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Review Article

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A Scientific Review on Aloe Vera

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ABSTRACT

Aloe Vera is a natural product that is now a day frequently used in the field of cosmetology. Though there are various indications for its use, controlled trials are needed to determine its real efficacy. We review the scientific literature regarding the aloe vera plant and its products. Aloe vera is known to contain several pharmacologically active ingredients. Several reputable suppliers produce a stabilized aloe gel for use as itself or in formulations and there may be moves towards isolating and eventually providing verified active ingredients. The aloe Vera plant, its properties, mechanism of action and clinical uses are briefly reviewed in this article.

Keywords: Aloe Vera, health and beauty, skin

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1. Introduction

The semi-tropical plant, Aloe Vera, has a long and illustrious history dating from biblical times. It has been mentioned throughout recorded history and given a high ranking as an all-purpose herbal plant. Aloe's thick, tapered, spiny leaves grow from a short stalk near ground level. It is

not a cactus, but a member of the tree lily family, know as Aloe barbadensis. Aloe is related to other members of the Lily family such as the onion, garlic and turnip families. Aloe's relationship to the lily family is evident from the tubular yellow flowers produced annually in the spring that

resemble those of the Easter lily. There are over 250 species of aloe grown around the world. However, only two species are grown today commercially, with *Aloe barbadensis* Miller and *Aloe arborescence* being the most popular. The Aloe plant is grown in warm tropical areas and cannot survive freezing temperatures. In the United States, most of the Aloe is grown in the Rio Grande Valley of South Texas, Florida and Southern California. Internationally, Aloe can be found in Mexico, the Pacific Rim countries, India, South America, Central America, the Caribbean, Australia and Africa. The leaves of the Aloe plant grow from the base in the rosette pattern. Mature plants can grow as tall as 2 and a half inches to 4 feet with the average being around 28 to 36 inches in length. Each plant usually has 12-16 leaves that, when mature, may weigh up to three pounds. The plants can be harvested every 6 to 8 weeks by removing 3 to 4 leaves per plant. The original commercial use of the Aloe plant was in the production of a latex substance called Aloin, a yellow sap used for many years as a laxative ingredient. This product became synonymous with the name "Aloe" and recorded in the trade, technical and government literature during the early 20th century. This terminology created much confusion later when Aloe's other main ingredient, Aloe Gel, a clear colorless semi-solid gel, was stabilized and marketed. This Aloe Vera Gel, beginning in the 50's, has gained respect as a commodity used as a base for nutritional drinks, as a moisturizer, and a healing agent in cosmetics and OTC drugs. Chemical analysis has revealed that this clear gel contains amino acids, minerals, vitamins, enzymes, proteins, polysaccharides and biological stimulators. Public interest in Aloe has grown quickly, and now there is a considerable amount of research into the various components of Aloe to find out more about their properties and to characterize these components so that more specific research can provide clues to the "magic" that is attributed to Aloe Vera.

The Aloe Vera plant has been known and used for centuries for its health, beauty, medicinal and skin care properties. The name Aloe Vera derives from the Arabic word "Alloeh" meaning "shining bitter substance," while "Vera" in Latin means "true." 2000 years ago, the Greek scientists regarded Aloe Vera as the universal panacea. The Egyptians called Aloe "the plant of immortality." Today, the Aloe Vera plant has been used for various purposes in dermatology. You must be familiar with Aloe Vera – the cactus-like plant with tiny thorns commonly found in our kitchen gardens. Many of us must have also used facial creams and shampoos enriched with Aloe juice. With so many benefits to offer, no wonder why Aloe Vera was considered the plant of "immortality" by the Egyptians. But do you know why this short and cacti plant is known as the 'miracle plant'? In this post, we will be discussing the various benefits of Aloe Vera juice, also known as 'Ghritkumari Saar' in Hindi. Aloe Vera is a succulent plant species that has thick fleshy stems with spiny leaves. The fleshy stem contains the Aloe juice which is being used for various purposes since the beginning of the first century as an excellent home remedy. The juice and the gel are used in numerous medicinal, cosmetic and health treatments

History

Aloe Vera has been used for medicinal purposes in several cultures for millennia: Greece, Egypt, India, Mexico, Japan and China. Egyptian queens Nefertiti and Cleopatra used it as part of their regular beauty regimes. Alexander the Great, and Christopher Columbus used it to treat soldiers' wounds. The first reference to Aloe Vera in English was a translation by John Goodyew in A.D. 1655 of Dioscorides' Medical treatise *De Materia Medica* by the early 1800s, Aloe Vera was in use as a laxative in the United States, but in the mid-1930s, a turning point occurred when it was successfully used to treat chronic and severe radiation dermatitis.

Plant

The botanical name of Aloe Vera is "*Aloe barbadensis miller*" It belongs to "*Asphodelaceae*" (*Liliaceae*) family, and is a shrubby or arborescent, perennial, xerophytic, succulent, pea- green color plant. It grows mainly in the dry regions of Africa, Asia, Europe and America. In India, it is found in Rajasthan, Andhra Pradesh, Gujarat, Maharashtra and Tamil Nadu.



Figure 1: Aloe Vera Images

2. Scientific Classification

Kingdom	: Plantae
Clade	: Angiosperms
Clade	: Monocots
Order	: Aaparagales
Family	: Xanthorrhoeaceae
Subfamily	: Asphodeloideae
Genus	: Aloe
Species	: A. Vera

Key points for Aloe vera

- Aloe vera has succulent leaves and is used widely for many purposes.
- Its first written mention comes from an Egyptian source in the 16th century BC.

- c. There are many health claims surrounding Aloe vera, some of which appear to be true.
- d. Aloe gel is used in foods, cosmetics, supplements and herbal remedies.
- e. Cleopatra used Aloe vera to keep her skin soft.
- f. Aloe latex can ease constipation.
- g. Baby aloe shoot extract might protect the skin against sun damage.
- h. One study found that Aloe vera enhanced learning and memory and alleviated depression in mice.

Anatomy

The plant has triangular, fleshy leaves with serrated edges, yellow tubular flowers and fruits that contain numerous seeds. Each leaf is composed of three layers:

- a. An inner clear gel that contains 99% water and rest is made of glucomannans, amino acids, lipids, sterols and vitamins.
- b. The middle layer of latex which is the bitter yellow sap and contains anthraquinones and glycosides.
- c. The outer thick layer of 15–20 cells called as rind which has protective function and synthesizes carbohydrates and proteins. Inside the rind are vascular bundles responsible for transportation of substances such as water (xylem) and starch (phloem).

Active components with its properties

Aloe Vera contains 75 potentially active constituents: vitamins, enzymes, minerals, sugars, lignin, saponins, salicylic acids and amino acids.

Vitamins:

It contains vitamins A (beta-carotene), C and E, which are antioxidants. It also contains vitamin B12, folic acid, and choline. Antioxidant neutralizes free radicals.

Enzymes:

It contains 8 enzymes: amylase, alkaline phosphates, amylase, bradykinase, carboxypeptidase, catalase, cellulase, lipase, and peroxidase. Bradykinase helps to reduce excessive inflammation when applied to the skin topically, while others help in the breakdown of sugars and fats.

Minerals:

It provides calcium, chromium, copper, selenium, magnesium, manganese, potassium, sodium and zinc. They are essential for the proper functioning of various enzyme systems in different metabolic pathways and few are antioxidants.

Sugars: It provides monosaccharide (glucose and fructose) and polysaccharides: (glucomannans /polymannose). These are derived from the mucilage layer of the plant and are known as mucopolysaccharides. The most prominent monosaccharide is mannose-6-phosphate, and the most common polysaccharides are called glucomannans [beta-(1, 4)-acetylated mannan]. Acemannan, a prominent glucomannan has also been found. Recently, a glycoprotein with anti-allergic properties, called alprogen and novel anti-inflammatory compound, C-glucosyl chromone, has been isolated from Aloe Vera gel.

Anthraquinones: It provides 12 anthraquinones, which are phenolic compounds traditionally known as laxatives. Aloin and emodin act as analgesics, antibacterial and antiviral.

Fatty acids:

It provides 4 plant steroids; cholesterol, campesterol, stigmasterol and lupeol. All these have anti-inflammatory action and lupeol also possesses antiseptic and analgesic properties.

Hormones:

Auxins and gibberellins that help in wound healing and have anti-inflammatory action.

Others: It provides 20 of the 22 human required amino acids and 7 of the 8 essential amino acids. It also contains salicylic acid that possesses anti-inflammatory and antibacterial properties. Lignin, an inert substance, when included in topical preparations, enhances penetrative effect of the other ingredients into the skin. Saponins that are the soapy substances form about 3% of the gel and have cleansing and antiseptic properties.

3. Mechanism of actions

Healing properties:

Glucomannan, a mannose-rich polysaccharide, and gibberellins, a growth hormone, interacts with growth factor receptors on the fibroblast, thereby stimulating its activity and proliferation, which in turn significantly increases collagen synthesis after topical and oral Aloe Vera. Aloe gel not only increased collagen content of the wound but also changed collagen composition (more type III) and increased the degree of collagen cross linking. Due to this, it accelerated wound contraction and increased the breaking strength of resulting scar tissue. An increased synthesis of hyaluronic acid and dermatan sulfate in the granulation tissue of a healing wound following oral or topical treatment has been reported.

Effects on skin exposure to UV and gamma radiation:

Aloe Vera gel has been reported to have a protective effect against radiation damage to the skin. Exact role is not known, but following the administration of aloe Vera gel, an antioxidant protein, metallothionein, is generated in the skin, which scavenges hydroxyl radicals and prevents suppression of superoxide dismutase and glutathione peroxidase in the skin. It reduces the production and release of skin keratinocyte-derived immunosuppressive cytokines such as interleukin-10 (IL-10) and hence prevents UV-induced suppression of delayed type hypersensitivity.

Anti-inflammatory action:

Aloe Vera inhibits the cyclooxygenase pathway and reduces prostaglandin E2 production from arachidonic acid. Recently, the novel anti-inflammatory compound called C-glucosyl chromone was isolated from gel extracts.

Effects on the immune system: Alprogen inhibit calcium influx into mast cells, thereby inhibiting the antigen-antibody-mediated release of histamine and leukotriene from mast cells.⁷ In a study on mice that had previously been implanted with murine sarcoma cells, Acemannan stimulates the synthesis and release of interleukin-1 (IL-1) and tumor necrosis factor from macrophages in mice, which in turn initiated an immune attack that resulted in necrosis and regression of the cancerous cells. Several low-molecular-weight compounds are also capable of inhibiting the release of reactive oxygen free radicals from activated human neutrophils.

Laxative effects:

Anthraquinones present in latex are a potent laxative. It increases intestinal water content, stimulates mucus secretion and increases intestinal peristalsis.

Antiviral and antitumor activity:

These actions may be due to indirect or direct effects. Indirect effect is due to stimulation of the immune system and direct effect is due to anthraquinones. The anthraquinones alone inactivates various enveloped viruses such as herpes simplex, varicella zoster and influenza. In recent studies, a polysaccharide fraction has shown to inhibit the binding of benzopyrene to primary rat hepatocytes, thereby preventing the formation of potentially cancer-initiating benzopyrene-DNA adducts. An induction of glutathione S-transferase and an inhibition of the tumor-promoting effects of phorbol myristic acetate has also been reported which suggest a possible benefit of using aloe gel in cancer chemoprevention.

Moisturizing and anti-aging effect:

Mucopolysaccharides help in binding moisture into the skin. Aloe stimulates fibroblast which produces the collagen and elastin fibers making the skin more elastic and less wrinkled. It also has cohesive effects on the superficial flaking epidermal cells by sticking them together, which softens the skin. The amino acids also soften hardened skin cells and zinc acts as an astringent to tighten pores. Its moisturizing effects has also been studied in treatment of dry skin associated with occupational exposure where aloe Vera gel gloves improved the skin integrity, decreases appearance of fine wrinkle and decreases erythema. It also has anti-acne effect.

Antiseptic effect:

Aloe Vera contains 6 antiseptic agents: Lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulfur. They all have inhibitory action on fungi, bacteria and viruses.

Clinical uses:

The clinical use of aloe Vera is supported mostly by anecdotal data. Though most of these uses are interesting, controlled trials are essential to determine its effectiveness in all the following diseases.

A. Uses based on scientific evidence:

These uses have been tested in humans or animals. Safety and effectiveness have not always been proven.

Conditions:

Seborrheic dermatitis, psoriasis vulgaris, genital herpes, skin burns, diabetes (type-2), HIV infection, cancer prevention, ulcerative colitis wound healing (results of aloe on wound healing are mixed with some studies reporting positive results and others showing no benefit or potential worsening), pressure ulcers, mucositis, radiation dermatitis, acne vulgaris, lichen planus, frostbite, aphthous stomatitis, and constipation.

B. Uses based on tradition or theory:

The below uses are based on tradition or scientific theories. They often have not been thoroughly tested in humans, and safety and effectiveness have not always been proven.

Conditions: Alopecia, bacterial and fungal skin infections, chronic leg wounds, parasitic infections, systemic lupus erythematosus, arthritis and tic douloureux.

Side effects

Topical: It may cause redness, burning, stinging sensation and rarely generalized dermatitis in sensitive individuals. Allergic reactions are mostly due to anthraquinones, such as aloin and barbaloin. It is best to apply it to a small area first to test for possible allergic reaction.

Oral: Abdominal cramps, diarrhea, red urine, hepatitis, dependency or worsening of constipation. Prolonged use has been reported to increase the risk of colorectal cancer. Laxative effect may cause electrolyte imbalances (low potassium levels).

Contraindication: Contraindicated in cases of known allergy to plants in the Liliaceae family.

Pregnancy and breastfeeding:

Oral aloe is not recommended during pregnancy due to theoretical stimulation of uterine contractions, and in breastfeeding mothers, it may sometime causes gastrointestinal distress in the nursing infant.

Interactions:

Application of aloe to skin may increase the absorption of steroid creams such as hydrocortisone. It reduces the effectiveness and may increase the adverse effects of digoxin and digitoxin, due to its potassium lowering effect. Combined use of Aloe Vera and furosemide may increase the risk of potassium depletion. It decreases the blood sugar levels and thus may interact with oral hypoglycemic drugs and insulin. Thus, though Aloe Vera has wide spectrum of the properties and uses, some of them could be myths and some of them could be real magic. In future, controlled studies are required to prove the effectiveness of Aloe Vera under various conditions.

4. Uses

- Aloe Vera is very useful for curing bowel problems due to its high anti-inflammatory properties.
- Having Aloe juice for two weeks can help reduce inflammation in the body like rheumatism, inflammation of ears and eyes and arthritis.
- Applying the gel externally can ease muscle and joint pains. But do not forget to use freshly prepared gel.
- Having severe digestive problems? Drink Aloe Vera juice as it reduces symptoms of heart reflux and stabilizes the alkaline levels of the body. Due to its laxative properties, it is also good for constipation.
- Aloe is great for maintaining the cholesterol level by reducing triglycerides. Include fresh Aloe juice in your daily diet to maintain your cholesterol level and increase the level of good cholesterol.
- Want to lose weight naturally? By aiding the stabilization of metabolic rate, reducing lipid levels and helping burn fat, Aloe Vera juice is useful for weight loss. Studies have shown that regular consumption of Aloe juice improves oral health and hygiene. It reduces gingivitis and plaque formation. It provides a laxative relief for cold sores and mouth ulcers.

- Aloe Vera is good for diabetes patients because it helps to regulate the blood sugar levels when consumed regularly. However consult your doctor before you start consuming the aloe juice.
- Mix two teaspoons of fresh Aloe Vera juice with one glass of water and drink it every day early in the morning. This will help detoxify and cleanse your system. This also helps in treating ulcers and detoxifying the digestive system.
- Applying fresh aloe gel directly to the gums reduces the pain and inflammation.
- Create your own natural eye wash with Aloe Vera gel. Mix two teaspoons of aloe gel in a cup of water. You can also add a teaspoon of boric acid. Use this eye wash to reduce the reddening and irritation in the eyes.
- Suffering from constant sinus problems? Now ditch your medicines and try the natural option. Aloe Vera is rich in magnesium lactate that works as an antihistamine which helps in reducing the problem of sinus and chest inflammation due to various allergies.
- Fight away cancer with the regular intake of the aloe juice. It contains high level of anti-carcinogenic properties that hinder the growth of tumors.
- Drinking aloe juice regularly replenishes the amino acid deficiency in your body. The high vitamin content in it boosts up your body's immune system and self-defense mechanism.
- Those who regularly suffer from cold, coughs, flu, stuffy nose, bronchitis, and other respiratory disorders, Aloe Vera juice is the best natural solution.

5. Conclusion

Aloe Vera is suitable for all skin types including highly sensitive skin. You must have seen and used various skin care products which contain the Aloe gel. It is the most common remedy for all skin problems.

- a) The anti-aging property of Aloe keeps the skin supple and rejuvenated and also lightens blemishes. It moisturizes the skin and gets rid of dead cells along with wrinkles and fine lines. It also helps in getting rid of stretch marks.
- b) Men can use Aloe Vera gel as an after shave. It reduces the irritation and inflammation of the skin and heals the cuts due to shaving.
- c) Suffering from acne for a long time? Then make Aloe Vera your friend as it is the best natural remedy for curing acne and pimples and also its scars. It has antimicrobial property that helps kill the bacteria causing acne and reduces the acne marks by lightening the skin.
- d) All of us apply numerous sun blocks and creams to prevent harmful sun rays from damaging our skin. But the rays sometimes penetrate through them. Aloe Vera gel is highly beneficial for treating sunburns. It is an excellent cooling agent. Apply

fresh gel on your skin every day to get immediate results. It reduces the pain and the redness of the skin and forms a protective layer which reduces further damage.

- e) It heals cuts and wounds, dermatitis and also insect bites when applied externally.
- f) Aloe gel is hydrating and moisturizes the skin well. So it can be used in all weathers to prevent dry and patchy skin.

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