



A REVIEW ON PHARMACOLOGICAL PROPERTIES OF ALOE VERA

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Abstract: Aloe vera is a perennial, drought-resisting succulent herb that belongs to the asphodelaceae family. Aloe vera contains numerous vitamins and minerals, enzymes, amino acids, natural sugars and agents which may be anti-inflammatory & anti-microbial. Hence, it is called "THE HEALING PLANT" (or) "THE SILENT HEALER" because of its healing properties. The combination & balance of the plant's ingredients are what purportedly gives it its healing properties. Aloe vera has been known and used for centuries for its health, beauty, medicinal and skin care attributes and is used in a variety of commercial products. The aloe is an emollient, purgative & vulnerary. It is a good to use as a tool for restoring the tissue. It also has vast traditional role in indigenous system of medicine like ayurveda, siddha, unani and homeopathy. The pharmacologically active ingredients of aloe are concentrated in inner parenchymatous tissue, called aloe gel and outer pericyclic tubules called aloe sap or aloe juice. It's most used for various treatments such as burns, allergic reactions, rheumatoid arthritis, rheumatic fever, acid indigestion, ulcers, diabetes, skin diseases, dysentery, diarrhoea, piles, inflammatory conditions of the digestive system. Aloe be made into a warm tea, made from juice as a wash for eyes. Washing with aloe protects the eyes from ultraviolet rays from the sun. Most of the health benefits associated with aloe vera have been attributed to the polysaccharides contain in the gel of the leaf. Cosmetic products made from aloe give a healthy and supple look to the skin by reducing the wrinkles, curing acne, rejuvenating and giving it a youthful glow. Aloe is also an extremely powerful laxative and it is not recommended that it is taken internally. It is recommended that the fresh juice from the plant is used, and not the store brought juice within the other products. The reason for that is that the medicinal use of the plant diminishes with time and there is much questioning about whether or not you can receive benefits from the store brought aloe, even if the product has been filled with preservatives. In the pharmaceutical industry, it has been used for the manufacture for topical products such as ointment & gel preparations as well as in production of tablets and capsules.

Index Terms - Aloe vera, pharmacological properties, skin disorders, burning healing.

I. INTRODUCTION

Aloe vera (*Aloe barbadensis* Miller, family Xanthorrhoeaceae) is a perennial green herb with bright yellow tubular flowers that is extensively distributed in hot and dry areas of North Africa, the Middle East of Asia, the Southern Mediterranean, and the Canary Islands. *Aloe vera* derives from "Alleah" (Arabic word that means "shining bitter substances") and "Vera" (Latin word that means "true"). It is commonly called aloe, burnt plant, lily of the desert and elephant's gall. It is a cactus-like plant with green, dagger-shaped leaves that are fleshy, tapering, spiny, margined and filled with a clear viscous gel. The pharmacological actions of Aloe vera include anti-inflammatory and antiarthritic activity and antibacterial and hypoglycemic effects. It is called the healing plant or the silent healer, because of its wound and burn healing properties.

Aloe leaf consists of two parts, each of which produces different substances that have completely different composition and therapeutic properties. The inner parenchymal tissues form a clear, thin, tasteless, jelly-like material. The outer pericyclic tubules, occurring just beneath the outer green rind or cutinized epidermis of leaves, produce a bitter yellow exudate. The inner mucilaginous pulp called Aloe gel, lies in the Centre of leaf. Aloe gel consists of 96% water while the remaining 4% contains 75 known substances including Vitamins A, B, C, E, calcium, amino acids and enzymes. The second component of Aloe leaf is outer pericyclic tubules that produce an exudate which consists of bitter reddish yellow latex with powerful laxative properties and is available commercially. Its bitterness is due to the presence of aloin, aloe-emodin and related compounds the bio active compounds of Aloe are used as astringent, hemostatic, antidiabetic, antiulcer, anti-septic, antibacterial, anti-inflammatory, antioxidant and anticancer agent. They are also effective in treating stomach ailments, gastrointestinal problems, skin diseases, constipation, radiation injury, wound healing, burns, dysentery, and diarrhea and in the treatment of skin diseases.

The Aloe vera plant undergoes **Crassulacean Acid Metabolism** [CAM] metabolic pathway for conserving water within the parenchymatous tissue to withstand drought-like conditions. Aloe vera grown under normal water conditions behaves as a typical CAM plant, but when exposed to stress condition of excess water supply, it shifts to CAM-IDLING [A dampened form of CAM], in which the stomata closes day and night but with a continued, low diurnal organic acid fluctuation.

Higher K/Na Ratio & Lower Na/K Ratio indicates its salt tolerance capacity. Aloe plants uptake to Na is mediated by increasing K mineral uptake. This avoidance of salt stress damage, increases the agronomic & physiological characteristics of Aloe plant under salt stress, making this species attractive for industrial production in arid and semiarid areas around the world associated with moderate saline soils.

Furthermore, Aloe is also known as "AIR POLLUTION DETECTOR" because pollution of air retards its growth.

The pharmacological attributes of Aloe vera have been revalidated in modern sciences through various In vivo and In vitro studies.

PROPERTIES OF ALOEVERA

TAXONOMY:

KINGDOM	- plantae
ORDER	- Asparagales
DIVISION	-spermatophytes
SUBDIVISION	-Angiosperm
CLASS	-Monocotyledonous
GENUS	-Aloe
SPECIES	-Barbadense mill
SYNONYMS	- Aloe, Musabir, Kumari

BIOLOGICAL SOURCE:

Aloe vera consists of the fresh juice collected by incision, from the bases of the leaves of different species of aloe. Aloe perrieri, or Aloe barbadense mill and Aloe ferox.

MICROSCOPICAL DESCRIPTION:

The plant is a common looking perpetual with small, thick to some degree isolated stem 30-60 cm (about 1.97 ft) high. The leaves are opaque green stalkless, glaucous, lanceolate, erect spreading instead of inward, sharp toothed at edge, around 30-60 cm (about 1.97 ft) long 10cm (about 3.94 in) broad and 1.8cm (about 0.71 in) thick with juice. The plant achieves adulteration after four years and has leaves with a length averaging between two and three to five inches. Each leaf weighs from two to four pounds. The plants' complete life cycle is twelve years. It produces an average of twelve to thirty leaves.

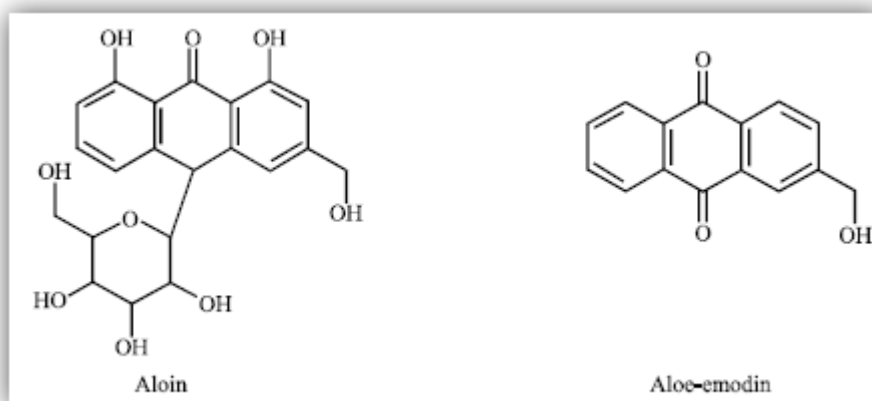
GEOGRAPHICAL SOURCE:

Aloe vera indigenous to east and south Africa yet have been brought into the west Indies and into tropical nations and will even thrive in the nations verging on the Mediterranean. In India, it is found in Rajasthan, Andhra Pradesh, and Tamil Nadu, it is economically developed in Aruba, Bonaire, Haiti, Himachal Pradesh, India, south Africa, the United States of America and Venezuela. It has turned into a typical family solution of an assortment of uses.

MORPHOLOGY:

TASTE	-Bitter
ODOUR	-None
SIZE&SHAPE	- plant growing to 60-100cm (about 3.28 ft) in lance-shaped with elongated strands
COLOUR	- leaves are green to grey-green flower
FLOWER	- yellow tubular in 25-35cm (about 1.15 ft) in a slender loose stamen
ROOT	- root fibers that can reach 30-40cm in length

GEL CONSTITUENTS:



The chemical composition of the Aloe vera gel is complex. Aloe vera contains 75 potentially active constituents: vitamins, enzymes, minerals, sugars, lignin, saponins, salicylic acids, and amino acids. The detail is as follows:

Vitamins: The plant contains many vitamins, including Vitamins A, C and E, which are antioxidants. It also contains thiamine, niacin, riboflavin, vitamin B12, choline and folic acid. Antioxidant neutralizes free radicals.

Enzymes: Amylases, lipases, alkaline phosphatases, cellulases, catalases and peroxidases are biochemical catalysts that help in digestion by breaking down fats and sugars. Carboxy peptidases and brady kinases produce an anti-inflammatory effect by inactivating bradykinins. Lectins give anti-tumor effects.

Minerals: Sodium, potassium, calcium, magnesium, selenium, manganese, copper, zinc, chromium and iron are all found in the aloe plant. These minerals play an important role in the functioning of enzymes involved in various metabolic pathways. Few of these, act as Antioxidants.

Sugars: Sugars are in the mucilaginous layer of the plant under the rind of the leaf. It includes monosaccharides (glucose and fructose) and polysaccharides (glucomannans and Poly mannose). The polysaccharides act as immune modulators.^{30,7} Glum Annan is a good moisturizer and used in cosmetic products.

Anthraquinones: The bitter reddish yellow exudates, located beneath the outer green rind, contain anthraquinones and their derivatives, Barbaloin, aloe-emodin-9-anthrone, Isobarbaloin, Anthrone-C-glycosides and chromones. These are phenolic compounds, traditionally known as laxatives. These compounds exert a powerful purgative effect, when in large amounts, but when smaller they appear to aid absorption from the gut and are potent antimicrobial agents and possess powerful analgesic effects.

Sterols: These include cholesterol, Campestral, β -Sitosterol 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.

Salicylic acid: This is an aspirin-like compound possessing anti-inflammatory and antibacterial properties

Amino acids: Aloe vera gel provides the amino acids required for repair and growth. It includes 20 of 22 non-essential amino acids and 7 of 8 essential ones.

Lignin: It is an inert substance which when included in topical preparations, enhances penetrative effect of the other ingredients into the skin.

Saponins: These are soapy substances that have cleansing and antiseptic properties.

PHARMACOLOGICAL PROPERTIES OF ALOE VERA

Burn and wound healing property

Aloe vera is best known for its soothing and healing effects on burns and other wounds. Aloe vera when applied to a wound increases both the rate of wound closure and the tensile strength of the wound via the proliferation of cells. It does so by accelerating the flow of blood towards the wounded area. Aloe is the best wound dressing ever discovered. The mechanism explained behind this acceleration is as follows; Aloe vera gel increases the collagen content and extent of collagen cross linking of the wound, resulting in enhanced wound contraction and breakage of scar tissue. Chithra et al. also reported the enhancement in content of hyaluronic acid and dermatan sulphate in the granulating tissue of healing wound. A 5.5 kDa glycoprotein, isolated from A. vera showed an increase in epithelial cell migration and enhanced wound healing process in a human keratinocyte monolayer.

Moisturizing and anti-aging effect

Aloe vera is currently utilized in manufacturing more than 95 % of dermatologically valuable products. This is because it possesses implausible moisturizing properties. It improves the ability of skin to hydrate itself and helps in removal of dead skin cells. It does so by producing collagen and elastin fibers, making the skin more elastic and less wrinkled, thereby reversing the degenerative skin changes. It softens the skin, by its cohesive action on superficial flaking epidermal cells and by the action of amino acids. For such incredible characteristics, Aloe vera is an ideal ingredient in cosmetics and dermatological procedures.

Effects on the immune system:

Alprene, an anti-allergic compound of Aloe vera inhibits calcium influx into mast cells, thereby inhibiting the antigen-antibody-mediated release of various mediators like histamine, serotonin, SRSA, leukotrienes etc from mast cells. Acemannan stimulates the synthesis and release of interleukin-1 (IL-1) and tumor necrosis factor from macrophages in mice that had previously been implanted with murine sarcoma cells, which in turn initiated an immune attack that resulted in necrosis and regression of the cancerous cells. Several low molecular constituents from Aloe vera gel are also capable of inhibiting the release of reactive oxygen free radicals from activated human neutrophils. Madan et al. reported Immunomodulatory properties of Aloe vera gel in mice. Im et al. reported optimal molecular size of modified Aloe polysaccharides with maximum immunomodulatory activity. Zhang et al. reported antioxidative and immunomodulatory properties of two novel dihydrocoumarins from Aloe vera.

Anti-diabetic effects

Aloe vera gel is well known for reducing the blood sugar level. However, the results may vary based on the differences in separation of mucilaginous layer from anthraquinones. It not only lowers the blood glucose level, but also reduces hepatic transaminases, plasma and tissue cholesterol, triglycerides, free fatty acids and phospholipids. In a study conducted by Rajasekaran et al., the treatment of gel extract could restore the decreased plasma levels of high-density lipoproteins and increased levels of low-density lipoprotein to normal levels. The mechanism behind lowering of blood glucose levels could be enhancement of glucose metabolism or it could also be attributed to the anti-oxidant effect,

which reduces the peroxide levels and hence oxidative damage. Aloe vera gel significantly lowered the triglycerides level. This explains its hypoglycemic and hypolipidemic effects.

Anti-bacterial/ anti-fungal/ anti-viral actions

The antibacterial action of Aloe vera gel enhances the wound healing process by its anti-inflammatory action. *Streptococcus pyogenes* and *Streptococcus faecalis* are the two microorganisms inhibited by Aloe gel. Aloe gel acts against both gram positive and gram negative bacteria. It possesses bactericidal action against *Pseudomonas aeruginosa*. Leaf pulp and liquid fraction of Aloe vera acts against plant pathogenic fungi. Aloe gel preparation is also inhibitory to *Candida albicans*. Lectin containing fraction of Aloe gel directly inhibits the growth of Cytomegalovirus, by interfering the protein synthesis. The anthraquinone derivatives of Aloe leaf have shown virucidal effects on enveloped viruses. Aloe emodin inactivates most of the viruses, including Varicella zoster, influenza and pseudorabies virus and herpes simplex viruses.

Effect on gastric acid secretion and ulcers

A. vera gel can cure gastric ulcers or protect against its formation in both animals and humans. The anti-ulcer activities of A. vera have been attributed to several possible mechanisms including its anti-inflammatory properties, healing effects, mucus stimulatory effects, regulation of gastric secretions and presence of lectins. The lectins inhibit aminopyrine uptake by parietal cells. Thus, this peculiar ability of the extract to inhibit gastric acid output could be a result of direct action on the acid producing cells.

Arthritis, Joint and Muscle Pain

Studies have found that ingestion of Aloe vera daily can help prevent and cause a regression of arthritis. Aloe gel also reduces pain related to tendinitis and injuries. When applied directly to the area of pain, Aloe vera penetrates the skin to soothe the pain. Biological Vehicle: Acts as a biological vehicle to aid penetration and absorption of other bio-active ingredients into deep tissue.

Laxative effects

Anthraquinones present in Aloe act as a potent laxative. It increases intestinal water content, stimulates mucus secretion and increases intestinal peristalsis.

Antiseptic effect

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

Effect on estrogen status

Isolated emodin and aloe-emodin from A. vera gel specifically suppress breast cancer cell proliferation by targeting estrogen receptor- α protein stability through distinct mechanisms, which suggests a possible application of anthraquinones in preventing breast cancer cell proliferation through estrogen receptor- α inhibition. A. vera gel also helps to maintain ovarian steroid status in polycystic ovary-like condition wherein steroidogenesis altered and disturbed estrogen: testosterone ratio.

Antihyperlipidemic activity

A. vera is known for its antihyperlipidemic property wherein it has beneficial effects on the prevention of fatty streak development and may help to reduce the development of atherosclerosis through modification of risk factors. A. vera leaf gel efficacy has been checked in hyperlipidemic type 2 diabetic patients: a randomized double-blind placebo-controlled clinical trial wherein it reduced total cholesterol and LDL levels significantly. A recent study also demonstrated that administration of phytosterols isolated from A. vera gel reduces visceral fat mass and improves hyperglycemia in Zucker diabetic fatty rats. Dried pulp of *Aloe succoring* leaves produced significant antihyperlipidemic effect in high-fat diet- and fructose-induced hyperlipidemic rats, where its significant decreased serum levels of total cholesterol, total triglycerides, low-density lipoprotein-cholesterol, very low-density lipoprotein, and high-density lipoprotein-cholesterol. Previous reports also suggested that A. vera gel-treated polycystic ovarian syndrome (PCOS) rats exhibited significant reduction in plasma triglyceride and LDL cholesterol levels, with an increase in high-density lipoprotein-cholesterol PCOS condition wherein hyperlipidemia is one of main consequences. The gel treatment also caused reversion of abnormal estrous cyclicity, glucose intolerance, and lipid metabolizing enzyme activities, bringing them too normal. It has phytochemicals with antihyperlipidemic effects and has shown efficacy also in management of PCOS but also the associated metabolic complications.

Anticancer activity

Aloin, an anthraquinone being a natural compound and the main ingredient of Aloe, has been documented for its remarkable potential therapeutic options in cancer, wherein it showed chemoprotective effects against 1,2-dimethylhydrazine-induced preneoplastic lesions in the colon of Wistar rats. Aloin treatment could inhibit the secretion of VEGF in cancer cells. VEGF is one of the most important proangiogenic cytokines known and well characterized as an inducer of tumor neovascularization. Aloin treatment significantly inhibited *in vitro* VEGF-induced angiogenic response of human endothelial cells, causing an inhibition of proliferation and migration of endothelial cells. Aloe-emodin (AE), is also a subtype of anthraquinone, a natural compound that has traditionally been found to have diverse biological activities including anticancer functions. AE (1,8-dihydroxy-3-hydroxymethyl-9,10-anthracenedione) is an herbal anthracene Dione derivative from A. vera leaves. Recent reports have shown that AE possesses antiproliferation effects on some types of cancer cells, such as lung, squamous, glioma, and neuroectodermal cancer cells. The inhibitory effect of AE on the activity and gene expression of N-acetyl transferase, which plays an initial role in the metabolism

of aryl amine carcinogens, was found in human malignant melanoma cells. Recently, Lin et al demonstrated that AE-induced apoptosis in T24 human bladder. Aloin, derived from *A. vera* leaves, has been shown to possess anticancer potential activities, as it inhibits tumor angiogenesis and growth via blocking signal transducer and activator of transcription 3 activation, with the potential of a drug candidate for cancer therapy. Anthraquinone derivatives such as emodin-like natural (emodin, Rhein, and aloin) and synthetic (anthraquinone-2-sulfonic acid) anthraquinones have recently been shown to protect in models of amyloid β and τ aggregation-induced cell death through antiaggregating properties, and/or enhancing the phosphatidylinositol-3-kinase/protein kinase B survival mechanism, which suggests that anthraquinone-2-sulfonic acid could be a new neuroprotective compound and a novel caspase inhibitor.

Hepatoprotective effect

Isolated phytosterols, namely lophenol and cycloartenol, can induce the downregulation of fatty acid synthesis and a tendency for upregulation of fatty acid oxidation in the liver, which favors the reduction in intra-abdominal fat and improvement of hyperlipidemia. Further, addition to sterol regulatory element-binding transcription factor 1/peroxisome proliferator-activated receptor (PPAR)- α ratio was decreased; metabolic syndrome-related disorders were improved and liver steatosis in *Aloe*-sterol-treated Zucker diabetic fatty rats. *Aloe* formulas also suppress obesity-induced inflammatory responses by reducing levels of the proinflammatory cytokines, PPAR γ /liver X receptor α , and 11 β -hydroxysteroid dehydrogenase 1, and enhance anti-inflammatory cytokines in white adipose tissue and liver. The beneficial effects of *Aloe* formula with respect to obesity-induced insulin resistance and hepatic steatosis have been associated with its action on PPAR γ /liver X receptor α . Saito et al showed that *A. vera* gel extract prevents ethanol-induced fatty liver by suppressing mRNA expression of lipogenic genes in the liver. The combination of probiotic *Lactobacillus rhamnosus* GG and *A. vera* gel have a therapeutic potential to decrease cholesterol levels and the risk of cardiovascular diseases.

Immunomodulatory effect

A. vera gel has strong immunomodulatory activity wherein it downregulates lipopolysaccharide-induced inflammatory cytokine production and expression of NLRP3 (NACHT, LRR, and PYD domain-containing protein 3) inflammasome in human macrophages. *A. vera* could inhibit the inflammatory process following burn injury, as characterized by the reduction of leukocyte adhesion, as well as proinflammatory cytokines. Liu et al have shown that *Aloe* polysaccharides pretreatment can attenuate the cerebral ischemia and reperfusion injury in severe traumatic-hemorrhagic rats by first entering high altitude through inhibiting systemic inflammatory response and leukocyte aggregation and lipid peroxidation in the brain. Administration of *A. vera* has been universally demonstrated to result in marked increase in phagocytic and proliferative activity of the reticuloendothelial system. *A. vera* directly inhibits the cyclooxygenase pathway and reduces prostaglandin E2 production, which plays an important role in inflammation. *Aloe* also contains anthraquinones and chromone in the inner gel, which possess strong anti-inflammatory effects as shown in murine macrophages. This report suggests that *Aloe* has anthraquinones (aloin) and chromone (aloesin) components, and *Aloe* gel has pharmacological activity to alleviate inflammatory responses in inflammatory bowel disease. A recent report of a clinical study evaluated the therapeutic effect of *A. vera* gel wherein 2% oral gel is not only effective in decreasing the pain score and wound size in recurrent aphthous stomatitis patients but also decreasing the aphthous wound healing period.

Intestinal absorption

Aloe material has been used for drug absorption enhancement for drugs with low bioavailability due to extensive efflux. *Lactobacillus brevis* strains were isolated from naturally fermented *A. vera* gel which inhibited the growth of many harmful enteropathogenesis without restraining most normal commensals in the gut and hence were named POAL (probiotics originating from *Aloe* leaf) strains; these and exhibit discriminative resistance to a wide range of antibiotics. Aloin, present in the gel, is metabolized by the colonic flora to reactive *Aloe*-emodin, which is responsible for the purgative activity. *Aloe*-emodin isolated from *A. vera* inhibits colon cancer cell migration by downregulating MMP-2/9 and inhibits *Ras a homolog* family member B and vascular endothelial growth factor (VEGF) via reducing DNA binding activity of nuclear factor κ -light-chain-enhancer of activated B cells. *A. vera* gel has been shown to contain five phytosterols, which are able to reduce visceral fat accumulation, and influences the metabolism of glucose and lipids in animal model experiments, where they reduced large-sized intestinal polyps and ameliorated reduction in plasma. High molecular weight adiponectin levels in adenomatous polyposis coli gene-deficient multiple intestinal neoplasia mice fed high-fat diet. Further, an *in vitro* study has shown that *A. vera* gel and whole leaf extract were able to reduce significantly the transepithelial electrical resistance of the Caco-2 cell monolayers and thereby showed the ability to open tight junctions between adjacent cells. Hence, *A. vera* gel and whole leaf extract solutions significantly enhanced the transport of insulin across the Caco-2 cell monolayers.

Antioxidant effect

A. vera contains substantial amounts of antioxidants including α -tocopherol (vitamin E), carotenoids, ascorbic acid (vitamin C), flavonoids, and tannins, and it has been suggested that antioxidant action may be an important property of plant medicines used in treatment of various diseases. Topical *A. Saponaria* treatment has shown antinociceptive and anti-inflammatory effects in ultraviolet B-induced sunburn model via its antioxidant components present in gel. *Aloe* gel can scavenge the free radicals 2,2-diphenyl-1-picrylhydrazyl (DPPH), 2,2'-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) $^{+\bullet}$, and nitric oxide in a concentration-dependent manner, as seen in an *in vitro* study of the radioprotective efficacy of *A. vera* gel. Administration of ethanolic extract of *A. vera* gel on tissue antioxidants led to

reduction in blood glucose level in diabetic rats, which helps to prevent excessive formation of free radicals through various biochemical pathways and reduces the potential glycation of the enzymes. *In vitro* and *in vivo* antioxidant potentials of a polysaccharide isolated from *A. vera* gel were investigated. Enzymatic extracts were prepared from *A. vera* gel using 10 digestive enzymes including five carbohydrase's and five proteases. Results suggested that *Aloe* polysaccharides exhibited a protective effect against 2,2'-azobis(2-amidinopropane) dihydrochloride-induced oxidative stress and cell death in kidney epithelial cells (Vero cells) as well as in an *in vivo* zebrafish model. One study determined the total phenolic content of *A. vera* leaf skin extracts and a significant correlation was established between the total phenolic content and the antioxidant capacity. The methanol extracts of leaf skins and flowers of *A. vera* were also screened for their antioxidant and antimycoplasmic activities, and *in vitro* antioxidant activities of both extracts exhibited antioxidant activity, with the leaf skin extract being the most active.

HEALTH BENEFITS OF ALOEVERA GEL

Aloe vera has been used from time immemorial to aid in smooth functioning of the gastrointestinal tract, mainly because of its properties of soothing, cleansing and helping the body to maintain healthy tissues. Aloe vera gel is famous for facilitating digestion, aiding blood and lymphatic circulation, as well as improving kidney, liver and gall bladder functions. Aloe vera has a minimum of three anti-inflammatory fatty acids, which help in smooth functioning of the stomach, small intestines and colon. It has a natural property to alkalize digestive juices and prevents over-acidity, which is one of the common causes of digestive ailments. Aloe vera juice concentrates are high in essential enzymes, which stimulate digestion and liver functions. The synergistic effect of Aloe vera juice used in combination with a few other herbs does wonders as a liver-cleansing agent. Aloe vera supplements also contain a rare natural ingredient called Saponins, which are provided by nature to cleanse and flush out waste products and toxins. More medicinal uses of Aloe vera are described in the following sections. Aloe vera could be used to reduce the burning sensation of burns and blisters. Applying the pure gel of Aloe vera would quell the sting of herpes. Juice or gel of Aloe vera is used to reduce warts, psoriasis and eczema. Today, skin doctors prescribe skin gels and creams made from Aloe vera. The fresh juice of Aloe vera is used to cure and heal rashes, vaginal infections, foot sores and fungus attacks of various types. It is one of the home remedies for these problems. Aloe vera is used in hair loss treatment. The enzyme content of Aloe vera prevents hair loss by protecting the scalp against any diseases. Aloe vera also helps in the reduction of dandruff. You can mix the juice of Aloe vera with coconut milk and wheat germ oil and massage your scalp before shampooing your hair. If used continuously it helps in hair re-growth. There is on-going research in the medical use of Aloe vera in the treatment and cure of AIDS and cancer. In the cure of cancer, there are many signs that medicines with Aloe vera content help in the activation of WBCs and in promoting the growth of non-cancerous cells. If people with HIV positive take regular doses of Aloe Vera, it helps in increasing the immunity of the body. The juice of Aloe vera mixed with milk is consumed for kidney infections. In Japan, Aloe vera is a main ingredient in the yogurt. In India, Aloe vera is used to make certain food dishes. Aloe vera was used as medicine by the people of the ancient world. The Greeks believe Alexander the Great conquered the island of Socotra, an island in Indian Ocean, because this island had ample growth of Aloe vera plants. Aloe vera is widely used for the following: Boosting of the immune system, as an anti-inflammatory for treating cuts and burns, Providing nutritional supplements.

Medicinal Uses of Aloe Vera

Aloe vera plays an important role in maintaining the healthy functioning of the major organs and preventing diseases.

- Aloe vera releases pepsin, which aids digestion, soothes digestive tract irritations, colic pain and ulcers. It also heals heart burns. This has come down from the traditions of folk medicine of Europe and proved in recent clinical trials in Japan.
- Aloe vera acts as a general tonic, raises immunity and fights diseases. Research reveals its efficacy in conditions like HIV and cancer, especially leukemia, due to its ability to produce white blood cells. Consequently, it can minimize the side effects of chemotherapy and radiation.
- It boosts circulation, and thus increases the supply of oxygen to the cells. Therefore, it could play a major role in alleviating the condition of thalassemia patients.
- Aloe vera is also beneficial for Asthma patients.
- It helps to maintain healthy joints and muscles, and thus, prevents arthritis.
- Aloe vera detoxifies the body and is considered the best colon cleanser. It prevents constipation; therefore, it is an effective blood purifier. It is beneficial for kidney and liver problems, like jaundice.
- Aloe vera also reduces blood sugar, and controls diabetes.
- It reduces cholesterol and triglycerides, leading to a healthy heart, and preventing cardiac problems.
- Aloe vera reduces inflammation and infection of the eye and ear.
- Finally, it provides energy, and acts as a restorative. Moreover, it is said to alleviate Depression.

Aloe Vera for A healthy skin

Apart from its effect on the internal organs, Aloe vera has a beneficial effect on the skin.

- ☐ It is rich in antioxidants, which neutralize free radicals. As a result, Aloe vera wards off wrinkles and age-related changes.
- ☐ It nourishes the skin, by boosting the circulatory system.
- ☐ Aloe vera is effective in treating skin disorders, like dermatitis, and even psoriasis.
- ☐ It heals cuts and wounds, blisters and burns, including sunburns, and even minor second-degree burns.
- ☐ Aloe vera clears acne and skin allergies, dark spots and skin blemishes, and makes the skin clearer.
- ☐ It is also good for the hair and scalp.

In the scientific community there has been a divergent theory on the application and workability of Aloe Vera. But in the last 20 years with the advent of intensified scientific research, evidence has been fully established, demonstrating its diverse medicinal properties. Some of these evidential Aloe vera medicinal uses and Aloe vera Juice health benefits are for the treatment of the following health conditions: -

Canker Sores (Aphthous stomatitis) Aloe vera Gel may treat recurrent aphthous ulcers, reduce pain and increase the amount of time between the appearances of new ulcers.

Dry Skin: Traditionally Aloe has been used as a moisturizer. Studies suggest that Aloe may effectively reduce skin dryness.

Lichen Planus: Studies suggest that Lichen Planus, which is a chronic inflammatory disease that affects the lining of the mouth, may be treated by Aloe.

Skin Burns/Skin Ulcers: It has been found that Aloe vera may aid healing of mild to moderate skin burns and ulcers. Extensive research carried out since the 1930's has shown that the clear Aloe Gel has a dramatic ability to heal wounds, ulcers and burns by putting a protective coating on the affected areas and speeding up the healing rate.

Radiation Dermatitis: Reports in the 1930s of tropical Aloe's beneficial effects on skin after radiation exposure, lead to widespread use in skin products. Currently Aloe vera Gel is sometimes recommended for skin irritation caused by prolonged exposure to radiation.

Genital Herpes: Evidence from human studies suggest that extracts from Aloe vera in a hydrophilic cream may be an effective treatment of genital herpes in men.

Psoriasis Vulgaris: Early evidence suggests that an extract from Aloe in hydrophilic cream may be an effective treatment of psoriasis vulgaris.

Seborrheic Dermatitis (Seborrhea, Dandruff): A study of Aloe vera lotions suggests effectiveness for treating seborrheic dermatitis when applied to the skin.

Cancer Prevention: There is early evidence that oral Aloe may reduce the risk of developing lung cancer. Aloe vera is used in alternative medicines and in home first aid.

Effect on HIV

Aloe vera contains Gluco-mannan, a special complex polysaccharide composed largely of the sugar Mannose. It interacts with special cell-surface receptors on those cells which repair damaged tissues, called fibroblasts, stimulating them, activating their faster growth and replication. An extract of Mannose, one of the sugars in Aloe vera can inhibit HIV-1, the virus associated with AIDS. In a 1991 study in Molecular Biotherapy, HIV-1 cells were treated in vitro – outside the body – with the Mannose extract. Virus reproduction was reduced by as much as 30% by Aloe Vera, viral load – total amount of the virus – as well as reduced, the spread of the virus from the infected cells was suppressed and the viability – chance of survival – of infected cells was increased. The Aloe vera gel also proved to be an effective part of a nutritional support program for HIV+ patients according to the Journal of Advancement in Medicine. For 4 months, 29 patients were given 100% pure Aloe vera gel (5 ounces (about 147.87 ml), 4 times daily) along with an essential fatty acid supplement and another supplement containing vitamins, minerals and amino acids. Patients were told to continue with their normal diet and not to take other supplements. After 90 days (about 3 months) all the patients had fewer occurrences of opportunistic infections, thrush, fatigue and diarrhea, as well as increased white blood cell counts meaning their immune systems were responding positively. Their assessment of overall quality of health also improved. In 255 of the patients, Aloe vera apparently knocked out the virus's ability to reproduce. Researchers found that Aloe vera stimulates the body's immune system, particularly T4 helper cells – white blood cells that activate the immune response to infection. The medicinal uses of Aloe vera extend to protection against radiation burns.

Protection against radiation

With the invention of the atom bomb it was discovered early in the search for protection against radiation burns that the best treatment was Aloe vera gel. It is rumored that the U.S.A. and the U.K. have huge stockpiles of Aloe vera for use in the event of a nuclear attack and doctors have even prescribed it for intravenous use when treating radiation burns. The Aloe vera gel has a dramatic ability to heal wounds, ulcers and burns by putting a protective coating on the affected areas, speeding up the healing rate, relieving pain and preventing blisters. It can also reduce inflammation, decrease swelling and redness and accelerate wound healing. Aloe vera increases availability of Oxygen to the skin and also increases the synthesis and strength of tissue. Aloe vera protects against skin damage from X-rays according to researchers at Hoshi University in Japan publishing in the journal Hakubaku Zashi. They found that Aloe vera was an

effective antioxidant, mopping up the free radicals caused by radiation, and that it protected two of the body's healing substances, Superoxide Dismutase (an antioxidant enzyme) and Glutathione (an amino acid which stimulates the immune system). The medicinal uses of Aloe vera also include protection against frostbite damage.

USES OF ALOEVERA IN DIFFERENT TRADITIONAL SYSTEMS

1. Indian system of medicine/ India.

In Ayurveda, Aloe is known as Kumari, or "young girl", because aloe is believed to bring back youthful energy and femininity. Aloe is used as a tonic for the female reproductive system. Aloe is said to have alliterative, tonic, rejuvenating, purgative and vulnerary actions in Ayurveda. Aloe is also believed to tone all three of the Ayurveda constitutions, Vata, Pitta, and Kapa. It is used in traditional Indian medicine for constipation, colic, skin diseases, worm infestation and infections. Aloe is used internally as a laxative. anthelmintic. hemorrhoids treatment, and uterine stimulant (menstrual regulator). It is used topically, often in combination with liquorice root, to treat eczema or psoriasis. People in Tamil Nadu, a state of India, often prepare a curry using A. vera which is taken along with Indian breads or rice

2. Chinese medicine system/China

The Chinese use of Aloe's skin and the inner lining of its leaves as a cold and bitter remedy is used to clear constipation due to accumulation of heat (fire). The gel is considered cool and moist and recommended in the treatment of fungal diseases. Like their Ayurvedic peers, Chinese herbalists recognized aloe's potential as a purgative; they used aloe to expel worms, alleviate constipation and normalize bowel movements

3. Egyptian system of medicine/ Egypt

Ancient Egyptian Papyrus and Mesopotamian described Aloe as being useful in curing infections. treating skin problems and as a laxative. Cleopatra was said to include Aloe cream in her beauty regimen

4. Arabian system of medicine/ Arab

In Arabian medicine Fresh gels rubbed on the forehead as a headache remedy or rubbed on the body to cool it in case of fever, as well as being used for healing wounds, curing conjunctivitis, and as a disinfectant and laxative.

5. Western system of medicine

In Western society, A. vera is one of the few herbal medicines in common usage, and it is found useful in the cosmetic, pharmaceutical, and food industries. Therapeutically it is used for topical and oral applications.

6. Greek system of medicine

The A. vera plant is described in detail in the Greek Herbal of Dioscórides (ca 70 AD), and its use is promoted for the treatment of wounds, hair loss, genital ulcers and hemorrhoids.

7. Spanish medicine system

Aloe was used by Hippocrates and Arab physicians, and was carried to the Western Hemisphere by Spanish explorers to treat the wounded soldiers

8. United States

A. vera was officially listed as a purgative and skin protectant by the U.S. pharmacopoeia in 1820 and was clinically used in the 1930s for the treatment of radiotherapy, burns to the skin and mucous membranes. Little is known of aloe's role in Native American. They gained the information from the Spanish explorers who brought Aloe with them. Modern native healers of American use Aloe in the same way as their European counterparts

9. Mexican

For the treatment of type 2 diabetes mellitus

10. Trinidad and Tobago

Used for the treatment of hypertension.

11. Roman

A. vera gel has been used for many purposes since the Roman era or even long before. Treating burns is one of the major applications of A. vera gel used in many countries

12. Japan

Commonly used as an ingredient in commercially available yogurt. There are also many companies that produce A. vera beverages

13. Philippines

Used with milk for kidney infections

14. Russia

used for treating cuts, scrapes, minor burns, cold sores, sun burns and other type of skin infections

15. Africa

Cultivation in East Africa is primarily on a small scale for ornamental purposes. A. vera L. (Syn. Aloe barbendensis mil) is most often encountered for its treatment of burns, however. a number of useful hair care references also exist. it was probably Discovered in about AD 74% who made the observation that A. Vera could stop hair loss. though it is not recorded whether this was the exudate. the gel or the whole leaf.

CONTRAINDICATIONS

Allergy

The use of A. vera preparations should be avoided in individuals with a known allergy to plants of the Liliaceae family, garlic, onions, and tulips etc.

Pregnancy

The use of *A. vera* as a laxative during pregnancy may pose potential teratogenic and toxicological effects on the embryo and fetus.

Renal or cardiac disease

Prolonged use of *A. vera* latex has been associated with watery diarrhea resulting in electrolyte imbalance and anecdotal reports suggest that the increasing loss of potassium may lead to hypokalemia. Therefore, the *A. vera* latex is contraindicated in patients with a history of renal or cardiac disorders.

Drug interactions

The potential interactions of *A. vera* with drugs have been suggested by many researchers. Possible hypokalemia-related arrhythmia suggests a potential herb-drug interaction with cardiac glycosides. Caution is warranted in patients taking hypoglycemic agents as interactions with *A. vera* gel have been reported. Application of Aloe to skin may also 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 *A. 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.

SAFETY AND EFFICACY OF ALOEVERA

Safety and efficacy of *A. vera* is difficult to determine due to the lack of standardization of commercially available *A. vera* products. The lack of a detailed understanding of the plant's active components makes it difficult to evaluate the optimal dose of a particular *A. vera* preparations for the treatment of specific disorders. Despite this, topical application of *A. vera* gel or extract is safe for the treatment of mild to moderate skin conditions, burns, wounds, and inflammation. Reports of its use in psoriasis, dermatitis, and surgical wound healing are contradictory. The Natural Standard Research Collaboration concluded that the oral use of *A. vera* gel for its potential hypoglycemic effects and the short-term use of oral Aloe latex as an laxative is possibly safe; however, prolonged use of the latex is likely to be unsafe due to a theoretical risk of dehydration and electrolyte imbalance. In short, *A. vera* has a wide spectrum of properties and uses, some of them could be myths and some of which could be the real magic. In future, controlled studies are required to prove the effectiveness of *A. vera* under various conditions.

CONCLUSION

Aloe vera has been traditionally used to treat skin injuries (burns, cuts, insect bites, and eczemas) and digestive problems because of its anti-inflammatory, antimicrobial, and wound healing properties. Research on this medicinal plant has been aimed at validating traditional uses and deepening the mechanism of action, identifying the compounds responsible for these activities. Likewise, new actions have been investigated for *Aloe vera* and its active compounds, especially highlighting its promising role as a cytotoxic, antitumoral, anticancer, and antidiabetic agent. In the last 6 years, most pharmacological studies have been in vitro and in vivo works. Among in vitro studies, antimicrobial, anti-inflammatory, cytotoxic, antitumor, anticancer, and skin protection activities are the most studied in number. It should be especially noted that among in vitro studies there are several works that evaluate the protective action of *Aloe vera* in bone diseases such as osteoporosis. The results on bone protection are promising; however, it is necessary to perform them with experimental animals and humans. Regarding in vivo studies, these are aimed at evaluating cardioprotective effect, cytotoxic, antitumor and anticancer activities, and skin protection activities. Compared to in vitro and in vivo assays, clinical trials are limited and focus on digestive and skin protective effects. In addition, these clinical trials have been conducted just with *Aloe vera*, but not with its isolated compounds; therefore, it would be of interest to study the clinical effect of relevant metabolites in different human conditions and pathologies. Among the major active compounds, research in the last six years focused on aloe-emodin, aloin, aloesin, Amodin, and ace Mannan. Of these, aloe-emodin and aloin have been the most studied ones. Particularly, aloe-emodin has resulted in being a promising agent as an antimicrobial, antidiabetic, cytotoxic, cardioprotective, and bone protective (in in vitro studies) as well as anti-inflammatory and skin protective compound (in in vivo studies). Aloin was effective in inflammatory process and bone diseases (in vitro studies) and in cancer and cardiovascular diseases (in vivo studies). The promising results of basic research encourage a greater number of clinical trials to test the clinical application of *Aloe vera* and its main compounds, particularly on bone protection, cancer, and diabetes.

REFERENCES

- [1] Yates A, Yates Garden Guide, Harper Collins Australia, Australia, 2002.
- [2] Vogler B, Ernst E, Aloe vera: a systematic review of its clinical effectiveness, British Journal of General Practice, 49(447), 1999, 823–828.
- [3] Chandegara VK, Varshney AK, Aloe vera L. Processing and products: A review. International Journal of Medicinal and Aromatic Plants 3(4), 2013, 492-506.
- [4] Cheesbrough M, Medical laboratory manual for tropical countries, 260, Butterworth, Oxford, 2000.
- [5] Joseph B, Raj SJ, Pharmacogenetic and phytochemical properties of Aloe vera linn –an overview, International Journal of Pharmaceutical Sciences Review and Research, 4(2), 2010, 106-110.
- [6] Manvitha K, Bidya B, Aloe vera: a wonder plant its history, cultivation and medicinal uses, Journal of Pharmacognosy and Phytochemistry, 2(5), 2014, 85-88.

- [7] Kumar KPS, Bhowmik D, Chiranjib and Biswajit, Aloe vera: A Potential Herb and its Medicinal Importance, Journal of Chemistry and Pharmaceutical Research, 2(1), 2010, 21-29.
- [8] Choi S, Chung MH, A review on the relationship between Aloe vera components and their biologic effects, Seminars in Integrative Medicine, 1, 2003, 53-62.
- [9] Marshall JM, Aloe vera gel: What is the evidence?, The Pharmaceutical Journal, 24, 1990, 360-362.
- [10] Basmatker G, Jais N and Daud F, Aloe vera: a multifunctional cosmetic ingredient, International Journal of Medicinal and Aromatic Plants, 1(3), 2011, 338-341.
- [11] Rajeswari R, Umadevi M, Sharmila Rahale C, Pushpa R, Selvavenkadesh S, Sampath Kumar KP, Bhowmik D, Aloe vera: The Miracle Plant Its Medicinal and Traditional Uses in India, Journal of Pharmacognosy and Phytochemistry, 1(4), 2012, 118-124.
- [12] Tarro VE, The honest herbal: A sensible guide to the use of herbs and related remedies 3rd ed., Pharmaceutical Products Press, New York, 1993, 25-28.
- [13] Ni Y, Turner D, Yates KM, Tizard I, Isolation and characterisation of structural components of Aloe vera L. leaf pulp, International Immunopharmacology, 4, 2004, 1745-1755.
- [14] Hamman JH, Composition and Applications of Aloe vera
- [15] Prakoso Y.A., Setiyo Rini C., Wirjaatmadja R. Efficacy of *Aloe vera*, *Ananas comosus*, and *Sansevieria masoniana* Cream on the Skin Wound Infected with MRSA. *Adv. Pharmacol. Sci.* 2018; 2018:4670569. Doi: 10.1155/2018/4670569.
- [16] Coelho F.H., Salvadori G., Rados P.V., Magnusson A., Danilevicz C.K., Meurer L., Martins M.D. Topical *Aloe Vera (Aloe barbadensis* Miller) Extract Does Not Accelerate the Oral Wound Healing in Rats. *Phytother. Res.* 2015; 29:1102–1105. doi: 10.1002/ptr.5352.
- [17] Tabatabaei S.R.F., Ghaderi S., Bahrami-Tapehebur M., Farbood Y., Rashno M. *Aloe vera* gel improves behavioral deficits and oxidative status in streptozotocin-induced diabetic rats. *Biomed. Pharmacother.* 2017; 96:279–290. doi: 10.1016/j.biopha.2017.09.146.18.
- [18] Abdollahnejad F., Mosaddegh M., Nasoohi S., Mirnajafi-Zadeh J., Kamalinejad M., Faizi M. Study of Sedative-Hypnotic Effects of *Aloe vera* L. Aqueous Extract through Behavioral Evaluations and EEG Recording in Rats. *Iran. J. Pharm. Res.* 2016; 15:293–300.
- [19] Mawarti H., Rajin M., Asumta Z. The Effects of *Aloe vera* on TNF- α Levels, the Percentage of Nk Cells and Th 17 Cells in Rat That Received Isoniazid and Rifampycin. *Med. Arch.* 2017; 71:308–311. doi: 10.5455/medarch.2017.71.308-311.
- [20] Boudreau M.D., Olson G.R., Tryndyak V.P., Bryant M.S., Felton R.P., Beland F.A. From the Cover: Aloin, a Component of the *Aloe vera* Plant Leaf, Induces Pathological Changes and Modulates the Composition of Microbiota in the Large Intestines of F344/N Male Rats. *Toxicol. Sci.* 2017; 158:302–318. doi: 10.1093/toxsci/kfx105. Leaf Gel, *Molecules*, 13, 2008, 1599-1616.
- [21] Cera LM, Hegggers JP, Robson MC, Hagstrom WJ, The therapeutic efficacy of *Aloe vera* cream (Dermaide Aloe) in thermal injuries: Two case reports, Journal of American Animal Hospital Association, 16, 1980, 768-772.
- [22] Azghani AO, Williams I, Holiday DB, Johnson AR, A beta- linked mannan inhibits adherence of *Pseudomonas aeruginosa* to human lung epithelial cells, *Glycobiology*, 5, 1995, 39-44.
- [23] Saoo K, Miki H, Ohmori M, Winters WD, Antiviral activity of aloe extracts against cytomegalovirus, *Phytotherapy Research*, 10, 1990, 348-350.
- [24] Sydiskis RJ, Owen DG, Lohr JL, Rosler KH, Blomster RN, Inactivation of enveloped viruses by anthraquinones extracted from plants, *Antimicrobial Agents and Chemotherapy*, 35, 1991, 2463-2466.
- [25] Alves DS, Pérez-Fons L, Estepa A, Micol V, Membrane- related effects underlying the biological activity of the anthraquinones: emodin and barbaloin, *Biochemical Pharmacology*, 68(3), 2004, 549-561.
- [26] Bhuvana KB, Hema NG, Patil RT, Review on *Aloe vera*, *International Journal of Advanced Research*, 2(3), 2014, 677-691.