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## REVIEW ARTICLE

### ALOE VERA – A PORTAL TO IMMORTALITY

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#### ABSTRACT

Aloe Vera has spread its roots deep into the field of cosmetics and medicine and has been in use for more than thousands of years. This plant is a perennial succulent xenophyte and it belongs to the Liliaceae family with over 250 species. Though treatment measures have evolved to the next era of advancement, the need for ancient herbal remedies is still persistent. This review article will highlight the multiple therapeutic and cosmetic properties such as anti-septic, anti-inflammatory, anti-microbial, anti-diabetic, wound healing, laxative, anti-oxidants, immunomodulatory effect, skin hydration, anti-neoplastic, anti-hyperlipidemia, and anti-ageing of the divine plant ‘ALOE VERA’.

#### INTRODUCTION

Aloe Vera is an all purpose herbal plant belonging to the Liliaceae family with over 250 species grown all over the world of which the two most popular species are Aloe Barbadensis Miller and Aloe Arborescens (Vogler B.K, *et al.*, 1999). The name aloe was derived from the Arabic word ‘alloeh’ or the Hebrew word ‘halal’ meaning shiny and bitter while the Latin word ‘Vera’ means true. Aloe Barbadensis Miller was first described from the Barbados Island by a botanist named Miller (Dheepika *et al.*, 2013).

Aloe Vera is a perennial succulent xenophyte with thick fleshy spiny leaves arranged in a rosette like pattern (Shelton *et al.*, 1991). The inner portion of the leaf contains a mucilaginous jelly from the parenchyma cells which possess more than 75 active ingredients such as vitamins, minerals, enzymes, sugars, carbohydrates, anthraquinones or phenolic compounds, lignin, saponins, sterols, amino acids and salicylic acid (Subramaniam *et al.*, 2010). Commercially, aloe vera gel is available as pills, sprays, ointments, lotions, drinks, jellies and cream. Hence, aloe vera is well known for its cosmetic and medicinal properties such as anti-septic (Cataldi *et al.*, 2015), anti-inflammatory (Güven *et al.*, 2015), anti-microbial (Joseph *et al.*, 2010), anti-diabetic (Yongchaiyudha, *et al.*, 1996), wound healing (Davis *et al.*, 1988), laxative (Surjushe *et al.*, 2008), anti-oxidants (Hu *et al.*, 2003), immunomodulatory effect (Van Enkevort *et al.*, 1988), skin hydration (Hamman J.H, *et al.*, 2008), anti-neoplastic (Pecere, *et al.*, 2000), anti-hyperlipidemia (Yeh *et al.*, 2003), and anti-ageing (Flower *et al.*, 2010).

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#### HISTORY

The virtues of Aloe Vera have been recorded for 1000 of years by many ancient civilization including Egypt, Persia, Greece, India and Africa (Husain *et al.*, 2014). The first description was found in Papyrus Ebers, an Egyptian document written in 1550 B.C.E. The Egyptian medics used aloe vera to keep the skin of the living healthy while the Egyptian morticians to embalm the skin of the dead forever. The Egyptians also called it the ‘Plant of Immortality’. The Egyptian Queen Nefertiti known as ‘the most beautiful woman who ever lived’ and Queen Cleopatra VII used it in their regular beauty regimes (Crosswhite *et al.*, 1984). Legend reports describe that Alexander the great upon the advice of Aristotle, conquered the island of Socotra, off the coast of Africa, to secure supplies of Aloe Vera for the treatment of his wounded soldiers. Dioscorides, a physician and a naturalist recommended the use of aloe juices for the treatment of numerous physical illnesses such as gastrointestinal discomfort, tonsillitis, skin irritations, arthralgia, gingivitis, sunburn, hemorrhoids, ulcerated genitals, acne and hair loss (Hasan *et al.*, 2014).

#### CHEMICAL COMPOSITION

Active ingredients of aloe vera leaf pulp and exudates are depicted in the table above (Subramaniam *et al.*, 2010).

#### PROPERTIES

**Anti Septic-** Aloe Vera produces six anti septic agents such as lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulphur. All these agents aid by elimination and controlling various micro-organisms (Cataldi *et al.*, 2015).

Class	Compounds
Vitamins	Vit. A, B1, B2, B6, A-Tocopherol, beta-Carotene, Choline, Folic acid, Ascorbic acid.
Enzymes	Cyclo-oxygenase, Oxidase, Amylase, Catalase, Lipase, Alkaline-phosphatase, Carboxy-peptidase
Anthraquinones	Aloin/Barb-aloin, Isobarba-aloin, Aloe-emodin, Emodin, Aloetic acid, ESTER of cinnamic acid, Anthranol, Chrysophanic acid, Resistannol, Anthracene, Ethereal oil
Saccharides	Mannose, Glucose, L-Rhamnose, Aldo-pentose.
Carbohydrates	Cellulose, acetylated mannan, Arabinogalactan, Xylan, Pure mannan, peptic substance, glucomannan, Glucogalctomannan, Galactan
Miscellaneous	Cholesterol, Steroids, Tricylglycerides, beta- sitosterol, Lignins, Uric acid, Gibberellin, Lectin like substance, Salicylic Acid, Arachidonic acid
Inorganic Compounds	Calcium, Sodium, Chlorine, Manganese, Zinc, Chromium, Copper, Magnesium, Iron
Non-Essential Amino Acids	Histidine, Arginine, Hydroxyproline, Aspartic acid, Glutamic acid, Proline, Glycine, Alanine.
Essential Amino Acids	Lysine, Threonine, Valine, Leucine, Iso-leucine, Phenyl-alanine, Methionine.

**Anti- Inflammatory-** Inflammation is a reaction by the body to an injury and is characterized by the five cardinal signs such as swelling, pain, redness, heat and loss of function. The appearance of these signs are due to production of prostaglandins. This natural phenomena may delay the healing process which renders the need for anti-inflammatory agents. The main components of aloe vera that helps in anti-inflammatory activity are fatty acids, cholesterol, maloyl glucans, campesterol, lupeol and beta sitosterol. These components act through activation of bradykinase, inhibition of prostaglandin F1 and E2 synthesis from arachidonic acid, thromboxane A2 inhibition and inhibition of IL-10 synthesis (Guven *et al.*, 2015).

**Anti-Oxidant-** Oxygen is a double edged sword which favours living and death. Oxygen is a highly reactive component which becomes a part of potentially damaging molecule called as free radicals. Free radicals are unstable due to presence of an unpaired electron and it reaches out to capture electrons from other substances in order to neutralize themselves. Anti-oxidants are chemicals (naturally occurring and man-made) which prevent oxidation of other molecules, stabilization of free radicals and slows down cell damage. Aloe Vera contains vitamins A, C, E, beta carotene, folic acid and flavanoids which are essential anti-oxidants. Isorabaichromone, a derivative of aloesin (c-glycosylated 5-methyl chromone), a potent anti-oxidant of Aloe vera scavenges the superoxide anions (free radicals), thereby exhibiting anti-oxidant property (Hu *et al.*, 2003).

**Anti-Diabetic or Hypoglycaemic-** Diabetes Mellitus also commonly known as diabetes is a metabolic disease with increase in blood glucose levels either due to deficiency or impairment in the effectiveness of endogenous insulin. It is characterized by hyperglycaemia, deranged metabolism and sequelae predominantly affecting vasculature. Diabetes mellitus can be of two types – type 1 DM and type 2 DM. Aloe vera contains phosterols, iophenol, cycloartenol and their alkylated derivatives. These components promote hypoglycaemic effect by normalising membrane-bound enzyme activities of phosphatase and hydase increases glucose metabolism. Aloe-emodin-8-O-glycoside isolated from aloe vera gel enhances glucose transport by modulating the proximal and distal markers involved in glucose uptake and its transformation into glycogen, thereby reducing glucose levels (Yongchaiyudha, *et al.*, 1996).

**Wound Healing-** It is a complex, systematic and a dynamic process of replacing devitalised and missing cellular structures and tissue layers. There are four distinct phases in wound healing namely haemostasis, inflammation, proliferation and

maturation. While platelets play a crucial role in clot formation during haemostasis, inflammatory cell such as macrophage activated by Acemannan polysaccharide present in aloe vera aid in debridement of the injured or necrosed tissue during the inflammatory phase (Davis R.H, *et al.*, 1988). Epithelialisation occurs by increased epithelial cell migration, fibroplasias -with high level of hyaluronic acid and dermatan sulphate in aloe vera and angiogenesis during the proliferative phase (Reddy, *et al.*, 2011). Finally, during maturation phase, collagen forms tight cross links to other collagen and with protein molecules, increasing the tensile strength of the scar, which is encountered by glucomannan, a mannose rich polysaccharide and gibberllin, a growth factor interacting with growth factor receptor in fibroblast leading to synthesis and proliferation of fibroblast resulting in increased collagen synthesis. There is an increase in collagen content of the wound but a change in the type of collagen- predominantly type III (Hegggers *et al.*, 1996).

**Anti-Microbial** – It is a substance that kills and inhibits the growth of microbes such as bacteria (anti-bacterial activity), fungi (anti-fungal), virus (anti-viral activity) or parasites (anti-parasitic activity). Aloe vera gel inhibits the growth of both gram-positive and gram-negative bacteria (Arunkumar, *et al.*, 2009). Anthraquinones is an active compound of aloe vera which acts by inhibiting bacterial protein synthesis by blocking ribosomal A site. Emodine has been reported to be effective against several gram positive bacteria (Joseph *et al.*, 2010). Polysaccharide of aloe vera gel has direct effect on bacteria through the stimulation of phagocytic leucocytes to destroy the bacteria. The anthraquinone, aloin inactivates enveloped viruses such as herpes simplex, varicella zoster and influenza (Sydiskis *et al.*, 1991).

**Laxative** – Laxatives contains chemicals that help increase stool mobility, bulk and frequency, thus relieving temporary constipation. These chemicals can be naturally occurring or man-made (Surjushe *et al.*, 2008). Aloe vera contains barbaloin and isobarbaloin which undergo decomposition in the large intestine to form active metabolites aloe-emodin-9anthrone and aloe emodin (Ishii *et al.*, 1994). Aloe-emodin-9anthrone inhibits sodium potassium adenosine triphosphatase (ATPase) activity and increases the paracellular permeability across colonic mucosa which decreases water absorption from intestinal lumen and stimulates water secretion resulting in softer stool formation (Boudreau *et al.*, 2006).

**Immunomodulatory Effect-** It is an immunological change or alteration or regulation of one or more immune system. It can either be immunosuppressive or immunostimulatory. Aloe has a whole contains Anthraquinones (aloin) and chromone (aloesin) possess strong anti-inflammatory effect.

Aloe vera inhibits inflammatory process in burn injury by reducing leucocyte adhesion as well as pro-inflammatory cytokines. Aloe vera acts directly on cyclo-oxygenase pathway and reduce prostaglandin E2 synthesis. It has strong immunomodulatory activity wherein it down regulates lipopolysaccharide-induced inflammatory cytokine production and expression of NLRP3 in human macrophage (Van Enchevort *et al.*, 1988).

**Anti-neoplastic-** It is an abnormal growth of tissue the growth of which exceeds and is uncoordinated with that of normal tissue, and persists even after the cessation of stimuli that evoked it. Aloin, an anthraquinone, inhibits the secretion of VEGF in cancer cells. VEGF is a pro-angiogenic cytokine and induces tumor neovascularisation (Pecere, *et al.*, 2000). Aloemodoin (1,8-dihydroxy-3-hydroxymethyl-9, 10-anthracenedione) is an herbal derivative of anthracenedione derivative of aloe vera leaf which posses inhibitory effect on gene expression of N-acetyl transferase which plays an initial role in the metabolism of aryl amine carcinogens in human malignant melanoma cells. Aloin posses anticancer activities as it inhibit tumor angiogenesis and growth via blocking signal transducer and activator of transcription 3 activation (Kim *et al.*, 1997).

**Anti-hyperlipidemia-** It is a condition characterized by abnormally high levels of lipids (fats) in the blood. While fat play a vital role in body's metabolic processes, high levels of fats increase the risk of coronary heart disease. There are two types of lipid abnormalities namely – hypercholesterolemia and hypertriglyceridemia. Phytosterols, such as lophenol, 24-methyl-lophenol, 24-ethyl-lophenol, cycloartanol and 24-methylene cycloartanol in aloe vera binds to the cholesterol and prevents it from binding thereby decreasing the plasma cholesterol levels (Moghadasian *et al.*, 1999).

**Skin Hydration-** There are numerous layers of water based cells in the skin. Dehydration of skin becomes an issue when stratum corneum is lost. Many factors such as decreased thyroid, hormone imbalance or dehydration can inhibit the production natural oil present in the skin. Aloe Vera posses the ability to penetrate into deeper layers of the skin. Mucopolysaccharides present in aloe help in binding of water content to stratum corneum after the application of aloe Vera gel. However, it was proposed that the aloe vera gel containing products improved skin hydration by means of a humectants mechanism (Hamman *et al.*, 2008).

**Anti-ageing-** Ageing is a physiological process or change that occurs in every beings life. Appearance of a person denotes the first sign to say if he or she is aged or not. This attributes to the lose of elasticity of skin that which was once firm and stiff now has wrinkles and overhangs. The mechanics behind anti-ageing effect is that aloe stimulates fibroblast which produces the collagen and elastin fibres making the skin more elastic and less wrinkled (Fowler *et al.*, 2010). They have cohesive effect on the superficial flaking epidermal cells by sticking them together, which softens the skin. The amino acid aid in softening of the hardened skin cells and Zinc acts as an astringent to tighten the pores (Reynolds *et al.*, 1999).

## CONTRAINDICATIONS

Contraindicated in cases of known allergy to plants in the Liliaceae family. Pregnancy and breastfeeding: It is not

recommended to use aloe Vera gel during pregnancy or while breastfeeding due to theoretical stimulation of uterine contraction (Maenthaisong *et al.*, 2007).

## ADVERSE EFFECTS

**Topical:** it may cause redness, burning, stinging sensation and rarely generalised dermatitis in sensitive individuals. Allergic reactions are mostly due to anthraquinones, such as Aloin and barboin (Meena *et al.*, 2013).

**Oral:** Abdominal cramps, diarrhoea, red urine, hepatitis, dependency or worsening of constipation. Prolonged use has been reported to increase the risk of cancer. Laxative effect may cause electrolyte imbalance (Subramaniam *et al.*, 2011).

## INTERACTION

Application of aloe to skin may increase the absorption of steroid cream 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 interacts with oral hyperglycaemic drugs and insulin (Maenthaisong *et al.*, 2007).

## Conclusion

Aloe vera with its immense potential to treat several illness can be utilized for medical treatment and care. This herb also offers a great promise in the management of autoimmune diseases, skin diseases and metabolic disorders like diabetes mellitus. It can be used in surgical cases to enhance wound healing and post operative trauma. Thus, though Aloe vera has wide spectrum of the properties and uses, controlled studies are required to prove the effectiveness of Aloe vera under various conditions.

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