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# FORMULATION AND EVALUATION OF POLYHERBAL ANTI- INFLAMMATORY GEL CONTAINING MORINGA OLEIFERA AND CURCUMA LONGA

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## ABSTRACT

Herbal medicines are widely used for primary healthcare due to their natural origin, cultural acceptance, and minimal side effects. The present study aimed to formulate and evaluate a polyherbal anti-inflammatory gel containing Moringa oleifera and curcumin extracts for topical drug delivery. Carbopol 934 and propylene glycol were used as the gel base and penetration enhancer. The prepared gel formulations were evaluated for parameters such as compatibility, viscosity, drug content, spreadability, swelling index, and stability. The formulations showed good consistency, optimum spreadability, stable behavior, and effective anti-inflammatory activity without causing skin irritation. The study concludes that the polyherbal gel may serve as a safe and effective topical treatment for inflammatory conditions.

**KEYWORDS:** Gel, Curcumin, Moringa, anti-inflammatory.

## INTRODUCTION

Inflammation is a protective biological response of the body against harmful stimuli such as pathogens, irritants, damaged cells, or toxic substances. It is characterized by redness, swelling, heat, pain, and loss of function. Although inflammation helps in tissue repair and healing, prolonged inflammation may lead to chronic diseases such as arthritis, cardiovascular disorders, diabetes, and skin diseases. Conventional anti-inflammatory drugs like NSAIDs and steroids are effective but may cause side effects such as gastric irritation, ulcers, and kidney damage during long-term use. Therefore, herbal medicines are gaining attention due to their safety, effectiveness, and fewer adverse effects.

Moringa oleifera is a well-known medicinal plant belonging to the family Moringaceae and is widely used in traditional medicine due to its therapeutic properties. The leaves, seeds, bark, and roots of Moringa contain various bioactive compounds such as flavonoids, tannins, saponins, alkaloids, phenolic compounds, and vitamins, which contribute to its pharmacological activities. Moringa exhibits significant anti-inflammatory activity by inhibiting the release of inflammatory mediators such as prostaglandins, cytokines, cyclooxygenase (COX), and lipoxygenase (LOX) enzymes. It also possesses strong antioxidant properties that help reduce oxidative stress associated with inflammation. Due to these properties, Moringa oleifera is widely used in the treatment of pain, swelling, wounds, arthritis, and skin inflammation, making it a promising natural anti-inflammatory agent for herbal formulations.

Curcuma longa possesses strong anti-inflammatory activity mainly due to the presence of curcumin, its major active constituent. Curcumin inhibits inflammatory mediators such as prostaglandins, cytokines, and enzymes like cyclooxygenase (COX) and lipoxygenase (LOX). It also suppresses inflammatory pathways such as NF-κB and exhibits antioxidant properties, which help reduce pain, swelling, and tissue inflammation. Therefore, Curcuma longa is widely used in herbal formulations for the treatment of wounds,

arthritis, and skin inflammation.

**MATERIAL AND METHODS MORINGA OLEIFERA**

**Synonym:** Horseradish tree, Shigru and Drumstick tree
**Biological Source:** Moringa oleifera is obtained from the fresh or dried leaves, seeds, roots, bark, and pods of the plant Moringa oleifera Lam.
**Family:** Moringaceae

**EXTRACTION PROCEDURE OF MORINGA OLEIFERA: PROCEDURE**

1. Extraction Process of Moringa oleifera
2. Collection of fresh Moringa leaves
3. Washing to remove dust and impurities
4. Shade drying at room temperature
5. Grinding dried leaves into coarse powder
6. Soaking powder in ethanol/methanol (maceration)
7. Keeping for 48–72 hours with occasional stirring
8. Filtration using muslin cloth or filter paper
9. Concentration of filtrate by solvent evaporation
10. Collection of semisolid extract
11. Storage in airtight container for further use

**PRIMARY PHYTOCHEMICAL SCREENING OF MORINGA OLEIFERA**

| Sr. No | Component | Test | Inference |
|---|---|---|---|
| 1. | Alkaloids | Dragendorff's Test | Positive |
| 2. | Flavonoids | Shinoda Test | Positive |
| 3. | Tannins | Ferric Chloride Test | Positive |
| 4. | Saponins | Foam Test | Positive |
| 5. | Glycosides | Keller-Killiani Test | Positive |
| 6. | Proteins | Biuret Test | Positive |

**CURCUMA LONGA**

**Synonym:** Haldi, Rhizoma Curcumae Longae
**Biological Source:** The biological source of Curcuma longa is the dried and fresh rhizomes of Curcuma longa Linn., belonging to the family Zingiberaceae.
**Family:** Zingiberaceae

**MACERATION PROCEDURE FOR CURCUMA LONGA**

1. Collection of rhizomes of Curcuma longa
2. Cleaning, washing, and drying of rhizomes
3. Grinding into coarse or fine powder
4. Transfer of powdered drug into a closed container
5. Addition of suitable solvent (ethanol / methanol /

water)
6. Soaking for 3–7 days with occasional stirring
7. Filtration to separate liquid extract from marc (residue)
8. Collection of filtrate (extract solution)
9. Concentration of filtrate by evaporation or water bath
10. Drying and storage of the final Curcuma extract

**PHYTOCHEMICAL SCREENING OF CURCUMA LONGA**

| Sr. No | Component | Test | Inference |
|---|---|---|---|
| 1. | Alkaloids | Dragendorff's Test | Positive |
| 2. | Flavonoids | Shinoda Test | Positive |
| 3. | Tannins | Ferric Chloride Test | Positive |
| 4. | Glycosides | Keller-Killiani Test | Positive |
| 5. | Carbohydrates | Molisch's Test | Positive |
| 6. | Test for Curcuminoid | Boric Acid Test | Positive |

**PROCEDURE FOR PREPARATION OF ANTI-INFLAMMATORY GEL FORMULATION TABLE**

| Sr. No | Ingredient | (F3) | (F4) |
|---|---|---|---|
| 1. | Moringa Oleifera Extract | 1ml | 1ml |
| 2. | Curcuma longa extract | 4ml | 6ml |
| 3. | Carbopol | 2 gm | 2 gm |
| 4. | Polyethylene glycol | 7.5ml | 7.5ml |
| 5. | Methyl paraben | 0.9gm | 0.9gm |
| 6. | Propyl paraben | 0.01gm | 0.01gm |
| 7. | Glycerine | 2.5ml | 2.5ml |
| 8. | Triethanolamine | 2ml | 2ml |
| 9. | Alcohol | 7.5ml | 7.5ml |
| 10. | Rose Water | Q. S | Q. S |
| 11. | Distilled Water | Q. S | Q. S |

**PROCEDURE**

**Step 1: Preparation of Carbopol Gel Base**

Accurately weigh 2 g of Carbopol and disperse it slowly in a sufficient quantity of distilled water with continuous stirring to avoid lump formation.

Allow the dispersion to stand for about 24 hours for complete hydration and swelling of Carbopol.

**Step 2: Preparation of Preservative Solution**

Dissolve 0.9 g methyl paraben and 0.01 g propyl paraben in 7.5 ml alcohol using gentle stirring.

Add 7.5 ml polyethylene glycol (PEG) and 2.5 ml

glycerine to the above solution and mix properly until a clear mixture is obtained.

**Step 3: Incorporation of Herbal Extracts**
Add 1 ml Moringa oleifera extract to the prepared mixture. Add Curcuma longa extracts according to formulation batches:

F3 = 4 ml F4 = 6 ml

Stir continuously to obtain a uniform herbal mixture.

**Step 4: Preparation of Gel**
Add the herbal mixture slowly into the hydrated Carbopol gel base with continuous stirring.

Add 2 ml triethanolamine dropwise to neutralize Carbopol and to form a smooth gel consistency.

Add rose water and sufficient quantity of distilled water (Q.S.) to obtain the desired final volume and consistency.

**Step 5: Final Processing**
Stir the formulation continuously until a homogeneous gel is formed. Remove entrapped air by keeping the gel undisturbed for some time.

Transfer the prepared gel into a suitable airtight container and store at room temperature.

**EVALUATION OF ANTI-INFLAMMATORY GEL**
The prepared gel was evaluated using a range of parameters in accordance with conventional protocols.

**Physical Evaluation**
In this test, the gel was observed for colour, odour, appearance, structure.

| Sr. No | Parameters | Formulation (F3) | Formulation (F4) |
|---|---|---|---|
| 1. | Colour | Yellow Green | Yellow Green |
| 2. | Odour | Characteristic Herbal | Characteristic Herbal |
| 3. | Appearance | Smooth | Smooth |
| 4. | State | Semi- Solid | Semi- Solid |

**pH**
The pH of the prepared formulation was measured using a digital pH Meter.


| Sr. No | Formulation | pH |
|---|---|---|
| 1. | Formulation | 4.20 |
| 2. | Formulation | 4.73 |
| 3. | Formulation | 5.21 |

**Spreadability**
The spreadability was determined by placing sample between two glass slides which was compressed to uniform thickness by applying definite time period.

Where, S = L*M/ T

| Sr. No | Formulation | Time(sec) | Spreadability |
|---|---|---|---|
| 1. | Formulation (F3) | 12 | 23.6 |
| 2. | Formulation (F4) | 07 | 29.2 |
| 3. | Formulation (F5) | 20 | 17.9 |

**Consistency**
Smooth and no greeting is observed.

## RESULT AND DISCUSSION

The polyherbal anti-inflammatory gel containing Moringa oleifera and Curcuma longa extracts was prepared successfully and evaluated for various physicochemical parameters. The formulation showed good appearance, homogeneity, stability, spreadability, extrudability, pH, viscosity, and drug content uniformity, indicating suitability for topical application. Good homogeneity and smooth consistency are essential for patient acceptability and uniform drug distribution. The prepared gel showed satisfactory aesthetic properties suitable for topical use. The following are the outcomes of the same.

## PRELIMINARY PHYTOCHEMICAL SCREENING

Alkaloids, flavonoids, phenols, tannins, saponins, glycosides, terpenoids, steroids, carbohydrates, proteins, and amino acids were found to be present in the ethanolic extract of Moringa oleifera according to phytochemical screening. The presence of these constituents was confirmed by Mayer's test, Shinoda test, ferric chloride test, foam test, Keller–Killiani test, Salkowski test, Molisch test, and Ninhydrin test, which showed positive result.

Phytochemical screening of Curcuma longa confirms the presence of curcuminoids, phenols, flavonoids, tannins, alkaloids, saponins, and essential oils. These constituents are responsible for its medicinal and antioxidant properties.

**Evaluation of Gel**
**Physical Evaluation**

1. **Colour –** Yellow Green
2. **Odour –** characteristic Herbal
3. **Appearance –** Smooth
4. **State –** Semi-solid

**pH**
The pH of the formulated polyherbal gel was found to be within the suitable skin pH range, indicating good compatibility for topical application.

**Spreadability**
The formulated polyherbal gel showed good spreadability, indicating easy application and uniform distribution on the skin surface.

**consistency**
The formulated polyherbal gel showed smooth and homogeneous consistency with good appearance and ease of application.

## CONCLUSION

The formulated polyherbal anti-inflammatory gel containing Moringa oleifera and Curcuma longa was successfully prepared using a suitable gel base and evaluated for various physicochemical parameters. The results of the evaluation studies such as pH, homogeneity, viscosity, spreadability, extrudability, and stability indicated that the formulation possesses acceptable gel characteristics for topical application. The incorporation of phytoconstituents like flavonoids, phenols, and curcuminoids contributes to the potential anti-inflammatory and antioxidant activity of the formulation. Overall, the developed polyherbal gel can be considered a promising, safe, and effective topical herbal formulation for the management of inflammation, with scope for further in vitro and in vivo pharmacological studies.

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