IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 5, October 2026
Impact Factor: 8.2

Review on Formulation and Evaluation of Topical Polyherbal Anti-Inflammatory Gel

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Abstract: *This article surveys the development and testing of a herbal gel for skin application that combines turmeric (Curcuma longa) and ginger (Zingiber officinale) to fight inflammation. It describes what inflammation is and what provokes it, the steps for making such gels, and the way curcumin and ginger together shut down the COX-2 and LOX enzymes. Phytochemical and chemical tests, undesirable effects, and quality checks (pH, viscosity, spreadability, drug content, in-vitro anti-inflammatory activity) are discussed as well. Relative to synthetic NSAID gels, this pairing promises stronger action with fewer unwanted reactions and holds wide potential for topical herbal treatment.*

Keywords: Polyherbal Gel, Anti-inflammatory Activity, Curcuma longa, Zingiber officinale, Curcumin, Carbopol 940

I. INTRODUCTION

Inflammation is a defence mechanism that switches on whenever tissue is injured, infected or irritated. Redness, swelling, pain and heat, along with a temporary drop in function, are its hallmark signs. While it is necessary for healing, inflammation that drags on or becomes chronic is a factor behind illnesses like arthritis, skin disease and muscle pain.[1]

1.1 Types of Inflammation :

1. Acute Inflammation:

This form appears suddenly, is short in duration and normally fades within hours to days.

A small cut that closes quickly and a cold that disappears after a few days are typical cases.

2. Chronic Inflammation:

This form lingers, lasting from several months to years.

It develops when the original trigger cannot be eliminated or when the immune system mistakenly attacks normal tissue.

It has been connected to a number of lasting diseases such as heart disease, diabetes, cancer and arthritis.[2]

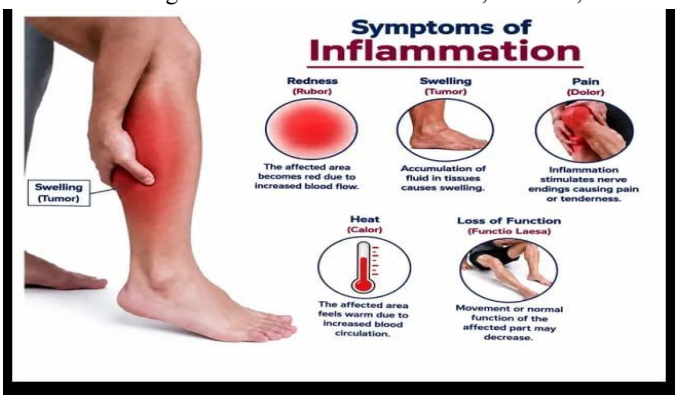


Fig. Symptoms of Inflammation.

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DOI: 10.48175/IJARSCT-40147

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Skin-applied NSAIDs, chiefly diclofenac and ibuprofen, are used extensively; however, extended use can bring skin irritation, allergic reactions and stomach or bowel problems. Safer substitutes are consequently needed.[1]

The phenolic compounds in ginger, 6-gingerol in particular, are held responsible for its anti-inflammatory activity.[3]

Turmeric's capacity to reduce inflammation has been investigated at length in animal and human studies. The active polyphenols, called curcuminoids, include curcumin.[4]

Plants that contain flavonoids and phenolic compounds display strong anti-inflammatory effects.[1] For thousands of years, the Indian System of Medicine (ISM) has relied on herbal drugs against inflammation.[5]

Anti-inflammatory gels are applied on the skin to ease pain and swelling at the spot of use, working through suppression of mediators such as prostaglandins. They help with arthritis, aching muscles, sprains and stiff joints. Compared with oral NSAIDs, gels are favoured since they act locally and are less likely to upset the digestive tract.

1.2 GELS

A gel is a semi-solid system where a liquid is confined within a three-dimensional polymeric framework.

Types of Gels:

1. Hydrogel: water-based, for example Carbopol gel
2. Organogel: made with an organic solvent
3. Xerogel: solid gel with a small amount of solvent

Gels suit skin delivery of drugs since they spread easily, stay in contact with the skin for a longer time, and cause fewer side effects than other topical preparations and oral administration.[6]

1.3 Management of Local Inflammation.

Polyherbal gels are typically used to relieve these local signs of inflammation:

- ➢ Redness
- ➢ Swelling or oedema
- ➢ Warmth and discomfort in the affected area
- ➢ Mild to moderate inflammation of skin, muscles or soft tissues

For this reason, the review centres on making and testing a topical polyherbal gel with turmeric (Curcuma longa) and ginger (Zingiber officinale). Curcumin inhibits NF-kB and COX-2, and gingerol inhibits COX and LOX, so together they hit several targets and reinforce each other.

Plant Profile

1. Curcuma

Synonym : Turmeric

Biological Source : Curcuma longa Linn.

Family : Zingiberaceae

Synonym : Curcuma domestica, Turmeric, Rhizoma Curcumae.

Medicinal use : Across Asia, Curcuma longa has traditionally been employed as a medicinal herb because of its antioxidant, anti-inflammatory, antimutagenic, antimicrobial and anticancer properties.

Other Information : Turmeric, a spice from the kitchen, has drawn strong interest from medical and scientific researchers too. The plant, Curcuma longa, is a rhizomatous perennial herb belonging to the ginger family and is where curcumin comes from. People have known of its medicinal value for thousands of years.

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Fig. curcuma longa

2. Ginger
Biological source : Zingiber officinale
Family : Zingiberaceae
Synonym : Zingiber, Rhizoma Zingiberis, sonth, Adarak.
Medicinal Uses : Ginger is a common spice in food and drink around the globe. In Southeast Asia, it has been a traditional treatment for digestive trouble, throat soreness, cough, fever and similar complaints.
Active Constituent : Ginger's biological effects come from volatile and non-volatile compounds. Its volatile part consists of aromatic essential oils, including sesquiterpenes and monoterpenoids. The non-volatile part, made up of gingerol, shogaol, zingerone and paradol, creates the hot, pungent taste. Fresh ginger mostly contains gingerol, which changes into shogaol, zingerone and paradol in products made from ginger.



Fig. Ginger

II. MATERIALS AND METHODS

1.1.Plant Derived Ingredients :
Curcuma longa rhizome dried and powdered (Turmeric / Haldi) Zingiber officinale rhizome :- dried and powdered (Ginger / Sunthi)

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1.2. Formulation Excipients :

Sr. No.	Ingredients	Functions
1.	Turmeric Extract	Anti-Inflammatory and Antioxidant
2.	Ginger Extract	Anti-Inflammatory Agent
3.	Carbopol 940	Gelling Agent
4.	Propylene Glycol	Solvent and Penetration Enhancer
5.	Glycerin	Moisturizer
6.	Triethanolamine	pH Adjuster and Gel Neutralizer
7.	Distilled water	Vehicle or Solvent

1.3. Method of preparation of Polyherbal Gel :

1. Curcuma Longa Polyherbal Gel Formulation.

a. Preparation of Herbal Extract

To obtain the turmeric extract, Curcuma longa rhizomes are collected, rinsed thoroughly to clear away soil and impurities, and dried under proper conditions. The dried rhizomes are milled to a fine powder, then extracted by maceration or another suitable technique with a solvent such as ethanol. The resulting mixture is filtered to remove solids, and the solvent is evaporated off the filtrate to leave a concentrated turmeric extract. Until it goes into the polyherbal gel, the extract is stored in a tightly closed container.[7]

b. Preparation of the gel base

The gel base is made by gradually sprinkling a gelling agent, such as Carbopol 940, into purified water while stirring continuously so it disperses uniformly. After that, the mixture rests for enough time for the polymer to hydrate properly. Glycerin or propylene glycol can be added as a humectant to improve consistency and retain moisture. A neutralizing agent such as triethanolamine is used where needed to adjust pH, and stirring continues until a uniform, smooth gel base forms that is ready to receive the turmeric extract.[8]

c. Incorporation of Herbal extract

Under constant stirring, the turmeric extract is added bit by bit to the hydrated base so that it is spread evenly in the formulation. Where needed, a suitable solvent or co-solvent assists incorporation. Stirring goes on until the gel turns smooth and homogeneous, and pH is adjusted with a neutralizing agent if required. At the end, the turmeric gel is moved into a well-closed container and kept under suitable conditions until it is evaluated.[9]

2. Zingiber officinale Polyherbal Gel Formulation.

a. Preparation of Herbal Extract from Ginger

For the ginger extract, Zingiber officinale rhizomes are collected, washed carefully to get rid of soil and impurities, and dried under suitable conditions. The dried rhizomes are crushed to a coarse powder and extracted with a solvent like ethanol, either by maceration or by Soxhlet extraction. In maceration, the powder sits in ethanol for a set time and is occasionally stirred. Filtration separates the liquid extract from the leftover solids, and the filtrate is then evaporated to concentrate it into ginger extract. The extract is held in a tightly closed container until it is needed in the polyherbal gel.[10]

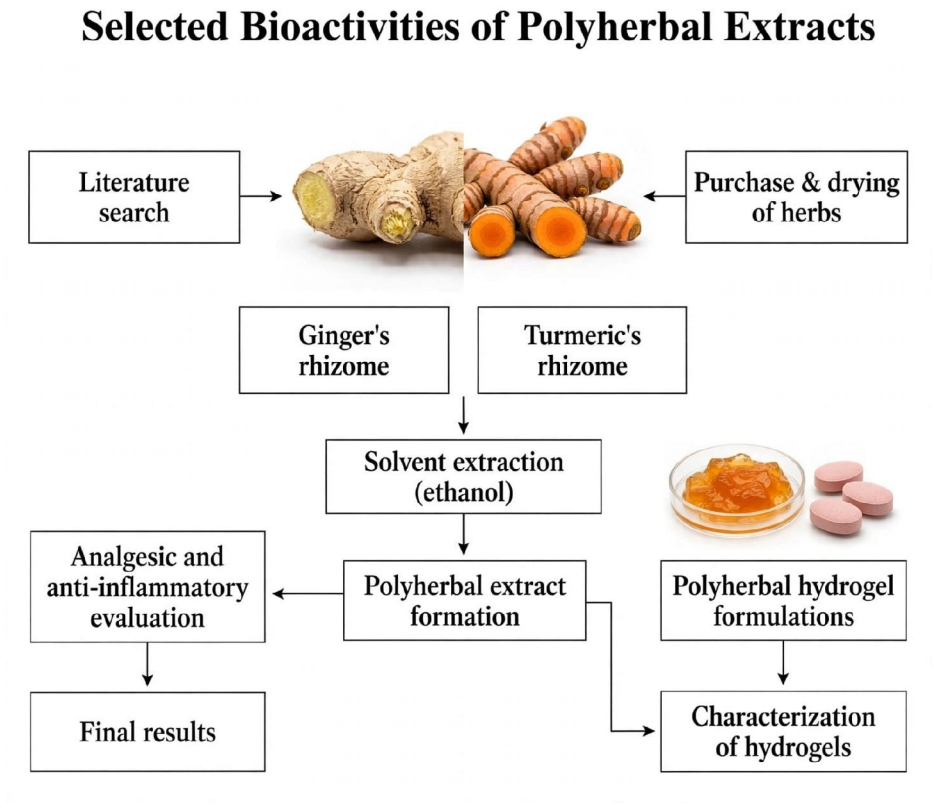
b. Preparation of Gel Base

The ginger gel is built around Zingiber officinale extract, whose bioactive constituents, such as gingerols and shogaols, may have anti-inflammatory potential. Carbopol 940 acts as the gelling agent that gives the semisolid body. To begin, Carbopol 940 is dispersed in purified water and left until fully hydrated. Then ginger extract premixed with propylene glycol is slowly added to the hydrated base while stirring, and triethanolamine is put in drop by drop to set the pH and form the gel. The final gel is blended to uniformity and examined for pH, viscosity, spreadability and stability.[11]

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c. Incorporation of herbal extract

Slowly and under continuous stirring, the ginger extract is blended into the gel base for even distribution. Carbopol 940 or sodium CMC serves as the gelling agent that holds the consistency. The blend is stirred until it becomes a smooth, uniform gel without lumps or trapped air, and pH is adjusted when required for skin use. The gel is then assessed for appearance, pH, viscosity, spreadability, drug content and stability before being packed in clean, well-closed containers and stored under proper conditions.[12]



III. EVALUATION

pH: Each gel, including the polyherbal gel, had its pH read on a digital pH meter.

Appearance and Homogeneity: Every formulation was visually inspected for colour, consistency and uniformity.

Viscosity: Viscosity was determined on a Brookfield viscometer (Model RVTDV II), using spindle no. 6 at a speed of 100 rpm.

Spreadability: A 1 g portion of gel was placed between two glass plates under a 125 g weight, and the spread diameter was recorded after one minute.

Skin irritation studies: The gel was applied daily for seven days to shaved skin on Wistar rats (150–200 g), after which the area was examined for any redness or swelling.

Extrudability: Gels were loaded into collapsible tubes and squeezed, and the percentage of gel expelled was calculated to indicate how easily it extrudes.

Stability study: The formulations were subjected to stability testing following ICH guidelines.

Primary Dermal Irritation Index (PDII): The gels were categorised as irritant or non-irritant based on the skin reactions seen.[13]

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IV. FUTURE SCOPE

A polyherbal gel made from turmeric and ginger could be developed further into a topical herbal product. Future research may concentrate on boosting its stability, safety and effectiveness. Investigating skin irritation, anti-inflammatory action and storage over a long period would help show whether it is appropriate for skin use, and its prospects as a marketed herbal product might also be studied.

V. CONCLUSION

Polyherbal gels are a fresh and effective option for combination therapy built on natural plant extracts. Combining herbs that act in different pharmacological ways can raise efficacy, safety and user satisfaction. Their action on several targets, simple application on the skin and pleasant look make them a useful alternative to synthetic products. To be established as trustworthy therapeutic agents in modern medicine, they still require standardisation, optimisation and clinical validation.

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