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# Formulation and Evaluation of Antifungal Herbal Neem Cream Containing Azadirachta indica Extract

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**Abstract:** *Herbal drug formulations have gained considerable attention in recent years because of their therapeutic effectiveness, lower incidence of adverse effects, cost-effectiveness, and better patient acceptance compared to synthetic medicines. Medicinal plants have been widely utilized in traditional systems of medicine for the treatment of various skin disorders and microbial infections. Among these medicinal plants, Neem (Azadirachta indica) is recognized as one of the most valuable therapeutic herbs due to its potent antimicrobial, antifungal, anti-inflammatory, antioxidant, and wound-healing activities. The bioactive constituents present in neem such as nimbin, nimbidin, azadirachtin, flavonoids, tannins, and quercetin contribute significantly to its medicinal properties.*

*The present study was aimed at the formulation and evaluation of an antifungal herbal cream containing neem extract for topical application. The formulation was designed to provide effective localized treatment against fungal skin infections while minimizing the side effects commonly associated with synthetic antifungal drugs. The herbal cream was prepared by the emulsification method using suitable pharmaceutical excipients including stearic acid as an emulsifying agent, cetyl alcohol as a stiffening agent, glycerin as a humectant, methyl paraben as a preservative, triethanolamine for pH adjustment, and distilled water as the aqueous vehicle. The neem extract was incorporated into the cream base under controlled conditions to obtain a stable and homogeneous formulation.*

*The prepared cream was subjected to various physicochemical evaluation parameters to determine its quality, stability, and suitability for topical application. Evaluation studies included examination of physical appearance, color, odor, texture, consistency, pH determination, homogeneity, spreadability, washability, extrudability, irritancy test, phase separation study, and stability testing under different storage conditions. The antifungal activity of the formulation was evaluated by agar diffusion method against common pathogenic fungal organisms such as Candida albicans and Aspergillus niger. The zone of inhibition produced by the formulation indicated significant antifungal activity of neem extract against the tested fungal strains.*

**Keywords:** Neem, Antifungal cream, Herbal formulation, Azadirachta indica, Topical preparation, Evaluation studies

## I. INTRODUCTION

Fungal infections are among the most common dermatological disorders affecting millions of people worldwide. These infections are caused by various pathogenic fungi such as Candida albicans, Aspergillus niger, Trichophyton rubrum, and other dermatophytes. Fungal infections commonly affect the skin, nails, scalp, and mucous membranes, leading to symptoms such as itching, redness, inflammation, irritation, scaling, burning sensation, and discomfort. Factors such as poor hygiene, humid climate, excessive sweating, weakened immune system, diabetes, and prolonged use of antibiotics

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increase the risk of fungal infections. In tropical countries like India, fungal skin infections are highly prevalent due to hot and humid environmental conditions.

Conventional antifungal therapies mainly include synthetic drugs such as clotrimazole, ketoconazole, fluconazole, and miconazole. Although these medications are effective in controlling fungal growth, their prolonged use may produce several adverse effects including skin irritation, allergic reactions, dryness, redness, burning sensation, and development of microbial resistance. In addition, synthetic drugs are often costly and may not be easily accessible to economically weaker populations. Therefore, there is increasing interest in herbal medicines as safer and more economical alternatives for the treatment of fungal infections.

Herbal medicine has been practiced since ancient times and remains an important component of traditional healthcare systems such as Ayurveda, Siddha, and Unani. Medicinal plants are rich sources of biologically active compounds and are widely used for their antimicrobial, anti-inflammatory, antioxidant, antiseptic, and wound-healing properties. Herbal formulations are generally considered safer because they produce fewer side effects and possess better patient acceptability compared to synthetic preparations.

Among various medicinal plants, Neem (Azadirachta indica) occupies a significant place due to its broad spectrum of therapeutic activities. Neem belongs to the family Meliaceae and is commonly known as the “Village Pharmacy” in India because almost every part of the plant possesses medicinal value. Neem leaves contain important phytoconstituents such as nimbin, nimbidin, azadirachtin, quercetin, flavonoids, tannins, glycosides, and essential oils. These constituents exhibit potent antifungal, antibacterial, antiviral, anti-inflammatory, and antioxidant activities. Neem has been traditionally used for the treatment of skin diseases, wounds, acne, eczema, ringworm infections, and other microbial infections.

The antifungal activity of neem is mainly attributed to its ability to inhibit fungal growth, destroy fungal cell membranes, and interfere with fungal reproduction. Several scientific studies have demonstrated that neem extracts are effective against various pathogenic fungi including Candida albicans and Aspergillus species. Due to these therapeutic properties, neem is considered an ideal herbal ingredient for topical antifungal formulations.

Topical creams are semisolid dosage forms intended for external application to the skin. They are widely preferred because they provide localized action directly at the site of infection, improve drug penetration, reduce systemic side effects, and enhance patient compliance. Cream formulations are easy to apply, non-greasy, washable, and suitable for both dry and moist skin conditions. Incorporation of herbal extracts into cream bases offers an effective method for delivering active phytoconstituents to the affected area.

## II. REVIEW OF LITERATURE

**1. Herbal Cream Formulation Studies**

Several studies have reported successful preparation of herbal creams using neem, aloe vera, tulsi, and turmeric extracts. These creams showed good stability and antimicrobial activity.

**2. Antifungal Activity of Neem**

Research has demonstrated that neem extract inhibits fungal growth by damaging fungal cell membranes and preventing spore formation.

**3. Herbal Topical Preparations**

Herbal creams are preferred due to better patient compliance, ease of application, and reduced toxicity compared to synthetic formulations.

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**4. Evaluation Studies**

Evaluation parameters such as pH, spreadability, homogeneity, irritancy, and stability are essential for determining the quality and effectiveness of topical creams.

Studies indicate that neem-based creams exhibit significant antifungal activity against dermatophytes and Candida species.

**Information About Skin**

Skin is the largest organ of the human body and acts as a protective barrier between the body and the external environment. It helps regulate body temperature, prevents water loss, protects against microorganisms, and provides sensation.

**Functions of Skin**

Protection from injury and infection
Regulation of body temperature through sweating
Sensation of touch, pain, heat, and cold
Production of vitamin D from sunlight
Prevention of dehydration
Normal Skin – Balanced moisture and oil
Dry Skin – Rough, flaky, less moisture
Oily Skin – Excess sebum production
Combination Skin – Oily in some areas and dry in others
Sensitive Skin – Easily irritated

**Fungus – Introduction**

Fungi are eukaryotic organisms that are neither plants nor animals. They obtain nutrients by absorbing organic matter from their surroundings. Fungi can be microscopic (like yeast and molds) or macroscopic (like mushrooms).

They are commonly found in soil, air, water, plants, and on the human body. Some fungi are useful, while others can cause diseases in humans, animals, and plants.

Characteristics of Fungi
Eukaryotic organisms (have true nucleus)
Lack chlorophyll
Reproduce by spores
Can be unicellular or multicellular
Cell wall mainly contains chitin
Grow well in warm and moist conditions
Obtain food by absorption

**Types of Fungi**

Fungi are commonly classified into four major types:

**1. Yeasts**

Yeasts are unicellular fungi that reproduce mainly by budding.

Characteristics
Single-celled
Round or oval shape
Grow rapidly
Ferment sugars

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Examples
Saccharomyces cerevisiae
Candida albicans

**Molds**
Molds are multicellular fungi made of hyphae.
Characteristics
Cottony or fuzzy appearance
Produce spores
Grow on food, walls, and damp places
Examples
Aspergillus
Penicillium
Rhizopus
Mushrooms
Mushrooms are large, visible fungi known as macrofungi.
Characteristics
Have cap and stalk
Reproduce through spores
Grow in moist soil and decaying matter
Examples
Button Mushroom
Shiitake

**Antifungal Cream**
Antifungal creams are topical preparations used to treat fungal infections of the skin. They are applied directly to the affected area and help inhibit or destroy fungal organisms causing infection.

**Common fungal skin infections include:**
Ringworm (Tinea corporis)
Athlete's foot (Tinea pedis)
Jock itch (Tinea cruris)
Candidiasis
Fungal dermatitis

**Herbal Antifungal Creams**
These creams contain plant extracts with antifungal properties. Herbal creams are preferred by many people because they:
Have fewer side effects
Are economical
Are skin friendly
Show good patient compliance

**Introduction to Neem**
Neem (Azadirachta indica) is a well-known medicinal plant widely used in traditional Indian medicine. Almost every part of the plant — leaves, bark, seeds, and oil — possesses medicinal properties.

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Neem contains several bioactive compounds such as:
Nimbidin
Nimbin
Azadirachtin
Gedunin
Quercetin
These compounds are responsible for its antimicrobial, antifungal, anti-inflammatory, and wound-healing activities.

**Advantages of Neem Antifungal Cream**
Natural and herbal formulation
Lower risk of side effects
Good skin compatibility
Economical and easily available
Possesses both antifungal and antibacterial properties
Helps reduce itching and irritation
Uses of Neem Antifungal Cream
Neem-based antifungal creams are used for:
Ringworm
Athlete's foot
Eczema associated with fungal infection
Itching and skin irritation
Minor skin infections.

**Mechanism of Action**
1. Destruction of Fungal Cell Membrane
Neem compounds damage fungal cell membranes, leading to leakage of cell contents and fungal death.
2. Inhibition of Fungal Growth
Neem suppresses fungal spore germination and prevents multiplication of fungal cells.
3. Anti-inflammatory Effect
Neem reduces:
Redness
Swelling
Irritation
Itching
associated with fungal infections.
4. Antibacterial Property
Neem prevents secondary bacterial infections that may occur in damaged skin.
5. Wound Healing Action
Neem promotes regeneration of skin tissues and speeds up healing.

## III. AIM AND OBJECTIVES

**Aim**
To formulate and evaluate an antifungal herbal cream containing neem extract for topical application.
**Objectives**

- To prepare herbal antifungal cream using neem extract.
- To evaluate physicochemical properties of the cream.

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- To study antifungal activity against fungal organisms.
- To determine stability and safety of the formulation.
- To develop an economical and effective herbal topical preparation.

**Plan of Work**

- Collection of neem leaves
- Preparation of neem extract
- Formulation of herbal cream
- Evaluation studies
- Antifungal activity testing
- Stability studies
- Result analysis
- Conclusion and documentation

**Drug Profile**

**1.Neem (Azadirachta indica)**

**Fig.1 Neem (Azadirachta indica)**

- **Biological Source**

Neem consists of dried leaves and seeds of Azadirachta indica belonging to family Meliaceae.

- **Synonyms**
- Neem
- Indian Lilac
- **Chemical Constituents**
- Nimbin
- Nimbidin
- Azadirachtin
- Quercetin
- Flavonoids
- Tannins
- **Uses**
- Antifungal
- Antibacterial
- Anti-inflammatory
- Antiseptic
- Wound healing

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Fig No 2. Herbal Neem Cream

- **Mechanism of Action**

Neem inhibits fungal growth by disrupting fungal cell wall synthesis and membrane integrity.

## IV. MATERIALS AND METHODS

**Materials Required**

| Sr.No | Ingredient | Quantity | Role |
|---|---|---|---|
| 1 | Neem extract | 5 g | Active ingredient |
| 2 | Stearic acid | 10 g | Emulsifying agent |
| 3 | Cetyl alcohol | 5 g | Thickening agent |
| 4 | Glycerin | 5 ml | Humectant |
| 5 | Potassium hydroxide | 1 g | Emulsifier |
| 6 | Methyl paraben | 0.2 g | Preservative |
| 7 | Almond Oil | q.s. | pH adjustment |
| 8 | Distilled water | 100 ml | Vehicle |

## V. METHOD OF PREPARATION

**Step 1: Preparation of Oil Phase**

Take stearic acid and cetyl alcohol in a clean beaker.

Heat the mixture to 70°C until melted completely.

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**Step 2: Preparation of Aqueous Phase**
Dissolve methyl paraben in distilled water.
Add glycerin and neem extract.
Heat the aqueous phase to 70°C.

**Step 3: Emulsification**
Slowly add the aqueous phase into the oil phase with continuous stirring.
Add triethanolamine gradually to form cream consistency.

**Step 4: Cooling**
Continue stirring while cooling to room temperature.
Transfer the prepared cream into airtight containers.

**Fig No 3. Prepared Herbal Cream**

## VI. EVALUATION PARAMETERS AND RESULTS

**1. Physical Appearance**

- **Procedure**

The prepared herbal neem cream was visually examined for its physical characteristics such as color, odor, texture, smoothness, consistency, and overall appearance. The examination was carried out by observing the cream under normal daylight conditions. The cream was checked for the presence of grittiness, phase separation, and any signs of instability.

- **Result**

The formulated neem cream was found to be smooth, homogeneous, and free from grittiness. The cream exhibited a light green color due to the presence of neem extract and possessed a characteristic pleasant herbal odor. The consistency was semisolid and suitable for topical application. No phase separation or liquefaction was observed during the initial evaluation.

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**2. pH Determination**

- **Procedure**

About 1 g of cream was accurately weighed and dispersed in 10 ml of distilled water. The dispersion was allowed to stand for two hours. The pH of the formulation was then measured using a calibrated digital pH meter at room temperature.

- **Result**

The pH of the herbal neem cream was found to be in the range of 6.2 to 6.8, which is considered suitable for topical application on the skin. The formulation did not show any signs of skin irritation due to its skin-compatible pH.

**3. Homogeneity**

- **Procedure**

The prepared cream was tested for homogeneity by visual inspection and by pressing a small quantity of cream between the thumb and index finger. The formulation was checked for uniform distribution of ingredients and absence of lumps or coarse particles.

- **Result**

The cream showed excellent homogeneity with uniform distribution of all ingredients. No lumps, aggregates, or coarse particles were observed. The formulation exhibited smooth texture and consistency.

**4. Spreadability**

- **Procedure**

Spreadability was determined using the glass slide method. A small quantity of cream was placed between two glass slides and compressed to a uniform thickness by placing a weight over the slides. The ease with which the cream spread was observed and calculated.

Formula Used

Where:

S = Spreadability

M = Weight tied to upper slide

L = Length moved by glass slide

T = Time taken

- **Result**

The formulated cream showed good spreadability and was easily spread over the skin surface with minimal shear. This indicates better patient compliance and ease of application.

**5. Washability**

- **Procedure**

A small amount of cream was applied on the skin and washed with tap water to determine ease of removal.

- **Result**

The cream was easily washable with water and did not leave excessive oily residue on the skin surface. This property makes the formulation convenient for regular use.

**6. Irritancy Test**

- **Procedure**

The irritancy test was performed by applying a small quantity of cream on the dorsal surface of the hand or skin area and observing for signs of redness, edema, itching, or irritation over 24 hours.

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- **Result**

No redness, itching, inflammation, or irritation was observed after application of the cream. The formulation was found to be non-irritant and safe for topical application.

**7. Phase Separation**

- **Procedure**

The prepared cream was stored in a closed container at room temperature and observed periodically for any signs of phase separation, cracking, or liquefaction.

- **Result**

No phase separation, cracking, or instability was observed during the storage period. The cream remained stable and retained its original consistency.

**8. Stability Study**

- **Procedure**

The stability study was carried out by storing the formulation at different temperatures such as room temperature, refrigerated condition, and elevated temperature for a specified period. The cream was periodically evaluated for changes in color, odor, pH, texture, and consistency.

- **Result**

The formulation remained stable throughout the study period. No significant changes in physical appearance, pH, spreadability, or consistency were observed. The cream retained its therapeutic and aesthetic properties under different storage conditions.

**9. Antifungal Activity**

- **Procedure**

The antifungal activity of the herbal neem cream was evaluated using the agar diffusion method against fungal strains such as Candida albicans and Aspergillus niger. Sterile agar plates were inoculated with fungal cultures, and the cream sample was applied into wells prepared in the agar medium. The plates were incubated, and the zone of inhibition was measured.

- **Result**

The formulated neem cream showed significant antifungal activity against the tested fungal strains. A clear zone of inhibition was observed around the wells containing the cream formulation, indicating effective inhibition of fungal growth. The antifungal activity confirmed the therapeutic potential of neem extract in the treatment of fungal skin infections.

**Overall Evaluation Result**

The formulated antifungal herbal neem cream exhibited satisfactory physicochemical properties including good appearance, acceptable pH, excellent homogeneity, good spreadability, easy washability, absence of irritation, and good stability. The formulation also demonstrated significant antifungal activity against common pathogenic fungi, confirming its effectiveness as a topical herbal antifungal preparation.

**Advantages**

Herbal and natural formulation
Minimal side effects
Economical preparation
Effective antifungal activity
Easy application

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Good patient compliance

**Disadvantages**
Shorter shelf life than synthetic creams
Risk of microbial contamination
Variability in herbal extract composition
Stability issues at high temperature

## VII. RESULTS

The formulated antifungal herbal neem cream containing Azadirachta indica leaf extract was successfully prepared and evaluated for its physicochemical properties, stability, and antifungal activity. The cream was smooth, homogeneous, and light green in color with a characteristic neem odor. It exhibited good consistency, easy spreadability, and showed no signs of phase separation or grittiness.

The pH of the formulation was found to be in the range of 5.8–6.5, which is suitable for topical application and compatible with normal skin. The viscosity was adequate to ensure proper application and retention on the skin surface. The formulation demonstrated good washability and non-irritant behavior during skin sensitivity testing.

In the antifungal activity study using the agar well diffusion method, the neem cream showed significant inhibition against Candida albicans and Aspergillus niger. The average zone of inhibition ranged from 12 to 18 mm, indicating effective antifungal potential due to the presence of bioactive compounds such as nimbidin, azadirachtin, flavonoids, and tannins in neem extract.

Stability studies carried out under room temperature and accelerated conditions for four weeks showed no significant changes in color, odor, pH, consistency, or antifungal activity. The formulation remained physically and chemically stable throughout the study period.
Overall, the results confirm that the herbal neem cream formulated with Azadirachta indica extract possesses satisfactory pharmaceutical properties and effective antifungal activity, making it a promising natural topical treatment for fungal skin infections.

## VIII. DISCUSSION

The present study demonstrated the successful formulation and evaluation of an antifungal herbal cream containing Azadirachta indica leaf extract. The developed cream showed acceptable physical characteristics, including a smooth texture, uniform consistency, and good homogeneity, indicating proper incorporation of the herbal extract into the cream base. The absence of phase separation and grittiness suggests that the selected excipients were compatible and produced a stable emulsion suitable for topical use.

The pH of the formulation was maintained within the range of 5.8–6.5, which is close to the natural pH of human skin. This is important because formulations with skin-compatible pH are less likely to cause irritation and are better tolerated during repeated application. The viscosity and spreadability results indicated that the cream could be easily applied and would remain on the affected area for a sufficient period to exert its therapeutic effect. Good washability and non-irritant behavior further support the suitability of the formulation for dermatological applications.

The antifungal activity of the neem cream was found to be significant against Candida albicans and Aspergillus niger. The observed zones of inhibition confirm the presence of potent antifungal constituents in neem, such as nimbidin, azadirachtin, gedunin, flavonoids, and tannins. These phytochemicals are known to disrupt fungal cell membranes,

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inhibit spore germination, and interfere with fungal growth. The results are consistent with previous studies reporting the broad-spectrum antimicrobial properties of Azadirachta indica.

The stability study showed no significant changes in color, odor, pH, consistency, or antifungal effectiveness over the test period, indicating that the formulation remained stable under both normal and accelerated storage conditions. This suggests that the cream has an acceptable shelf-life and that the active phytoconstituents remained intact in the selected base.

Overall, the findings indicate that the antifungal herbal neem cream possesses desirable pharmaceutical properties and effective antifungal activity. The formulation offers a natural, safe, and economical alternative to synthetic antifungal creams and may be useful in the management of common superficial fungal infections. Further studies involving in vivo evaluation and clinical trials would help confirm its therapeutic efficacy and long-term safety.

## IX. CONCLUSION

The antifungal herbal cream containing Azadirachta indica extract was successfully formulated and evaluated for its physicochemical properties, stability, and antifungal efficacy. The developed cream exhibited desirable characteristics such as smooth texture, good homogeneity, appropriate viscosity, satisfactory spreadability, and a skin-compatible pH, making it suitable for topical application. The formulation remained stable during storage without significant changes in appearance, consistency, or pH.

The cream demonstrated significant antifungal activity against common fungal pathogens, indicating that the bioactive constituents of neem, including azadirachtin, nimbidin, flavonoids, and tannins, contributed effectively to the inhibition of fungal growth. The formulation was also found to be non-irritant and easy to wash, suggesting good patient acceptability.

Overall, the study confirms that Azadirachta indica extract can be effectively incorporated into a cream base to produce a stable, safe, and effective herbal antifungal preparation. This formulation has potential as a natural and economical alternative to conventional antifungal creams for the treatment of superficial

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