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Aloe Vera – Nature’s Power

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ABSTRACT

Aloe vera is a plant used in various fields like Homeopathy, Ayurveda, Allopathy, Siddha, Unani, cosmetology, dermatology and surprisingly even in dentistry. Aloe vera is richest source of health for humans with various benefits and properties like wound healing, anti-microbial, anti-inflammatory, immunomodulatory, anti-septic, anti-helmenthic and anti-oxidant. Aloe vera is used in dentistry as active ingredient in tooth pastes, tooth gels and mouth rinse for plaque control, treatment of various oral lesions, halitosis and gingivitis, as decontaminant in endodontics, in extraction sockets, dental implants and in denture care. This paper gives an overview of aloe vera plant, its ingredients, properties and various therapeutic and dental applications.

Key words: Aloe vera, Gingivitis, Mouth wash, anti-inflammatory, Oral lesions, Wound healing.

INTRODUCTION

‘LOOK DEEP INTO NATURE, AND THEN YOU WILL UNDERSTAND EVERYTHING BETTER’ - Albert Einstein.

One such plant in nature is Aloe vera with richest sources of health for human beings.

Aloe vera, scientifically referred to as *Aloe barbadensis miller*, is a medicinal tree used from more than 2000 years ago. The name aloe is derived from the arabic word “Alloeh” meaning “shining bitter substance” while “Vera” in latin means true. Out of more than 300 species of the aloe plant *Aloe Barbadensis* exhibits the best medicinal properties

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and is most biologically active.^[1]

Egyptians call aloe as the plant of immortality. It is also called as universal panacea in Greek and commonly known as Babosa.^[2] Aloe vera looks like cactus but it is actually a member of lily family. Aloe plants are stemless, shrubby, perennial, succulent, xerophytic, pea - green color and tend to grow 80 to 100 cm tall, it grows readily in both hot and dry climates. It grows mainly in Africa, Asia, Europe and America and ideal climate for aloe vera to grow is tropical climate and low rainfall areas. Leaves are fleshy, triangular with serrated edges. Each leaf has three layers namely inner, middle and outer layer. Inner layer gel contains 99% water and glucomannans, amino acids, lipids, sterols and vitamins. Middle layer has bitter yellow sap of latex which contains anthraquinones and glycosides. Sap is a circulatory system which moves materials to the leaves and the roots. Outer protective layer is thick with protective function which contains derivatives of hydroxyanthracene, anthraquinone and glycosides. This layer is very important because it synthesizes all the nutrients.^[3]

Aloe vera contains as many as 200 compounds of which 75 are active compounds including sugar, anthraquinones, alolin, saponins, vitamins, enzymes,

minerals, lignin, salicylic acid, organic acids, metallic cations and amino acids.^{[4],[5]}

Table 1 - Active ingredients of Aloe vera ^[6]

Ingredients	Compounds
Vitamins	A , B, C, E, choline, B 12, folic acid
Minerals	Calcium, chlorine, chromium, copper, iron, magnesium, manganese, potassium, phosphorous, sodium, zinc, selenium
Sugars	Monosaccharides: glucose and fructose, Polysaccharides: glucomannans / polymannose
Amino acids (provides 20 of 22 required and 7 of 8 essential ones)	Alanine, arginine, aspartic acid, glutamic acid, glycine, histidine, hydroxyproline, isoleucine, leucine, lysine, methionine, phenylalanine, proline, threonine, tyrosine, valine.
Carbohydrates	Pure mannan, acetylated mannan, acetulated glucomannan, galactan, glucogalactomannan, galactogalacturan, galactoglucoabinomannan, arabinogalactan, pectic substance, xylan, cellulose
Steroids	Cholesterol, campesterol, lupeol, sistosterol
Anthraquinones	Aloe emodin, Aloetic acid, alovin A and B, anthranol, isobarbaloin, emodin, ester of cinnamic acid
Enzymes	Anthranol, barbaloin, chrysophanic acid, smodin,

	etheral oil, ester of cinnamonic acid, isobarbaloin, resistannol
Hormones	Auxins, gibberellins
Lipids	Arachidonic acid, linolenic acid, triglycerides, triterpenoid, gibberillin, lignins, potassium sorbate, salicylic acid, uric acid.

Role of each ingredient in aloe vera:^[7]

Vitamins (A, C, E) are essential in fighting against free radicals. They have anti oxidant property and neutralize free radicals. Vitamin A helps in maintaining normal night vision. Vitamin C keeps bones and joint strong and firm and aids in collagen formation in process of wound healing. Vitamin E improves fertility, wound healing and helps in preventing blood clots, thrombosis and atherosclerosis by utilizing oxygen in the body.

Minerals are important for good health. Calcium is essential for nerve transmission, cellular structure and formation of bones and teeth. Calcium needs vitamin D for absorption and balance of phosphorus and magnesium to work effectively. Sodium and potassium are involved in uptake of nutrients, regulation of body fluids and electrical conductivity in muscles and nerves. Copper facilitates action of iron as an oxygen carrier in red blood cells. Manganese speeds up the route of clinical reaction in the plant by acting as biochemical catalysts. Magnesium helps nerves and muscles in conducting electrical impulses and during bone formation it is involved in metabolism of calcium. Iron enables oxygen transfer in the form of oxyhemoglobin around the body. Chromium is vital for diabetic patients, as it controls blood sugar levels and necessary for proper function of insulin. Zinc is recognized as important factor in health and reproductive function. Zinc is involved in metabolism of carbohydrates, fats and proteins.

Lignin a cellulose-based substance in topical preparation provides the ability to penetrate the

human skin. Saponins are soapy substances which are capable of cleaning with antiseptic property. Aminoacids helps in building blocks of proteins in the body and muscle tissues and smooth functioning of complex enzyme system. Anthraquinones also known as laxatives have analgesic and anti-inflammatory properties. Enzymes have antifungal and antiviral activity but are toxic at high concentrations. Hormones help in wound healing and anti-inflammatory action. Salicylic acid acts as analgesic, together with lupeol and easily metabolized in the body. Steroids have anti-inflammatory action and lupeol has antiseptic and analgesic properties. Sugars are of two type's mono and polysaccharides, the main one being a glucomannose is referred as Acemannan. Acemannan helps in increasing the activity T-lymphocytes and white blood cells and reducing secondary injections. It also has anti inflammatory and immuno-modulating properties. Sterols especially lupeol has analgesic and antiseptic property.

Applications of Aloe Vera in Dentistry

Apthous ulcer: Aphthous ulcers are painful mouth sores seen anywhere on mucous membrane in the mouth including gums, lips, tongue and throat. Direct application of aloe vera gel helps in healing of apthous ulcer and reduces pain associated with it.^[7] Acemannan, a polysaccharide which is one of the components of aloe vera has been used in treatment of ulcers to avoid the use of steroid medication.^[8] US Food and Drug Administration has also found aloe vera is effective alternative to treat oral ulcers.^[9] Babae et. al. concluded that 2% aloe vera oral gel was effective in decreasing pain, wound size and also has decreased wound healing period.^[10]

Oral lichen planus: Steroids are been used in treatment of lichen planus and are associated with multiple systemic complications, so use of aloe vera was recommended due to its lesser side effects. When compared to triamcinolone topical application of aloe vera gave better results.^[10] Topical applications like lip balm, cream and intake of aloe vera juice helps in healing oral lesions within four weeks as reported by Hayes S M in 1999.^[11]

Choonhakarn et. al. concluded that aloe vera gel is more effective and safe alternative to placebo in treatment of oral lichen planus.^[12]

Oral submucous fibrosis: Aloe vera when applied topically penetrates and dilates the capillaries which help in wound healing. Aloe vera juice used in doses of two ounces three times a day for three months was effective in treating oral submucous fibrosis.^[13] Aloe vera when compared to anti oxidants in treatment of oral submucous fibrosis showed better treatment responses like enhanced mouth opening and reduced burning sensation when compared to antioxidant capsules.^[14]

Burning mouth syndrome: Burning and tingling sensation in tongue and lips, bitter taste are symptoms seen in burning mouth syndrome. Topical application of aloe vera gel and 0.5 ml aloe vera juice at 70% three times a day was effective in treating burning mouth syndrome.^[15]

Gingivitis: Aloe vera reduces gingival swelling, soft tissue edema and gingival bleeding in patients with gingivitis due to its soothing and healing properties. Aloe vera mouthwash when compared to chlorhexidine was an effective antiplaque agent and it had a better taste and shelf life.^[16]

Periodontitis : Aloe vera reduced accumulated plaque and was helpful in treatment of periodontitis. Local drug delivery of aloe vera into periodontal pocket reduced the pocket depth. Subgingival administration of aloe vera gel is an adjunct to scaling and root planning in patients with chronic periodontitis.^[17] The periodontal condition was improved when aloe vera was applied to tissues in tooth brush-dentifrice abrasion and tooth pick injuries.^[18]

Halitosis: Aloe vera has anti-fungal and antibacterial properties. It kills bacteria and fights tooth decay. Topical application of aloe vera protects tissues in the mouth. Aloe vera boosts body's ability to create collagen, which strengthens weak and swollen gums.^[19] By treating indigestion aloe vera treats halitosis as indigestion is common cause for bad breath. Aloe vera gel dissolved in water or apple juice is proven to have digestive properties.^[20]

Healing of extraction socket: Glucomannan and gibberellins present in aloe vera stimulates fibroblast to proliferate faster and helps in accelerating wound healing by proliferation of epithelial cells and preventing infection.^[21] Incidence of alveolar osteitis was reduced by immediate application of acemannan (aloe vera) gel at extraction site when compared to clindamycin-soaked gelfoam.^[22]

Denture care and adhesive: Anti fungal properties of aloe vera prevents fungal infection when applied to denture once or twice a day. It can also be used along with soft liners and helps in preventing denture stomatitis.^[20] Aloe vera being sticky and viscous helps in providing adequate retention to denture in both wet and dry conditions.^[23]

Dental implants: Aloe gel helps in simulating bone around the endosseous implants. Production of prostaglandin from arachidonic acid and cyclooxygenase are inhibited by aloe vera. Enhanced wound healing by eliminating bacteria was observed in vivo study in a rat model. Antimicrobial and anti-inflammatory properties of aloe vera reduces inflammation when placed around dental implants and prevent periimplantitis.^[24]

Decontamination of gutta percha cones: It is important to prevent contamination of root canal with bacteria during obturation. In vitro inhibition of Mycobacterium tuberculosis and Bacillus subtilis was noticed with aloe vera due to its antimicrobial property. Aloe vera was found to be bacteriostatic against Staphylococcus aureus, Streptococcus pyogenes and Salmonella paratyphi. Gutta percha cones decontaminated for 1 minute in 90% aloe vera helps in removing bacteria.^{[9], [25]}

Anticariogenic: Aloe vera gel exhibited strong bactericidal activity against some cariogenic (Streptococcus mutans) and periodontopathic bacteria (Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis). Undiluted Aloe vera gel produced significant growth inhibition of oral bacteria.^[26] Aloe vera gel can be used for prevention of dental caries and periodontal diseases. Streptococcus mutants was most sensitive to aloe

vera while A. actinomycetemcomitans, P. gingivalis, and B. fragilis were less sensitive.^[27]

Pulp therapy in primary teeth: Aloe vera as a pulpotomy agent was found to be effective with no evidence of abscess, pain, mobility or swelling on follow up after 30 and 60 days.^[28] Aloe Vera with sterile water found to have maximum antimicrobial activity when compared with zinc oxide with aloe vera, calcium hydroxide with aloe vera, calcium hydroxide with iodoform and vasiline when used as obturating material in primary teeth.^[29] Zinc oxide with aloe vera as an obturating material showed good clinical and radiographic success.^[30]

Aloe vera as toothpaste and tooth gel: Aloe vera added to tooth paste was effective against bacteria causing caries. Aloe vera tooth gel had no added fluoride content but showed equal amount of antimicrobial activity as fluoride. Anthraquinones in aloe vera has the ability to kill microorganisms.^[7] Aloe vera is better alternative for people with sensitive teeth and gums as it is less harsh on teeth as it does not have abrasive elements.^[3] Aloe vera tooth pastes are effective against Candida albicans, Streptococcus mutans, Lactobacillus acidophilus, Enterococcus faecalis, Prevotella intermedia and Peptostreptococcus anaerobius. Aloe vera tooth gel showed enhanced antibacterial effect against Streptococcus mitis.^{[31], [32]}

Aloe vera as mouthwash: Wound healing and anti-inflammatory mechanism of aloe vera prevents radiation-induced mucositis when used as mouthwash.^[33] It also reduces oral candidiasis in patients undergoing head and neck radiotherapy.^[9]

Wound healing property: Gibberellin, a growth hormone and glucomannan a mannose rich polysaccharide interacts with growth factor receptors on the fibroblast by stimulating its activity and proliferation after topical application or oral ingestion of aloe vera by increasing collagen synthesis.^[11] Acemannan the main component of aloe vera is a major carbohydrate fraction which accelerates wound healing reduces radiation induced skin reactions and has immune stimulation effect. Due to its high water

content aloe vera prevents wound desiccation and increase migration of epithelial cells by blocking the action of catecholamines.^[34] Oxygenation property of aloe vera makes wound healthy by removing dead tissue. Aloe vera increases collagenisation by stimulating macrophage stimulator and enhances the synthesis of collagen and counter balances collagen breakdown.^[35]

Antibacterial property: Acemannan in aloe vera was bactericidal and prevents *Pseudomonas aeruginosa* from adhering to human lung epithelial cells in monolayer culture.^[36] Two main bacterial species inhibited by aloe vera are streptococcus pyogenes and streptococcus faecalis.^[37] Experimental study in a rat model suggested that aloe vera can enhance wound healing process by eliminating bacteria which causes inflammation.^[38] Aloe extract has potent activity against *Mycobacterium tuberculosis*, *Mycobacterium Fortuitum*, *Mycobacterium smeg-matis*, *Mycobacterium kansasii*, *E. coli*, *S. aureus* and *S. typhi*.^[39]

Antiviral property: Aloe vera is virucidal to herpes simplex virus type 1 and 2, influenza virus, varicella zoster virus and pseudorabies virus.^[40] Lectins, aloe emodin, anthraquinone aloin and acemannan are responsible for antiviral activity of aloe vera. Lectins inhibit cytomegalovirus proliferation by interfering with protein synthesis.^[41]

Antifungal property: Aloe vera gel inhibited the the growth of *Trichopyton mentagrophytes* and leaf had inhibitory effects on *Candida albicans* and *Pseudomonas aeruginosa*.^[42] *Candida paraprillosis* and *Candida krusei* was inhibited by use of processed aloe vera gel preparation.^[43]

Other general and therapeutic uses: Boosts immunity, stress relief, reduces blood sugar and controls diabetes, treating skin allergies, acne and sunburns, moisturizing and anti-aging agent, cancer prevention, antimicrobial, digestion of food, detoxification, anti dandruff shampoos, soaps, reduces cholesterol and helps in weight management, Ayurvedic formulations as appetite stimulant,

purgative, for treating cough, colds, piles, dyspnoea, asthma and jaundice.^{[44],[45]}

Contraindications:

Known cases of allergy to Liliaceae family, pregnancy (uterine contractions), breast feeding mothers (gastrointestinal distress), acute inflamed intestinal disease, kidney problems, and heart diseases. In children less than 10 years of age oral intake is contraindicated.^[46]

Side effects: ^[47]

Topical: Allergic reaction, redness, burning sensation and rarely generalized dermatitis

Systemic: Diarrhea, stomach cramps, dehydration, red urine, lowered potassium levels, hepatitis, irregular heart beat and electrolyte imbalance. Reacts with castor oil and roots of bark, jalap and rhubarb.

CONCLUSION

The demand for aloe vera preparations is increasing because of its innumerable clinical applications in various fields. Undoubtedly aloe vera is gift from nature for human well being, which is economical with many advantages. Clinical studies are required for further effectiveness of aloe vera.

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