

A Review On Traditional And Antifungal Application Of Moringa, Tulsi And Curry Leaves In Treating Fungal Infection

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ABSTRACT

The global trend toward herbal alternatives has accelerated due to the increasing drawbacks of synthetic antifungal medications, including drug resistance, high cost, toxicity, and restricted accessibility. Bioactive phytochemicals with strong antifungal and therapeutic properties are abundant in medicinal plants. Among these, *Ocimum sanctum* (Lamiaceae), *Murraya koenigii* (Rutaceae), and *Moringa oleifera* (Moringaceae) have drawn a lot of interest due to their wide range of pharmacological activities and safety profiles. Because of its flavonoids, phenolic acids, alkaloids, and tannins, *Moringa oleifera** has antifungal, antibacterial, and antioxidant qualities. Eugenol and other essential oils found in *Ocimum sanctum* (tulsi) have potent antifungal, antioxidant, and immunomodulatory properties. Mahanimbine and girinimbine, two carbazole alkaloids found in *Murraya koenigii* (curry leaves), have strong antifungal, anti-inflammatory, and wound-healing qualities.

Keywords: *Ocimum sanctum*, *Murraya koenigii*, *Moringa oleifera*, antifungal properties, herbal remedies, phytochemicals, and substitutes for synthetic drugs.

INTRODUCTION

Global healthcare practices have undergone a paradigm shift in recent years, moving toward the use of plant-based medications as safer and more environmentally friendly substitutes for synthetic drugs. Despite their effectiveness, synthetic medications frequently have serious disadvantages, including drug resistance, unfavorable side effects, expensive manufacturing, and restricted availability in low-resource environments. Because medicinal plants are stores of various bioactive phytochemicals with exceptional therapeutic potential, the scientific community has focused on them. Among these, *Murraya koenigii* (curry leaves), *Ocimum sanctum* (tulsi), and *Moringa oleifera* have shown promise because of their broad range of pharmacological actions, conventional acceptability, and low toxicity

therapeutic and nutritional qualities. Its antioxidant, antimicrobial, anti-inflammatory, and antifungal properties are attributed to its abundance of flavonoids, phenolic acids, alkaloids, and tannins. The ability of the plant's leaves, seeds, and bark to fight microbial infections and oxidative stress has been thoroughly studied, making *Moringa* a powerful natural substitute for traditional synthetic drugs.

Another popular medicinal herb in South Asian ethnomedicine is *Murraya koenigii*, also referred to as the curry leaf and a member of the Rutaceae family. Mahanimbine and girinimbine, two carbazole alkaloids found in it, have strong anti-inflammatory, anti-microbial, antidiabetic, and antioxidant qualities. Apart from its culinary significance, *M. Koenigii* is important for preserving metabolic balance and fighting off microbial infections.

The "miracle tree," *Moringa oleifera*, is a member of the Moringaceae family and is well known for its

When combined, these medicinal plants offer a natural, affordable, and biocompatible substitute for

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synthetic medications. Their potential for creating innovative phytopharmaceutical formulations is highlighted by their multifunctional bioactivity, centuries of traditional use, and recent scientific validation. Therefore, the objective of this review is to thoroughly examine the pharmacological mechanisms, phytochemical composition, and therapeutic uses of *Murraya koenigii*, *Ocimum sanctum*, and *Moringa oleifera*, highlighting their function as safe and sustainable substitutes in contemporary medicine.[1,2,3,4]

What is fungal infection

Certain fungi are dimorphic, meaning they can be molds or yeasts. Based on environmental factors like temperature. The classification of fungal species based on which area of the body is impacted, such as the superficial (topical), subcutaneous, and systemic. A disease that only affects the skin can be brought on by a fungus that attacks the tissue. Affects the entire body or spreads to the body's tissues, bones, and organs. Its symptoms vary and are dependent on the affected area. Depending on the kind and place, but possibly Consist of redness, rash, scaling, discharge, or itching.[5,6,7]

Although they are ubiquitous, fungi only cause illness; they can be inhaled or Enter the body through cuts, wounds, or infections on the skin, or come into contact with Skin. It is more likely to happen to those with weakened immune systems, such as Suffering from diseases like HIV/AIDS and cancer patients undergoing treatment.[8]

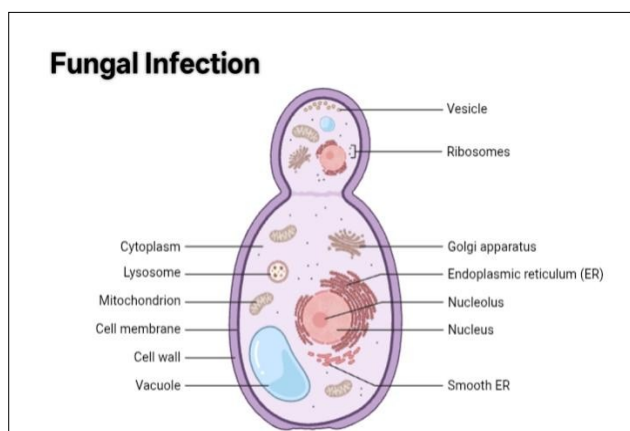


Figure 1. Fungal infection

TYPES OF FUNGAL INFECTION

A. Topical/Superficial infection

Fungal infections that are superficial affect the epidermis, nails, hair, and Membranes of mucus. [9]

Fungi typically target the skin's surface in the first phase, and then, through Thin filtration, desquamation, and One of the fungi that causes the most superficial skin infections is found in the deeper layer of the skin. Species of candidiasis.

A fungal infection showed up as dermal layer cutaneous mycoses. A widely used phrase "Dermatophytes" is the term for fungal diseases of the skin. Tinea Pedis, Tinea corporis, and Tinea cruris

One of the fungi commonly linked to a variety of dermatomycoses is Cruris. Systemic toxicity and pre-systemic metabolism can be avoided by topically applying medication. [10] [11]

The benefits of topical therapy for fungus infections [12 ,13]

1. The infection site is targeted.
2. Boosts therapeutic effectiveness and treatment efficacy
3. Decrease in toxicity and systemic side effects
4. Boost the level of patient compliance
5. Increased site-specific drug delivery and bioavailability

Clinically, the following fungal infections are classified based on the region in question:

1. Tinea capitis on the scalp, particularly in young children
2. Tinea barbae the affects adult males' beard area.
3. Tinea corporis, which affects the surface of the body at any age.
4. In obese men, tinea cruris is most common in the groin area, particularly during hot weather.

5. The webspace between the toes is where the tinea pedis is situated.
6. The nail substance disintegrates in onychomycosis.
7. The upper trunk is typically affected by tinea versicolor, which is brought on by *Malassezia furfur*. [14]

B. Subcutaneous Infection

The term “subcutaneous mycosis” refers to a fungal infection that Enters the skin’s tissue more deeply. [15]

C. Systemic fungal infection

Systemic fungal infections can be divided into two distinct categories:

The endemic or dimorphic mycoses. In contrast to mold and yeast infections, which are These diseases are opportunistic and only infect hosts with compromised immune systems. Are brought on by actual harmful fungi. There is a significant risk of death from these infections and Possess a high death rate. Solid organ transplant recipients who are on Immunosuppressive medications that lower the risk of organ rejection are more Susceptible to fungal infections throughout the body. [16] [17]

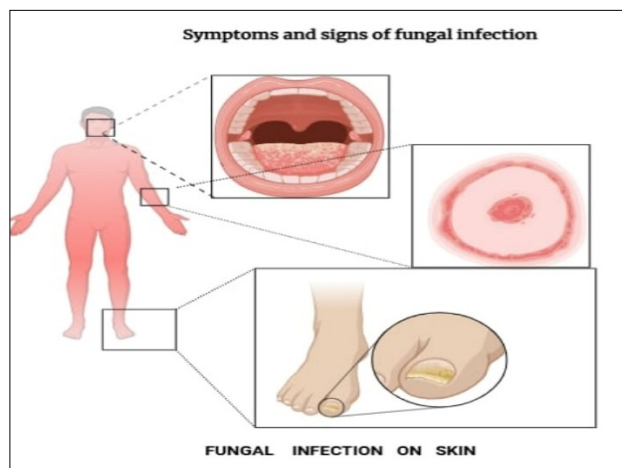


Figure 2: Symptoms of Fungal infections

Conventional medicine and Drug reaction [18][19] :

The side effects are caused by uncontrolled drug release. Due to limited penetration, These adverse effects can result in Prolonged treatment since the medicine may not reach The intended region, which could lead to incomplete infection Clearance.

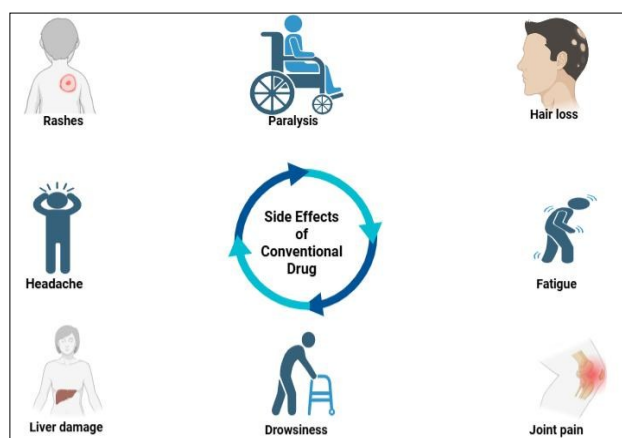


Figure 3: Side effects of Conventional Drug

Some examples of conventional drug and its adverse effect

Sr.No.	Drug	Adverse Reaction
1	Fluconazole	induce light-headedness', headaches, and excessive amounts of alopecia. [20]
2	Amphotericin B	danger of headache, chills, and hypotension, anemia, hypokalemia, hypomagnesemia, renal function and insufficiency anomalies, pain at the injection site, nausea,



		fever, rigors, and vomiting. [21]
3	Voriconazole	Prolonged non-melanoma skin cancer therapy.
4	Ketoconazole, Clotrimazole.	Fever, chills
5	Flucytosine	Leukopenia, Thrombocytopenia.
6	Caspofungin	Decreased renal function.
7	Anidulafungin C, Micafungin.	Dark urine, clay colored stools.
8	Flucytosine, Isavuconazole.	Abdominal pain.

ADVANTAGES OF HERBAL AGENT

1) Minimal resistance development:

Advocates of herbal remedies contend that the possibility of becoming resistant to Herbal remedies might be less expensive than synthetic antifungals. The reason for this is that plants The complex composition of many compounds can make it challenging for fungi to Create resistance [22].

2) Potential integration with traditional therapeutic approaches:

In addition to traditional treatments, some people may decide to use herbal remedies for Yeast infections. Nonetheless, it's critical to speak with medical experts to Verify that there are no contraindications or interactions [23].

3) Simplicity of establishing a daily schedule:

It's simple to include a lot of herbal products in your regular skin care regimen. Because they can be applied directly to afflicted areas, ointment oils and creams are convenient for standard use.

4) Accessible in various formats:

Antifungal herbs come in a variety of forms, including teas, lotions, creams, and essential oils. As well as supplements. People can select the shape that best fits their needs with this option. Skin type and preferences [24].

5) Traditional and cultural use:

In many cultures, herbal remedies and traditional drugs have been used to Address skin disorders. The experience and knowledge that have been accumulated through The use of herbal remedies for skin issues has grown in popularity over the generations. [25]

Herbal therapy

1. Moringa



Biological name - Moringa oleifera Lam.

Family – Moringaceae [26]

Part- leaves

Chemical constituents –

Flavonoids: Quercetin and myricetin (antioxidant and anti-inflammatory).

Phenolic Acids: Chlorogenic acid (helps lower blood sugar levels) • Vitamins: Vitamin A (beta-carotene), Vitamin C, Vitamin E, and Vitamin K.

Amino Acids: Includes all nine essential amino acids.



Alkaloids and Tannins: With antimicrobial and anti-inflammatory properties.[22] [23]

🌿 USES OF MORINGA OLEIFERA [27,28,29]

1. Medicinal Uses-

- Antifungal & Antibacterial - Effective against *Candida albicans*, *Aspergillus niger*, and *Trichophyton* species.
- Anti-inflammatory- Reduces swelling, redness, and inflammation.
- Antioxidant - Protects cells from oxidative damage.
- Antidiabetic - Lowers blood sugar and improves insulin sensitivity.
- Anticancer- Inhibits tumours cell growth Protects liver from toxins.
- Antihypertensive- Reduces high blood pressure.
- Antipyretic and Analgesic- Reduces fever and pain.
- Antifungal topical uses- Used in ointments and creams for ringworm, athlete's foot, and skin fungal infections.

2. Nutritional Uses

- Leaves: Rich in protein, calcium, iron, and vitamins A, C, and E — used as a natural dietary supplement and in malnutrition therapy.
- Pods (Drumsticks): Commonly consumed as a vegetable; rich in fiber and essential amino acids.
- Seeds: Contain oil (Ben oil) used in cooking and cosmetics; high in oleic acid and antioxidants.

3. Cosmetic and Topical Uses

Used in herbal creams, soaps, and oils for:

- Skin hydration and anti-aging effects.
- Treating fungal infections, acne, and minor wounds.
- Improving skin texture due to its antioxidant and antimicrobial compounds.

Industrial and Environmental Uses

- Water purification: Crushed seeds act as natural coagulants for removing impurities and microbes.
- Biofuel: Seed oil is explored for biodiesel production.
- Animal feed: Leaves used as a protein-rich feed supplement.

4. Traditional Uses (Ayurveda and Folk Medicine)

Used to treat:

- Skin diseases (eczema, fungal infections)
- Respiratory problems (asthma, cough)
- Digestive issues (ulcers, gastritis)
- Joint pain and rheumatism

2.Tulsi



Biological source- Tulsi consists of the fresh and dried leaves of *Ocimum* species like *ocimum sanctum* L.[30]



Family- Lamiaceae

Parts – leaves

Chemical Constituents- 70% Eugenol, Caryophylline, Volatile oil, essential oil.

🌿 USES OF OCIMUM SANCTUM

1. Medicinal Uses

- Antimicrobial & Antifungal:

Effective against *Candida albicans*, *Aspergillus*, and various bacteria due to compounds like eugenol and linalool. Commonly used in herbal antifungal formulations.

- Antioxidant:

Neutralizes free radicals, protecting against oxidative stress.

- Anti-inflammatory:

Reduces swelling and pain; used in joint pain and respiratory issues.

- Immunomodulatory:

Strengthens immune response; often used to prevent colds and infections.

- Adaptogenic (Stress-relieving):

Helps the body adapt to physical and emotional stress.

- Respiratory Benefits:

Used to treat cough, asthma, bronchitis, and cold — acts as an expectorant and bronchodilator.

- Antidiabetic:

Helps lower blood sugar levels and improves insulin function.

- Cardioprotective:

Lowers cholesterol and supports heart health.

- Wound Healing:

Topical Tulsi extract helps heal wounds and skin infections faster.

2. Traditional / Ayurvedic Uses

- Used in Ayurveda as a “Rasayana” (rejuvenating herb).
- Commonly taken as Tulsi tea, extract, or powder for overall wellness.
- Tulsi paste or oil is applied externally for skin diseases, insect bites, and fungal infections.

3. Others

- The antifungal properties of tulsi leaves were demonstrated against clinically isolated dermatophyte at a 0.2 mg/ml concentration.
- An essential oil with antifungal properties was produced by nearly every *Ocimum* species. The leaves of tulsi have been demonstrated to have potent antifungal properties against species of *Aspergillus* [31]
- Antifungal activity against species of *Candida* in vitro.

3. Curry leaves



Biological name – *Murraya koenigii* (L.)

Family – Rutaceae

Part- leaves

Chemical constituents –



Alkaloids: Mahanimbine and Koenimbine inhibit fungal growth.

Flavonoids & Phenolics: Disrupt fungal cell membranes and prevent replication.

Essential oils: Contain monoterpenes and sesquiterpenes with broad-spectrum antifungal activity.[32]

🌿 USES OF MURRAYA KOENIGII

1. Medicinal Uses

- Antimicrobial & Antifungal:

Exhibits strong activity against fungi like *Candida albicans* and *Aspergillus* species due to alkaloids, carbazole compounds, and essential oils. Commonly used in herbal antifungal creams and wound-healing preparations.

- Antioxidant:

Rich in phenolic compounds and flavonoids that neutralize free radicals and prevent cell damage.

- Antidiabetic:

Helps regulate blood glucose and improves insulin sensitivity.

- Cardioprotective:

Reduces cholesterol and triglycerides, promoting heart health.

- Hepatoprotective (Liver protection):

Protects the liver from toxin-induced damage.

- Anti-inflammatory:

Reduces inflammation and pain in arthritis and skin infections.

2. Other Uses

- Culinary Use: Because it contains aromatic essential oils like β -caryophyllene, α -pinene,

and sabinene, it is widely used in Indian cuisine as a flavoring agent.

- Insecticidal Activity: Extracts have larvicides and insect repellent properties of their own. [33,34,35]

CONCLUSION

A viable and long-term strategy for treating fungal infections is the combination of *Moringa oleifera*, *Ocimum sanctum*, and *Murraya koenigii*. They are perfect candidates for creating innovative herbal formulations as substitutes for synthetic antifungal medications due to their broad-spectrum antifungal potential, safety, and accessibility. To guarantee efficacy and safety in extensive therapeutic applications, future research should concentrate on standardizing extracts, clarifying molecular mechanisms, and carrying out clinical evaluations.

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