh day, the blood samples were collected via orbital sinus puncture for the estimation of biochemical marker enzymes and allowed to clot and serum was separated by centrifuge at 2500 rpm for 15 min and analyzed for various biochemical parameters. Then the liver was carefully isolated and cleaned off extraneous tissue and preserved in 10% neutral formalin and then subjected to histopathological studies.

Statistical Analysis

All the values ware statistically analyzed by one-way analysis of variance (ANOVA) followed by Dunnette multiple Comparisons test. Statistically significance of * $P<0.01$, ** $P<0.001$, when compared with respective control. All values are expressed as mean ± SEM.

Assessment of Liver Function

The liver was removed and weighed**.** Biochemical parameters i.e., Serum glutamic Pyruvate transaminase (SGPT), serum Glutamic Oxaloacetic Transaminase (SGOT), Alkaline phosphatase (ALP) were analyzed according to the reported methods [6-7].

Histopathological Studies

Liver slices fixed for 12 hrs in Bouin's solution were processed for paraffin embedding following standard micro technique. 5µ section of the livers stained with alum haematoxylin and eosin, were observed microscopically for histopathological changes i.e., normal liver, damaged and recovered liver were studied and compared [8-10].

Results and Discussion

The results of the study demonstrated that both aqueous and ethanolic extracts of Achyranthes aspera L. exhibited significant hepatoprotective activity against paracetamol-induced liver damage in rats. Administration of paracetamol alone produced marked hepatotoxicity, as evidenced by a significant elevation in serum biochemical markers such as SGOT, SGPT, ALP, and total bilirubin, along with a reduction in total protein levels when compared to the normal control group. Histopathological examination of liver tissues also revealed severe cellular degeneration, necrosis, and inflammatory changes in the toxic control group. However, pre-treatment with aqueous and ethanolic extracts of Achyranthes aspera resulted in a remarkable improvement in liver function, showing a significant reduction in elevated serum enzyme levels and restoration of protein content towards normal values. Among the two extracts, the ethanolic extract showed slightly higher hepatoprotective efficacy, which could be attributed to better solubility and extraction of bioactive phytoconstituents such as flavonoids and saponins. Histopathological studies further confirmed the biochemical findings, where liver sections of extract-treated groups showed preserved architecture, reduced necrosis, and near-normal hepatic cells compared to the paracetamol group. These results collectively indicate that Achyranthes aspera possesses potent hepatoprotective potential, validating its traditional use in the treatment of liver disorders.

Table 1: Effect of Aqueous and Ethanolic Extract of Achyranthens aspera L. on Paracetamol induced Hepatotoxicity in Rats

Treatment	Total Bilirubin (mg %)	Direct Bilirubin (mg %)	SGOT (µ/min/l)	SGPT (µ/min/l)	ALP (µ/min/l)
Normal	0.44 ± 0.21	0.43 ± 0.64	183.02 ± 2.1	77.40 ± 2.43	192.0 ± 6.2

Induced (PCM 500 mg/kg)	8.61 ± 2.46	7.45 ± 8.60	345.41± 10.42	153.7± 8.44	358.22±8.85
Standard (Silymarin 50mg/kg)	0.53 ±4.39**	0.49 ±0.19**	197.07±9.43**	88.07±8.79**	199.21 ±10.61**
AEASL (100 mg/kg)	0.62 ±0 .61**	0.54 ±0.22**	206.19± 9.66**	94.54±8.04**	204.43± 8.51**
AEASL (200 mg/kg)	0.61 ±0 .64**	0.55 ±0.26**	206.24± 9.64**	95.24±8.24**	204.52± 8.48**
EEASL (100 mg/kg)	0.65 ± 4.59*	0.53 ± 0.19*	214.38± 8.58*	101.82± 4.58*	214.49± 9.59*
EEASL (200 mg/kg)	0.66 ± 4.51*	0.55 ± 0.18*	211.38± 8.55*	100.82± 4.50*	213.31± 9.52*
AEASS (100 mg/kg)	0.63 ±0 .64**	0.52 ±0.26**	204.24± 9.64**	97.24±8.24**	206.14± 7.25**
AEASS (200 mg/kg)	0.62 ±0 .39**	0.53 ±0.17**	204.39± 9.12**	96.19±7.48**	205.42± 8.48**
EEASS (100 mg/kg)	0.69 ± 4.62*	0.58 ± 0.28*	213.48± 8.64*	99.84± 4.62*	216.46± 9.64*
EEASS (200 mg/kg)	0.71 ± 4.59*	0.59 ± 0.21*	212.41± 8.61*	99.82± 4.59*	215.41± 9.61*

Note: Values are mean ±SEM, n= 6. (One way ANOVA Followed by Dunnette multiple Comparisons test). Statistically significance of * P<0.01, ** P<0.001, when compared with respective control

Table 2: Effect of Aqueous and Ethanolic Extract of Achyranthens aspera L. on liver weight variation of paracetamol induced hepatotoxicity in rats

Treatment	**Liver weight in g/100g**
Normal	6.82 ± 0.46
Induced (PCM 500mg/kg)	8.22 ± 0.24
Standard (silymarin 50mg/kg)	7.12 ± 0.26**
AEASL (100 mg/kg)	7.90 ± 0.44**
AEASL (200 mg/kg)	7.88 ± 0.27**
EEASL (100 mg/kg)	8.14 ± 0.62*
EEASL (200 mg/kg)	8.07± 0.52*
AEASS (100 mg/kg)	7.47 ± 0.34**
AEASS (200 mg/kg)	7.31 ± 0.45**
EEASS (100 mg/kg)	8.01 ± 0.62*
EEASS (200 mg/kg)	7.98± 0.57*

Values are mean ±SEM, n= 6. (One way ANOVA Followed by Dunnette multiple Comparisons test). Statistically significance of * P<0.01, ** P<0.001, when compared with respective control.

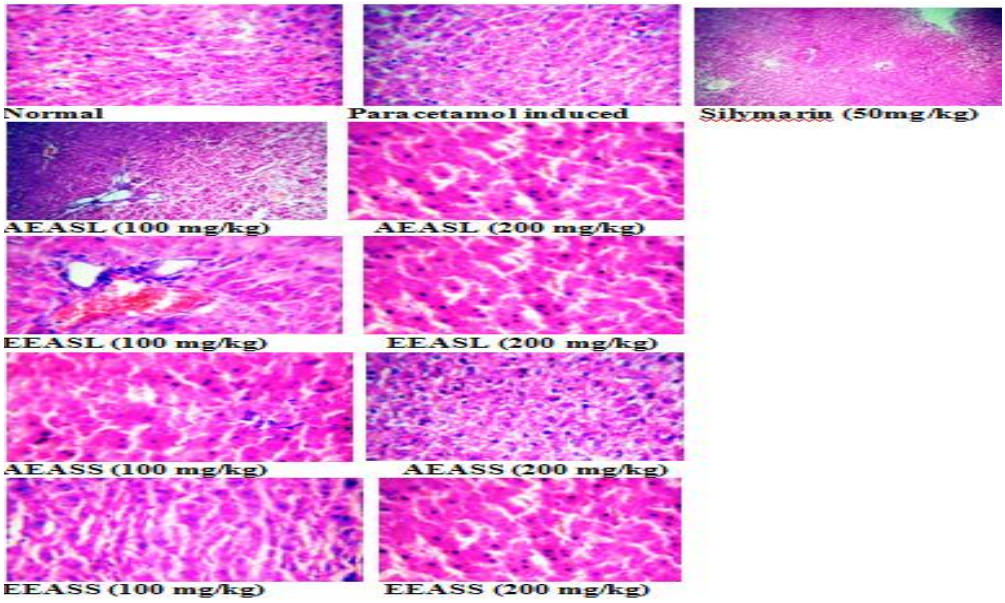

Fig. 1: Histopathologic Section of Liver of Rats in Paracetamol induced Hepatotoxicity

CONCLUSION

The present study concludes that both aqueous and ethanolic extracts of Achyranthes aspera L. possess significant in-vivo hepatoprotective activity against paracetamol-induced hepatotoxicity in rats. The extracts effectively restored altered biochemical markers, improved total protein levels, and preserved normal liver histoarchitecture, thereby demonstrating their protective effect against drug-induced oxidative stress and hepatic injury. Among the two, the ethanolic extract showed comparatively better efficacy, which may be attributed to the higher concentration of bioactive compounds such as flavonoids, alkaloids, and saponins extracted in ethanol. These findings provide strong scientific support to the traditional use of Achyranthes aspera in managing liver disorders and highlight its potential as a natural source for developing safe and effective hepatoprotective agents. Further studies focusing on the isolation of specific active constituents, mechanism of action, and clinical evaluation are warranted to establish its therapeutic application in liver diseases.

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