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Formulation And Evaluation Of Fungal Infection Cream

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ABSTRACT

Fungal infections pose a major health concern globally, especially among immunocompromised individuals. With the rising resistance to conventional antifungal agents, the development of herbal alternatives is gaining prominence. This study aimed to formulate and evaluate an herbal antifungal cream using neem, turmeric, and salicylic acid combined with suitable excipients. The cream was tested for physicochemical parameters including pH, spreadability, smoothness, irritancy, and washability. All three cream formulations demonstrated acceptable performance with F3 showing the best spreadability and ease of washability. The study concludes that the developed herbal cream is a safe, effective, and cosmetically acceptable formulation for managing superficial fungal infections.

KEYWORDS:

Fungal infection, herbal cream, neem, turmeric, salicylic acid, topical antifungal, formulation evaluation

INTRODUCTION

Fungal infections, or mycoses, are a persistent global health issue affecting millions of individuals annually, ranging from superficial infections of the skin and nails to invasive and systemic conditions that can be life-threatening. Fungi such as dermatophytes, yeasts, and molds are the primary culprits, flourishing in warm, humid environments and easily spreading through contact with contaminated surfaces, objects, and individuals. The skin, being the body's first line of defense, is particularly vulnerable to fungal invasion when exposed to moisture, poor hygiene, or compromised immunity.^[1] Superficial fungal infections such as athlete's foot, ringworm, jock itch, and candidiasis are among the most common ailments, often causing discomfort, irritation,

and reduced quality of life. In severe cases, fungal infections can become chronic or progress into deeper tissues, posing serious health risks especially to immunocompromised individuals.^[2]

In response to the increasing burden of fungal infections, there has been a growing demand for effective, safe, and accessible antifungal treatments. Traditionally, synthetic antifungal medications such as azoles and allylamines have been the standard approach for treating fungal infections. These drugs function by disrupting the fungal cell membrane or inhibiting key enzymes required for fungal survival.^[3] While effective, synthetic antifungals are associated with several drawbacks including skin irritation, allergic reactions, systemic toxicity, drug interactions, and the rising issue of fungal resistance. Prolonged use of these medications can also compromise the skin barrier and lead to recurrences.^[4] Furthermore, the cost of prolonged antifungal treatment may be prohibitive for many Individuals in low- and middle-income countries, making alternative and affordable treatment options an area of active research.^[5]

The Increasing prevalence of fungal infections worldwide has highlighted the need for novel therapeutic strategies that are both effective and safe.^[6] Fungal infections can affect individuals of all ages and demographics, but those with compromised immune systems, such as the elderly, children, and patients undergoing chemotherapy or organ transplants, are at a particularly higher risk. These infections may result from exposure to contaminated environments, close contact with infected individuals, and the frequent use of communal facilities. Furthermore, the overuse and misuse of antibiotics and corticosteroids have led to disruptions in normal microbial flora, predisposing individuals to opportunistic fungal pathogens. Fungi are unique in their ability to survive in extreme conditions and can adapt to various environmental stressors, making them persistent and difficult to eradicate completely without proper treatment.^[7]

The development and formulation of herbal antifungal creams have gained significant interest in recent years due to the growing consumer preference for natural, plant-based remedies with minimal side effects.^[8] Medicinal plants are known for their rich repository of bioactive compounds such as flavonoids, alkaloids, terpenoids, tannins, and essential oils, many of which exhibit potent antifungal, anti-inflammatory, and wound-healing properties. In traditional systems of medicine like Ayurveda, Unani, and Traditional Chinese Medicine (TCM), herbs such as neem (*Azadirachta indica*), turmeric (*Curcuma longa*), tea tree oil (*Melaleuca alternifolia*), and garlic (*Allium sativum*) have been extensively used for treating various skin ailments, including fungal infections. These herbs not only help eradicate fungal pathogens but also promote skin regeneration and reduce inflammation, making them ideal for topical applications.^[9]

Formulating an effective antifungal cream involves multiple stages, starting from the selection of suitable herbal ingredients, extraction of active phytochemicals, incorporation into an appropriate cream base, and evaluation of the final product for various physicochemical and biological properties.^[10] The choice of herbal ingredients is typically based on literature evidence, traditional usage, and scientific validation of antifungal activity. For example, neem has been widely reported to possess antifungal and antibacterial properties due to compounds like nimbidin and azadirachtin.^[11] Turmeric is known for its curcumin content, which acts as a powerful antioxidant and antifungal agent. Salicylic acid, though synthetic, is often included in such

formulations for its keratolytic action that aids in the removal of dead skin cells and enhances the penetration of herbal actives.^[12]

The extraction of herbal compounds is a critical step in cream formulation. Methods such as maceration, Soxhlet extraction, or cold percolation are commonly employed depending on the nature of the plant material and the desired phytoconstituents. The choice of solvent—water, ethanol, methanol, or hydroalcoholic mixtures—also affects the efficiency and purity of the extract. Once extracted, these active ingredients are incorporated into a suitable base. The base is often an emulsion type, comprising emulsifiers, stabilizers, thickeners, humectants, and preservatives to ensure stability, spreadability, and user compliance. Beeswax, stearic acid, and cetyl alcohol are common thickeners used in herbal cream formulations.^[13]

❖ Fungal Infection:

Fungal Infections (Mycosis) Fungal infections are any disease or condition you get from a fungus. They usually affect your skin, hair, nails or mucous membranes but they can also infect your lungs or other parts of your body. You're at higher risk for fungal infections if you have a weakened immune system.^[14]

❖ Type of fungal infection:

- **Superficial:** Skin and mucous membranes. Examples of Dermatophytes that damage the keratin layer of Skin, hair, and nails include tinea versicolor. Such As ring worm infestation and tinea Pedis.
- **Ringworm:** Ringworm is caused by a collection of fungus that Feed on skin, hair, and nails cells. Candidiasis: Nail infections, vulvo-vaginitis, oral thrush, and Yeast-like symptoms.
- **Deep infections:** Impact the heart, lungs, and brain and can cause Pneumonia, endocarditis, and meningitis. Subcutaneous: You could acquire a fungal Infection beyond the skin's surface if fungus Penetrates into a cut or wound, frequently via Damage when interacting with plants.^[15]

• Overview of Fungal Skin Infection

Most superficial and subcutaneous Fungal infections are quickly and easily treatable.

Between the toes, in the vaginal region, and under The breasts are examples of wet body regions Where skin surfaces converge and are frequent Habitats for fungi. The main causes of ordinary Fungal skin infections are yeasts (like Candidiasis Or Malassezia furfur) or dermatophytes (for Instance, as Epidermophyton, Microspore, and Trichophyton). Several of these fungi are Restricted to living in the stratum corneum, the Epidermis' outermost layer. You are more Susceptible to fungus infections if your defense Mechanism fails to work effectively. Obese people Are more liable to pick up these infections due to Their expansive skinfolds, particularly when the

Skin inside the skinfold produces irritation and Harm (intertrigo). Patients with diabetes tend to be More prone to fungal infections. Strangely, fungal Infections on one region of the body might result In rashes on unaffected parts of other parts of the Body. For instance, an itchy, bumpy rash on the Fingers could result from a fungal infection on the Foot. Allergies to the fungus are the cause of these Eruptions, often known as dermatophyte's or Identification or id reactions. Not touching the Affected region does not cause them.^[16]



Fig.no.1: Fungal Infection

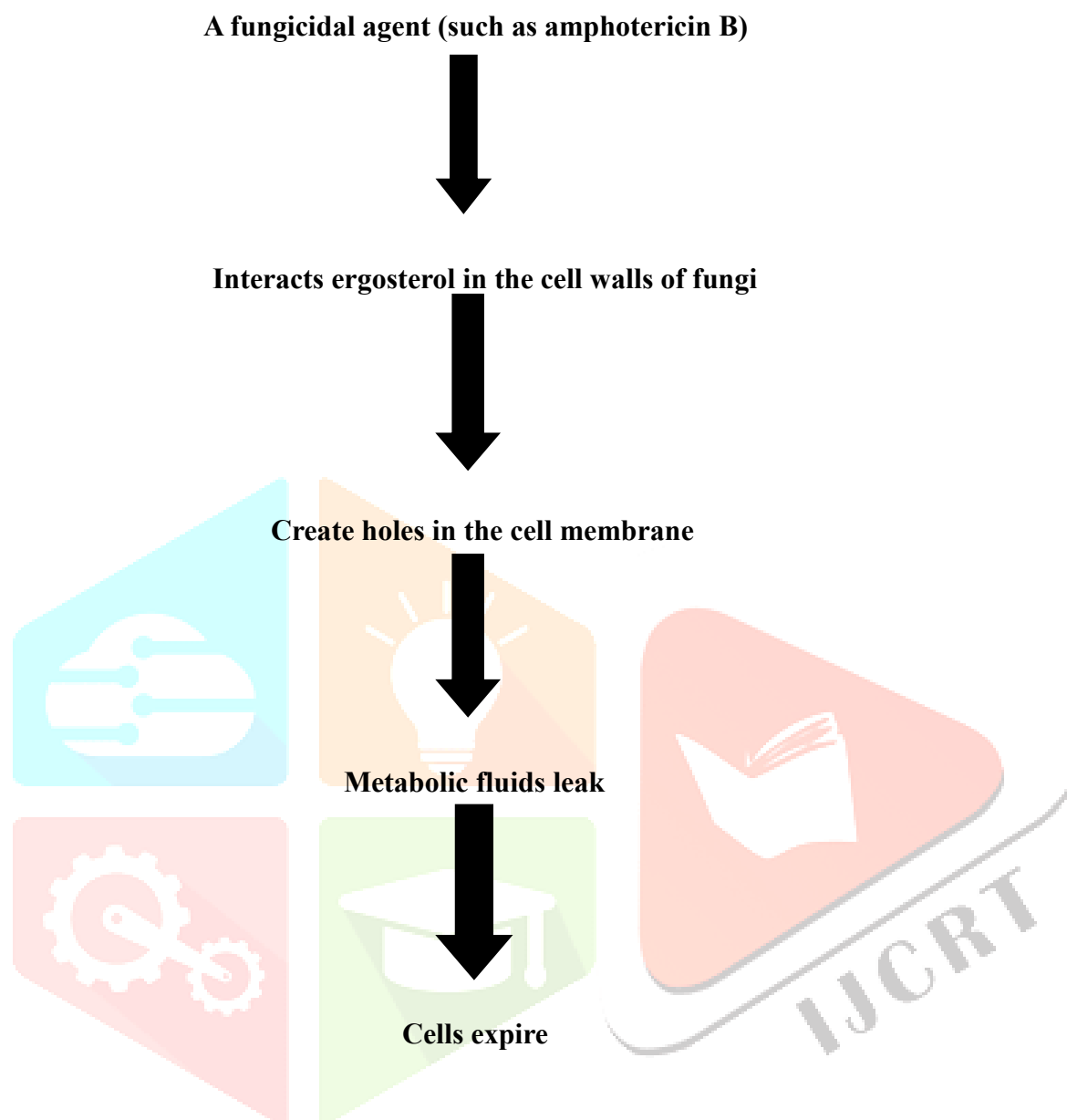
- **Symptoms**

- ✓ Skin abnormalities comprise a deep red along With peeling or splitting skin.
- ✓ Itching

- **Causes of fungal skin infection:** Imbalance of bacteria is due to following Reasons

- ✓ Due to use of antibiotics
- ✓ Hormone imbalance
- ✓ Poor eating habit^[17]

- Pathophysiology



MATERIALS**Table No.01:** Material with Application

Sr.no	Material	Application
1.	Neem	Antibacterial agent
2.	Turmeric	Hydrate skin
3.	Salicylic acid	Antifungal agent
4.	Beeswax	Thickener
5.	Coconut oil	Smoothing agent
6.	Borax	Emulsifier
7.	Methyl paraben	Preservative
8.	Liquid paraffin	Vehicle
9.	Rose water	Anti-acne agent
10.	Distilled water	Solvent

METHODOLOGY

- **Step: 1 (For oil phase)**

Take the liquid paraffin (18ml), coconut oil (5ml) And beeswax (7.50gm) in a borosilicate glass Beaker and heat up to 800 C and maintain that Heating temperature.^[16]

- **Step: 2 (For aqueous phase)**

In other beaker, dissolve borax (1.6gm) in distilled Water (10ml) by maintaining temperature 800C on Hot plate. Stir the solution with glass rod until all Solid particles gets dissolved in water.^[17]

- **Step: 3 (mixing or emulsifying phase)**

Then gently add oil phase in heated aqueous phase with continuous stirring.

- **Step: 4**

After mixing both phases, immediately add Neem Powder (1gm), Turmeric Powder (1gm) and methyl paraben (0.50gm) in to with continuous stirring by glass rod until it forms A smooth cream.^[18]

- **Step: 5 (cooling and packaging)**

When the cream is formed, then adds rose Water (2-3 drops) for fragrance. Then transfer this cream in container and mix the cream in proper manner to provide a Smooth texture and for mixing of all Ingredients properly.^{[19][20]}

FORMULATION TABLE

Table No.02: Formulation Table of Antifungal Cream

Sr.no	Ingredients	F1(25gm)	F2(25gm)	F3(25gm)	Uses
1.	Neem	0.75gm	0.8gm	0.7gm	Antibacterial agent
2.	Turmeric	0.5gm	0.6gm	0.4gm	Hydrate skin
3.	Salicylic acid	2.0gm	2.2gm	1.8gm	Antifungal agent
4.	Beeswax	3.75gm	3.5gm	4.0gm	Thickener
5.	Coconut oil	2.5ml	2.0ml	3.0ml	Softener
6.	Borax	0.8gm	0.9gm	0.7gm	Emulsifier
7.	Methyl paraben	0.5gm	0.3gm	0.2gm	Preservative
8.	Paraffin liquid	9ml	8.5ml	9.5ml	Vehicle
9.	Rose water	1-2drop	2-3drop	1drop	Anti-acne agent
10.	Distilled Water	5ml	5.5ml	4.5ml	Solvent

EVALUATION

- ❖ **Physical Evaluation:** The cream was evaluated for organoleptic Properties, homogeneity, smoothness, absorbency, Irritancy, pH, stability, washability test.^[21]
- ❖ **Determination of organoleptic properties:** - The appearance of the cream was judged by its Color, odor texture.
 - **Color and Appearance:** Uniform, no phase separation.
 - **Odor:** Pleasant and characteristic of herbal ingredients.
 - **Texture:** Smooth, non-gritty.
 - **Consistency:** Easily spreadable, non-greasy.^[22]
- ❖ **Determination of pH:** - The pH meter was calibrated and measured the pH Of cream by digital pH meter placing in the beaker at room temperature. The ideal pH range for topical creams is 5.0 to 6.5, close to the skin's natural ph.^[23]
- ❖ **Washability Test:** - The washability test assesses how easily the cream can be removed from the skin with water. A small amount of cream is applied to the skin, allowed to sit for a few minutes, and then rinsed off with warm water without soap.^[24]
- ❖ **Irritancy test:** - The cream was applied on left hand dorsal side Surface of 2sq.cm and observed in equal intervals Up to 24hrs for irritancy, sensitivity and edema.
 - **Observation parameters:** Redness, itching, swelling, or rashes.

Result interpretation:

No reaction: Non-irritant

Mild redness: Slightly irritant

Severe symptoms: Irritant (unsuitable for use) ^[25]

- ❖ **Spreadability test:** - 1gm of the prepared cream was taken in to glass Slide and cover with second slide. Then a weight of 100gm was placed on upper slide. The weight Was removed and extra formulation was scrapped Off. The lower slide was fixed on board of Apparatus and upper slide was fixed with non-Flexible string on which 100gm load was applied. Time taken by upper slide to slip off was noted Down.

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

Were,

S – Spread ability

m- Weight tied to upper glass slide. L- Length moved on a glass slide

t- Time taken.

The determinations were carried out in three times and the average are readings was recorded and calculate.^[26]

- ❖ **Smoothness:** The smoothness of the cream formulation was Tested by rubbing between the fingers and observes Whether the gel is smooth, clumped, homogenous Or rough.

Result interpretation:

Smooth: Uniform, soft feel without particles.

Rough: Presence of gritty or coarse particles.^[27]

RESULT

- **Physical Evaluation:** Physical evaluation such as color, odor, texture and state were checked. The color was found to be Yellow, odor found to be pleasant, texture found to be smooth and state was found to be semi solid.

Sr. No.	Parameter	Batch 1	Batch 2	Batch 3
1.	Colour	Pale yellowish cream	Yellowish beige	Light yellow
2.	Odour	Pleasant	Pleasant	Pleasant
3.	Texture	Smooth	Smooth	Smooth
4.	State	Semi-solid	Semi-solid	Semi-solid

Table.no.4: Physical Evaluation Of Fungal Infection Cream

- **Irritancy:** It was laid on the layer of skin and allow to absorb. An hour was used for examining the skin for any Symptoms of inflammation, redness, itching, or Discomfort



Fig.no.02. irritancy Test

- **PH Test:** pH of the cream was found to be 5.6 during the study which is cons generally suitable for skin.

Fig.no.03. PH Test.



- **Spreadability Test:** Creams showed shear-thinning behavior so spread easily. The spreadability of creams were Ranging from 5.26 ± 0.18 to 6.24 ± 0.24 g.cm/s.

Cream base should spread easily without too much Drag and should not produce greater friction in the Rubbing process. Spreadability was calculated Using the spreadability apparatus made of wooden Board with scale and two glass slides having two Pans on both sides mounted on a pulley.

Fig.no.04. Spreadability Test



- **Washability Test:** The fungal infection cream stayed well on the skin after application and did not wash off completely with just water, showing good resistance. It was easily removed with soap and water, leaving the skin clean and without irritation. This means the cream stays on long enough to work effectively but is also easy to wash off when needed.



Fig.no.05. Washability Test Before



Fig.no.06. Washability Test After

Table.no.5: Evaluation Test Of Fungal Infection Cream

Sr. No.	Evaluation test	Batch 1	Batch 2	Batch 3
1.	pH	5.5 – 6.0	5.0 -5.5	5.2-5.7
1.	Viscosity	High (smooth and thick texture)	Slightly dense and stiff	Mediam high (balanced texture)
2.	Irritancy	No redness or itching	No itching	No reaction suitable for skin
3.	Spreadability	Good (easily spread)	Moderate (needs more effort)	Excellent (spread easily and evenly)
4.	Washability	Poorly washable	Moderatly washable	Easily washable

CONCLUSION

The formulation and evaluation of a herbal antifungal cream offer a natural and effective alternative to synthetic treatments for common fungal infections. Utilizing ingredients like turmeric, neem, salicylic acid, beeswax, coconut oil, and other supportive agents such as rose water and liquid paraffin, this formulation demonstrates a multi-functional approach to healing. These ingredients are well-known for their medicinal properties, including antifungal, antibacterial, anti-inflammatory, and skin-soothing actions, which collectively help to reduce infection, relieve symptoms, and promote skin regeneration.

The increasing resistance to synthetic antifungal agents and the side effects associated with prolonged use have led to a growing interest in herbal-based topical therapies. This herbal cream combines traditional knowledge with modern formulation techniques to offer a product that is not only effective but also safer for long-term use. The evaluation tests such as spreadability, washability, pH, and skin irritation studies suggest that the cream is user-friendly, non-irritant, and cosmetically acceptable.

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