

**FORMULATION AND EVALUATION OF AN ANTI-ACNE GEL
CONTAINING *MURRAYA KOENIGII* EXTRACT**

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1. ABSTRACT

Acne is an inflammatory disease of the sebaceous follicles of the skin. The present study was conducted to formulate and evaluate a topical anti-acne gel containing *Murraya koenigii* extract. *Murraya koenigii* (curry leaf), belonging to the family Rutaceae, is traditionally used in the Indian system of medicine. Curry leaves are commonly used as natural flavouring agents and contain various bioactive constituents. The aim of the present study was to formulate an anti-acne gel containing *Murraya koenigii* extract and evaluate its physicochemical characteristics. Phytochemical screening of the extract revealed the presence of alkaloids, carbohydrates, glycosides, flavonoids, terpenoids, and amino acids. The formulated topical gel was evaluated for physical characteristics, pH, spreadability, skin irritation, drug content, and stability. The formulation exhibited acceptable physical characteristics, a pH ranging from 5.7 to 6.0, and good spreadability. No visible skin irritation was observed under the

conditions of the study. The formulation was also evaluated for physical stability under the specified storage conditions. These findings indicate that the formulated *Murraya koenigii* gel

showed acceptable preliminary physicochemical characteristics and may warrant further investigation as a topical anti-acne formulation.

KEYWORDS: Anti-acne; *Murraya koenigii*; Curry leaves; Herbal gel; Phytochemical screening; Topical formulation.

2. INTRODUCTION

Acne is one of the most prevalent skin disorders and commonly affects adolescents and young adults. Although acne is generally not considered a life-threatening disease, it may adversely affect physical appearance, self-confidence, and daily activities. Acne vulgaris is characterized by various clinical manifestations, including seborrhea, erythematous papules and pustules, comedones, nodules, deep pustules, and, in some cases, scarring.^[1,2] (Fig. 1).

The pathogenesis of acne involves increased sebum production, follicular hyperkeratinization, bacterial colonization, and inflammation. *Staphylococcus epidermidis* within the sebaceous unit may contribute to superficial infection. Bacterial colonization of comedones may promote the release of inflammatory mediators, resulting in the progression of comedones to pustules and inflammatory lesions. Severe inflammation may lead to rupture of the follicular wall and formation of nodules and scars after healing.^[2]

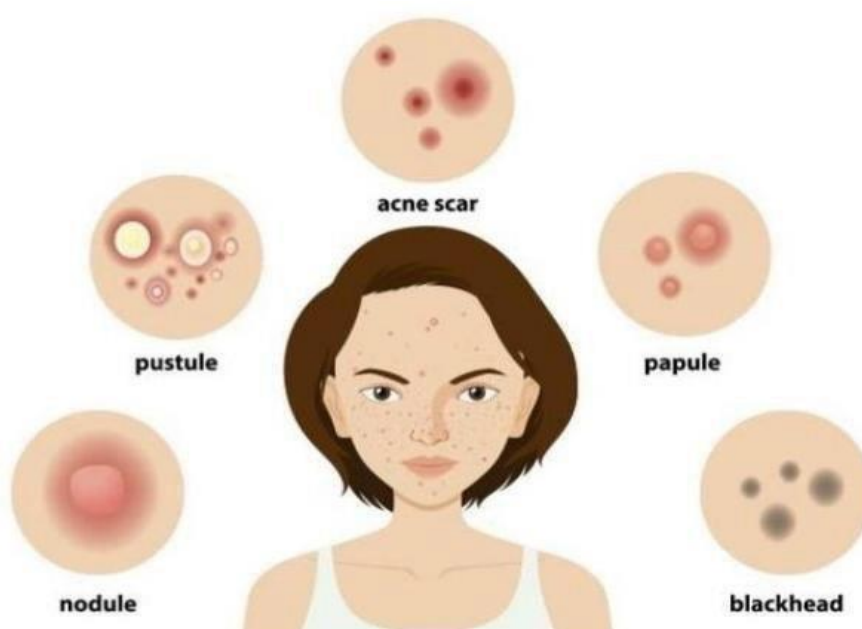


Fig. 1 Types of acne.

The treatment of acne may involve topical or systemic therapy. Topical therapies include antibiotics, anti-inflammatory agents, and comedolytic agents.^[3] Systemic therapy may include oral antibiotics such as tetracyclines and their derivatives, which are commonly used

for moderate-to-severe inflammatory acne.^[4] However, prolonged antibiotic therapy may contribute to bacterial resistance and has also been associated with adverse effects, including upper respiratory tract infections. The development of antibiotic resistance is multifactorial and may depend on the characteristics of the microorganism, antibiotic use, host factors, and environmental factors.^[5]

The emergence of bacterial resistance and adverse effects associated with conventional therapies has increased interest in traditional medicinal plants as potential sources of therapeutic agents. *Murraya koenigii*, a tropical plant belonging to the family Rutaceae, is widely used in Indian cuisine as a flavouring agent. Different parts of the plant, including the leaves, roots, and seeds, have traditionally been used for various medicinal purposes. The leaves have also been reported to be used traditionally for conditions such as wounds, dysentery, and other ailments.^[6]

The leaves of *Murraya koenigii* contain proteins, carbohydrates, fibre, minerals, carotenoids, nicotinic acid, vitamins, calcium, and oxalic acid. They also contain various phytoconstituents, including crystalline glycosides and carbazole alkaloids such as koenigin, girinimbin, isomahanimbin, koenine, koenidine, and koenimbine. Other compounds, including triterpenoid and carbazole alkaloids, have also been reported from the leaves of *Murraya koenigii*.^[7] (Fig. 2).



Fig. 2: Plant of Murraya.

Table 1: Taxonomic Classification of *Murraya Koenigii*.

Taxonomic Rank	Classification
Subkingdom	Tracheobionta (Vascular plants)
Superdivision	Spermatophyta (Seed plants)
Division	Magnoliophyta (Flowering plants)
Class	Magnoliopsida
Subclass	Rosidae
Order	Sapindales
Family	Rutaceae
Genus	<i>Murraya</i>
Species	<i>Murraya koenigii</i>

**Fig. 3 Pharmacological activities of *Murraya koenigii***

The reported pharmacological activities of *Murraya koenigii* are summarized in Fig. 3.

USES OF *MURRAYA KOENIGII*

1. Antidiabetic Activity

The petroleum ether extract of *Murraya koenigii* contains the carbazole alkaloid mahanimbine. Studies have reported that mahanimbine may help reduce blood glucose levels and enhance insulin secretion by improving pancreatic β -cell function.^[6]

2. Wound-Healing Activity

Wound healing is a complex and multifactorial process involving various biochemical and cellular events that contribute to the restoration of functional and anatomical continuity.

Murraya koenigii has been reported to possess wound-healing activity, which has been associated with constituents such as mahanine, mahanimbicine, mahanimbine, and essential oil.^[7]

3. Antifungal Activity

The antifungal activity of *Murraya koenigii* leaves has been associated with phytochemical constituents of diverse molecular structures and mechanisms of action, including alkaloids, terpenoids, flavonoids, phenolic compounds, tannins, and saponins, which are reported to possess antimicrobial properties.^[9]

4. Food-Preservative Activity

*Murraya koenigii** contains bioactive compounds, including carotenoids, flavonoids, and phenolic compounds, which possess antioxidant properties. Constituents such as mahanimbine and koenigine have also been associated with antioxidant and antimicrobial activities. The plant has therefore been investigated for its potential role in food preservation, including the maintenance of food quality and prevention of oxidative deterioration.^[10]

5. Anticancer Activity

The anticancer activity of *Murraya koenigii* has been associated with bioactive constituents such as mahanimbine, girinimbine, mahanine, and murrayafoine. These constituents have been investigated for their potential to promote cancer-cell death and inhibit proteasome activity.

BENEFITS OF MURRAYA KOENIGII

The reported traditional and pharmacological benefits of *Murraya koenigii* include:

1. Support for eye health
2. Potential cholesterol-lowering activity
3. Traditionally used for relief of gastrointestinal discomfort
4. Potential support for blood circulation
5. Potential role in weight management
6. Traditionally used to support hair growth
7. Traditionally used for management of diarrhoea
8. Potential antidiabetic activity
9. Potential role in stress management
10. Traditional use in skincare

11. Potential anticancer activity
12. Potential antimicrobial activity against pathogens

3. MATERIALS AND METHODS

3.1 Experimental Work

A. Drug and Excipient Profile

Carbopol 934

Carbopol 934 is a cross-linked polymer used as a gelling agent in topical formulations.

Triethanolamine (TEA)

Triethanolamine is an organic compound containing both alcohol and amine functional groups. It is commonly used as a pH-adjusting and neutralizing agent in pharmaceutical and cosmetic formulations.

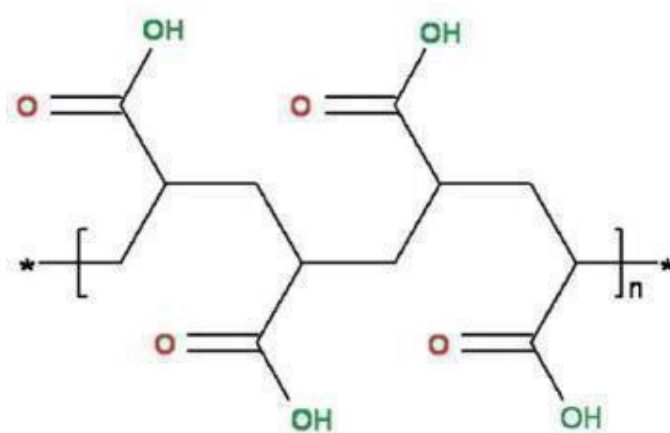


Fig: 4 Structure of Carbopol 934.

Methyl Paraben

Methyl paraben is a preservative commonly used in pharmaceutical and cosmetic formulations. It is the methyl ester of p-hydroxybenzoic acid.

Polyethylene Glycol (PEG 400)

PEG 400 is a low-molecular-weight polyethylene glycol widely used as a pharmaceutical excipient and solvent.

B. Analysis of Raw Material

Moisture Content

Dried curry leaves were powdered using a laboratory mixer. Approximately 10 g of the powdered sample was transferred to a small aluminium pan and dried in a hot-air oven at 130

$\pm 5^{\circ}\text{C}$ for 17 ± 2 h The pan was then covered, cooled in a desiccator, and weighed. The moisture content was expressed as a percentage on a wet basis.

C. Extraction of Dried Curry Leaves

Ten grams (10 g) of curry leaf powder was added to 100 mL of 70% aqueous methanol solution. The mixture was covered with filter paper and kept on a rotary shaker for 24 h. It was then kept in a dark place at room temperature for 2–3 days. The mixture was filtered, and the supernatant was collected. The solvent was evaporated to obtain the curry leaf methanolic extract for further analysis.

D. Soxhlet Extraction

A laboratory-scale Soxhlet apparatus was used for extraction of curry leaves. Approximately 300 g of size-reduced leaf material was placed in a Soxhlet extractor fitted with a 1-L round-bottom flask and a condenser. Extraction was carried out using 0.6 L of n-hexane on a water bath for 56 h. After extraction, the solvent was removed under reduced pressure using a rotary evaporator. The resulting extract was stored under refrigeration until further analysis. (Fig. 5).



Fig. 5: Soxhlet Apparatus.



Fig. 6: Thermostatic Water Bath.

The thermostatic water bath used in the study is shown in Fig. 6.

E. Phytochemical Studies

Phytochemical screening of the **methanolic extract** was performed to determine the presence of various phytoconstituents using standard procedures.

Test for Alkaloids

Dragendorff's Test

Two millilitres of the aqueous extract was taken, and a few drops of Dragendorff's reagent were added. The formation of a reddish-brown precipitate indicated the presence of alkaloids.^[11]

Test for Carbohydrates

Molisch's Test

Two millilitres of the aqueous extract was taken in a test tube, and a small amount of Molisch's reagent (α -naphthol dissolved in ethanol) was added. After mixing, concentrated sulfuric acid was carefully added along the side of the inclined test tube.

Test for Glycosides

Kedde Test

The aqueous extract was treated with a small amount of Kedde reagent. The development of a blue or violet colour that faded within 1–2 h indicated the presence of glycosides.^[12]

Test for Flavonoids**Shinoda Test**

A few fragments of magnesium and concentrated hydrochloric acid were added to the ethanolic extract. The appearance of a red to pink colour indicated the presence of flavonoids.^[12]

Test for Terpenoids**Salkowski Test**

Two millilitres of chloroform was added to the extract solution. Concentrated sulfuric acid was carefully added to form a separate layer. The development of reddish-brown coloration at the interface indicated the presence of terpenoids.^[12]

Test for Tannins

Approximately 0.5 g of the sample was stirred with 10 mL of boiling distilled water. The mixture was filtered, and a few millilitres of 6% ferric chloride solution were added to the filtrate. The appearance of a deep green colour indicated the presence of tannins. A second portion of the filtrate was treated with a few millilitres of iodine solution. The appearance of a faint bluish colour was reported as confirmation of the presence of tannins.^[12]

Test for Amino Acids**Ninhydrin Test**

Three drops of 1% ninhydrin solution in ethanol were added to 1 mL of the extract solution and heated for 5 min in a boiling water bath. The formation of a blue or purple colour indicated a positive test for amino acids.^[12]

Table 2: Phytochemical Screening of Methanolic Extract of *Murraya Koenigii*.

Phytochemical Constituent	Methanolic Extract
Alkaloids	Present
Carbohydrates	Present
Glycosides	Present
Flavonoids	Present
Terpenoids	Present
Tannins	Absent
Amino acids	Present

Table 3: Composition of the Gel Formulation.

Ingredient	Quantity	Function
Carbopol 934	0.8% w/w	Gelling agent

Triethanolamine	q.s.	Alkalizing agent
Methyl paraben	0.2% w/w	Preservative
Propyl paraben	0.1% w/w	Preservative
Polyethylene glycol 400	20 mL	Solvent
Propylene glycol 400	3 mL	Emollient
Methanolic extract of <i>Murraya koenigii</i>	0.5% w/w	Antibacterial activity
Distilled water	q.s. to 100	Vehicle

3.2 Evaluation of Gel

The prepared gel formulation was evaluated using various physical and physicochemical parameters, including organoleptic characteristics, pH, spreadability, drug content, skin irritation, and stability.

A. Physical Evaluation of Gel

Organoleptic Characteristics

The physical appearance of the prepared gel formulation was evaluated visually for the following characteristics

1. Colour

The Colour of the formulation was examined visually against a white background.

2. Odour

The Odour of the gel formulation was evaluated by diluting a small quantity of the gel with water and assessing its characteristic odour.

3. Consistency

The consistency of the gel was evaluated by applying a small quantity of the formulation to the skin and observing its consistency.

3. Greasiness

The greasiness of the formulation was assessed by applying a small quantity of the gel to the skin.

4. Grittiness

The formulation was examined microscopically at 40× magnification for the presence of particulate matter or aggregates.

5. Homogeneity

Homogeneity was evaluated by visual inspection of the formulation after allowing it to stand in a container. The formulation was examined for its appearance and the presence of any aggregates.

6. Skin Irritation Test

The skin irritation test was performed on 10 healthy human volunteers of either sex after obtaining consent. Approximately 0.5 g of the gel was applied to an area of approximately 6 cm² on the skin of the hand and covered with a gauze patch. The patch was kept in contact with the skin for 1 h. The gauze was then removed, and any residual test substance was carefully removed without altering the existing skin response or integrity of the epidermis. The skin was observed at 1, 3, 6, 12, 24, 48, and 72 h for any visible skin response.

B. pH Determination

Approximately 20 mg of the formulation was taken in a beaker, and the pH was measured using a digital pH meter within 24 h of manufacture.

C. Spreadability

Spreadability indicates the extent to which a gel spreads readily upon application to the skin or affected area. It is an important property of topical formulations. Spreadability was determined by measuring the time required for the upper slide to separate from the lower slide when the gel was placed between two glass slides under a specified load. A shorter separation time indicates greater spreadability.

Approximately 500 mg of the formulation was placed between two glass slides, each measuring 6 × 2 cm. A weight of 100 g was placed on the upper slide to ensure uniform spreading of the formulation into a thin layer. The weight was then removed, and excess formulation adhering to the slides was carefully removed.

The lower slide was fixed to the board of the apparatus, while the upper slide was attached to a non-flexible string. A 20 g load was applied through a simple pulley positioned horizontally with respect to the fixed slide. The time required for the upper slide to separate from the lower slide was recorded.

Spreadability was calculated using the following equation:

$$S = m \times l / t$$

Where:

S = Spreadability

m = Weight attached to the upper slide

l = Length of the glass slide (6 cm)

t = Time required for separation of the slides (s)

D. Drug Content

The drug content of the formulation was determined by accurately weighing 1 g of the gel and transferring it to a 100 mL volumetric flask. Approximately 70 mL of methanol was added, and the mixture was shaken thoroughly. The volume was then made up to 100 mL with methanol. The solution was filtered through a suitable filter paper. One millilitre of the filtrate was further diluted, and the extract content was estimated using a UV–Visible spectrophotometer at 250 nm.

E. Stability Study

The physical stability of the prepared herbal gel formulation was evaluated for four weeks under different temperature conditions.

The storage conditions as 2°C, 25°C, and 37°C in the methodology and results.



Fig. 7 Stability study at 2°C.



Fig. 8 Stability study at 25°C.



Fig. 9 Stability study at 37°C.

The formulation was reported to remain physically stable under the tested temperature conditions during the four-week study period (Figs. 7–9).

4. RESULTS AND DISCUSSION

The anti-acne gel containing *Murraya koenigii* extract was prepared using Carbopol as a gelling agent. The prepared formulation was evaluated for its physical and physicochemical characteristics, including colour, odour, consistency, greasiness, grittiness, homogeneity, pH, spreadability, skin irritation, and stability.

The prepared formulation exhibited an olive-green colour and a characteristic odour of curry leaves. It showed a smooth consistency, was non-greasy, had no visible particulate matter, and appeared homogeneous. These observations indicate acceptable physical characteristics of the prepared formulation under the conditions of the present study.

The pH of the formulation was found to be 5.7 after 12 h and 6.0 after 24 h. These values were recorded under the experimental conditions described in the present study.

The spreadability of the formulation was observed to be easily spreadable. The skin irritation test was conducted on 10 healthy human volunteers. The formulation was reported as non-irritant during the observation period. However, this observation should be interpreted within the conditions and sample size of the present study and should not be considered as evidence of overall clinical safety.

The formulation was reported to remain physically stable during the four-week stability study. However, the storage temperature 2°C, 25°C, and 37°C,

Overall, the prepared formulation demonstrated acceptable physical characteristics, pH, spreadability, and observed skin tolerability under the conditions of the present study. Further

studies, including appropriately designed microbiological evaluation and additional efficacy and safety investigations, would be required to establish the anti-acne efficacy and broader safety profile of the formulation.

4.1 Physical Appearance

The prepared formulation was evaluated for its organoleptic and physical characteristics. The observations are presented in Table 4.

Table 4: Organoleptic and Physical Evaluation of the Formulation.

Sr. No.	Test	Observation
1	Colour	Olive green
2	Odour	Characteristic odour of curry leaves
3	Consistency	Smooth
4	Greasiness	Non-greasy
5	Grittiness	Absence of particulate matter
6	Homogeneity	Homogeneous
7	Skin irritancy test	Non-irritant
8	Stability study	Stable at 2°C, 25°C and 37°C*

4.2 pH Determination

The pH of the prepared anti-acne gel formulation was determined using a digital pH meter. The observed pH values are presented in Table 5.

Table 5: pH of the Prepared Anti-Acne Gel Formulation.

Sr. No.	Observation Time	Observed pH
1	After 12 h	5.7
2	After 24 h	6.0

4.3 Spreadability

The spreadability of the prepared anti-acne gel formulation was evaluated, and the formulation was observed to be easily spreadable. The observation is presented in Table 6.

Table 6: Spreadability of the Prepared Anti-Acne Gel Formulation.

Sr. No.	Test	Observation
1	Spreadability	Easily spreadable

5. CONCLUSION

The present study focused on the formulation and evaluation of an anti-acne gel containing *Murraya koenigii* extract. The prepared formulation exhibited an olive-green colour,

characteristic odour of curry leaves, smooth consistency, non-greasy nature, absence of visible particulate matter, and homogeneity.

The pH values recorded after 12 h and 24 h were 5.7 and 6.0, respectively, and the formulation was observed to be easily spreadable. In the skin irritation study involving 10 healthy human volunteers, the formulation was reported as non-irritant under the conditions of the study.

The formulation was also reported to remain physically stable during the four-week stability study, subject to verification of the storage temperatures used. These findings suggest that the prepared formulation exhibited acceptable physical and physicochemical characteristics under the experimental conditions investigated.

However, the present findings alone do not establish clinical anti-acne efficacy or overall safety of the formulation. Further studies involving appropriate microbiological evaluation, efficacy assessment, and adequately designed safety studies are warranted to substantiate the potential use of *Murraya koenigii* extract in topical anti-acne formulations.

6. REFERENCES

1. Lynn DD, Umari T, Dunnick CA, Dellavalle RP. The epidemiology of acne vulgaris in late adolescence. *Adolesc. Health Med. Ther.*, 2016; 7: 13-25. doi:10.2147/AHMT.S55832.
2. Ebling FJG. Acne vulgaris. In: Champion RH, Burton JL, Ebling FJG, editors. *Textbook of Dermatology*. 6th ed. Oxford: Blackwell Scientific; 1998; 3: 552-554.
3. Daud FS, Wankhede S, Joshi M, Pande G. Development of herbal anti acne gel and its evaluation against acne causing bacteria *Propionibacterium acne* and *Staphylococcus epidermidis*. *Int. J. Res., Ayurveda Pharm.*, 2013; 4(5): 781-786. doi:10.7897/2277-4343.04530.
4. Cunliffe WJ, Gollnick HPM. *Acne: Diagnosis and Management*. 1st ed. London: Martin Dunitz Ltd; 2001.
5. Margolis DJ, Bowe WP, Hoffstad O, Berlin JA. Antibiotic treatment of acne may be associated with upper respiratory tract infections. *Arch. Dermatol.*, 2005; 141(9): 1132-1136. doi:10.1001/archderm.141.9.1132.

6. Yadav S, Vats V, Dhunnoo Y, Grover JK. Hypoglycemic and antihyperglycemic activity of *Murraya koenigii* leaves in diabetic rats. *J Ethnopharmacol.*, 2002; 82(2-3): 111-116. doi:10.1016/S0378-8741(02)00167-8.
7. Samanta SK, Kandimalla R, Gogoi B, Dutta KN, Choudhury P, Deb PK, et al. Phytochemical portfolio and anticancer activity of *Murraya koenigii* and its primary active component, mahanine. *Pharmacol. Res.*, 2018; 129: 227-236. doi:10.1016/j.phrs.2017.11.024.
8. Nagappan T, Segaran TC, Wahid MEA, Ramasamy P, Vairappan CS. Efficacy of carbazole alkaloids, essential oil and extract of *Murraya koenigii* in enhancing subcutaneous wound healing in rats. *Molecules.* 2012; 17(12): 14449-14463. doi: 10.3390/molecules171214449.
9. Tripathi YC, Anjum N, Rana A. Chemical composition and in vitro antifungal and antioxidant activities of essential oil from *Murraya koenigii* (L.) Spreng. leaves. *Asian J. Biomed. Pharm. Sci.*, 2018; 8(65): 6-13. doi:10.4066/2249-622X.65.18-729.
10. Chelliah R, Ramakrishnan SR, Premkumar D, Antony U. Bio-fortification and shelf-life extension of idli batter using curry leaves (*Murraya koenigii*). *J Food Sci. Technol.*, 2016; 53(6): 2851-2862. doi:10.1007/s13197-016-2264-2.
11. Trease GE, Evans WC. Trease and Evans' Pharmacognosy. 13th ed. London: Baillière Tindall; 1989.
12. Mojab F, Kamalinejad M, Ghaderi N, Vahidipour HR. Phytochemical screening of some species of Iranian plants. *Iran J. Pharm. Res.*, 2003; 2(2): 77-82.