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REVIEW ON ALOE-VERA: A HERB WITH MEDICINAL PROPERTIES

[1]Komal Sadanand Shirsath, [2]Manoj. G. Shere

[1,2] Rajesh Bhaiyya Tope College Of Pharmacy Nipani Bhalgaon, Chhatrapati Sambhaji Nagar, Maharashtra-431005[1,2]

Abstract:

Aloe vera, a perennial succulent belonging to the Liliaceae family, has been esteemed for centuries across various traditional medical systems for its diverse medicinal properties. The plant's fleshy, mucilaginous leaves contain a rich reservoir of biologically active constituents, including polysaccharides (notably acemannan), glycoproteins, vitamins (A, C, E, and B12), enzymes (such as bradykinase), amino acids, anthraquinones, and minerals like calcium, magnesium, and zinc. These compounds contribute synergistically to Aloe vera's wide-ranging pharmacological effects, including anti-inflammatory, antimicrobial, antioxidant, immunomodulatory, and wound-healing activities. Clinically, Aloe vera gel is widely utilized to promote skin regeneration, expedite healing of burns, cuts, and abrasions, and manage dermatological conditions such as psoriasis, acne, and eczema. Additionally, Aloe latex, containing anthraquinones like aloin, exerts laxative effects that have been historically used to alleviate constipation, though its use requires caution due to potential gastrointestinal irritation.

Beyond dermatological and gastrointestinal applications, recent scientific research suggests that Aloe vera may play a role in modulating glucose metabolism, enhancing immune function, and exhibiting anticancer potential through mechanisms like free radical scavenging and modulation of inflammatory pathways. Despite its therapeutic promise, the efficacy and safety of Aloe vera formulations are influenced by factors such as processing methods, dosage, and purity, underscoring the need for standardized preparations and further clinical trials. Overall, Aloe vera remains a versatile herbal remedy with multifaceted applications, bridging traditional uses and contemporary biomedical interest.

Keywords:*Aloe vera, therapeutic properties, phytoconstituents, wound healing, dentistry, antimicrobial, anti-inflammatory*

Corresponding author:

Komal Sadanand Shirsath,

Rajesh Bhaiyya Tope College Of Pharmacy,
Nipani Bhalgaon, Chhatrapati Sambhaji Nagar,
Maharashtra-431005

QR code

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INTRODUCTION:

Aloe vera, often referred to as the "plant of immortality," is one of the most widely recognized medicinal herbs known for its extensive therapeutic applications across traditional and modern medicine. Belonging to the family Liliaceae, Aloe vera is a succulent plant native to North Africa but is now cultivated globally due to its resilience and versatility. For centuries, it has been utilized in various cultures, including Egyptian, Greek, Chinese, and Indian systems of medicine, for treating a wide range of ailments. The gel and latex derived from its thick, fleshy leaves contain a diverse array of bioactive compounds such as polysaccharides, vitamins, enzymes, minerals, and anthraquinones, which collectively contribute to its medicinal value. Aloe vera exhibits multiple pharmacological effects, including anti-inflammatory, antimicrobial, antioxidant, wound-healing, immunomodulatory, and laxative properties. [1][2][3]

These attributes make it a common ingredient in dermatological products, dietary supplements, and traditional remedies aimed at promoting skin health, digestive well-being, and overall vitality. In recent years, growing scientific interest has focused on understanding the mechanisms behind its therapeutic actions, as well as evaluating its efficacy and safety in various clinical settings. This introduction aims to provide a comprehensive overview of Aloe vera's botanical characteristics, phytochemical composition, and wide-ranging health benefits, establishing its relevance as a valuable herbal resource in contemporary healthcare.[4][5]

History

The medicinal use of Aloe vera can be traced back thousands of years, making it one of the oldest known therapeutic plants in human history. Ancient civilizations, including the Egyptians, Greeks, Romans, Chinese, and Indians, documented its application in treating various ailments and enhancing beauty. The earliest recorded use of Aloe vera dates back to around 2200 BCE in Sumerian clay tablets, and it was later revered in Ancient Egypt, where it was called the "plant of immortality" and used in embalming rituals and skin treatments for royalty such as Cleopatra. Greek physicians such as Dioscorides and Roman naturalists like Pliny the Elder praised Aloe for its wound-healing and soothing properties in their medical texts during the first century CE. In traditional Chinese medicine, Aloe was prescribed for fungal diseases, while the Indian Ayurvedic system recognized its purgative and rejuvenating properties under the name Kumari.[6][7]

During the medieval period, Arab traders played a key role in spreading Aloe vera cultivation to Europe and Asia through trade routes, further enhancing its global significance. By the 16th century, Aloe vera was introduced to the Americas, where indigenous populations adopted it into their healing practices. Over time, as scientific advancements progressed, the therapeutic claims of Aloe vera began to be explored through modern pharmacological studies, validating many of its traditional uses. Today, Aloe vera holds a respected position in both herbal medicine and cosmetic industries worldwide, symbolizing a rich heritage of natural healing across cultures and continents[8][9].

The aloe vera plant Profile

- **Scientific Name:** Aloe barbadensis Miller
- **Family:** Liliaceae (sometimes classified under Asphodelaceae)
- **Common Names**: Aloe, Aloe vera, True Aloe, Burn Plant, Lily of the Desert, Elephant's Gall
- **Botanical Description**: Aloe vera is a stemless or short-stemmed succulent plant that forms a dense rosette of thick, fleshy, green to grey-green leaves. The leaves are lance-shaped, with serrated edges lined with small white teeth or spines. Each leaf measures approximately 30–60 cm in length and 5–8 cm in width. The plant produces tall inflorescences bearing tubular yellow, orange, or red flowers, typically blooming during late winter or early spring.[10]
- **Parts Used:**
  - Leaf Gel (clear, mucilaginous tissue from inner parenchyma) — primarily used for skin care, wound healing, and anti-inflammatory purposes.
  - Leaf Latex (yellow bitter sap found under the leaf rind) — traditionally used as a potent laxative.
  - Whole Leaf Extract — sometimes used in commercial products, combining gel and latex components (requires careful processing).[11][12]
- **Geographical Distribution:** Native to the Arabian Peninsula, Aloe vera is now widely cultivated in tropical, subtropical, and arid regions across Africa, Asia, Europe, the Americas, and parts of Australia due to its adaptability and economic importance.
- **Cultivation Conditions:** Aloe vera thrives in warm, dry climates with well-drained, sandy or

loamy soils. It prefers full sunlight and minimal watering, making it suitable for arid and semi-arid regions. The plant is propagated mainly through offshoots or pups that grow from the base of the parent plant.[13]

- **Phytochemical Constituents:**
  - Polysaccharides (acemannan, glucomannan)
  - Vitamins (A, C, E, B12, folic acid)
  - Minerals (calcium, magnesium, zinc, selenium)
  - Enzymes (amylase, lipase, bradykinase)
  - Anthraquinones (aloin, emodin)
  - Saponins, lignin, salicylic acid, amino acids
- **Key Properties:** Anti-inflammatory, antimicrobial, antioxidant, wound-healing, immunomodulatory, laxative (latex), moisturizing, and soothing.[15][16]

Fig(1):- Aloe vera plant

Aloe Vera Constituents And Its Properties

Aloe vera is widely acclaimed for its rich and complex phytochemical composition, which underpins its broad spectrum of therapeutic properties. The plant contains over 75 biologically active constituents, which can be broadly classified into several key categories, each contributing to its pharmacological effects.

1. **Polysaccharides**
   - Key compounds: Acemannan, Glucomannan, Mannose, Glucose, Galactose
   - Properties: Polysaccharides, especially acemannan (a β-(1,4)-acetylated mannan), are among the most significant bioactive components of Aloe vera. They exhibit potent immunomodulatory, wound-healing, anti-inflammatory, and antiviral activities. Acemannan stimulates macrophage activity, enhancing the production of cytokines and nitric oxide, thus boosting immune defense. These polysaccharides also support tissue regeneration, hydration, and skin repair.[17]
2. **Vitamins**
   - Key vitamins: Vitamins A (beta-carotene), C, E (antioxidants), B1, B2, B3 (niacin), B6, B12, folic acid, choline
   - Properties: The vitamin content, especially vitamins A, C, and E, provides antioxidant protection by neutralizing free radicals, reducing oxidative stress, and preventing cellular damage. B vitamins support metabolic functions and skin repair, while vitamin B12 and folic acid play roles in red blood cell formation and DNA synthesis.
3. **Minerals**
   - Key minerals: Calcium, Magnesium, Zinc, Selenium, Potassium, Sodium, Iron, Copper, Manganese, Chromium
   - Properties: These minerals are vital for enzyme function, antioxidant defense, anti-inflammatory action, and tissue repair. For example, zinc and selenium support immune response and wound healing, while magnesium plays a role in muscle relaxation and metabolic processes.
4. **Enzymes**
   - Key enzymes: Amylase, Lipase, Cellulase, Catalase, Bradykinase, Alkaline Phosphatase
   - Properties: Aloe enzymes assist in digestive support by breaking down sugars and fats. Notably, bradykinase helps reduce excessive inflammation when applied topically by breaking down bradykinin, a pro-inflammatory mediator. Catalase and superoxide dismutase (SOD) are antioxidant enzymes that further combat oxidative damage.[18][19]
5. **Anthraquinones and Phenolic Compounds**
   - Key compounds: Aloin, Emodin, Barbaloin, Isobarbaloin, Anthranol
   - Properties: Anthraquinones possess laxative, antibacterial, analgesic, and antiviral properties. Aloin and emodin, present primarily in Aloe latex, stimulate bowel motility, making them effective as purgatives (though caution is needed due to potential toxicity with prolonged use). Emodin also exhibits antimicrobial and anticancer effects.[20]
6. **Saponins**
   - Properties: Saponins account for approximately 3% of Aloe gel and have cleansing, antiseptic, and antimicrobial properties. They help eliminate microbes and act as natural detergents,

contributing to Aloe's ability to cleanse wounds and prevent infection.

7. **Lignin**
- Properties: Although lignin itself is inert, its presence enhances the penetrative ability of Aloe gel, allowing other active ingredients to reach deeper skin layers, improving their effectiveness in topical treatments.

8. **Salicylic Acid**
- Properties: Known for its anti-inflammatory and antibacterial effects, salicylic acid contributes to Aloe vera's pain-relieving and acne-treating abilities by reducing inflammation and preventing bacterial infections.

9. **Amino Acids**
- Key amino acids: 20 of the 22 essential and non-essential amino acids (including 7 of 8 essential amino acids)
- Properties: Amino acids contribute to tissue repair, skin rejuvenation, and immune function. They serve as the building blocks of proteins vital for cell growth and healing.[21]

Functions

Aloe vera serves multiple therapeutic, cosmetic, and nutritional functions due to its rich profile of bioactive compounds. Below is a comprehensive overview of its key functions

1. **Wound Healing and Skin Repair**
   - Aloe vera accelerates the healing of wounds, burns, cuts, and abrasions by promoting fibroblast activity, enhancing collagen synthesis, and stimulating epithelial cell growth.
   - Its moisturizing properties help restore skin elasticity and hydration, making it valuable in treating dry skin and minor skin irritations.
2. **Anti-Inflammatory Function**
   - The bradykinase enzyme, polysaccharides (acemannan), and salicylic acid in Aloe vera reduce inflammation both topically and internally.
   - It alleviates swelling, redness, and pain associated with inflammatory skin conditions like eczema, psoriasis, and acne.
3. **Antimicrobial and Antiseptic Function**
   - Aloe vera exhibits antibacterial, antiviral, antifungal, and antiseptic activities due to anthraquinones, saponins, and phenolic compounds.
   - It helps prevent infections in wounds, inhibits acne-causing bacteria, and combats fungal skin infections.[22][23]
4. **Antioxidant Function**
   - Rich in vitamins A, C, E, and enzymes like superoxide dismutase and catalase, Aloe vera neutralizes free radicals and protects tissues from oxidative stress.
   - This function supports skin aging prevention and reduces the risk of chronic diseases associated with oxidative damage.
5. **Digestive and Laxative Function**
   - Aloe vera latex (containing aloin and emodin) acts as a potent stimulant laxative, promoting bowel movements and relieving constipation (though should be used cautiously).
   - The gel soothes gastrointestinal tract irritation, reduces symptoms of acid reflux, and aids in digestion by promoting gut health.
6. **Immunomodulatory Function**
   - Polysaccharides like acemannan stimulate the immune system by activating macrophages and enhancing cytokine production, strengthening the body's defense mechanisms.
   - It may also support faster recovery from infections and general immune resilience.
7. **Hydrating and Moisturizing Function**
   - Aloe vera gel provides deep skin hydration, locks in moisture, and prevents transepidermal water loss, making it a popular ingredient in skincare products like lotions, creams, and gels.
8. **Analgesic (Pain-Relieving) Function**
   - Compounds like salicylic acid and anthraquinones contribute to mild analgesic (pain-relieving) effects, soothing pain from burns, insect bites, and minor wounds.
9. **Anticancer and Antitumor Potential (Under research)**
   - Some studies suggest that compounds like emodin and acemannan may inhibit tumor growth and exert anticancer activity by modulating immune response and inducing apoptosis in cancer cells (though more clinical evidence is needed).
10. **Detoxifying and Cleansing Function**
    - The saponins in Aloe vera exhibit natural cleansing properties, helping to remove toxins from the skin and digestive tract, supporting detoxification processes.
11. **Oral Health Function**
    - Aloe vera exhibits antibacterial and anti-inflammatory effects in the oral cavity, helping to reduce plaque buildup, gingivitis, and oral ulcers. It is increasingly used in

natural mouthwashes and toothpaste formulations.

12. **Nutritional Support**
    - Aloe vera provides essential vitamins, minerals, amino acids, and enzymes that contribute to overall nutritional balance, supporting skin health, metabolism, and tissue repair.[24][25]

Uses Of Aloe In Dentistry

1. **Treatment of Gingivitis and Periodontitis:** Aloe vera gel reduces plaque formation, gingival inflammation, and bleeding by inhibiting plaque-causing bacteria like Streptococcus mutans and Porphyromonas gingivalis.
2. **Management of Oral Ulcers and Aphthous Stomatitis:** Aloe vera promotes healing and reduces pain in recurrent aphthous ulcers (canker sores) by soothing mucosal tissues and accelerating epithelial regeneration.
3. **Reduction of Dental Plaque and Bacterial Load:** Aloe vera mouthwash has been shown to be as effective as chlorhexidine in reducing plaque levels, making it a natural alternative with fewer side effects (e.g., no staining).
4. **Relief from Burning Mouth Syndrome:** Aloe vera gel soothes oral mucosa and reduces the burning sensation in patients suffering from burning mouth syndrome.
5. **Alleviation of Oral Lichen Planus:** The anti-inflammatory and immunomodulatory actions of Aloe vera help reduce discomfort and lesion size in patients with oral lichen planus.
6. **Post-Extraction Healing Aid:** Application of Aloe vera gel on extraction sites can promote faster healing, reduce pain, and minimize infection risk by enhancing tissue regeneration.
7. **Mouth Ulcer and Mucositis Management (Cancer Patients):** Aloe vera is beneficial in reducing the severity of oral mucositis caused by chemotherapy or radiotherapy, promoting mucosal healing and pain relief.
8. **Toothpaste and Oral Care Products:** Aloe vera is used in natural toothpastes and gels to enhance gum health, prevent plaque formation, and provide a soothing effect during brushing.
9. **Management of Denture-Induced Stomatitis:** Aloe vera gel reduces inflammation and fungal infections caused by denture irritation, especially Candida albicans infections.
10. **Treatment of Tooth Sensitivity and Minor Oral Lesions:** Aloe vera provides relief from minor irritations and sensitivity through its soothing and anti-inflammatory effects.[26][27]

Scope and limitations Aloe Vera

Limitations

- Limited clinical evidence for some claimed therapeutic benefits.
- Risk of allergic reactions and skin irritation in sensitive individuals.
- Potential laxative side effects from anthraquinones (aloin) in latex.
- Long-term oral consumption may cause electrolyte imbalance and liver toxicity.
- Variability in bioactive compound concentration due to plant cultivation conditions.
- Product adulteration and lack of standardization in commercial preparations.
- Interaction risk with certain medications (e.g., diabetes or diuretic drugs).
- Regulatory restrictions on internal use in some countries due to safety concerns.[28][29]

Scope

- Broad application in wound healing and dermatological care.
- Widely used in cosmetic formulations for hydration and skin rejuvenation.
- Emerging use in nutraceuticals and functional food products.
- Potential application in pharmaceutical drug delivery systems.
- Valuable in traditional and complementary medicine practices.
- Increasing interest in oral health care products (toothpaste, mouthwash).
- Ongoing research into anticancer, hepatoprotective, and immune-boosting roles.[30]

CONCLUSION:

Aloe vera stands out as a versatile and valuable medicinal herb, deeply rooted in traditional medicine and increasingly validated by modern scientific research. Rich in bioactive compounds such as polysaccharides, vitamins, enzymes, and antioxidants, Aloe vera exhibits a broad spectrum of therapeutic properties including anti-inflammatory, antimicrobial, antioxidant, wound-healing, and immunomodulatory effects. Its applications span across various fields, including dermatology, dentistry, gastrointestinal health, cosmetics, and nutraceuticals, making it a widely appreciated natural remedy.

Despite its extensive benefits, it is essential to acknowledge certain limitations, such as variability in

plant composition, potential allergic reactions, and safety concerns associated with long-term or excessive use of Aloe latex. Nevertheless, with appropriate standardization and usage, Aloe vera holds immense scope for future applications in both healthcare and industry. Continued research and clinical trials will further elucidate its mechanisms and expand its therapeutic potential. Overall, Aloe vera remains a remarkable herb that bridges the gap between ancient healing practices and modern scientific advancements, offering safe, effective, and holistic benefits to human health.

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