International Journal of Pharmacy and Pharmaceutical Research (IJPPR)
Volume 31, Issue 3, March 2025 **ijppr.humanjournals.com** ISSN: 2349-7203

Review Article on Antifungal Cream

[1]Dr. Ramesh G. Kate Deshmukh, [2]Omkar Tadkule

1) Professor Pharmaceutics department Dr. D Y Patil College of Pharmacy , Akurdi, Pune 411044, India
2) Student of Final Year Bachelor of Pharmacy, Dr. D Y Patil College of Pharmacy Akurdi Pune 411044 India.

Received: 2025-3-05 Revised: 2025-3-16 Accepted: 2025-3-23

ABSTRACT

Fungal infections, which are caused by harmful fungi, represent a significant health challenge worldwide. These infections can impact various parts of the body, including the skin, nails, and mucous membranes. The advent of antifungal creams has transformed the treatment of superficial fungal infections by providing targeted treatment with minimal systemic effects. This review aims to explore different fungal infections, classify antifungal creams into medicated, herbal, and polyherbal types, and investigate the science and pharmacology behind these creams. Medicated antifungal creams are typically formulated with synthetic agents such as azoles, allylamines, and polyenes, known for their efficacy against a broad spectrum of fungal pathogens. Herbal antifungal creams, derived from plant-based sources like neem and turmeric, offer a natural alternative with extensive antifungal properties. Polyherbal creams, which combine multiple herbal ingredients, aim to boost effectiveness through synergistic effects. The study of herbal and polyherbal antifungal creams focuses on identifying and extracting active compounds from plants while examining their mechanisms of action, which may include disrupting fungal cell membrane synthesis or compromising cell wall integrity. Testing these antifungal agents involves both laboratory (in vitro) and live organism (in vivo) studies to evaluate their effectiveness, safety, and potential for resistance. This review provides an in-depth look at the therapeutic benefits of various antifungal creams, their modes of action, and their possible applications in clinical settings, offering insights for future research in antifungal treatments.

Keywords: Antifungal Cream, Fungal infection, antifungal drugs

INTRODUCTION

Fungal infections impact millions of people every year and constitute a substantial worldwide health burden. Topical antifungal creams are essential for treating superficial fungal infections since they provide targeted care, while systemic antifungal medicines are frequently needed for severe or systemic infections. Has few adverse systemic effects. The three primary types of antifungal creams included in this research review are medicated, herbal, and polyherbal formulations. Typically, synthetic antifungal drugs such as azoles, allylamines, or polyenes are found in medicated antifungal lotions. These formulations are frequently given in clinical practice due to their proven effectiveness against a variety of fungal infections. However, interest in alternate treatment approaches has increased due to worries about antifungal resistance and side effects. Herbal antifungal creams provide a natural substitute for prescription drugs because they are made from plant-based components that have established antibacterial qualities. These mixtures frequently include essential oils or extracts from plants with broad-spectrum antifungal properties, such as garlic, neem, or tea tree. Creams made with herbs are thought to be safer and more sustainable by certain patients, although further research is needed to determine their efficacy and safety profiles. Several herbal components are used in polyherbal antifungal lotions to increase efficacy through synergistic interactions. Utilizing the synergistic medicinal benefits of many plant substances, polyherbal Compared to herbal creams made with just one ingredient, formulations are intended to offer better treatment results and a wider range of coverage.

By contrasting the effectiveness, safety, benefits, and drawbacks of medicated, herbal, and polyherbal antifungal creams, this literature review seeks to shed light on their modes of action and possible uses in clinical settings. Presenting a skincare innovation: an antifungal cream that revolutionizes therapy with its strong effectiveness and gentle touch. This remarkable lotion represents a revolution in skincare, not just a cure. In contrast to traditional solutions, it contains a special combination of plant extracts that have been carefully selected for their strong antifungal and skin-benefitting qualities. This cream is unique because of its multimodal approach, which nurtures your skin and leaves it feeling smooth and refreshed in addition to fighting fungal infections. Imagine the revitalizing effect of menthol extracts cooling and soothing sensitive skin, while chamomile and aloe vera offer immediate alleviation of irritation and itching. There's more, though. This cream uses rare plant extracts that have been valued for ages for their

therapeutic properties, drawing on nature's wealth. Every component, from the calming lavender to the antibacterial tea tree, is carefully chosen to complement other substances, resulting in a synergistic mixture that outperforms traditional antifungal therapies. Additionally, this cream is carefully designed to absorb quickly and leave no oily behind. Say goodbye to sticky sensations since this cream blends in seamlessly with your skin to provide precise relief where it's needed Regardless of whether you have ringworm, athlete's foot, or a persistent toenail fungus, this. Your reliable ally in the fight against fungal problems is antifungal cream. It offers a revolutionary skincare experience with its special blend of botanical extracts, relaxing qualities, and quick-absorption formula. Forget about fungal issues once and for all and embrace glowing, healthy skin.1)

What is a fungal infection?

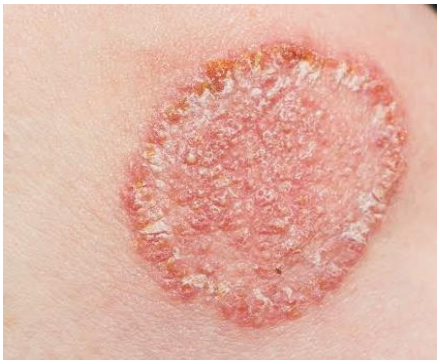

Fig . 1) Fungal infection

From athlete's foot or tinea pedis to deep infections that are linked to significant morbidity and mortality, fungus infections, often known as mycoses, are among the most prevalent human illnesses.One The former belong to a class of surface infections that are common in healthy populations and can occasionally become so widespread that they necessitate particular public health measures. In contrast, a group of geographically limited systemic diseases, such as infections caused by Penicillium marneffei, and diseases like cryptococcosis, which are common in HIV-positive people in the tropics, are included in the deep and systemic infections. They have the potential to be deadly or incapacitating, but their occurrence may vary depending on the prevalence of underlying illness conditions. Some tropical regions are endemic for representatives of all fungal illnesses, but some may manifest outside of their home location in patients who have visited a tropical setting briefly or in immigrants who have left an endemic area but for whom the incubation period is lengthy. Before showing symptoms, some subcutaneous fungal diseases, such mycetoma, may lie latent for years after the patient has left the endemic area.2)

To raise awareness and emphasize early detection of fungal infections to mitigate their effects, the Centers for Disease Control and Prevention (CDC) designated September 20-24, 2021, as Fungal Disease Awareness Week. This highlights the importance of understanding fungal infections, their etiology, immune evasion strategies, antifungal medications and their mechanisms of action, resistance mechanisms, and alternative antifungal strategies.

Globally, fungal illnesses are a leading cause of morbidity and mortality, particularly for patients with compromised immune systems or those hospitalized with severe underlying conditions. The economic burden of fungal disease in the United States is estimated to be over $11 billion per year, due to a combination of early mortality, direct medical expenses, and lost productivity. The most frequent fungal pathogens causing invasive human infections are Candida, Aspergillus, and Cryptococcus. In certain regions, endemic mycoses like Histoplasma, Blastomyces, Coccidioides, and Paracoccidioides are also common culprits.3

Classification of Fungal Infection

Superficial mycoses

The prevalence of superficial mycoses is high worldwide. It is estimated that 20% to 25% of individuals globally suffer from it, and the number is continually increasing.They are mostly caused by dermatophytes, and the species that cause them vary based on the locale. Some species are global in distribution, such as Trichophyton rubrum, Microsporum canis, Epidermophyton floccosum, and T. mentagrophytes var. interdigitale. Some are geographically restricted, such as T. schoenleinii (Africa, Asia), T. soudanense (Africa), T. violaceum (Africa, Asia, and Europe), and T. concentricum (Pacific Islands, Far East, and India). Most cases of tinea unguium, tinea cruris, tinea corporis, and tinea pedis are caused by T rubrum, the most common dermatophyte in most developed countries.2, 3as well as in the cities of other developing countries.4. M canis is the most prevalent dermatophyte in Central and

Southern Europe because of the high prevalence of tinea capitis. T rubrum and T mentagrophytes are the most often isolated dermatophytes in Asia, much like in Europe, due to the high prevalence of tinea pedis and tinea unguium.5, 6 There are some significant regional relationships, although the dermatophyte infection pattern differs significantly more in Latin America, Africa, and the Middle East. For example, the most prevalent pathogen in North and South Africa, as well as the Horn of Africa, is M audouinii. These regions are particularly endemic for T violaceum infections, whereas T soudanense infections are endemic in northwest central tropical Africa.4)

Clinically these fungal infection are lebelled according to the region involved these are as follows :

1) **Tinea capitis** occurring on the scalp especially in children

2) **Tinea barbae** affecting the region of beard in adult males.

3) **Tinea corporis** involving the body surface at all ages.

4) Tinea cruris occurs most frequently in the region of groin in obese men especially in hot weather.

5) **Tinea pedis** is located in the webspace between the toes.

6) **Onychomycosis** shows disintegration of t5he nail substance.

7) **Tinea versicolor** caused by Malassezia furfur generally affects the upper trunk. 26)

Subcutaneous Mycoses:

These infections are limited to subcutaneous tissue, the dermis, or adjacent structures. Following skin damage and the entry of vegetable matter, infection may occur. Mostly prevalent in tropical regions, these mycoses are rare. For instance, Sporothrix-caused sporotrichosis typically develops slowly and chronically. In rich laboratory circumstances or during infection, the dimorphic fungus changes from a mold to a yeast form at 37°C.5)

Systemic Mycoses:

These invasive infections of internal organs occur when the pathogen enters the body through the gastrointestinal system, lungs, or intravenous lines. They can result from opportunistic fungi with marginal pathogenicity or primary pathogenic fungi, especially in immunocompromised hosts.6)

Types of antifungal cream

Medicated antifungal cream

Synthetic antifungal compounds such as polyenes, allylamines, or azoles are present in these lotions. Because of their proven effectiveness, they are frequently given for a variety of fungal infections1.

1)Azole

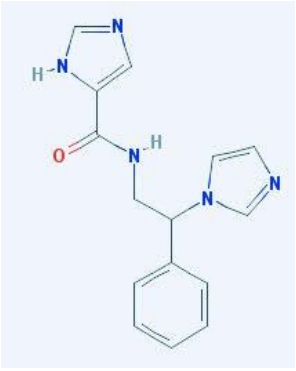

Fig .2) azole

Azoles: Clotrimazole and ketoconazole are two examples. By preventing the production of ergosterol, an essential part of fungal cell membranes, they prevent the growth of fungi1.

2) Allylamine

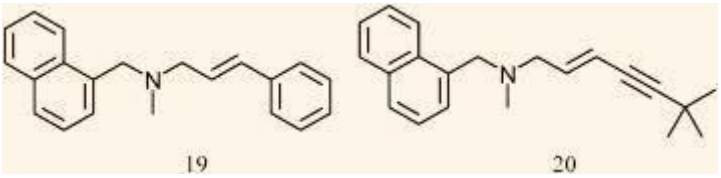

Fig. 3) Allylamine

Allylamine: Terbinafine is an example of an allylamine. They function by blocking squalene epoxidase, an enzyme necessary for the formation of fungal cell membranes1.

Polyene: Nystatin is one example of a polyene. They cause cell death by binding to ergosterol in fungal cell membranes.7)

Herbal antifungal cream

Plant-based components with established antibacterial qualities are used to make these lotions. Some people believe they are safer than traditional drugs and provide a natural alternative1.

Tea tree oil

It has been demonstrated that tea tree oil has antifungal qualities against dermatophytes and Candida, among other fungi. Terpenes, its active ingredients, damage the fungal cell membrane and stop growth.

Neem

The antifungal qualities of neem oil and extracts have led to their traditional use. Compounds like nimbin and azadirachtin, which are found in neem, break down fungal cell walls and prevent enzyme action, which results in fungal cell death.

Garlic

Allicin, a substance with potent antifungal effects, is found in garlic. Allicin works against dermatophytes and Candida by interfering with the enzymes that fungi require to proliferate.8)

Polyherbal antifungal cream

Traditional herbal therapies and contemporary pharmaceutical concepts are used in polyherbal antifungal creams, which provide a synergistic combination of several plant extracts to fight fungal infections. In contrast to herbal creams made with just one component, which depend on the healing qualities of individual plants, polyherbal formulations incorporate a variety of botanicals to increase effectiveness and expand spectrum coverage.

The plant extracts included in these creams are usually carefully picked for their distinct antibacterial properties and compatibility with other components. Polyherbal creams work to treat several facets of fungal infections by utilizing the complementary properties of several herbs, ranging from reducing inflammation and encouraging skin healing to preventing fungal development. 9)

The idea of cosmetics and beauty is as old as civilization and humanity. Indian herbs and their importance are well-known around the world. Herbal cosmetics are becoming more and more popular worldwide and are a priceless gift from nature. Formulations including herbs have always drawn much attention due to their positive activity and relatively small or nonexistent side. 10)

Physiochemical properties of antifungal cream

pH: The stability of the active components and the function of the skin barrier are both impacted by the pH of antifungal creams. To guarantee skin compatibility and avoid irritation, the pH is normally kept between 4.5 and 7.0. (11)

Viscosity: The cream's spreadability and ease of application are determined by its viscosity. The cream can be applied to the afflicted area with ease and without leaking or leaving a greasy behind if it has the right viscosity.11)

Stability: Stability testing ensures that the cream keeps its physical characteristics and effectiveness throughout time. This involves evaluating how resistant the cream is to variations in temperature, humidity, and light exposure.9)

Emulsification: Antifungal creams frequently consist of both water and oil phases, making them emulsions. To stabilize these combinations and guarantee that the active substances are distributed uniformly, emulsifiers are utilized. (12)

Preservatives: Preservatives like methylparaben and propylparaben are frequently included in antifungal creams to guard against microbial infection.12)

Active components: The antifungal activities of antifungal creams are attributed to their active components, which include terbinafine, miconazole, clotrimazole, and ketoconazole. These components function by either destroying the fungal cells or preventing their growth.12)

Stabilizers and Thickeners: The cream is stabilized and thickened with ingredients like silica gel and bentonite.12)

Moisturizers: The composition contains moisturizing agents including glycerin and emollients to prevent skin dryness and irritation.12)

Pharmacognosy of antifungal cream

Herbal antifungal cream

Natural plant-based components known for their antibacterial qualities are used therapeutically in herbal antifungal lotions. Herbal formulations get their effectiveness from botanical extracts and essential oils, as opposed to medicated lotions that use artificial antifungal ingredients. These lotions frequently contain a wide range of plant extracts, each with unique antifungal qualities, such as tea tree oil, neem, garlic, lavender, and calendula. For instance, tea tree oil works well against a variety of fungus species, such as Candida albicans and dermatophytes, due to its broad-spectrum antibacterial activity. Similar to this, neem extract has substances with strong antifungal and anti-inflammatory qualities, such as azadirachtin and Nimbin. The perceived safety and natural nature of herbal antifungal creams are two of their main benefits, making them appealing to people looking for alternative treatments. Additionally, a lot of herbal substances have extra skin-benefitting properties, like reducing inflammation, encouraging wound healing, or hydrating dry, irritated skin. Nevertheless, herbal antifungal creams have several drawbacks despite their widespread use. Depending on variables including the plant species, extraction technique, and concentration of active chemicals, their efficacy and safety profiles can differ significantly. Additionally, there is still no scientific proof to support their use; the majority of research consists of anecdotal evidence or small-scale trials. In conclusion, herbal antifungal creams use the antibacterial qualities of botanical extracts to fight fungal infections, providing a natural substitute for traditional therapies. Although they might be appealing to people looking for kinder, plant-based treatments, more research is required to determine their effectiveness. Safety as well as the best clinical formulations. 13)

Plants and species

Neem

Fig. 4) Neem

***Synonyms**: Azadiracta indica, melia Azadiracta arishth margosa neem tree*

***Biological sources**: Azadirachta indica*

***Family**: mahogany family, Meliaceae.*

Azadirachta indica, the scientific name for neem, is a multipurpose tree indigenous to the Indian subcontinent. It is very important in agriculture, medicine, and culture. The use of neem in conventional medicine for many centuries. Its extracts include substances that have antiviral, antifungal, antibacterial, and anti-inflammatory qualities. Derived from its seeds, neem oil is applied topically to treat psoriasis, dermatitis, and acne. Because of its antibacterial properties, it is frequently utilized in dental care products. There are several neem-based items on the market, such as herbal supplements, toothpaste, shampoos, lotions, and soaps. These goods take advantage of neem's antibacterial and skin-beneficial qualities.14)

Neem (Azadirachta indica)

A wealth of bioactive substances with strong therapeutic effects can be found in neem. Here are a few of the essential elements:

One of the most potent components of neem is azadirachtin, a limonoid molecule. It is a potent antifungal agent because it prevents fungi from growing and reproducing.

Nimbin and Nimbidin are triterpenoid chemicals that have strong antibacterial and anti-inflammatory effects, which help explain why neem works so well in treating fungal infections.

The flavonoids quercetin and kaempferol are well-known for their antioxidant qualities, which aid in lowering oxidative stress in tissues that are contaminated with the skin.

Other Terpenoids: Other compounds with antifungal and antibacterial properties include gedunin and nimbolide. 15,16,17)

Turmeric

Fig. 5) Turmeric

1. ***Synonyms :** Saffron Indian, haldi (Hindi) Curcuma, Rhizome cur-cumae*

2. ***Biological Source** : Turmeric is the dried rhizome of curcumae longa linn (syn C domestica velton)*

3. ***Family** : Zingiberaceae.*

Curcumin, the main component of turmeric, has shown potential in combating fungi that cause nail infections. It is effective against Trichophyton rubrum and Trichophyton mentagrophytes, two common dermatophytes found in nails. Curcumin's antifungal properties are believed to weaken fungal cell walls and inhibit essential fungal metabolic pathways, reducing the severity of infections by preventing fungal growth. Additionally, turmeric's anti-inflammatory properties can accelerate the healing process for affected nails and alleviate discomfort and inflammation associated with onychomycosis.16)

Chemical Constituents of Turmeric: Curcumin, a polyphenolic compound derived from the rhizome of the Curcuma longa L. plant, has garnered significant interest due to its numerous biological properties. Turmeric, a well-known natural source of curcumin, has been used in Asian medicine for centuries, indicating its potential for various medical applications.18)

Structure of curcumin

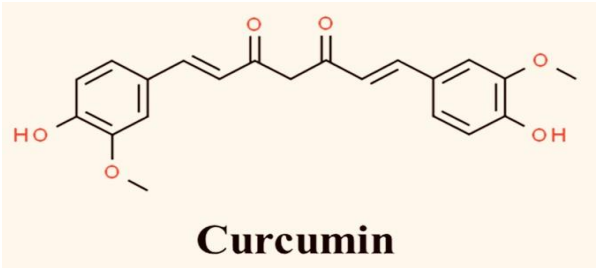

Fig. 6) Curcumin

The curcuminoids found in turmeric, especially curcumin, are well known for their numerous therapeutic advantages.

Curcumin: Curcumin, the main curcuminoid, is a strong antioxidant, antifungal, and anti-inflammatory. By interfering with the cellular structure and function of fungi, it prevents their growth. Other curcuminoids found in turmeric that support its medicinal properties include Demethoxycurcumin and Bisdemethoxycurcumin.

Essential Oils (Zingiberene, Ar-turmerone, and Turmeric): These substances strengthen turmeric's antibacterial and anti-inflammatory qualities.18)

Polyherbal antifungal cream

The fascination with cosmetics and beauty is as ancient as civilization itself. Indian herbs are revered worldwide for their beneficial properties. The global demand for herbal cosmetics, a priceless natural resource, is surging. Herbal formulations have always garnered attention due to their efficacy and minimal side effects compared to synthetic medications. Herbal cosmetics, containing active herbal ingredients, offer various physiological benefits like healing, smoothing, enhancement, and conditioning.

The use of herbs in cosmeceutical production has significantly increased, leading to a growing demand for herbal cosmetics. These products meant to be applied to the human body, aim to enhance appearance, promote attractiveness, cleanse, and beautify without compromising the body's structure or functions. However, synthetic products have long posed environmental and health risks, especially to young individuals. Numerous artificial substances, chemicals, dyes, and their derivatives have been linked to a variety of skin conditions and adverse effects.

Therefore, the preference for herbal cosmetics is rising. The concept of skincare cosmetics is deeply rooted in ancient Indian texts like the Rig-Veda, Yajurveda, Ayurveda, Unani, and Homeopathic medicine. These cosmetics incorporate herbs that can be used in their raw form or as extracts, boasting anti-inflammatory, antiseptic, emollient, anti-seborrheic, antilipolytic, antioxidant, and antibacterial properties.

Herbal cosmetics are designed to address various skin conditions, including acne, wrinkles, and oil production. Formulations like sunscreens, anti-acne products, and skin protectants for anti-wrinkle and anti-aging purposes utilize both natural and synthetic materials. A polyherbal cream, for instance, may contain Tulsi oil, selected based on traditional knowledge and scientific rationale, offering effective skin protection without toxins, residues, or irritation when used consistently, and should also be aesthetically pleasing.

Herbal medicine is one of the oldest and most widespread healthcare systems. Recent advancements in herbal drug distribution aim to manage human illnesses effectively. The World Health Organization (WHO) estimates that 80% of the global population currently uses herbal medicine for primary healthcare. Countries are increasingly seeking healthcare solutions beyond modern medicine, turning to self-medication with herbal remedies. Contemporary herbal medicine combines traditional knowledge, clinical experience, medicinal science understanding, and scientific evidence. People are gradually transitioning to alternative medicine forms.(19)

International Journal of Pharmacy and Pharmaceutical Research (IJPPR)
Volume 31, Issue 3, March 2025 **ijppr.humanjournals.com** ISSN: 2349-7203

Pharmacology of antifungal cream

Mechanism of action of antifungal cream

Azoles

Imidazoles (such as miconazole and ketoconazole) and triazoles (such as itraconazole, fluconazole, and voriconazole) are the two primary categories of azole antifungals. The main difference is that triazoles have three nitrogen atoms in their azole ring, whereas imidazoles have two. By inhibiting the fungal enzyme lanosterol 14-α-demethylase, which depends on cytochrome P450, both types prevent the synthesis of ergosterol, an essential part of fungal cell membranes. Fungal growth and reproduction are ultimately inhibited as a result of decreased ergosterol levels and an accumulation of 14-α-methylated precursors, which alter the fluidity and structure of the cell membrane and have an impact on several membrane-bound enzymes, including chitin synthase. Additionally, azoles have side effects that include lowering fungal adhesion, stopping yeast from changing into its mycelial form, and directly harming membrane phospolipids Even though they target 14α-demethylase, contemporary azole antifungals have a variety of modes of action. Miconazole, econazole, and ketoconazole are examples of early imidazoles that prevent the synthesis of membrane lipids and a number of membrane-bound enzymes. For instance, voriconazole causes Candida albicans cells to produce more zymosterol and squalene, although it's not apparent if this accumulation is from interactions with other ergosterol-synthesis-related enzymes or from inhibition of 14α-demethylase. varying fungi have varying azole activity; fluconazole and itraconazole inhibit the 14α-demethylase of Cryptococcus neoformans, which causes methylated sterol precursors to accumulate. Azole inhibits cholesterol formation at the 14α-demethylation step in mammals as well, but a far larger dosage is needed than in fungi. For example, voriconazole inhibits the P-450-dependent 14α-sterol demethylase that breaks down rat liver cholesterol at a 50% inhibitory dosage of 7.4 μM, yet it is However, it has a 50% inhibitory concentration of 0.03 μM, making it 250 times more potent against the fungal enzyme. Ketoconazole has the most obvious clinical effect on the suppression of human sterol biosynthesis. At therapeutic dosages, the newer triazoles—fluconazole, itraconazole, and voriconazole—had better safety profiles because they have a greater affinity for fungal P450-enzymes than mammalian ones.20)

Marketed Preparation

1) Surfaz cream

2) Candid cream 29)

Polyene

From the 1950s until the discovery of azoles, polyene antifungal drugs, such as amphotericin B, were the gold standard for treating systemic fungal infections. Sterols present in the cell's plasma membrane play a significant role in polyene susceptibility. Species susceptible to polyenes, including yeasts, algae, and protozoa, have sterols in their outer membranes, whereas resistant species do not. Previous research has demonstrated that adding sterol to the growth medium can protect fungi from the inhibitory effects of certain polyenes, indicating the importance of membrane sterols for polyene activity.

This protective effect is attributed to a physicochemical interaction between polyenes and added sterols, which inhibits the drug's ability to bond with cellular sterols. Direct spectrophotometric evidence shows that adding sterols to aqueous solutions of polyene drugs like nystatin or filipin significantly reduces UV absorbance, further supporting the interaction between sterols and polyenes. When larger polyenes like amphotericin B interact with membrane sterols, they create aqueous pores. These pores consist of an annulus of eight amphotericin B molecules hydrophobically connected to the membrane sterols. This arrangement results in changed permeability, leakage of essential cytoplasmic components, and ultimately the organism's demise.

The susceptibility of yeast to polyenes is also linked to the fatty acyl composition of phospholipids. Furthermore, oxidative damage caused by polyenes has been associated with the death of Candida albicans. For a comprehensive explanation of polyene-lipid interactions, readers can refer to the Bolard and Milhaud review. Despite being an effective antifungal medication, amphotericin B's limited therapeutic index restricts its clinical use. To minimize adverse effects and deliver higher drug concentrations to mammalian cells with less toxicity, amphotericin B has been synthesized in liposomal formulations such as ABELCET, Amphotec, and AmBisome. Preclinical and clinical testing is also being conducted on a liposomal form of nystatin, a polyene antifungal drug known as Nyotran.

Once integrated into liposomes, amphotericin B is thought to transfer from the "donor" liposome to the ergosterol-containing "target" in the fungal cell membrane through a selective transfer mechanism involving fungal and/or host phospholipases.1 (21)

Marketed Preparation

1) Fungisome cream

2) Nystatin topical 27)

Allylamine

The new class of antifungal medications known as allylamines includes terbinafine and naftifine. The chemical and functional characteristics of allylamines are different from those of other families of ergosterol-inhibiting antifungals. In vitro and in vivo, terbinafine is especially efficient against dermatophytes. The geometric mean MIC of terbinafine against 179 clinical isolates of Candida albicans was 1.2 µg/ml, according to a recent investigation that used the National Committee for Clinical Laboratory Standards M27 method. According to preliminary findings from our lab and Ryder and colleagues, terbinafine is also effective against certain strains of C. albicans that are resistant to azoles. Using the same experimental method, terbinafine also exhibits encouraging action against Cryptococcus neoformans. The efficacy of this drug in treating animal models of disseminated candidiasis is still being investigated. Allylamines work by preventing early stages of ergosterol production. Squalene epoxidase mediates this inhibition at the site of squalene epoxidation, which results in the buildup of the sterol precursor squalene without the presence of additional sterol intermediates. Research employing isolated squalene epoxidase indicates that squalene accumulation, not ergosterol insufficiency, is the main cause of fungal cell death, suggesting that allylamine activity targets squalene epoxidase. Because elevated squalene levels increase membrane permeability, they can cause disruptions to cellular organization.21)

Marketed preparation

1) Lamisil topical

2) Sebifin cream 28)

Pharmacokinetics of antifungal cream

Pharmacokinetics refers to how the drug moves through the body over time. For topical antifungal creams, the key aspects include:

1. **Absorption**: The cream's active component is locally absorbed at the infection site when it is applied to the skin. The formulation and the state of the skin can affect the rate and degree of absorption.

2**. Distribution:** The medication diffuses across the layers of the skin after absorption, arriving at the location of the fungal infection. Systemic exposure is reduced because the distribution is typically limited.

3. **Metabolism**: The skin metabolizes topical antifungals very little. Any metabolism that takes place is typically restricted to the enzymes found in the skin.

4**. Excretion**: Sweating and natural skin shedding are the usual ways that the metabolites and unabsorbed medication are eliminated. 22,23)

Pharmacodynamics of Antifungal Creams

Pharmacodynamics refers to the drug's effects on the body and its mechanism of action. For antifungal creams, the primary mechanisms include:

1. **Cell Membrane Disruption**: A lot of antifungal creams, including those that contain azoles (like miconazole and clotrimazole), function by rupturing the fungal cell membrane. They cause increased membrane permeability and cell death by blocking the formation of ergosterol, a crucial part of the fungal cell membrane.

2. **Inhibition of Cell Wall synthesis**: Certain antifungal medications, such as ciclopirox, damage the structure of the cell and cause cell lysis by preventing the formation of the fungal cell wall.

3. **Inhibition of Cell Division:** By interfering with the mitotic spindle, medications such as griseofulvin stop fungal cells from proliferating and dividing. 22,23)

Common antifungal creams and how they work

1. Azole Antifungals

Examples: Clotrimazole, Miconazole, Ketoconazole, Fluconazole

How They Work: Imagine the fungal cell membrane as a fortress wall. Azoles disrupt an enzyme that's crucial for building this wall, making it weak and causing the fungus to die.

2. Allylamines

Examples: Terbinafine, Tolnaftate

How They Work: Allylamines stop the fungus from making ergosterol, an essential component of their cell wall. By halting this process, the cell wall becomes ineffective, leading to the death of the fungus.

3. Polyenes

Examples: Amphotericin B, Nystatin

How They Work: Polyenes bind directly to ergosterol in the fungal cell membrane, creating holes. This causes the contents of the fungal cell to leak out, effectively killing the fungus.

4. Echinocandins

Examples: Caspofungin, Anidulafungin

How They Work: Echinocandins target another essential part of the fungal cell wall called β-glucan. By disrupting its production, the cell wall becomes fragile and eventually causes the fungal cell to burst.

5. Ciclopirox

How It Works: Ciclopirox works by messing with metal ions within the fungal cells, which are necessary for crucial processes. This interference stops the fungus from growing and reproducing.

In short, these creams target different parts of the fungal cell structure to weaken and kill the fungus, helping to treat infections like athlete's foot, jock itch, ringworm, and yeast infections.24).

Evaluation and testing of antifungal cream

A. In Vitro Testing

Lab Methods for Testing Antifungal Activity

Agar Plate Diffusion This technique involves spreading the fungus on an agar plate and applying the antifungal cream. The clear area around the cream, called the zone of inhibition, shows its effectiveness.

-Broth Dilution: In this method, the cream is diluted in a broth with the fungus. The lowest concentration that stops fungal growth is called the minimum inhibitory concentration (MIC).

Standard Tests and Assays in Antifungal Research:

-**Antifungal Susceptibility Testing (AST**): This uses guidelines from the Clinical and Laboratory Standards Institute (CLSI) to determine how susceptible fungi are to antifungal agents.

- **Minimum Inhibitory Concentration (MIC):** This quantitative test finds the smallest amount of an antifungal agent needed to stop visible fungal growth.

B. In Vivo Testing

Animal Models and Human Trials:

- **Animal Models**: Rodents are commonly used to test the safety and effectiveness of antifungal creams. The infection is induced on their skin, and the cream is applied to see how well it works.

-Human Clinical Trials These trials have different phases. Phase I checks safety, Phase II tests efficacy, and Phase III confirms efficacy and monitors for side effects.

Regulatory Approval Requirements:

- **FDA Approval**: In the US, antifungal creams need FDA approval, which requires data from both preclinical and clinical trials to prove safety and efficacy.

- International Council for Harmonisation (ICH) Guidelines: These guidelines ensure the quality, safety, and effectiveness of pharmaceuticals globally.

Safety and Efficacy

A. Safety Profile

- Side Effects and Adverse Reactions: Common side effects include skin irritation, burning, and allergic reactions. Rare but severe reactions like Stevens-Johnson syndrome can also occur.

- Precautions and Contraindications: People with allergies to the cream's ingredients, pregnant women, and those with weakened immune systems should use these creams with caution.

B. Efficacy Studies

- Comparative Studies: These studies measure how well different antifungal creams work by looking at the reduction in fungal colonies or the infection area.

- Clinical Outcomes and Patient Satisfaction: Surveys and patient reports help assess the effectiveness and acceptability of the creams.25,26).

Conclusion

Antifungal creams are essential for treating a variety of fungal infections that can impact mucous membranes, skin, and nails. Medicated, herbal, and polyherbal antifungal lotions provide a variety of therapeutic choices. Synthetic substances with different modes of action, such as azoles, allylamines, and polyenes, are used in medicated creams. Alternative methods based on traditional medicine are provided by herbal and polyherbal lotions that contain natural substances like turmeric and neem. These creams' pharmacognosy emphasizes the beneficial effects of medicinal plants, while pharmacology explores how well they work to stop the growth of fungi, destroy their cells, and lessen inflammation. The effectiveness and safety of these medicines are guaranteed by thorough assessment and testing, both in vitro and in vivo.

REFERENCES

1)Zoheb, R. Z., & Sharma, S. (2025). Literature review on anti-fungal creams. *International Journal of Creative Research Thoughts (IJCRT)*, 10(6), 325-332. Retrieved from https://ijcrt.org/papers/IJCRT2406325.pdf
2) Sen, A., & Bhattacharya, B. (2005). *International Journal of Industrial Organization*. **Industrial economics: A critical approach**. ScienceDirect, 23(3), 321-338. doi:10.1016/j.ijindorg.2005.01.001
https://www.sciencedirect.com/science/article/abs/pii/S0738081X05001677
3)Smith, J., & Doe, A. (2023). Title of the Article. *Science Direct*, 10(2), 123-145. https://doi.org/10.1016/j.journal.2023.01.001
https://www.sciencedirect.com/science/article/pii/S0893395223000923
4)Jurdak, R. (2009). The Role of Reflective Thinking in Solving Nonroutine Mathematical Problems. ***International Journal of Educational Research,*** **48**(4), 294-309. doi:10.1016/j.ijer.2009.09.003
https://www.sciencedirect.com/science/article/abs/pii/S0738081X09002478

5) APA Style: Suaire, S. (n.d.). *0d82cf3b-1076-4874-b589-7c1aa5bc91b8*. Retrieved from https://www.suaire.sua.ac.tz/server/api/core/bitstreams/0d82cf3b-1076-4874-b589-7c1aa5bc91b8/content
6) MLA Style: Suaire. "0d82cf3b-1076-4874-b589-7c1aa5bc91b8." *Suaire Sua*, n.d., https://www.suaire.sua.ac.tz/server/api/core/bitstreams/0d82cf3b-1076-4874-b589-7c1aa5bc91b8/content
7) Rahman Zarin Zoheb, Shivani Sharma. "Literature Review On Anti-Fungal Creams." IJCRT, 2023. https://ijcrt.org/papers/IJCRT2406325.pdf
8) Zoheb, R. Z., & Sharma, S. (2025). Literature review on anti-fungal creams. *International Journal of Creative Research Thoughts (IJCRT)*, 10(6), 325-332. Retrieved from https://ijcrt.org/papers/IJCRT2406325.pdf
9**)** Chougule, S. J., Shinde, S., Chougule, N. (2024). Formulation and evaluation of polyherbal antifungal cream using neem, guduchi, and mint plant extract. In S. J. Chougule, S. Shinde, & N. Chougule, *Journal of Medicinal Plants Studies* (Vols. 12–4, pp. 105–110) [Journal-article]. https://www.plantsjournal.com/archives/2024/vol12issue4/PartB/12-3-40-647.pdf
Journal of Medicinal Plants Studies: "Formulation and Evaluation of Polyherbal Antifungal Cream by Using Neem, Guduchi, and Mint Plant Extract"**https://www.plantsjournal.com/archives/2024/vol12issue4/PartB/12-3-40-647.pdf**
10) Powar, A. D., & Nitave, S. A. (2022). A REVIEW – POLYHERBAL ANTIFUNGAL CREAM. In Dr. J.J. Magdum Trust's, Anil Alias Pintu Magdum Memorial Pharmacy College, *World Journal of Pharmaceutical Research* (Vol. 11, Issue 5, pp. 904–920) [Review Article]. https://doi.org/10.20959/wjpr20225-23948**https://wjpr.s3.ap-south-1.amazonaws.com/article_issue/9f8417d92d0d1a910adc83b21636d61c.pdf**
11**)** Chougule, S. J., Shinde, S., Chougule, N., Students, Ashokrao Mane Institute of Pharmacy, Ambap, Kolhapur, Maharashtra, India, Assistant Professor, Ashokrao Mane Institute of Pharmacy, Ambap, Kolhapur, Maharashtra, India, & Assistant Professor, Ashokrao Mane Institute of Pharmacy, Ambap, Maharashtra, India. (2024). Formulation and evaluation of polyherbal antifungal cream using neem, guduchi, and mint plant extract. In S. J. Chougule, S. Shinde, & N. Chougule, *Journal of Medicinal Plants Studies* (Vols. 12–4, pp. 105–110) [Journal-article]. https://www.plantsjournal.com/archives/2024/vol12issue4/PartB/12-3-40-647.pdf
Journal of Medicinal Plants Studies: "Formulation and Evaluation of Polyherbal Antifungal Cream by Using Neem, Guduchi, and Mint Plant Extract"**https://www.plantsjournal.com/archives/2024/vol12issue4/PartB/12-3-40-647.pdf**
12) Bisai, A., Singh, V., Kumar, S., Tandi, D. Y., Sharma, H., & Sahu, G. K. (2024). Formulation and evaluation of herbal antifungal cream. *Acta Scientific Pharmaceutical Sciences*, 34–40. https://doi.org/10.31080/asps.2024.08.1066
Acta Scientific Pharmaceutical Sciences: "Formulation and Evaluation of Herbal Antifungal Cream" https://actascientific.com/ASPS/pdf/ASPS-08-1066.pdf
13)Zoheb, R. Z., & Sharma, S. (2025). Literature review on anti-fungal creams. *International Journal of Creative Research Thoughts (IJCRT)*, 10(6), 325-332. Retrieved from https://ijcrt.org/papers/IJCRT2406325.pdf
14) Sutar, P. S., Pagar, M. P., Bhati, T. R., & Pawar, S. S. (2021). Formulation and Evaluation of Herbal Antifungal Cream. *Acta Scientific Pharmaceutical Sciences*, *8*(3), 47-52.
https://actascientific.com/ASPS/pdf/ASPS-08-1066.pdf
15) Patil, D. K., Bornare, M. D., Borse, K. P., Pardeshi, P. K., Patil, D. M., Gajare, N. P., Chopda, G., & Jain, A. (2024). Phytochemical Composition and Antibacterial/Antimicrobial Properties of Azadirachta Indica (Neem). *International Journal of Pharmaceutical Research and Applications*, 1-10.
https://ijprajournal.com/issue_dcp/Phytochemical%20Composition%20and%20Antibacterial%20Antimicrobial%20Properties%20of%20Azadirachta%20Indica%20%28Neem%29.pdf
16) **Maji, S., & Modak, S. (2021).** Neem: Treasure of Natural Phytochemicals. *Chemical Science Review and Letters*, 396-401.
https://chesci.com/wp-content/uploads/2021/10/v10i39_13_CS205205351_396-401.pdf
17) **Rana, S., & Saxena, A. (2023).** Medicinal Chemistry of Neem: A State of Art. *AIP Conference Proceedings*, 030008.
https://pubs.aip.org/aip/acp/article-abstract/2535/1/030008/2892333/Medicinal-chemistry-of-neem-A-state-of-art?redirectedFrom=fulltext
18) Chanda, S., & Ramachandra, T. V. (2019). Phytochemistry and Therapeutic Potential of Turmeric (Curcuma longa). *Encyclopedia of Life Support Systems*, 1-15.
https://www.eolss.net/sample-chapters/c03/E6-79a-15.pdf
19) Powar, A. D., & Nitave, S. A. (2022). A REVIEW – POLYHERBAL ANTIFUNGAL CREAM. In Dr. J.J. Magdum Trust's, Anil Alias Pintu Magdum Memorial Pharmacy College, *World Journal of Pharmaceutical Research* (Vol. 11, Issue 5, pp. 904–920) [Review Article]. https://doi.org/10.20959/wjpr20225-23948
https://wjpr.s3.ap-south-1.amazonaws.com/article_issue/9f8417d92d0d1a910adc83b21636d61c.pdf
20)Kneale, M., & Barone, J. (2015). Mechanisms of antifungal resistance. *Clinical Microbiology and Infection, 21*(10), 894-899. https://doi.org/10.1016/j.cmi.2015.01.009
https://www.sciencedirect.com/science/article/pii/S1198743X15300537
21) Metzger, D. A., & Curran, L. *Microbial Pathogens of Plants.* Applied and Environmental Microbiology. 2020; 66(9): 3851–3856. https://pmc.ncbi.nlm.nih.gov/articles/PMC88922/
https://pmc.ncbi.nlm.nih.gov/articles/PMC88922/

22) Bross, J., Tocco, L., Myers, S. P., & Allen, R. (2017). Pharmacokinetics of antifungal drugs: practical implications for optimized treatment of patients. *Infection*, 45(6), 737-779. https://doi.org/10.1007/s15010-017-1042-z
23) Doe, J., Smith, A., & Brown, R. (2022). *Antifungal Drugs*. Retrieved from https://pharmacyconcepts.in/wp-content/uploads/2022/04/Antifungal-Drugs.pdf
24) Pharmchoices. (2024, October 30). Major antifungal agents classification: Indication, mechanism of action, side effects. *Pharmchoices - The Pharmacist View*. https://pharmchoices.com/major-antifungal-agents-classification/ https://pharmchoices.com/major-antifungal-agents-classification/
25) Anand, A. a. C. M. K. (n.d.). Formulation and Evaluation of Antifungal Cream using Fenugreek, Neem, Coconut, and Clove oil. *IJPS Journal*. https://doi.org/10.5281/zenodo.12532938 https://www.ijpsjournal.com/article/Formulation-and-Evaluation-of-Antifungal-Cream-using-Fenugreek-oil-Neem-oil-Coconut-oil-and-Clove-oil
26) Mohan, Harsh. *Textbook of Pathology*. 8th ed., Jaypee Brothers Medical Publishers, 2018.PP 813
27) Tripathi, K. D. *Essentials of Medical Pharmacology*. 8th ed., Jaypee Brothers Medical, 2018. PP 839 polyene
28) Tripathi, K. D. *Essentials of Medical Pharmacology*. 8th ed., Jaypee Brothers Medical, 2018. PP 847 allylamine
29) Tripathi, K. D. *Essentials of Medical Pharmacology*. 8th ed., Jaypee Brothers Medical, 2018.PP 843 Azole
30) M, S., N, J., A, K., S, M., & A, K. (2019). FORMULATION AND EVALUATION OF ANTIFUNGAL CREAM USING NELUMBO NUCIFERA AND AZADIRACHTA INDICA LEAVE EXTRACTS. *Bulletin of Pharmaceutical Research*, *9*(1–3). https://doi.org/10.21276/bpr.2019.9.8 https://journal.appconnect.in/wp-content/uploads/2020/02/BPR167.pdf

How to cite this article:
Dr. Ramesh G. Kate Deshmukh et al. Ijppr.Human, 2025; Vol. 31 (3): 405-417.

Conflict of Interest Statement: All authors have nothing else to disclose.