



HERBAL REMEDIES FOR SKIN INFECTION- A SHORT REVIEW

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ABSTRACT

Infection may arise if the human body's defense mechanism is compromised or if the concentration of germs is excessively high. Medical professionals classify infectious sickness as any condition in which signs and symptoms become clinically evident as a result of the body's response to invading invaders. Bacterial illnesses were among the most feared forms of infectious disease. In recent years, various studies have shown that the prevalence of this condition has increased in India. It is also becoming more difficult to treat fungal infections using antifungal medications. In addition, the high expense of these medicines in underdeveloped nations like India was a major hurdle. The inability of existing available medication draws our attention toward the development of alternative therapeutic options. In this paper, we have highlighted the role of promising herbal bioactives that can prove to be beneficial for the prevention and management of skin infections.

Keywords: Bioactives, pathophysiology, skin infection, bacterial infection, viral infection

Introduction

Skin infections are a common and wide-ranging health issue that affect people of all ages and backgrounds. They can occur due to various causes,

including bacteria, viruses, fungi, and parasites. Skin infections can manifest in different forms, from mild conditions such as acne and impetigo to more severe and potentially life-threatening infections like cellulitis and necrotizing fasciitis^[1]. The skin is the largest organ of the body and serves as a protective barrier against external elements. However, when this barrier is compromised or invaded by harmful microorganisms, it can lead to infection.

Skin infections can occur anywhere on the body and may present with a range of symptoms, including redness, swelling, pain, itching, and the formation of rashes, blisters, or lesions. Understanding the underlying causes of skin infections is crucial for effective diagnosis, treatment, and prevention. Bacterial infections, such as *Staphylococcus aureus* or *Streptococcus pyogenes*, are among the most common culprits. Fungal infections, caused by organisms like *Candida* or dermatophytes, also contribute significantly to skin infections. Additionally, viral infections like herpes simplex virus and human papillomavirus can affect the skin^[2].

Several risk factors can increase an individual's susceptibility to skin infections. These include poor hygiene practices, compromised immune system function, pre-existing skin conditions (e.g., eczema or psoriasis), close contact with infected individuals, and exposure to contaminated environments^[3]. Certain professions or activities that involve frequent contact with water, soil, or animals can also elevate the risk of acquiring a skin infection. Prompt identification and appropriate management of skin infections are vital to prevent complications and promote healing^[4].

Treatment may involve topical or systemic medications, depending on the type and severity of the infection. In some cases, additional measures like wound care, drainage of abscesses, or surgical intervention may be necessary. Prevention plays a crucial role in minimizing the occurrence and spread of skin infections. Practicing good personal hygiene, such as regular handwashing, keeping the skin clean and dry, and avoiding sharing personal items, can help reduce the risk. Vaccinations, where available, can provide protection against specific viral infections that affect the skin. Hence, skin infections encompass a broad spectrum of conditions that can range from mild to severe. They can result from various microorganisms and may present with diverse symptoms^[5]. Recognizing the causes, risk factors, and appropriate preventive measures are essential for effectively managing and reducing the burden of skin infections.

Types of infection

Skin infections can arise from different microorganisms and have distinct characteristics and presentations. Here are some common types of skin infections viz. bacterial, fungal, viral and parasitic infection.

Bacterial skin infections

Bacteria can cause various skin infections, including cellulitis, impetigo, folliculitis, boils, and carbuncles^[6-7]. Cellulitis is a bacterial infection affecting the deeper layers of the skin, causing redness, warmth, swelling, and pain. Impetigo is a highly contagious infection characterized by red sores or blisters that ooze and form a yellowish crust. Folliculitis is the infection of the hair follicles, resulting in small, inflamed bumps or pustules. Boils (Furuncles) are deep, pus-filled nodules that develop around hair follicles. Carbuncles are the multiple interconnected boils that often form a larger, painful lump.

Fungal skin infections

Fungi are responsible for several skin infections, such as ringworm, athlete's foot, candidiasis, and onychomycosis^[8-9]. Ringworm (Tinea) is a group of fungal infections that can affect various parts of the body, causing circular, itchy, and scaly rashes. Athlete's foot (Tinea pedis) is a fungal infection that typically affects the feet, causing itching, redness, scaling, and sometimes blisters. Candidiasis is an infection caused by *Candida* yeast, commonly affecting areas like the groin, armpits, and skin folds. It can result in red, itchy rashes with satellite lesions. Onychomycosis is a fungal infection that affects the nails, causing discoloration, thickening, and crumbling.

Viral skin infections

Viruses can lead to various skin infections, including herpes simplex, varicella-Zoster Virus (VZV) infection and molluscum contagiosum^[10-11]. Herpes simplex is caused by the herpes simplex virus (HSV), and it manifests as painful, fluid-filled blisters on the skin or mucous membranes. Varicella-Zoster Virus (VZV) Infection causes chickenpox (varicella) in the initial infection and may later reactivate as shingles (herpes zoster), resulting in a painful rash. Molluscum Contagiosum is characterized by small, flesh-colored bumps with a central indentation caused by the molluscum contagiosum virus.

Parasitic skin infections

Parasites can also cause skin infections, such as scabies and pediculosis. Scabies is caused by the microscopic mite *Sarcoptes scabiei*, resulting in intense itching, rash, and small burrow tracks on the skin^[12]. Pediculosis (Lice

infestation) is a lice infestations that can lead to itching, inflammation, and the presence of lice or their eggs (nits) on the hair or body.

It's important to note that some skin infections can have overlapping features or variations in presentation. Proper diagnosis and treatment by a healthcare professional are crucial for effectively managing these infections and preventing complications.

Pathology of infections^[13]

The pathophysiology of skin infections involves the interaction between the invading microorganisms and the host's immune response. Skin infections occur when microorganisms, such as bacteria, fungi, viruses, or parasites, gain access to the skin through breaches in the skin barrier, cuts, or insect bites. These pathogens can be introduced externally or arise from the body's normal microbial flora. Once the microorganisms gain entry, they adhere to the surface of the skin or penetrate the deeper layers. Adherence is facilitated by various mechanisms, including specific adhesion molecules or surface structures present on the pathogens. The microorganisms then multiply, forming colonies and spreading within the skin tissues. The presence of microorganisms triggers an immune response in the host, leading to inflammation. This response aims to control and eliminate the invading pathogens. Immune cells, such as neutrophils and macrophages, migrate to the infected site to engulf and destroy the microorganisms.

The release of cytokines and chemokines further activates the immune response, recruiting more immune cells to the infection site. As the immune response intensifies, it can cause tissue damage. The release of enzymes and toxic substances by immune cells, along with the direct effects of microbial toxins, can lead to destruction of skin cells, disruption of tissue architecture, and the formation of inflammatory exudates. This tissue damage contributes to the characteristic signs and symptoms of skin infections, including redness, swelling, pain, and the formation of rashes or lesions. If left untreated or if the immune response is inadequate, skin infections can spread to adjacent areas or deeper tissues. Bacteria can invade blood vessels, leading to bacteremia or sepsis, while certain viruses can travel along nerve fibers, resulting in the spread of infection to other regions of the body. Severe complications, such as abscess formation, tissue necrosis, or systemic infections, can occur in some cases.

Diagnosis of skin infection

The diagnosis of a skin infection involves a combination of clinical evaluation, medical history assessment, and sometimes laboratory tests^[14]. The

goal is to identify the causative organism and determine the appropriate treatment. The healthcare provider will begin by gathering information about the patient's medical history, including any previous skin infections, underlying health conditions, recent exposure to infectious agents, and current symptoms. A thorough physical examination of the affected area will be conducted to observe the appearance of the skin, presence of rashes, lesions, or other abnormalities. In certain cases, the healthcare provider may collect samples from the affected area for laboratory analysis. This can involve swabbing the skin surface, obtaining a skin scraping, or aspirating fluid from a lesion. The collected samples are then sent to a laboratory for further testing, such as microbial culture or microscopic examination. Microbiological tests^[15] are used to identify the specific microorganism causing the infection. These tests may include microbial culture, gram stain, and blood test etc. In microbial culture method, the collected sample is cultured on specific growth media to allow the microorganisms to grow and be identified. Bacterial, fungal, or viral cultures may be performed depending on the suspected pathogen.

Gram stain is a staining technique that helps identify the type of bacteria based on their cell wall structure, distinguishing between Gram-positive and Gram-negative bacteria. Molecular techniques like PCR can detect and identify the genetic material of microorganisms, providing rapid and accurate results. In some cases, blood tests may be ordered to assess the overall health of the patient and determine if the infection has spread systemically. Blood tests can include complete blood count (CBC), inflammatory markers (e.g., C-reactive protein), and specific serological tests for certain infections. In certain situations where the diagnosis is unclear or to rule out other conditions, a skin biopsy may be performed. A small sample of the affected skin is surgically removed and examined under a microscope to determine the nature of the infection and any underlying pathology.

Herbal remedies for the treatment of skin infection

Many synthetic drugs likeazole derivatives are currently being used for the treatment of several types of skin infections. But due to associated side effects, there is a need to put some light on alternative remedies. though the emphasis is still more on allopathic medication, the utilization of herbal remedies has proved their potential worldwide as a traditional approach. Herbal remedies have been used for centuries to address various health conditions, including skin infections. It's important to note that while some herbal remedies may offer potential benefits, scientific evidence supporting their efficacy and safety in

treating skin infections is limited. Hence, this review aims to highlight the potential of herbs in managing skin infections. Numerous plant studies having the potential to be used for the treatment of skin infections have been depicted in Table 1.

Table 1: Plant bioactives and their mechanism

S.NO	Name of Herb	Constituents	MOA	Reference
1.	Datura metel	Atropine, hyoscyamine and Scopolamines	Anti-fungal, anti-bacterial, anti-oxidant	31 32
2.	Achyranthes aspera	Alkaloids, carbohydrate, glycoproteins, sterols, tripenes and flavonoids	Leaf decoction is applied on skin eruptions	33 34
3.	Coriander	Vit.c, Fatty acids, Minerals and also Linolool, Terpenoid	Anti-inflammatory, anti-microbial, anti-oxidant effect	35,36
4.	Glycyrrhiza glabra	Glycyrrhizic acid, glycyrrhizin, glabrin A and B	Anti-viral, anti-tumor, and anti-inflammatory, anti-bacterial	37,38
5.	Curcuma longa	Curcumin, Demethoxycurcumim or Bisdemethoxycurcumin	Antimicrobial, Antiviral, anti-inflammatory, Asthma Hepatoprotective Wound healing, anticancer	39,40
6.	Safforn	Crocin, Picrocrocin, Safranal, Crocetin, Monoterpenes, Aldehydes	Anti-oxidant	41
7.	Carrot	Flavonoids, Phenolic derivatives	Analgesic, Inflammatory, Anticancer,	42,43

			Hepatoprotective , Anti-tumor	
8.	Capparis deciduas(Forsk k) Edgew	Plants have produced alkaloid, flavonoid, pure chemical such as caparisinine, cadabicine.	Antiviral, Anti-inflammatory, Analgesic, Anti-bacterial activity	26
9.	Banana peel	Vit.A, Vit.C, Magnesium, Phosphorus, Potassium, Iron, Succinic acid, Malic acid, tannins, flavonoid	Anti-microbial, abti-fungal, anti-biotic, anti-bacterial, anti-inflammatory	44,45
10.	Citrus limon	Alkaloids, Vit,c	Anti-oxidant, anti-bacterial, anti-fungal	46, 47
11.	Urtica dioica L.	Flavonoids, tannins, volatile compound, sterols, terpenes, vitamins, fatty acids, proteins	Anti-oxidant, anti-bacterial	48, 49
12.	Hibiscus	Triterpenoids, naphthalene, lignans, flavonoids, sterols	Anti-oxidant, anti-microbial	50 51
13.	Thymus Uvlgaris Linn	Linalool, Borneol, Geraniol, Sabinene hydrate, Thymol, Carvacol, P-Cymene, f γ -terpine	Anti-bacterial, Anti-inflammatory, Anti-microbial	52,53
14.	Pycnogenol	Bioflavonoid, Catechin, taxifolin, phenol carboni acid	Anti-oxidant, Anti-inflammatory	54 55
15.	Punica granatum peel	Polyphenols, tannins, ellagic acid, anthocynins, flavonoids, proanthocyanidin,	Anti-oxidant, Anti-microbial	56,57

		calcium, magnesium etc		
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Blackberry

The Myrtaceae family member *Syzygium cumini* is also known as *Eugenia cumini* and *Syzygium jamunum*. The Indian blackberry is also known by the names Jambul, Black Plum, Java Plum, Jamblang, and Jamun. The pulp of Indian blackberries contains the phytochemicals maleic acid, oxalic acid, gallic acid, tannins, cyanidin glycoside, oleanolic acid, flavonoid, essential oils, and betulinic acid. Blackberries contain vitamin E, which protects skin from wrinkles and other oxidative damage and keeps it vibrant¹⁶. In conclusion, our research indicates that the extract of blackberry, with its fast virucidal and virus replication-inhibitory effects, may be an efficient surface therapeutic and/or preventative therapy for oral herpetic infections. These results pave the way for additional research that will seek to isolate and characterize the bio-active (Herpes simplex virus) molecules in the extract of blackberry as well as ascertain whether the bioactive principle in blackberry extract has an antiviral effect against additional herpes simplex virus strains and serotypes in pre-clinical and toxicity evaluations.¹⁷

Ajwain

Ajowan or Ajwain is the popular name for *Trachyspermum ammi* or *Carum copticum*. The primary phenolic ingredient in ajowan, thymol, is a potent anti-spasmodic and germicide. Additionally, it is utilized to clean wounds and treat skin infections.¹⁸ In conclusion, the core-shell nanofiber containing Ajwain essential oil was effectively created to speed up the healing of wounds that are contaminated with bacteria. The SEM pictures demonstrated the development of fibers with a mean diameter of 623 ± 160.04 nm that were uniform and bead-free. The significant antibacterial ability of the core-shell nanofiber mats against both gram-positive and gram-negative bacteria and fungus was generated by the addition of Ajwain EO.¹⁹

Azadirachta indica

Since it has been utilized from centuries in Ayurvedas, Unani, and homoeopathic system of medication, *Azadirachta indica* (neem), belong to Meliaceae family, has become a focus of modern medicine. Leaf and seed extracts have anti-tumor, anti-cancer, anti-viral, anti-fungal, and anti-protozoal capabilities in addition to having immunomodulatory and insecticidal effects.²⁰ The only medicinal plant that has antibacterial effect against various germs is neem. In new drug delivery systems with excellent therapeutic efficacy, microspheres serve as

better carriers. The improved formulation of neem extract-containing microspheres was added to the gel and demonstrated improved antibacterial activity. All of the formulations were also determined to be stable and secure over the course of the investigation. These results can undoubtedly be used to treat fungal diseases on the skin.²¹

Diospyros montana Roxb

Diospyros, a bisnaphthoquinonoid molecule discovered from *Diospyros montana* Roxb, could strongly inhibit *Leishmania donovani* promastigotes, the organism responsible for VL.²² A bis-naphthoquinone derivative called diospyrin, a natural substance with antileishmanial properties, was discovered in the bark of the *Diospyros montana* Roxb plant (Ebenaceae). By interacting with parasite topoisomerase I, Diospyros stabilizes the complex of enzymes and DNA cleavable. According to reports, Diospyros structural alteration is effective against *L. major* and *L. donovani* promastigotes.²³

H. perforatum

St. John's Wort, also known as *H. perforatum*, Topical St. John's wort products, such as oils or tinctures, are used to treat a variety of conditions, including myalgia, ulcers, small burns, bruises, contusions, abrasions, and sunburns.²⁴ The HP extract has antifungal, anti-inflammatory, antimycobacterial, and antiviral properties that aid in the healing of wounds. It also contains phloroglucinols, flavonoids, bioflavonoids, and phenylpropanoids. The plant has a wide range of therapeutic uses, including treating burns, eczema, psychiatric disorders, intestinal illnesses, and skin wounds.²⁵

Aloe vera

400 species in the Aloe genus is aloe vera. The Asphodelaceae family is its home. Studies have shown that it has qualities that help fight cancer, heal wounds, prevent ulcers, reduce inflammation, and fight diabetes. Aloe has a high concentration of aloein, as well as nataloins such as picric and oxalic acids and a-barbaloin. Salicylic acid and lupeol, which are both present, are what give it its antibacterial effects. It was a great analgesic due to the presence of lupeol.²⁶ Reducing wound inflammation, promoting fibroblast proliferation, collagen synthesis, wound contraction, re-epithelialization, and angiogenesis, as well as boosting the production of growth factors like transforming growth factor- β 1 (TGF-1) and vascular endothelial growth factor (VEGF) in wounds, are all ways that aloe vera has been shown to speed up wound healing. Studies conducted in vitro showed that β -sitosterol and aloesin from aloe had an angiogenic effect by

promoting the growth and movement of HUVECs, which aided in the healing of wounds.²⁷

Alangium Salvifolium

Alangium salvifolium Wang, sometimes known as sage-leaved Alangium, is a member of the Alangiaceae family. It is a known medicinal herbal plant that used for centuries in India. It is also one of the most adaptable medicinal plants, possessing a broad range of biological properties including anti-oxidant, anti-diabetic, diuretic, analgesic, anti-ulcer, anti-inflammatory, anti-microbial, anti-arthritic, antifertility, anthelmintic, anti-fungal, and anti-epileptic effects. According to reports, the tribes in Kerala use it as a contraceptive for raising pigs and cattle as well as to treat skin conditions, leprosy, and scabies. *A. salvifolium*'s root barks were applied externally as an antidote for attacks from dogs, rabbits, rats, and snakes.²⁸

Matricaria recutita

An annual plant belonging to the family Asteraceae, *Matricaria recutita* is most often known as chamomile or German chamomile.²⁹ Sesquiterpenic and phenolic compounds are just two examples of the chemical compounds found in it. The primary bioactive components of chamomile are believed to be sesquiterpene compounds like bisabolol, bisabolol oxides A and B, chamazulene, and farnesene, phenolic compounds like the flavonoids apigenin, quercetin, patuletin, and luteolin, and their glucosides, as well as coumarins (herniarin and umbelliferone). Apigenin is the flavonoid that holds the most promise. Additionally, it was used topically to treat skin conditions, mastitis, leg ulcers, renal colic, nausea, skin eruption, and constipation. It was also used as a sedative and to expel parasitic worms. The biological properties of chamomile include antioxidant, antimicrobial, anti-inflammatory, and anti-cancer properties.³⁰

Tea tree oil

Tea tree oil, derived from the leaves of the tea tree (*Melaleuca alternifolia*), has antimicrobial properties and is commonly used in topical applications. It may help in the treatment of bacterial and fungal skin infections, including acne, athlete's foot, and impetigo. However, it should be used with caution as it can cause skin irritation in some individuals.

Calendula

Calendula (Calendula officinalis) is an herb with anti-inflammatory and antimicrobial properties. It has been used topically to treat various skin conditions, including minor wounds, rashes, and dermatitis. Calendula creams or

ointments may help soothe and promote healing of skin infections, although more research is needed to confirm its effectiveness.

Garlic

Garlic (*Allium sativum*) contains compounds with antimicrobial properties. It has been used traditionally to address various infections, including skin infections. Some studies suggest that garlic extracts or preparations may exhibit antimicrobial activity against certain bacteria and fungi. However, further research is required to establish its effectiveness and appropriate application for skin infections.

Turmeric

Turmeric (*Curcuma longa*) is a spice with anti-inflammatory and antimicrobial properties. It contains a compound called curcumin, which has been investigated for its potential therapeutic effects. While research on its specific role in treating skin infections is limited, turmeric may offer some benefits due to its antimicrobial and anti-inflammatory properties. Topical application or consumption as part of a balanced diet may be considered

CONCLUSION

The role of herbal bioactives in the treatment of skin infections is an area of interest and ongoing research. Herbal bioactives are compounds derived from plants that have shown potential antimicrobial, anti-inflammatory, and wound-healing properties. While scientific evidence supporting their efficacy is limited, some studies have suggested their potential benefits in treating various types of skin infections. Tea tree oil, manuka honey, garlic extract, aloe vera, licorice extract, lemon balm, turmeric, and chamomile are the examples of herbs found to be effective for the management of various types of skin infections. While these herbal bioactives show promise, more research is needed to establish their efficacy, optimal dosages, and safety profiles for specific skin infections.

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