

Biologic Effects Of Aloe Vera Gel

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Citation

N Kathuria, N Gupta, Manisha, R Prasad, Nikita. *Biologic Effects Of Aloe Vera Gel*. The Internet Journal of Microbiology. 2010 Volume 9 Number 2.

Abstract

Aloe vera is known for its many health benefits. It helps in improving the appearance of skin, treat digestive problems and boost immune systems. Use of aloe vera is beneficial in many oral conditions. Due to its anti bacterial qualities it is effective in fighting the bacteria and preventing bad breath, gingivitis, stomatitis and periodontitis. Acute mouth lesions are improved by direct application of aloe vera gel on herpetic viral lesions, aphthous ulcers and cracks occurring at corner of mouth. Denture patients with sore spots and ill fitting complete or partial dentures can benefit by the use of aloe vera. It also promotes cell growth and act as detoxifying agent.

INTRODUCTION

The use of aloe vera is being promoted for a large variety of conditions. Aloe vera looks like a cactus but it isn't – the plant is a member of the lily family which includes garlic and onion. The aloe plant is grown in warm tropical areas and cannot survive freezing temperatures. There are many species of aloe grown around the world but the main medicinal one is Aloe vera Barbadensis. Aloe vera a popular herbal remedy used medicinally for thousand years has multiple dental uses. It has been shown to enhance defence mechanisms, and has variety of components to help combat periodontal diseases and other oral conditions. The pharmacologic actions of aloe vera as studied invitro or in animals include anti-inflammatory anti-arthritis, anti-bacterial, anti-viral and anti-fungal (1). The table provides a list of reported actions, properties and uses of aloe vera (2).

The aim of this review was to summarize various biologic effects of aloe vera particularly antimicrobial, anti inflammatory and wound healing.

COMPOSITION OF ALOE VERA

The Aloe barbadensis plant consists of two different parts, each of which produce substances with completely different compositions and therapeutic properties. The parenchymal tissue makes up the inner portion of the aloe leaves and produces the aloe vera gel (or mucilage), a clear, thin, tasteless, jelly-like material. This tissue is recovered from the leaf by separating the gel from the inner cellular debris. The other part of the plant is a group of specialized cells known as the pericyclic tubules, which occur just beneath

the outer green rind of the leaf. These cells produce an exudate that consists of a bitter yellow latex with powerful laxative-like actions. This exudate, which is not to be confused with the gel/mucilage from the parenchymal leaf tissue—is available commercially for systemic ingestion to produce catharsis (3).

The composition of aloe vera is complex. It consists of 75 different ingredients including vitamins, minerals, enzymes, sugars, anthraquinones or phenolic compounds, lignin, saponins, sterols, amino acids and salicylic acid (4-7). The plant contains vitamins A, C and F. Vitamins B (thiamine), niacin, vitamin B₂ (riboflavin), choline and folic acid along with traces of vitamin B₁₂. Enzymes such as acid phosphatase, alkaline phosphatase, amylase, lactic dehydrogenase and lipase. When taken orally, these biochemical catalysts, amylase and lipase aid in digestion by breaking down fats and sugars (8). Yamaguchi et al reported the presence of aluminium, sodium, potassium, calcium, magnesium, manganese, copper, zinc, chromium and iron in the aloe plant (9). Sheldon MS reported that magnesium lactate inhibits histidine decarboxylase and prevents the formation of histamine from the amino acid, histidine. The prevention of its formation may explain the antipuritic effect of aloe vera (7). Sugars are derived from the mucilage layer of the plant, surrounding the inner parenchyma or gel. They form 25 per cent of the solid fraction and comprise both mono- and polysaccharides. The most important are the long chain polysaccharides, comprising glucose and mannose, known as the gluco-mannans. Yaron's 1991 study regarding the gel's viscosity and rheology indicated that the

glucomannans in aloe rarely were found in other plants and provided the plastic properties of the gel that are similar to the properties of human body fluids (10). When taken orally, some of these bind to receptor sites that line the gut and form a barrier, to prevent 'leaky gut syndrome'. Others are ingested by process of cellular absorption known as pinocytosis. Anthraquinones are the phenolic compounds are found in the aloe vera. The aloes consist of free anthraquinones and their derivatives: Barbaloin, Isobarbaloin, Anthrone-C-glycosides and chromones. In large amounts these compounds exert a strong purgative effect, but in smaller they appear to aid in absorption from the gut, are potent antimicrobial agents and possess powerful analgesic effects. Topically, they can absorb ultra violet light, inhibit tyronase activity, reduce the formation of melanin and any tendency to hyper-pigmentation. Lignin present in aloe vera is a woody substance, inert in itself, endows topical aloe preparations with their penetrative ability to carry other active ingredients deep into the skin to nourish the dermis. Saponins are soapy substances form 3 per cent of the gel and are general cleansers, having antiseptic properties. These act powerfully as anti-microbials against bacteria, viruses, fungi and yeasts. Cholesterol, Campesterol, b. Sisosterol and Lupeol are fatty acids present in aloe vera. These four plant steroids are important anti-inflammatory agents. Salicylic acid is an aspirin-like compound possessing anti-inflammatory and antibacterial properties. Topically, it has a kerolytic effect which helps to debride a wound of necrotic tissue. Amino acids are the building blocks of proteins. Aloe vera gel provides 20 of the 22 necessary amino acids required by the human body and seven of the eight essential amino acids which the body cannot synthesise.

BIOLOGIC EFFECTS OF ALOE VERA GEL MOISTURIZING ACTIONS

The moisturizing effect of aloe vera gel appears to be due to the mix of water and polysaccharide components, creating a jelly-like consistency that holds the water within the mix and minimizes its evaporation, providing a sustained moist environment when applied to drying tissues and humectant properties that promote retention of moisture in tissues (11).

WOUND HEALING EFFECTS

Many studies have demonstrated the healing powers of aloe vera gel. A 1996 study reported that a high molecular weight polypeptide constituent from the gel demonstrated a healing effect on excisional wounds in rats (12). Yagi et al reported that aloe vera gel contains a glycoprotein with cell

proliferating-promoting activity, while Davis et al noted that aloe vera gel improved wound healing by increasing blood supply, which increased oxygenation as a result (13,14). Thompson reported that topical application of the aloe vera-derived allantoin gel stimulated fibroblast activity and collagen proliferation (15). Hegggers et al in 1993 conducted a study and concluded that topical application of aloe vera gel re-established vascularity of burn tissue for a guinea pig, although no specific constituents were identified. Lee et al reported that the low molecular weight component of freeze-dried aloe vera gel stimulated blood vessel formation in a chick chorioallantoic membrane; in addition, a methanol-soluble fraction of the gel stimulated proliferation of artery endothelial cells in an in vitro assay and induced them to invade a collage substrate (16). The aloe vera gel polysaccharide acemannan was shown to activate macrophages, an effect that improved wound healing in a rat model (17,18). A mannose-6-phosphate component of the gel has been credited with a wound healing effectt (19). Various cell toxicity studies were conducted in which human embryonic kidney cells were utilized to determine the effectiveness of aloe gel on cellular longevity. The cellular death rate was found to be reduced by two third when cultured with aloe gel. Aloe vera promoted growth and healing of healthy human cells, the gel did not have the unwanted effect of stimulating the growth of cancer cells.

ANTI-INFLAMMATORY EFFECTS

The literature has many reports concerning the anti-inflammatory effect of aloe vera gel; Hanley et al reported that an aloe vera extract (described as 5.0% leaf homogenate) decreased inflammation by 48% in a rat adjuvant-induced arthritic inflammatory model (20). More recently, the peptidase bradykinase was isolated from aloe and shown to break down the bradykinin, an inflammatory substance that induces pain (21). The gel was found to possess as effective anti-inflammatory effects as Prednisolone and Indomethacin, without having the long term toxicity of either drug (22).

ANTIBACTERIAL/ANTIFUNGAL/ANTIVIRAL EFFECTS

Streptococcus pyogenes and Streptococcus faecalis are two microorganisms that have been inhibited by aloe vera gel (23,24). Hegggers et al suggested that the antibacterial effect of the aloe vera gel in vivo could enhance the wound healing process by eliminating the bacteria that contributed to inflammation (25). Aloe vera gel reportedly was bactericidal against Pseudomonas aeruginosa while acemannan

prevented it from adhering to human lung epithelial cells in a monolayer culture. A processed aloe vera gel preparation reportedly inhibited the growth of *Candida albicans* (23). In terms of antiviral effects, acemannan reduced herpes simplex infection in two cultured target cell lines (26). In a study Saoo et al noted that fractions of aloe vera gel containing lectins directly inhibited the cytomegalovirus proliferation in cell culture, perhaps by interfering with protein synthesis (27). Sydiskis et al tested a purified sample of aloe emodin on the infectivity of herpes simplex virus Type 1 and Type 2 and found that aloe emodin inactivated all of the viruses, including varicella-zoster virus, influenza virus, and pseudorabies virus (28). Electron micrograph examination of anthraquinone-treated herpes simplex virus demonstrated that the envelopes were partially disrupted. These results showed that anthraquinones extracted from a variety of plants (including aloe vera) are directly virucidal to enveloped viruses (29). In a 2003 study by Barrantes and Guinea, a collagenase from *Clostridium histolyticum* was dose-dependently inhibited by aloe vera gel and an active aloe vera gel fraction containing phenolics and aloins; aloe vera gel and aloins also were effective inhibitors of stimulated granulocyte matrix metalloproteinases (MMPs). The authors observed some chemical structural similarities between the aloins and the MMP inhibitory tetracyclines and finally suggested that the aloe derivatives could inhibit the MMPs through a mechanism similar to that of inhibitory tetracyclines such as doxycycline.

An important finding by Zimmerman was that these effects of aloe vera were not apparent until there was at least 70% concentration of the gel. To achieve 70% or more concentration an aloe vera gel must be stabilized with antioxidants in order to minimize the otherwise necessary preservatives which lessens the percentage of aloe vera in the product (30). According to George D aloe must not be treated with excessive heat or filtered during the manufacturing process, as this destroys or reduces the effects of certain essential compounds such as enzymes or polysaccharides (31).

ALOE VERA IN DENTAL HEALTH PRACTICE

The mouth is a breeding ground for bacteria which can be a major problem if preventative measures are not taken because these bacteria can attack the teeth and gums, and can lead to bad breath, gingivitis, stomatitis and periodontitis. Aloe vera, however, has many anti-bacteria qualities that is why it is said to be very effective in fighting the bacteria and preventing these problems. It is extremely helpful in the

treatment of gum diseases. It reduces swelling of the soft tissues and consequently this reduces the bleeding of the gums. It exhibits strong antiseptic action in gum pockets where normal cleaning is difficult. Its antifungal properties help greatly in the management of denture stomatitis. Cracked and split corners of the mouth are also subject to fungal infection and this can be cured by Aloe. Its antiviral properties help in the treatment of cold sores (Herpes Simplex) and shingles (Herpes Zoster). It is a powerful healing promoter and when inserted into extraction sockets is very beneficial. It can be used in any surgical wound. It has a use in root canal treatment as a sedative dressing, healing promoter and file lubricant. Aloe vera can be used around dental implants to control inflammation from bacteria contamination. An extract from aloe vera has been shown to be beneficial and some dentists recommend 1-3 tablespoon of aloe vera juice to be used as a mouthwash, then swallowed three times daily (32).

ALOE VERA AS TOOTH GEL

Aloe vera as a tooth gel is intended to perform the same function as tooth paste which is to eliminate disease causing bacteria in the mouth. Aloe vera in tooth gel is used to cleanse teeth and gums as effectively as toothpaste does. Because aloe vera tooth gel does not contain the abrasives found in most tooth pastes, it is less harsh on teeth and is a great alternative for people with sensitive teeth or gums.

George D, Bhat SS, Antony B conducted a study to compare the antimicrobial efficacy of aloe vera tooth gel (Forever Bright, Forever Living Products, Scottsdale, AZ), and two popular tooth pastes pepsodent (Unilever, Englewood Cliffs, NJ) and colgate (Colgate-Palmolive, Canton, MA), and concluded that aloe vera tooth gel was as effective as two commercially popular tooth pastes in controlling all the organisms (*S.mutans*, *candida albicans*, *lactobacillus acidophilus*, *enterococcus faecalis*, *prevotella intermedia* and *peptostreptococcus anaerobius*, *S.mitis*) used in the study. In addition gel demonstrated superior antibacterial effect against *S. mitis* despite the absence of additional fluoride (31).

ALOE VERA AS DENTURE CLEANSER

A small amount of gel can be placed in the denture once or twice daily. Taste is not bad and is not harmful if swallowed. It acts as an antifungal agent. This can also be used along with soft liners (33).

ALOE VERA EXTRACT AS DENTURE ADHESIVE

Because of the sticky and viscous nature of gel, a prototype acemannan was formulated into a denture adhesive and evaluated for adhesive strength in both wet and dry conditions; the adhesive also was used to evaluate cytotoxicity to human gingival fibroblasts. An optimal formula with a high and relatively stable adhesive bond strength and minimum cytotoxicity was observed (34).

CONCLUSION

The fresh gel or mucilage from aloe vera is a home grown remedy which possess moisturizing, wound healing, anti bacterial, anti viral and anti fungal effects.

Figure 1

Table : Properties, actions, and uses of aloe vera gel

<ul style="list-style-type: none">• Moisturizing properties• Anti-inflammatory• Antibacterial• Antifungal• Antiviral• Wound healing• Pain relief• Treatment of minor burns, skin abrasions, and irritations• Treatment of psoriasis and frostbite
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