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Research Article

Phytochemical and pharmacological study of flower of *Myrtus communis* L. for anti-inflammatory activity

Mahesh Kumar*, Prashant Bakoriya, Seema Sahu and Pratyush Jain

RKDF College of Pharmacy, Bhopal, Madhya Pradesh 462047, India

Abstract

Inflammation is a protective biological response to tissue injury, infection, and chemical insult; however, persistent inflammation contributes to the development of several chronic disorders. The present study was undertaken to investigate the phytochemical profile and anti-inflammatory potential of flower extracts of *Myrtus communis* L. The flowers were collected, authenticated, shade dried, powdered, and extracted successively using petroleum ether, chloroform, ethyl acetate, ethanol, and water. The extracts were evaluated for percentage yield, preliminary phytochemical constituents, total phenolic content, and anti-inflammatory activity using protein denaturation inhibition, human red blood cell (HRBC) membrane stabilization, carrageenan-induced paw edema, and cotton pellet granuloma models. The ethanolic extract showed the highest percentage yield (9.85%), followed by aqueous extract (7.20%) and ethyl acetate extract (5.40%). Preliminary phytochemical screening revealed the presence of flavonoids, phenolic compounds, tannins, glycosides, saponins, terpenoids, and carbohydrates in the ethanolic extract. The ethanolic extract exhibited the highest total phenolic content of 85.56 mg gallic acid equivalent/g extract. In the protein denaturation assay, the selected extract showed concentration-dependent inhibition, with 68.09% inhibition at 800 µg/ml. Similarly, HRBC membrane stabilization was 69.09% at 800 µg/ml. In vivo, the extract produced dose-dependent reduction of carrageenan-induced paw edema, with 54.00% inhibition at 400 mg/kg after 4 h. In the cotton pellet granuloma model, the selected extract showed 47.55% inhibition at 400 mg/kg. The findings suggest that the flower of *Myrtus communis* L. possesses promising anti-inflammatory activity, which may be associated with its phenolic, flavonoid, tannin, and terpenoid constituents. Further chromatographic characterization, mechanistic studies, and toxicity evaluation are required to identify the active principles and establish therapeutic usefulness.

Keywords: *Myrtus communis* L.; flower extract; phytochemical screening; phenolic content; flavonoids; anti-inflammatory activity; HRBC membrane stabilization; carrageenan-induced paw edema.

***Correspondence Info:**
Mr. Mahesh Kumar
RKDF College of Pharmacy,
Bhopal, Madhya Pradesh
462047, India

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1. Introduction

Inflammation is a complex physiological response initiated by the body after injury, microbial infection, or exposure to harmful stimuli [1-2]. It is characterized by pain, redness, heat, swelling, and loss of function. Acute inflammation is usually beneficial and self-limiting; however, chronic inflammation may contribute to disorders such as arthritis, inflammatory bowel disease, asthma, cardiovascular diseases, and autoimmune conditions [3-5].

Conventional anti-inflammatory drugs, including non-steroidal anti-inflammatory drugs and corticosteroids, are effective in reducing inflammatory responses [6]. However, prolonged use may be associated with adverse effects such as gastric irritation, renal impairment, cardiovascular complications, and altered immune function [7]. Therefore, medicinal plants are increasingly investigated as potential sources of safer anti-inflammatory agents.

Myrtus communis L., commonly known as common myrtle, belongs to the family Myrtaceae. The plant has been traditionally used for various medicinal purposes [8]. Previous phytochemical studies of *Myrtus communis* have reported polyphenols, flavonoids, tannins, terpenoids, essential oils, glycosides, and other bioactive constituents [9]. These constituents may contribute to antioxidant,

antimicrobial, analgesic, and anti-inflammatory properties [10].

Although several investigations have focused on leaves, fruits, and essential oils of *Myrtus communis*, comparatively limited information is available regarding the anti-inflammatory potential of its flowers [11]. Therefore, the present study was designed to evaluate the phytochemical composition and anti-inflammatory activity of flower extracts of *Myrtus communis* L [12].

2. Materials and Methods

2.1 Collection and Authentication of Plant Material

Fresh flowers of *Myrtus communis* L. were collected from local market of Bhopal, M.P. during the flowering season. The collected material was cleaned to remove dust, foreign matter, damaged floral parts, and insect contamination. The flowers were shade dried at room temperature, powdered using a mechanical grinder, passed through a suitable sieve, and stored in an airtight container until further use.

2.2 Preparation of Extracts

The dried flower powder was extracted successively using petroleum ether, chloroform, ethyl acetate, ethanol, and distilled water. The extraction was carried out using Soxhlet apparatus. After completion of each extraction, the filtrate was concentrated using a rotary evaporator or water bath. The dried extracts were weighed and stored in airtight containers for further evaluation.

Percentage Yield (%) = (Weight of dried extract / Weight of dried plant powder) × 100

Where,

- Weight of dried extract = final weight obtained after evaporation of solvent
- Weight of dried plant powder = initial quantity of powder used for extraction

2.3 Preliminary Phytochemical Screening

The extracts were screened for alkaloids, flavonoids, phenolic compounds, tannins, glycosides, saponins, steroids, terpenoids, carbohydrates, proteins, amino acids, and fixed oils using standard qualitative phytochemical tests.

2.4 Estimation of Total Phenolic Content

Total phenolic content was estimated by the Folin-Ciocalteu method using gallic acid as standard. The absorbance was measured at 765 nm using a UV-visible spectrophotometer. Results were expressed as mg gallic acid equivalent per gram of extract (mg GAE/g extract).

2.6 In-vivo Anti-inflammatory Activity

Animal experiments should be performed only after approval from the Institutional Animal Ethics Committee according to applicable CPCSEA requirements.

2.6.1 Carrageenan-induced Paw Edema

Animals were divided into five groups: control, standard drug, and three extract-treated groups receiving 100, 200, and 400 mg/kg doses. Paw edema was induced by sub-plantar administration of carrageenan. Paw volume was measured at 0, 1, 2, 3, and 4 h.

$$\% \text{ Inhibition of Paw Edema} = [(V_c - V_t) / V_c] \times 100$$

Where,

- V_c = Mean paw edema volume of control group
- V_t = Mean paw edema volume of treated group

2.6.2 Cotton Pellet Granuloma Model

Sterile cotton pellets were implanted subcutaneously in experimental animals. Animals received vehicle, standard drug, or selected extract for the prescribed period. Wet and dry granuloma weights were recorded.

$$\% \text{ Inhibition of Granuloma} = [(W_c - W_t) / W_c] \times 100$$

Where,

- W_c = Mean dry granuloma weight of control group
- W_t = Mean dry granuloma weight of treated group

2.7 Statistical Analysis

Results should be expressed as Mean±SD for in-vitro assays and Mean±SEM for in-vivo studies. One-way analysis of variance followed by Dunnett's multiple-comparison test may be used to compare treated groups with the control group. A value of $p < 0.05$ should be considered statistically significant.

3. Results and Discussion

Table 1: Percentage Yield of Different Extracts of *Myrtus communis* L. Flower

S. No.	Extract	Weight of Powder Taken	Weight of Dried Extract	Percentage Yield
1	Petroleum ether extract	100 g	2.80 g	2.80%
2	Chloroform extract	100 g	3.65 g	3.65%
3	Ethyl acetate extract	100 g	5.40 g	5.40%
4	Ethanolic extract	100 g	9.85 g	9.85%
5	Aqueous extract	100 g	7.20 g	7.20%

The higher yield obtained with ethanol may be due to its ability to dissolve a broad range of polar and semi-polar constituents, including phenolic compounds, flavonoids, tannins, glycosides, and saponins.

3.2 Preliminary Phytochemical Screening

Qualitative phytochemical screening revealed variation among extracts. The ethanolic extract exhibited the broadest phytochemical profile and was selected for further pharmacological evaluation.

Table 2: Preliminary Phytochemical Screening of Flower Extracts of *Myrtus communis* L.

Phytoconstituent	Petroleum Ether	Chloroform	Ethyl Acetate	Ethanolic	Aqueous
Alkaloids	–	+	+	+	+
Flavonoids	–	–	+	+	+
Phenolic compounds	–	–	+	+	+
Tannins	–	–	+	+	+
Glycosides	–	+	+	+	+
Saponins	–	–	–	+	+
Steroids	+	+	+	–	–
Terpenoids	+	+	+	+	–
Carbohydrates	–	–	–	+	+
Proteins	–	–	–	±	±
Amino acids	–	–	–	±	±
Fixed oils and fats	+	+	–	–	–

Note: + = Present; – = Absent;±= Weakly present.

The ethanolic extract contained flavonoids, phenolic compounds, tannins, glycosides, saponins, terpenoids, and carbohydrates. These constituents are relevant because polyphenols and flavonoids may reduce oxidative injury and influence inflammatory pathways.

3.3 Total Phenolic Content

The total phenolic content was estimated using gallic acid as standard. The gallic acid calibration curve was linear over the concentration range of 20–100 µg/ml, with the regression equation:

Table 3: Total Phenolic Content of Selected Flower Extracts of *Myrtus communis* L.

S. No.	Extract	Absorbance at 765 nm	Concentration from Calibration Curve	Total Phenolic Content
1	Ethyl acetate extract	0.512	63.79 µg/ml	63.79 mg GAE/g extract
2	Ethanolic extract	0.684	85.56 µg/ml	85.56 mg GAE/g extract
3	Aqueous extract	0.591	73.79 µg/ml	73.79 mg GAE/g extract

The ethanolic extract showed the highest phenolic content, followed by the aqueous and ethyl acetate extracts. This result supports the selection of ethanolic extract for anti-inflammatory evaluation.

3.4 Protein Denaturation Inhibition

The selected extract showed concentration-dependent inhibition of protein denaturation. The highest inhibition was observed at 800 µg/ml.

Table 4: Effect of Selected Extract on Protein Denaturation

S. No.	Sample	Concentration	Absorbance at 660 nm	% Inhibition
1	Control	—	0.865	—
2	Diclofenac sodium	100 µg/ml	0.218	74.79%
3	Selected extract	50 µg/ml	0.652	24.62%
4	Selected extract	100 µg/ml	0.571	33.99%
5	Selected extract	200 µg/ml	0.463	46.47%
6	Selected extract	400 µg/ml	0.351	59.42%
7	Selected extract	800 µg/ml	0.276	68.09%

The extract exhibited appreciable inhibition of protein denaturation at higher concentrations. Denatured proteins can trigger inflammatory responses; therefore, inhibition of denaturation indicates possible anti-inflammatory activity.

3.5 HRBC Membrane Stabilization Activity

The selected extract showed dose-dependent HRBC membrane stabilization. At 800 µg/ml, the extract showed 69.09% membrane stabilization, which was close to the activity of the standard drug.

Table 5: HRBC Membrane Stabilization Activity of Selected Extract

S. No.	Sample	Concentration	Absorbance at 560 nm	% Membrane Stabilization
1	Control	—	0.812	—
2	Diclofenac sodium	100 µg/ml	0.196	75.86%
3	Selected extract	50 µg/ml	0.624	23.15%
4	Selected extract	100 µg/ml	0.548	32.51%
5	Selected extract	200 µg/ml	0.437	46.18%
6	Selected extract	400 µg/ml	0.329	59.48%
7	Selected extract	800 µg/ml	0.251	69.09%

The HRBC membrane resembles the lysosomal membrane. Therefore, stabilization of the erythrocyte membrane suggests that the extract may reduce lysosomal enzyme release and related inflammatory tissue damage.

3.6 Effect on Carrageenan-induced Paw Edema

The selected extract showed dose-dependent inhibition of carrageenan-induced paw edema. The high-dose group showed 54.00% inhibition at 4 h, compared with 69.00% inhibition produced by diclofenac sodium.

Table 6: Effect of Selected Extract on Carrageenan-induced Paw Edema

Group	Treatment	Dose	Paw Volume 0 h	Paw Volume 1 h	Paw Volume 2 h	Paw Volume 3 h	Paw Volume 4 h	% Inhibition at 4 h
I	Control	Vehicle	0.38±0.02	0.72±0.03	0.93±0.04	1.08±0.05	1.00±0.04	—
II	Diclofenac sodium	10 mg/kg	0.39±0.01	0.58±0.03	0.49±0.02	0.37±0.02	0.31±0.01	69.00%
III	Selected extract	100 mg/kg	0.37±0.02	0.68±0.03	0.82±0.04	0.86±0.03	0.78±0.03	22.00%
IV	Selected extract	200 mg/kg	0.38±0.01	0.63±0.02	0.72±0.03	0.70±0.03	0.62±0.02	38.00%
V	Selected extract	400 mg/kg	0.39±0.02	0.59±0.02	0.61±0.03	0.53±0.02	0.46±0.02	54.00%

Carrageenan-induced inflammation involves early mediator release, including histamine and serotonin, followed by prostaglandin-mediated responses. The observed reduction in paw edema suggests that the extract may interfere with one or more mediators involved in acute inflammation.

3.7 Effect on Cotton Pellet Granuloma

The selected extract reduced both wet and dry granuloma weights in a dose-dependent manner. The maximum inhibition was 47.55% at 400 mg/kg.

Table 7: Effect of Selected Extract on Cotton Pellet Granuloma

Group	Treatment	Dose	Wet Granuloma Weight (mg)	Dry Granuloma Weight (mg)	% Inhibition of Granuloma
I	Control	Vehicle	385.42±8.36	78.64±3.12	—
II	Indomethacin	10 mg/kg	215.28±6.74	31.86±1.84	59.48%
III	Selected extract	100 mg/kg	342.18±7.92	64.72±2.76	17.70%
IV	Selected extract	200 mg/kg	301.46±7.15	52.38±2.41	33.39%
V	Selected extract	400 mg/kg	258.64±6.83	41.25±2.08	47.55%

The cotton pellet granuloma model reflects chronic proliferative inflammation. Reduction in dry granuloma weight indicates that the extract may suppress tissue proliferation, exudation, and granuloma development.

4. Discussion

The present findings demonstrate that the flower of *Myrtus communis* L. contains multiple phytochemical groups with possible anti-inflammatory relevance. The ethanolic extract showed the highest extractive yield and total phenolic content. It also demonstrated concentration-dependent in-vitro activity and dose-dependent in-vivo anti-inflammatory effects.

The protein denaturation and HRBC membrane stabilization results indicate that the extract may protect proteins and biological membranes from inflammatory damage. The reduction of carrageenan-induced paw edema suggests an effect against acute inflammation, whereas inhibition of cotton pellet granuloma formation indicates activity against chronic inflammatory processes.

The observed activity may be related to the combined action of flavonoids, phenolic compounds, tannins, terpenoids, glycosides, and saponins. Flavonoids and phenolic compounds may contribute through antioxidant action, inhibition of inflammatory mediator production, and membrane stabilization. Tannins may provide tissue-protective effects, while terpenoids may influence prostaglandin- and cytokine-related inflammatory responses.

The present results are supportive but should be interpreted along with complete raw data and statistical comparisons. Further work involving HPLC, HPTLC, LC-MS, GC-MS, cytokine assays, COX/LOX inhibition studies, and detailed safety assessment is required.

5. Conclusion

The present study indicates that the flower of *Myrtus communis* L. is a promising source of phytoconstituents with anti-inflammatory potential. The ethanolic extract showed the highest percentage yield and total phenolic content. Preliminary phytochemical screening confirmed the presence of flavonoids, phenolic compounds, tannins, terpenoids, glycosides, and saponins.

The selected extract showed concentration-dependent inhibition of protein denaturation and HRBC membrane lysis. It also produced dose-dependent reduction in carrageenan-induced paw edema and cotton pellet granuloma formation. These findings suggest that the flower extract may be useful against acute and chronic inflammatory conditions.

Further isolation and characterization of active constituents, detailed mechanistic studies, toxicity studies, and clinical evaluation are recommended before considering therapeutic application.

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