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Research Article

Comparative Evaluation of the Anti-inflammatory Activity of Methanolic Leaf Extracts of *Alstonia scholaris* and *Mallotus philippensis* in Carrageenan-Induced Rat Paw Edema Model

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Abstract:
Inflammation is a protective biological response against tissue injury; however, chronic inflammation contributes to the progression of numerous diseases. Medicinal plants have been extensively explored as alternative therapeutic agents because of their rich phytochemical composition and reduced adverse effects. The present study evaluated the anti-inflammatory potential of methanolic leaf extracts of *Alstonia scholaris* and *Mallotus philippensis* using the carrageenan-induced rat paw edema model. Leaves of both plants were collected, authenticated, and extracted using Soxhlet extraction with 95% methanol. Acute oral toxicity was evaluated according to OECD Guideline 423. Anti-inflammatory activity was assessed in Wistar rats by measuring paw edema at different time intervals following carrageenan administration. Indomethacin (10 mg/kg) was used as the reference drug, while plant extracts were administered orally at doses of 200 and 400 mg/kg. Both extracts were found to be safe up to 2000 mg/kg body weight. In the carrageenan-induced paw edema model, both plant extracts significantly reduced paw swelling in a dose-dependent manner. The 400 mg/kg dose of both extracts exhibited greater inhibition of inflammation and showed activity comparable to indomethacin during the later phase of inflammation. The findings suggest that methanolic leaf extracts of *Alstonia scholaris* and *Mallotus philippensis* possess significant anti-inflammatory activity and may serve as potential sources for the development of plant-based anti-inflammatory agents.

Keywords: *Alstonia scholaris*, *Mallotus philippensis*, Anti-inflammatory activity, Carrageenan-induced paw edema, Methanolic extract.

1. Introduction

Inflammation is a complex biological response triggered by infection, tissue injury, or chemical mediators and is characterized by redness, swelling, pain, and loss of function. Although non-steroidal anti-inflammatory drugs (NSAIDs) are effective in managing inflammatory disorders, their long-term use is associated with gastrointestinal, renal, and cardiovascular adverse effects (Katzung, 2021). Consequently, there is increasing interest in identifying safer anti-inflammatory agents from medicinal plants.

Alstonia scholaris (Apocynaceae), commonly known as Saptaparni, is traditionally used for the treatment of fever, respiratory disorders, microbial infections, and inflammatory diseases. The plant contains alkaloids, flavonoids, triterpenoids, and phenolic compounds that have demonstrated anti-inflammatory and antioxidant activities (Arulmozhi et al., 2007). *Mallotus philippensis* (Euphorbiaceae), commonly known as Kamala tree, is another important medicinal plant rich in flavonoids, phenolics, tannins, and rottlerin, which have been reported to possess anti-inflammatory, antimicrobial, and antioxidant properties (Kirtikar & Basu, 2008).

Despite their traditional use, comparative pharmacological studies evaluating the anti-inflammatory potential of these two medicinal plants under identical experimental conditions remain limited. Therefore, the present study aimed to compare the anti-inflammatory activity of methanolic leaf extracts of *Alstonia scholaris* and *Mallotus philippensis* using the carrageenan-induced rat paw edema model.

2. Materials and Methods

Plant Collection and Authentication

Leaves of *Alstonia scholaris* and *Mallotus philippensis* were collected during the dry season from Ajmer District, Rajasthan, India. The plant materials were identified and authenticated by **Dr. Jagdish Nagar**, Department of Pharmacognosy. Healthy leaves were washed, shade-dried, and powdered prior to extraction.

Preparation of Methanolic Extract

The dried leaf powder of each plant was extracted separately using a Soxhlet apparatus with 95% methanol for 72 h. The extracts were filtered, concentrated under reduced pressure, and stored under refrigerated conditions until further use.

Experimental Animals

Healthy Wistar rats (150–180 g) of either sex were housed under standard laboratory conditions (24 ± 2°C, 60–70% relative humidity, 12 h light/dark cycle) with free access to food and water. All experimental procedures were conducted following institutional ethical guidelines.

Table 1:

Group no.	Group Specifications
I	Normal control treated with sterile normal saline (5 mL/kg)
II	Disease control treated with 0.1 mL of 1% Carrageenan
III	Standard control treated with Indomethacin (10 mg/kg)
IV	Methanolic extract of *Alstonia scholaris* (200 mg/kg)
V	Methanolic extract of *Alstonia scholaris* (400 mg/kg)
VI	Methanolic extract of *Mallotus philippensis* (200 mg/kg)
VII	Methanolic extract of *Mallotus philippensis* (400 mg/kg)

Acute Oral Toxicity Study

Acute toxicity was performed according to **OECD Guideline 423**. Methanolic extracts were administered orally at 2000 mg/kg, and animals were observed for 14 days for mortality and behavioral abnormalities. No toxic symptoms or mortality were observed.

Anti-inflammatory Activity

Anti-inflammatory activity was evaluated using the carrageenan-induced rat paw edema model. Rats were randomly divided into seven groups (n = 6). One hour after oral administration of extracts or indomethacin, 0.1 mL of 1% λ-carrageenan was injected into the right hind paw. Paw volume was measured at 0, 1, 2, 3, and 4 h using a plethysmometer. Data were expressed as mean ± SEM, and statistical significance was determined relative to the disease control group.

Results and Discussion

Acute Toxicity Study

No mortality or behavioral abnormalities were observed following oral administration of either methanolic extract at 2000 mg/kg. Both extracts were therefore considered safe according to OECD Guideline 423. Based on these findings, doses of 200 and 400 mg/kg were selected for pharmacological evaluation.

Table 2. Acute toxicity profile of methanolic extracts of *Alstonia scholaris* and *Mallotus philippensis*.

Sr. No.	Treatment	Dose (mg/kg)	No. of animals	Mortality			Toxicity Profile
				24 hrs	7 days	14 days	
1.	Mallotus Philippensis (methanolic extract)	2000	5	0	0	0	Safe
2.	Alstonia scholaris (methanolic extract)	2000	5	0	0	0	Safe

Anti-inflammatory Activity

Carrageenan administration produced marked paw edema in the disease control group, confirming successful induction of acute inflammation. Treatment with methanolic extracts of both plants significantly reduced paw edema compared with the disease control.

The methanolic extract of *Alstonia scholaris* at 200 mg/kg reduced paw volume to 0.57 ± 0.17 mL after 4 h, whereas the 400 mg/kg dose produced a greater reduction (0.52 ± 0.05 mL), indicating dose-dependent anti-inflammatory activity.

Similarly, *Mallotus philippensis* produced significant inhibition of paw edema. The 200 mg/kg dose reduced paw volume to 0.59 ± 0.19 mL, while the 400 mg/kg dose further reduced edema to 0.54 ± 0.07 mL after 4 h.

Indomethacin (10 mg/kg) exhibited the greatest inhibition (0.49 ± 0.02 mL); however, both plant extracts at 400 mg/kg demonstrated comparable anti-inflammatory activity during the later phase of inflammation.

The observed anti-inflammatory effects may be attributed to the presence of flavonoids, alkaloids, phenolic compounds, and triterpenoids, which inhibit inflammatory mediators such as prostaglandins, histamine, and cytokines. The dose-dependent response observed in both extracts further supports their therapeutic potential.

Table 3. Effect of methanolic extracts on carrageenan-induced rat paw edema.

Groups	0 h	1 h	2 h	3 h	4 h
Normal Control	0.34 ± 0.12	0.33 ± 0.11	0.32 ± 0.11	0.34 ± 0.11	0.36 ± 0.12
Disease Control	0.33 ± 0.11	0.47 ± 0.14*	0.82 ± 0.24**	0.94 ± 0.18***	0.87 ± 0.20***
Methanolic Extract of *Alstonia scholaris* (200 mg/kg)	0.35 ± 0.17	0.41 ± 0.17	0.46 ± 0.12**	0.51 ± 0.22**	0.57 ± 0.17**
Methanolic Extract of *Alstonia scholaris* (400 mg/kg)	0.30 ± 0.11	0.37 ± 0.11*	0.42 ± 0.16***	0.49 ± 0.10***	0.52 ± 0.05***
Methanolic Extract of *Mallotus philippensis* (200 mg/kg)	0.35 ± 0.18	0.41 ± 0.18	0.46 ± 0.11**	0.53 ± 0.23**	0.59 ± 0.19**
Methanolic Extract of *Mallotus philippensis* (400 mg/kg)	0.32 ± 0.13	0.39 ± 0.12*	0.44 ± 0.17***	0.51 ± 0.11***	0.54 ± 0.07***
Indomethacin (10 mg/kg)	0.32 ± 0.12	0.37 ± 0.05*	0.41 ± 0.07***	0.47 ± 0.04***	0.49 ± 0.02***

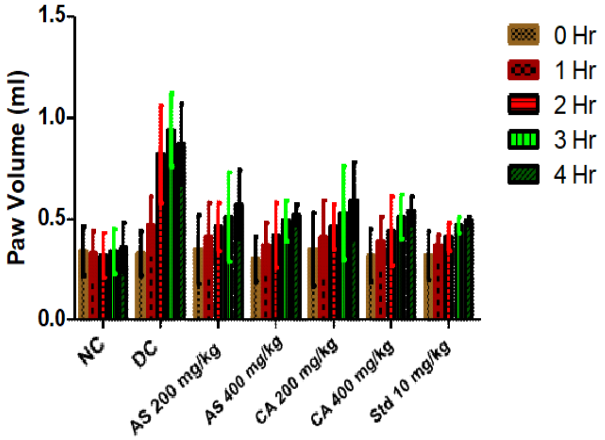

Figure 1. Effect of methanolic extracts of *Alstonia scholaris* and *Mallotus philippensis* on carrageenan-induced rat paw edema.

Conclusion

The present study demonstrated that methanolic leaf extracts of *Alstonia scholaris* and *Mallotus philippensis* possess significant anti-inflammatory activity in the carrageenan-induced rat paw edema model. Both extracts were found to be safe up to an oral dose of 2000 mg/kg and produced dose-dependent inhibition of paw edema. Among the tested doses, 400 mg/kg of both extracts exhibited the greatest anti-inflammatory effect, approaching the activity of the standard drug indomethacin. The results suggest that these medicinal plants are promising natural sources of anti-inflammatory phytoconstituents and warrant further phytochemical characterization and mechanistic studies for the development of novel herbal anti-inflammatory formulations.

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