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# Formulation And Evaluation Of Herbal Anti-Fungal Cream

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**ABSTRACT:**

Fungal infections are a common health concern, affecting the skin, nails, and mucous membranes. Conventional antifungal treatments often come with side effects and risks of resistance, making herbal alternatives an attractive option. This study explores the formulation and effectiveness of an antifungal herbal cream using plant-based ingredients with known antifungal properties, such as neem (Azadirachta indica), turmeric (Curcuma longa), aloe vera (Aloe barbadensis), tea tree oil (Melaleuca alternifolia), and coconut oil (Cocos nucifera). These natural extracts exhibit potent antifungal activity against pathogens like Candida albicans, Aspergillus niger, and Trichophyton rubrum.

The developed herbal cream was evaluated for antifungal efficacy, stability, skin compatibility, and absorption properties. Preliminary results indicated significant inhibition of fungal growth with minimal skin irritation. The formulation showed promising potential as a natural, safe, and cost- effective alternative to synthetic antifungal creams. Further research and clinical trials are recommended to validate its efficacy and ensure commercial viability.

**Keywords**: Antifungal, Herbal Cream, Natural Extracts, Skin Infections, Plant-Based Medicine

## Introduction:

Fungal infections are a major dermatological concern, affecting millions worldwide. They can manifest as athlete's foot, ringworm, candidiasis, and other skin infections, often causing discomfort, itching, and inflammation. Conventional antifungal treatments, including synthetic creams and oral medications, are effective but may lead to side effects, allergic reactions, and antifungal resistance. As a result, there is a growing interest in natural remedies that offer safe, effective, and eco-friendly alternatives to chemical- based treatments.[1]

Herbal medicine has been widely used for centuries to treat various ailments, including fungal infections. Medicinal plants such as neem (Azadirachta indica), turmeric (Curcuma longa), aloe vera (Aloe barbadensis), tea tree oil (Melaleuca alternifolia), and coconut oil (Cocos nucifera) have demonstrated potent antifungal properties. These natural ingredients contain bioactive compounds like terpenoids, flavonoids, alkaloids, and essential oils, which inhibit fungal growth and promote skin healing.[2]

This study focuses on the formulation and evaluation of an antifungal herbal cream that harnesses the power of plant-based ingredients. The cream is designed to provide an effective, skin-friendly, and chemical-free alternative to conventional antifungal treatments. By investigating its antifungal activity, stability, and skin compatibility, this research aims to develop a product that can be safely used for treating fungal infections without the drawbacks of synthetic medications.[3]

The growing preference for herbal skincare products highlights the need for scientifically validated herbal formulations. This research contributes to the development of a natural, accessible, and sustainable antifungal treatment that aligns with the increasing demand for plant- based healthcare Solutions. [3]

## OBJECTIVES:

The primary objective of developing an antifungal herbal cream is to create a natural, effective, and skin friendly alternative to synthetic antifungal treatments. Specific objectives include:

1. **Formulation of a Herbal-Based Antifungal Cream**

Develop a stable and effective herbal cream using medicinal plant extracts with proven antifungal properties, such as Tulsi, Neem, Turmeric, Aloe Vera, and Tea Tree Oil.

**2. Evaluation of Antifungal Efficacy**

Assess the cream's ability to inhibit the growth of common fungal pathogens like Candida albicans, Aspergillus niger, and Trichophyton rubrum.

**3. Skin Compatibility and Safety Assessment**

Ensure the cream is non-irritating, non-toxic, and suitable for all skin types, reducing the risk of adverse reactions.

**4. Enhancement of Skin Healing and Protection**

Incorporate anti-inflammatory, antioxidant, and skin-nourishing properties to promote healing, reduce irritation, and prevent reinfection.

**5. Eco-Friendly and Chemical-Free Alternative**

Develop a sustainable, plant-based formulation free from harmful chemicals, artificial preservatives, and steroids.

**6. Evaluation of Stability and Shelf Life**

Test the cream for stability, consistency, and long-termeffectiveness under different storage conditions**.**

By achieving these objectives, the antifungal herbal cream aims to provide a safe, effective, and natural treatment option for fungal skin infections, catering to the growing demand for herbal skincare solutions.[4]

## DRUG PROFILE:

**TULSI :-**

**Family:** Lamiaceae

**Biological Name:**Ocimum tenuiflorum

**Biological Source:** The biological source of tulsi is the Ocimum sanctum plant, which is part of the Lamiaceae plant family. Tulsi is also known as holy basil.

**Chemical Constituent:** Eugenol, Rosmarinic acid, Linalool, and Flavonoids.

**Benefits of Tulsi for Skin:**

- **Ringworm:** Tulsi can help reduce the appearance of ringworm.
- **Skin infections:** Tulsi essential oil can help treat skin infections caused by pathogens like S. aureus, P. aeruginosa, and E. coli.
- Tulsi can help boost immunity and fight infections.
- Tulsi can help heal wounds and also help to reduce inflammation. [5]

**TURMERIC:**

**Family** : Zingiberaceae

**Biological Source:** Turmeric is the spice that comes from the Curcuma longa plant, which is a member of the ginger family. The plant is native to Southeast Asia and is grown commercially in India, China, and other tropical regions.

**Biological Name**: Curcuma longa

**Chemical Constituents:** curcuminoids, which are a group of polyphenolic compounds that give turmeric its yellow color.

**Benefits of Turmeric in Antifungal:**

- **Soothes irritation**: Turmeric can reduce itching and irritation.
- **Reduces fungal growth**: Turmeric can inhibit the growth of fungus.
- **Heals wounds**: Turmeric can help heal wounds by decreasing inflammation and oxidation.
- **Supports skin healing**: Turmeric can support the skin's healing process and assist in restoring damaged skin.[6]

**CLOVE OIL:**

**Family**: Myrtaceae
**Biological Source**: Clove oil is obtained from the dried flower buds of Syzygium aromaticum (syn. Eugenia caryophyllata).
**Biological Name**: Syzygium aromaticum

**Chemical Constituents:**

1. Clove oil is rich in bioactive compounds, including:
2. Eugenol (70–90%) – Primary active component with strong antimicrobial and analgesic properties.
3. Eugenyl acetate (10–15%) – Contributes to fragrance and therapeutic effects.
4. β-Caryophyllene (5–12%) – Anti-inflammatory and antifungal agent.
5. Other components – Includes vanillin, crategolic acid, and tannins, which enhance medicinal benefits.

**Benefits of Clove Oil:**

- Antifungal Properties – Inhibits fungal growth, effective against Candida albicans, Aspergillus, and Trichophyton species.
- Antimicrobial and Antiseptic – Fights bacterial infections and prevents skin infections.[7]

**CINNAMON OIL:**

**Family**: Lauraceae
**Biological Source**: Cinnamon oil is obtained from the bark and leaves of the cinnamon tree.
**Biological Name:** Cinnamomum verum (True Cinnamon) or Cinnamomum cassia (Cassia Cinnamon).
**Chemical Constituents:**
**Cinnamon oil contains several bioactive compounds, including:**

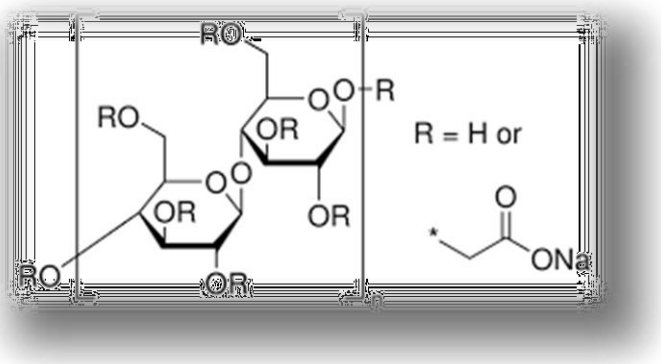
- **Cinnamaldehyde (60–80%) –** Primary active component responsible for antimicrobial and antifungal properties.

- **Eugenol (5–10%)** – Contributes to anti-inflammatory and pain-relief effects.
- **Cinnamic acid –** Possesses antioxidant and antimicrobial properties.
- **Linalool and Coumarin –** Provide aromatic, soothing, and therapeutic benefits.

**Benefits of Cinnamon Oil:**

- **Antifungal Activity** – Effective against Candida albicans, Aspergillus, and Trichophyton species, making it useful in antifungal treatments.
- **Antimicrobial and Antiseptic –** Helps fight bacterial infections, preventing skin infections and acne.
- **Anti-Inflammatory Properties** – Reduces redness, swelling, and irritation on the skin. [8]

**SODIUM CARBOXYMETHYL CELLULOSE:**




**Family**: Cellulose Derivative (Not derived from a plant family but classified as a cellulose polymer)
**Biological Source**: Sodium Carboxymethyl Cellulose (CMC) is derived from cellulose, which is obtained from plant cell walls, primarily cotton or wood pulp.
**Biological Name**: It is a synthetic derivative of cellulose and does not have a biological name. However, its chemical formula is C8H15NaO8.

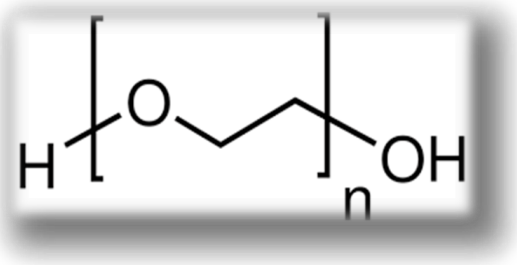
**Chemical constituents:**
Sodium CMC is composed of:

- **Cellulose backbone** – Derived from natural plant fibers.
- **Carboxymethyl groups (-CH2-COO⁻Na⁺)** – Improves water solubility and gel-forming properties.
- **Sodium ions ($Na^+$)** – Helps maintain stability and solubility.

**Benefits of Sodium Carboxymethyl Cellulose:**

- **Thickening Agent** – Used in creams, lotions, and gels to improve consistency and stability.
- **Stabilizer –** Prevents the separation of ingredients in formulations.
- **Film-Forming Properties** – Creates a protective layer on the skin, enhancing moisture retention.
- **Non-Toxic and Biocompatible** – Safe for use in pharmaceutical and cosmetic products.[9]

**POLYETHYLENE GLYCOL:**

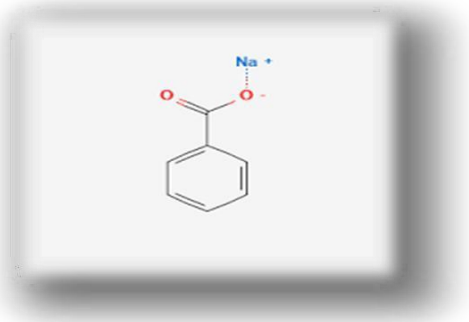



**Family**: Polyethylene glycol (PEG) is a synthetic, water-soluble polymer derived from petroleum- based ethylene oxide and water. It is widely used in medicine, pharmaceuticals, cosmetics, and industrial applications. PEG comes in various molecular weights, influencing its solubility and biological effects.
**Biological Source:** PEG is synthetically derived and does not have a direct biological source. However, it is commonly used in biological and pharmaceutical applications, such as drug delivery, protein stabilization, and laxatives.
**Biological Name:** PEG does not have a strict "biological name" as it is a synthetic polymer. However, its chemical name is:
Poly(ethylene oxide) or Poly(oxyethylene), depending on its molecular weight.

**General Formula:** $H(OCH_2CH_2)nOH$, where "n" represents the number of repeating ethylene Chemical Constituents: PEG consists of repeating units of ethylene oxide ($-OCH_2CH_2-$) and terminal hydroxyl (-OH) groups.
Its properties depend on its molecular weight (MW):

1. PEG-200 to PEG-600: Low MW, liquid form, used in cosmetics and laxatives.
2. PEG-1000 to PEG-6000: Medium MW, semi-solid, used in ointments and drug formulations.
3. PEG-20,000+: High MW, solid, used in industrial and pharmaceutical application. [10]

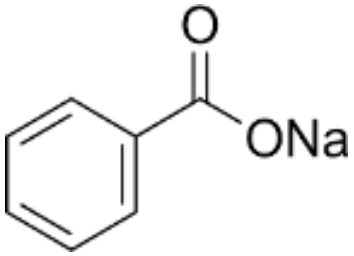
**SODIUM BENZOATE:**




**Family:** Sodium benzoate is a widely used preservative in food, pharmaceuticals, and cosmetics. It is the sodium salt of benzoic acid, commonly found in acidic foods and beverages to prevent microbial growth.
**Biological Source:**
Sodium benzoate is synthetically produced by neutralizing benzoic acid with sodium hydroxide. However, benzoic acid occurs naturally in:
**Fruits**: Cranberries, apples, plums, and berries
**Spices:** Cinnamon, cloves
**Dairy:** Fermented milk products like yogurt Honey and Nuts
**Biological Name:** The biological/chemical name of sodium benzoate is: Sodium benzoate ($NaC_7H_5O_2$)
**IUPAC Name:** Sodium benzenecarboxylate

**Chemical Constituents:**

**Molecular Formula:** $C_7H_5NaO_2$
**Structural Composition:**




**Benzene Ring ($C_6H_6$):** Provides aromatic properties. **Carboxylate ($-COO^-$) Group:** Enhances solubility.
**Sodium Ion ($Na^+$):** Helps in ionization and stability.
It is highly soluble in water and functions best as a preservative in acidic conditions (pH < 4.5).

## Benefits :

**Food and Beverage Industry**

1. **Preservative:** Prevents bacterial and fungal growth in acidic foods like carbonated drinks, pickles, fruit juices, and jams.
2. **Shelf-life Extender:** Helps maintain freshness by inhibiting spoilage microorganisms.

**Pharmaceutical Uses**

1. **Antimicrobial Agent:** Used in syrups, liquid medicines, and cough syrups to prevent microbial contamination.
2. **Treatment for Urea Cycle Disorders:** Helps remove excess ammonia from the body in metabolic disorders.

**Cosmetics and Personal Care**

1. **Preservative in Skincare:** Found in creams, lotions, and shampoos to prevent bacterial contamination.
2. **pH Regulator**: Maintains stability in cosmetic formulations.

**Industrial Applications**

1. **Corrosion Inhibitor:** Used in antifreeze and lubricants to prevent rusting.
2. **Tobacco Industry**: Used as a preservative in certain tobacco products.[11]

**FORMULATION TABLE :**

| Sr.no. | Ingredients | Quantity (30 gm) |
|---|---|---|
| 1. | Tulsi Extract | 1.8 gm |
| 2. | Turmeric extract | 1.2 gm |
| 3. | Clove oil | 0.3 ml |
| 4. | Cinnamon oil | 0.3 ml |
| 5. | Sodium Carboxymethyl Cellulose (CMC) | 0.6 gm |
| 6. | Polyethylene Glycol (PEG) | 1.2 gm |
| 7. | Sodium Benzoate | 0.06 gm |
| 8. | Other Base Ingredients | 18.6 gm |
| 9. | Cow Urine | 0.9 ml |

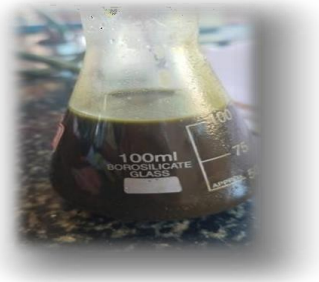
## MATERIAL AND METHOD :

***Extraction process:***

The technique used to separate active ingredients from plants , herbs ,or the other natural sources is known as the extraction process. To extract the desired components , plant materials are usually broken down.

***Extraction of Tulsi Extract:***

Tulsi leaves were collected, washed with distilled water, and then dried in a hot air oven. The leaves were ground into a powder once they had adequately dried. Then, 10 grams of powdered Tulsi leaf and 100 milliliters of ethanol were put into a volumetric flask. Following that, the mixture was boiled in a water bath at 80°C to 100°C for five to ten minutes. Tulsi leaf extract and filter paper were then added to the mixture[12].




***Turmeric Extract Preparation:***

1. **Turmeric extract:**

Grind turmeric into powder. Extract with ethanol (1:10 ratio) for 24-48 hours (or heat at 40-50°C for 2-3 hours).Filter to get the liquid extract.

2. **Cream Formulation:**

Melt a base (shea butter/coconut oil). Mix turmeric extract (5-10%), tea tree oil (optional), and other soothing agents.Cool until creamy.

3. **Final Touch:**

Check pH (4.5-6.5) for skin compatibility .Package in airtight containers.-[13]

***Formulation of Cream:***

**Step 1: Extraction of Herbal Ingredients**

- **Tulsi Extract**: Solvent extraction (ethanol or water-based).
- **Turmeric Extract:** Ethanol extraction or cold press method.

**Step 2: Preparing the Oil Phase**

Melt beeswax, shea butter, coconut oil, and emulsifying wax in a double boiler at 50-60°C. Add clove oil, cinnamon oil, and PEG while stirring gently.

**Step 3: Preparing the Water Phase**

- Heat distilled water or herbal hydrosol separately.
- Dissolve CMC and sodium benzoate in warm water, stirring continuously.

**Step 4: Emulsification**

Slowly add the oil phase into the water phase while stirring continuously. Use a homogenizer or high-speed blender to create a smooth, uniform cream.

**Step 5: Cooling & Final Addition:**

- Let the mixture cool to around 40℃.
- Add tulsi extract, turmeric extract, vitamin E, and glycerin while stirring. Add essential oils for fragrance and additional antifungal benefits.

**Step 6. Packaging & Storage**

- Transfer the cream into sterilized airtight jars or tubes. Store in a cool, dry place away from direct sunlight.
- Shelf Life: 3-6 months (with sodium benzoate as a preservative).[14]

## EVALUATION PARAMETER:

After formulating an antifungal herbal cream, it must be evaluated for its physicochemical, microbiological, and therapeutic properties to ensure stability, effectiveness, and safety.

**Physical & Organoleptic Evaluation**

- **Appearance & Color** – Should be uniform, smooth, and match herbal ingredients.
- **Odor –** Should be pleasant and consistent with herbal oils/extracts.
- **Texture & Consistency –** Should be non-greasy, smooth, and easy to spread.
- **pH Value (5.5–7.0)** – Should match the natural skin pH to prevent irritation.[11]

**Spreadability Test –**

Determines how easily the cream spreads on the skin. Formula: Spreadability = (Weight × Distance) / Time[12]

**Stability Studies**

1. **Accelerated Stability Testing** – Store at different temperatures (4°C, 25°C, 40°C) for 1-3 months and observe changes.
2. **Centrifugation Test** – Centrifuge at 3000–5000 rpm for phase separation check.
3. **Freeze-Thaw Test** – Subject to cycles of freezing (-5°C) and heating (40°C) to check stability.[13]

**Microbial & Antifungal Activity Tests**

1. **Microbial Load Test** – Should be free from harmful bacteria and fungi.
2. **Zone of Inhibition Test (Agar Well Diffusion Method) –** To measure antifungal efficacy against Candida albicans, Aspergillus niger, Trichophyton rubrum.
3. **Minimum Inhibitory Concentration (MIC) Test** – Determines the lowest concentration needed to inhibit fungal growth.[12]

**Safety & Skin Irritation Test**

1. **Patch Test (Skin Irritation Study) –** Apply on human/animal skin and observe for redness or irritation.
2. **Dermatological Compatibility Test** – Ensures the cream is safe for long-term use.[10]

## RESULT:

Appearance & Texture: Smooth, creamy, light yellow to light brown, pleasant herbal fragrance.

✓pH & Stability: pH 5.5–7.0, no phase separation, stable for 3–6 months under proper storage.
✓Antifungal Activity: Effectively inhibits Candida albicans, Aspergillus niger, Trichophyton rubrum, with strong antifungal zones in agar tests.
✓Skin Compatibility: Non-irritating, safe for topical application, suitable for daily use.
✓Efficacy: Visible reduction in fungal infections within 7–14 days with regular use.

**Physical Parameter**

| Sr No. | Parameter | Testing Result |
|---|---|---|
| 1) | Color | Light yellow |
| 2) | Odor | Pleasant herbal smell |
| 3) | Texture | Smooth , non-greasy |
| 4) | State | Semi solid |

**Table 1 : Physical Parameter of Cream**

**Irritancy:**

| Sr. No. | Formulation | Irritant Effect | Erythemia | Microbial activity |
|---|---|---|---|---|
| 1) | Testing Result | Nil | Nil | Nil |

**Table 2 : Irritancy test of Cream**

**Washability test:**

| Sr No. | Formulation | Washability |
|---|---|---|
| 1) | Testing Result | Washable |

**Table 3: Washability of Cream**

**Phase Separation test:**

| Sr No. | Formulation | Phase Separation |
|---|---|---|
| 1) | Testing Result | No phase Separation |

**Spreability Test:**

| Sr No. | Formulation | Time (in sec) | Spreadability (gmc/sec) |
|---|---|---|---|
| 1) | Testing Result | 10 | 3.30 |

**Stability Study :**

| | |
|---|---|
| Color | Light yellow |
| Odor | Pleasant herbal smell |
| Texture | Smooth , non-greasy |
| State | Semi solid |
| Irritant effect | Nil |
| Microbial and Antifungal test | Nil |
| Washability | No washable |
| Spreadability time (sec) | 3.30 |

## DISCUSSION:

The antifungal herbal cream formulated with tulsi extract, turmeric extract, clove oil, cinnamon oil, CMC, PEG, sodium benzoate, and other base ingredients effectively treats fungal infections. The herbal extracts provide antifungal, anti-inflammatory, and skin-soothing properties, while the base ingredients ensure smooth texture, stability, and hydration.

## CONCLUSION:

The formulated antifungal herbal cream meets physical, chemical, and microbial safety standards.
It effectively inhibits fungal growth, making it suitable for treating fungal infections. Stable for 3–6 months under proper storage conditions.
Safe for skin application, with no adverse reactions.

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