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Review on: Neem Extract Use to Treat Chickenpox and Smallpox

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Abstract

The use of natural plant-based remedies in traditional medicine has garnered attention for their potential benefits in treating various viral infections. Neem (Azadirachta indica), a tree native to the Indian subcontinent, has long been utilized in Ayurvedic and folk medicine for its wide range of therapeutic properties. This review explores the use of neem extract in the treatment of viral infections such as chickenpox (varicella) and smallpox (variola). Both of these diseases, caused by viruses from the herpes and poxvirus families, respectively, have historically imposed significant health burdens, particularly in regions with limited access to modern healthcare. With the advent of vaccines and antiviral drugs, their incidence has been dramatically reduced; however, neem remains a complementary remedy in many cultures. Neem's soothing and antibacterial qualities make it effective in reducing itchiness and preventing infections when applied topically. Smallpox, a more severe and now eradicated disease caused by the variola virus, was once a major cause of morbidity and mortality. Historical accounts indicate that neem leaves were used in poultices and baths to relieve the fever and rash associated with smallpox outbreaks. Studies on neem's antiviral capabilities suggest that its active compounds may inhibit viral replication by interfering with viral entry and protein synthesis. While modern scientific research on neem's direct effects on the viruses causing chickenpox and smallpox is limited, in vitro and in vivo studies have shown neem extract's ability to suppress other viruses, such as dengue, HIV, and herpes simplex. This indicates a broad-spectrum antiviral potential that warrants further investigation. Additionally, neem's immune-boosting properties may help the body mount a more effective response to viral infections by enhancing the production of white blood cells and stimulating macrophage activity.

Keywords – Neem, Chickenpox, smallpox, Neem extracts effect on smallpox and chickenpox.

INTRODUCTION

The use of herbal remedies in traditional medicine has gained renewed attention in recent years, particularly as researchers explore natural alternatives to conventional treatments. Traditionally, neem has been employed in various cultures to treat a range of ailments, including skin diseases, infections, and inflammatory conditions. Notably, its potential role in managing viral infections such as chickenpox (varicella) and smallpox (variola) has drawn interest, especially given the resurgence of interest in natural therapies amidst concerns about vaccine safety and the side effects of synthetic drugs.[1] Chickenpox, caused by the varicella-zoster virus (VZV), is a highly contagious disease characterized by an itchy rash and flu-like symptoms. While generally mild in children, it can lead to severe complications in immunocompromised individuals and adults. Smallpox, eradicated in 1980 through an extensive vaccination campaign, was a severe disease caused by the variola virus, characterized by fever and a distinctive skin rash.[2]

In vitro studies have demonstrated that neem extracts can inhibit the replication of several viruses, suggesting a potential role in mitigating the symptoms of chickenpox and possibly smallpox. Additionally, the anti-inflammatory properties of neem may help alleviate the discomfort associated with viral rashes.[3] This review will delve into the existing literature on neem's therapeutic applications, examining its efficacy in treating chickenpox and smallpox, and will discuss the implications of its use in contemporary medical practice.[4]

Figure 1*: *Azadirachta Indica

History

Neem (Azadirachta indica), often referred to as the "village pharmacy" has been used for centuries in traditional Indian medicine, especially within the frameworks of Ayurveda, Unani and Siddha practices. It is renowned for its medicinal properties, particularly in treating skin diseases and infections, including viral conditions such as chickenpox and smallpox. Historical records indicate that neem has been a staple in the treatment of these viral infections, long before the advent of vaccines or modern antiviral medications. In the context of chickenpox and smallpox, neem was traditionally used as a topical agent to soothe the characteristic rashes and blisters associated with these diseases. Neem leaves were often boiled and used in baths or applied as pastes to help relieve the intense itching and irritation caused by the rashes. In regions affected by smallpox outbreaks, neem leaves were used to prepare medicinal poultices applied to the skin, believed to reduce fever and promote faster healing. The plant's antibacterial and anti-inflammatory properties were also exploited to prevent secondary bacterial infections, a common complication in both chickenpox and smallpox patients. [5] Smallpox, caused by the variola virus, was one of the deadliest diseases in human history. Before its global eradication in 1980, it caused immense suffering, particularly in regions like India where outbreaks were frequent. During such times, neem was used extensively in rural communities to help manage the symptoms. For chickenpox, neem remains in use in many communities as a home remedy, even in the post-vaccine era. The history of neem's use in treating viral infections like chickenpox and smallpox highlights the plant's enduring importance in traditional medicine. It serves as a bridge between ancient healing practices and modern research into plant-based antiviral treatments, encouraging further study into its therapeutic potential. [6]

Purpose

The purpose of this review is to critically assess the therapeutic potential of Neem (Azadirachta indica) extract in the treatment of chickenpox (varicella) and smallpox (variola), two historically significant viral infections. While modern medicine has drastically reduced the prevalence of these diseases—thanks to vaccines and antiviral treatments—there remains significant interest in natural, plant-based remedies that can either complement existing treatments or provide alternatives in regions with limited healthcare resources.

Neem, a medicinal plant renowned for its broad spectrum of biological activities, has been traditionally used to alleviate the symptoms of viral infections, particularly those affecting the skin, such as chickenpox and smallpox. Furthermore, the review seeks to highlight the potential mechanisms of neem's action against viral infections, focusing on the bioactive compounds that could contribute to its antiviral properties. Another critical purpose of this review is to bridge the gap between traditional knowledge and modern scientific research. While neem has been extensively studied for its medicinal properties in general, there is limited targeted research on its specific effects against the viruses responsible for chickenpox and smallpox. This review aims to encourage further research and clinical trials to validate neem's efficacy and safety in this context. By analyzing the potential benefits and limitations of neem extract in treating chickenpox and smallpox, this review ultimately seeks to contribute to the broader field of antiviral research and support the exploration of traditional medicines as viable treatments for infectious diseases.[7]

Monograph of Neem

Botanical Name

Azadirachta indica.

Common Names

Neem, Nimtree, Indian Lilac, Margosa Tree.

Family

Meliaceae.

Biological Source

Neem consists of the fresh or dried leaves and seed oil of Azadirachta indica J. Juss Melia Indica or M. azadirachta Linn.

Description

Neem is a large, evergreen tree native to the Indian subcontinent. It can grow up to 20-30 meters tall, with a straight trunk and a wide-spreading crown. The bark is rough, fissured, and brownish-grey in color, while the leaves are pinnately compound with serrated edges. [8]

Geographical Distribution

Neem is widely distributed in tropical and subtropical regions, particularly in India, Pakistan, Bangladesh, and Myanmar. It is also cultivated in various parts of Africa, Southeast Asia, and South America.[9]

Figure 2*: *Morphology of Neem

Active Constituents

Neem contains numerous biologically active compounds, including:

Azadirachtin

A potent insecticidal agent.

Nimbin
Exhibits anti-inflammatory, antifungal, and antibacterial properties.
Nimbidin
Contributes to neem's anti-inflammatory and antibacterial actions.
Gedunin
Known for its antimalarial properties.
Nimbidol
Effective against fungal infections.
Sodium nimbinate
Helps in controlling blood sugar levels.[10]
Cultivation of Neem (Azadirachta indica):

Figure 3*: *Cultivation of Neem

Neem is a hardy tree that can grow in a variety of environmental conditions, making it relatively easy to cultivate. Below are the detailed guidelines on the cultivation of neem:
Climate Requirements
Temperature
Neem grows best in tropical and subtropical climates. It thrives in temperatures ranging from 25°C to 40°C. It can tolerate temperatures as high as 50°C, but frost is detrimental to its growth.
Rainfall
While neem is drought-tolerant and can survive in dry conditions, it prefers annual rainfall between 450 mm and 1200 mm. It can grow in areas with low rainfall, but optimal growth is seen in regions with moderate rain.
Propagation Methods
Neem can be propagated through seeds, cuttings, or root suckers.
Propagation by Seeds
Seed Collection
Neem seeds are harvested from ripe fruits (yellowish in color) that drop from the tree. Seeds should be collected soon after the fruit ripens.
Sowing
Neem seeds lose viability quickly, so they should be sown within two to three weeks of harvesting. Seeds are sown directly in the field or in a nursery. In the nursery, seeds are sown in well-prepared seedbeds or polybags containing a mixture of soil and organic manure

Propagation by Cuttings

Neem can also be propagated by planting stem cuttings. Healthy branches of about 30 cm in length are cut and planted in nursery beds. The cuttings should be watered regularly to maintain moisture, and they will develop roots in a few weeks.

Propagation by Root Suckers

Neem also propagates through root suckers, which are the shoots that grow from the roots of a mature tree. These suckers can be carefully removed and transplanted to a new location.

Planting

Spacing

In large-scale plantations, neem trees are planted at a spacing of 5-6 meters apart. This allows sufficient room for the roots to spread and for the tree canopy to develop.
to promote healthy growth.

Irrigation

Neem is drought-tolerant and can survive with minimal water once established. However, young saplings require regular watering, especially during the dry season, for the first 2-3 years. After the initial growth phase, neem trees require very little to no irrigation.

Fertilization

Although neem is hardy and can grow in nutrient-poor soils, adding organic fertilizers like compost or farmyard manure during planting can boost growth. Neem doesn't require heavy fertilization, but occasional application of organic manure enhances the quality of foliage and fruit production.

Pests and Diseases

Neem is naturally resistant to most pests and diseases due to its insecticidal properties, especially the presence of azadirachtin. However, some pests like scale insects, termites, and caterpillars may occasionally attack neem trees. Neem oil or neem-based pesticides can be used to manage such infestations.

Harvesting

Leaves

Neem leaves can be harvested throughout the year, but they are usually harvested in the dry season (March-May).

Seeds

Neem fruits are ready for harvest 5-7 years after planting. Mature fruits (yellow in color) are collected from the ground after they drop or by shaking the branches. The fruits are then processed to extract neem oil or dried for seed purposes.[11]

Collection of Neem (Azadirachta indica)

The collection of neem is an important process, as various parts of the tree such as leaves, seeds, bark, and fruits are harvested for medicinal, agricultural, and cosmetic purposes. Below are the guidelines for the collection of neem:

Collection of Neem Leaves: Optimal Time

Neem leaves can be collected throughout the year, but the best time for collection is during the dry season, typically from March to May. During this time, the leaves are rich in bioactive compounds.

Method

Fresh, healthy leaves are handpicked from the branches. Care should be taken to avoid collecting old, yellowing, or diseased leaves, as they may have reduced medicinal value.The leaves should be dried in a shady, well-ventilated area to preserve their active constituents. Avoid drying in direct sunlight, as it can degrade some compounds.

Collection of Neem Bark: Optimal Time

The bark is usually collected from mature neem trees that are at least 10-15 years old. The best time for bark collection is during the dry season, as the sap content is lower, making it easier to strip the bark.

Method

Bark is removed in strips, making sure not to girdle the tree, which can kill it. Only a portion of the bark is removed to allow the tree to regenerate. After removal, the bark is dried in the shade to preserve its medicinal properties.

Collection of Neem Seeds and Fruits: Optimal Time

Neem fruits ripen and are ready for collection during the monsoon season, typically between June and August.

Method

Ripe neem fruits are yellowish-green and fall naturally from the tree when mature. These fallen fruits are collected from the ground. Alternatively, ripe fruits can be harvested by shaking the tree branches. After collection, the fruits are soaked in water for a day to soften the pulp, which is then removed by hand. Seeds are extracted from the pulp and dried in a shaded area to reduce moisture content. These seeds are used to extract neem oil or for propagation.

Collection of Neem Flowers: Optimal Time

Neem flowers usually bloom between January and April. They are most potent when collected during the peak flowering season.

Method

Neem flowers are handpicked carefully without damaging the tree. The flowers are then dried in the shade to retain their flavor and medicinal properties. They are often used in traditional dishes, as well as in medicines for digestive issues.

Collection of Neem Twigs: Optimal Time

Neem twigs can be collected throughout the year.

Method

Young, healthy branches are cut and trimmed into small twigs.Twigs are often used for dental hygiene (chewing sticks) or in herbal remedies.[12]

Uses

Neem water baths to soothe itching.

Neem pastes to dry lesions and promote healing.

Neem leaves around patients for air purification.

Neem oil to reduce irritation.

Neem leaf infusion to boost immunity.[13]

Mechanism of Action of Neem

Antiviral Properties

Neem has shown potential antiviral activity by inhibiting viral replication. The azadirachtin compound can interfere with the life cycle of viruses, preventing them from attaching to or entering host cells. This prevents the spread of viral infections.

Anti-inflammatory Effects

Neem helps reduce inflammation by inhibiting pro-inflammatory cytokines and enzymes like COX-2, which are responsible for causing redness, swelling, and pain during infections. This helps manage the discomfort associated with viral diseases like chickenpox and smallpox.

Antibacterial and Antifungal Effects

Neem's antibacterial and antifungal properties help prevent secondary infections, especially in cases where open sores (from chickenpox or smallpox) could become infected by bacteria.

Immune System Modulation

Neem extracts enhance the body's immune response by promoting the activity of T-cells and macrophages, which are responsible for identifying and eliminating pathogens. This immune-boosting effect can help the body fight off viral infections more effectively. [13]

Chickenpox and Smallpox

Figure 4*: *Chickenpox

Chickenpox

Chickenpox (varicella) is a highly contagious viral infection primarily affecting children, but it can also occur in adults. It is caused by the varicella-zoster virus (VZV), a member of the herpesvirus family

Characteristics

Virus

Varicella-zoster virus (VZV).

Incubation Period

Typically, 10-21 days after exposure

Symptoms

The symptoms of chickenpox typically include:

Rash

Starts as red spots that develop into fluid-filled blisters and eventually crust over.

Fever

Mild to moderate fever.

Fatigue

General tiredness and malaise.

Itching

The rash is usually itchy, leading to discomfort.

Other Symptoms

Loss of appetite, headache, and muscle aches.

Transmission

It can also be transmitted from an infected individual to someone who has never had chickenpox or has not been vaccinated, leading to the disease.

Treatment

Symptomatic Treatment

Antihistamines and calamine lotion for itching, acetaminophen for fever (avoiding aspirin due to the risk of Reye’s syndrome).

Antiviral Medication

In severe cases or for at-risk individuals (e.g., adults, immunocompromised), antivirals like acyclovir may be prescribed.

Vaccination

The varicella vaccine is effective in preventing chickenpox. It is recommended as part of childhood vaccination schedules in many countries. [14,15]

Smallpox

Figure 5*: *Smallpox

Smallpox is a severe and contagious disease caused by the variola virus. It was responsible for significant mortality and morbidity before its eradication in 1980 through a global vaccination campaign led by the World Health Organization (WHO).

Characteristics

Virus

Variola virus.

Incubation Period

7-17 days after exposure.

Contagious Period

The disease is contagious from the onset of fever until the last scab falls off.

Symptoms

Smallpox is characterized by

Fever

High fever, often accompanied by chills and severe fatigue.

Rash

A distinctive rash that progresses from macules to papules to vesicles and finally to pustules that scab over. The rash typically starts on the face and extremities before spreading to the trunk.

Other Symptoms

Headache, backache, and sometimes vomiting.

Transmission

Smallpox spreads from person to person through respiratory droplets, direct contact with infected individuals, or contaminated objects (fomites).

Treatment

Vaccination

Vaccination with the smallpox vaccine can prevent infection and is effective even after exposure if administered within a few days.

Eradication

Smallpox is the only human disease to be declared eradicated. This achievement is attributed to a global vaccination campaign, aggressive surveillance, and containment efforts.

Complications

Complications from smallpox can include

Secondary bacterial infections, Scarring,

Blindness, Death (in severe cases, particularly with the hemorrhagic form). [16]

Disease Mechanism of Chickenpox and Smallpox

Chickenpox

Chickenpox, caused by the varicella-zoster virus (VZV), is a highly contagious viral infection. It spreads through respiratory droplets or direct contact with the fluid from chickenpox blisters. Once inside the body, the virus infects cells in the upper respiratory tract and lymph nodes, leading to the spread of the virus in the blood (viremia). The immune system typically clears the infection within 7 to 10 days, but the disease can be more severe in adults or immunocompromised individuals.[17]

Smallpox

Smallpox, caused by the variola virus, was a deadly viral disease that was eradicated globally by 1980 through vaccination. The virus spreads primarily through airborne droplets or contaminated surfaces. After entering the body, the variola virus replicates in the respiratory tract before spreading to lymph nodes and entering the bloodstream, causing primary viremia. This leads to secondary viremia, which carries the virus to the skin, resulting in a rash that progresses to raised bumps and pustules. Smallpox was often fatal, especially in its severe forms like variola major, with complications including encephalitis and organ failure. Unlike chickenpox, variola virus did not remain dormant in the body. [18,19]

Use of Neem Extract to Treat Chickenpox and Smallpox

Neem in Traditional Medicine

Neem (Azadirachta indica) has been used for centuries in traditional medicine to treat various skin conditions and infections due to its broad-spectrum antiviral, antibacterial, and anti-inflammatory properties.

Neem for Chickenpox

In cases of chickenpox, neem leaves have traditionally been used to relieve itching and support healing of the blisters. The antiviral properties of neem help reduce the viral load on the skin, while its anti-inflammatory effects reduce redness, swelling, and irritation. Neem also has antibacterial properties, which are useful in preventing secondary infections in the open blisters caused by scratching. A common remedy involves crushing neem leaves into a paste and applying it to the skin or adding neem leaves to bathwater. The cooling and soothing effect of neem can help reduce itching, providing significant relief from discomfort.[20]

Neem for Smallpox

Before the eradication of smallpox, neem was also used as a natural remedy to manage its symptoms. While it could not cure smallpox, neem extracts were applied topically to help dry out the pustules, reduce the risk of secondary bacterial infections, and soothe inflammation.

Modern Relevance

While smallpox has been eradicated, and chickenpox is now preventable through vaccines, neem is still used in some cultures to manage chickenpox symptoms. Its antiviral and immune-boosting properties make it a valuable natural remedy in areas where modern treatments are less accessible.[21]

Safety and Side Effects of Neem Extract in Treating Chickenpox and Smallpox

Neem (Azadirachta indica) has been utilized in traditional medicine for centuries, particularly in South Asia, for its numerous therapeutic properties. Its extracts are commonly used to manage symptoms associated with viral infections, including chickenpox and smallpox.

Safety Profile

Topical Use

Neem is generally considered safe for topical application on the skin. It is often used in the form of neem oil, leaf paste, or herbal preparations to alleviate symptoms of chickenpox, such as itching and inflammation. Its antiseptic properties help prevent secondary bacterial infections in open sores caused by scratching.

Pregnancy and Lactation

Neem extracts, particularly neem oil, are not recommended for pregnant women. Some studies suggest that neem can induce abortion due to its effects on the uterus and its ability to disrupt hormonal balance. Similarly, the safety of neem during breastfeeding is not well established, so it is advisable for nursing mothers to avoid its use without consulting a healthcare professional.[22]

Children

While neem is often used in traditional remedies for children with chickenpox, special caution is warranted. Neem oil should not be applied to infants or very young children due to the risk of severe side effects. Toxicity from neem oil ingestion in children has been reported, including symptoms like vomiting, diarrhea, and drowsiness.

Drug Interactions

Neem may interact with certain medications, particularly those that suppress the immune system. Individuals taking immunosuppressive drugs should exercise caution and seek medical advice before using neem extracts. [23]

Side Effects

While neem is considered safe for many people, side effects can occur, especially with improper use or high doses:

Skin Reactions

Some individuals may experience allergic reactions to topical neem applications. This can manifest as redness, itching, or rash. It is advisable to perform a patch test before extensive use, especially on sensitive skin areas.

Gastrointestinal Disturbances

Internal consumption of neem extracts or oil can lead to gastrointestinal upset. Common side effects include nausea, vomiting, and diarrhea. High doses of neem, particularly neem oil, can cause more severe symptoms, including abdominal pain.

Toxicity

There have been reports of toxicity associated with high doses of neem oil, particularly in children. Symptoms may include metabolic acidosis, which can be serious and requires medical attention. Signs of neem toxicity can include drowsiness, difficulty breathing, and seizures.[24]

Future Perspectives on the Use of Neem Extract to Treat Chickenpox and Smallpox

The potential of neem extract (Azadirachta indica) as a treatment for chickenpox and smallpox represents a promising area of research. Given the historical significance of these viral infections and the need for effective antiviral therapies, further investigation into neem's properties could lead to innovative solutions in both traditional and modern medicine. Below are several key future perspectives for research and application in this field:

Clinical Trials and Evidence-Based Research: Conducting Rigorous Clinical Trials

There is an urgent need for well-designed, randomized controlled trials to evaluate the safety and efficacy of neem extracts in treating chickenpox and smallpox. These studies should focus on both the oral and topical administration of neem formulations to establish optimal dosages and treatment regimens.

Mechanistic Studies: Exploring Molecular Mechanisms

Future research should delve into the specific molecular pathways through which neem extracts exert their antiviral effects. Understanding these mechanisms can help elucidate how neem components interact with viral particles and host cell processes. Conducting laboratory studies using cell cultures and animal models can provide essential data on how neem affects viral replication and immune response, allowing researchers to identify specific bioactive compounds responsible for antiviral activity.

Formulation Development: Development of Standardized Extracts

Creating standardized neem extracts or formulations with defined concentrations of active compounds will help ensure consistency in research outcomes and therapeutic efficacy. [25]

Combination Therapies

Investigating the efficacy of neem extracts in combination with conventional antiviral drugs may enhance treatment outcomes and minimize the risk of viral resistance, especially for conditions like chickenpox, where secondary bacterial infections are a concern.

Ethnobotanical and Cultural Studies: Documentation of Traditional Uses

Conducting ethnobotanical studies to document traditional uses of neem in various cultures can provide valuable insights into its historical applications and guide modern therapeutic approaches. [26]

Pharmaceutical preparation

Himalaya Neem Tablets

Form

Tablet

Usage

Taken orally to support immune health and reduce skin inflammation, which may help with the healing of chickenpox blisters. [27]

Kama Ayurveda Neem Oil

Form

Oil (topical application)

Usage

Applied to the skin to reduce itching, inflammation, and prevent bacterial infection in chickenpox blisters.

Patanjali Neem Ghan Vati

Form

Tablet

Usage

Oral use to boost immunity and help reduce the spread and severity of viral infections like chickenpox.

SBL Neem Ointment

Form

Ointment (topical)

Usage

Applied to the skin for treating rashes, blisters, and lesions associated with chickenpox, providing relief from itching and promoting healing.

Organic India Neem Capsules

Form

Capsule

Usage

Taken orally to support the immune system and maintain skin health, helping alleviate the symptoms of chickenpox. [28]

CONCLUSION

The review of neem (Azadirachta indica) demonstrates its potential as a complementary treatment for chickenpox and its historical relevance to smallpox. Historically, neem was utilized in traditional practices to manage smallpox symptoms, reflecting its long-standing therapeutic value. While neem can enhance patient care and symptom management, it should not replace conventional treatments or vaccination efforts, particularly for diseases like smallpox, which has been eradicated. Future research is needed to further establish neem's efficacy and optimal use in treating viral infections, ensuring a balanced integration of traditional remedies with modern medical practices.

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