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REVIEW ARTICLE

A REVIEW: THERAPEUTIC, MEDICINAL AND FOOD USES OF *ALOE VERA*

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Abstract

The history for the use of *Aloe vera* for medicinal purposes starts from about 3000 years. Medicinally, this plant may be able to treat skin cancer as well as sunburns, burns, and small wounds. More than 104 compounds from various parts of this plant, including minerals, vitamins, amino acids, enzymes, sterols, anthraquinone, flavonoids, terpenoids, coumarins, polysaccharides, sugars, and polyphenols, have been isolated thus far, according to scientific reports on phytochemical analysis of this plant. The biological activities of these compounds are diverse and include anthelmintic, hepatoprotective, antidiabetic, diuretic, antibacterial, antiviral, antioxidant, antiseptic, anti-inflammatory, anticancer, and cosmetic effects for medical therapy. This article mainly emphasizes therapeutic, medicinal and food uses of *A. vera.*

Keywords: *Aloe vera,* food, medicinal, therapeutic, flavonoids.

INTRODUCTION

Aloe is an individual from the 420-species of family Xanthorrhoeaceae, which has been utilized for medicinal purposes for around 3,000 years. Aloe is a genus of succulent herbs that grow to a height of 80–100 cm. They matured in 4 to 6 years and can live for just about 50 years in the right circumstances. Among the Aloe species, *A. vera* (L.) Burm. f. syn. *A. barbadensis* M. is the most physiologically active species[1,2]. According to the World Health Organization, medicinal plants will be the primary source of many different medications[3]. The plant was originally found in southern and eastern Africa, in the Sudan along the upper Nile. After that, it was brought to northern Africa, where it spread naturally to other parts of Africa and the Mediterranean. The plant is grown for commercial use in Venezuela, Aruba, Bonaire, Haiti, India, South Africa, and the United States of America[4]. While Southern California deserts are home to the highest-quality aloe plants. As long as its roots are not damaged, the plant can endure underneath frigid temperatures and temperatures as high as 104ºF.

Aloe vera (L.) Burm f. is a perpetual succulent xerophyte that produces tissue that holds water in its leaves in order to withstand arid environments with little to no precipitation. Additionally, this is a well-known medicinal plant that has been used extensively to cure different ailments in traditional Chinese medicine. There is a continuous search for new anti-pathogen compounds using plant-based extracts. A substantial percentage of recently created antibiotics available for purchase come from sources that are semi-synthetic or natural, and about 20% of all plants have undergone pharmacological or biological research[5]. The motivation behind this review is to introduce an exhaustive update on the utilization of *A. vera* in medication, food, and treatment.

Taxonomy

The following is the taxonomic classification of *A. vera*[6]:

Kingdom: Plantae	Subkingdom: Viridiplantae
Division: Tracheophyta	Class: Magnoliopsida
Order: Asparagales	Family: Xanthorrhoeaceae
Genus: *Aloe*	Species: *vera*

Binomial name: *Aloe vera* L.

Synonyms

Aloe vera is also known as (synonyms): *A. perfoliata* L., *A. barbadensis* Miller, *A. chinensis* Bak., *A. indica* Royle, *A. elongata* Murray, *A. officinalis* Forsk., *A. rubescens* DC, and *A. vera* L. var. *littoralis*. König ex

Bak., L. var. *chinensis*, *A. vera* Lam, *A. vulgaris* Berger. *A. vera* (L.) Burm. f. is considered a synonym, whereas *A. barbadensis* Mill. is considered the correct species name in most formularies and reference books. Depending to the International Rules of Botanical Nomenclature (IRBN), *A. vera* (L.) Burm. f. is the correct name for this species[7].

Botanical description

A sessile, three-sided stem, a shallow underground root growth, and beefy, toothed passes on assembled in a rosette 30 to 50 cm long and 10 cm wide at the base describe this succulent perennial herb, which has a pea-green tone. The radiant yellow, cylindrical blossoms are 25-35 cm long, with an axillary spike and stamens that oftentimes arise outside the sprouting tube. There are a lot of seeds in the fruits[4].

Active ingredients

More than one hundred potential active ingredients from six different classes make up the active components of *A. vera*: phenylpropanoids, flavonoids, and coumarins, phenylpyrone and phenol derivatives, phytosterols, anthraquinone and their glycosidic derivatives, chromone and its glycosidic derivatives, and others[8,9]. The leaf is transverse section displays three cell layers: the outer, protective layer, and the colorless inner layer[10].

The outer protective layers of the leaf

According to several studies, derivatives of hydroxy anthracene, anthraquinone, and the glycosides aloin A and B are available in the severe yellow plastic of pericyclic tubules in the external layer of the leaves in levels going from 15 to 40%[11]. Substances such as moisture, fiber, ash, lipids, protein, organic acids, minerals, free sugars, and polysaccharides were identified through chemical analysis of the basic ingredients of leaves of *A. vera*. Fructose, glucose and sucrose were the three basic free sugars. The primary organic acids were lactic, fumaric, acetic, malic, lactone, citric, and oxalic acids. *A. vera* has been used to isolate and characterize approximately 29 chromone, 32 anthraquinones, 13 flavonoids, 12 phenylpropanoid acids, 4 coumarins, 3 phenylpyrone, 1 naphthalene triglucosylated (alloferoside A), 1 methyltetraline (ferroxidine), and their derivatives[9].

The middle layer of the leaf

It is vital to recognize this juice from *A. vera* gel, which is a comparable boring adhesive gel produced using parenchymatous leaf cells. The pericycle and adjacent leaf parenchyma cells are the source of this juice, which flows spontaneously from the sliced leaf. This gel can be dried without the use of heat. Water (>98%), polysaccharides (cellulose, pectins, glucomannan, hemicellulose, acemannan), lipids, proteins, vitamins, enzymes, inorganic compounds, amino acids, and phytosterols (cycloartanol, lophenol, 24-methylenecycloartanol, 24-ethyl-lophenol, and 24-methyllophenol) make up the majority of the chemical constitution of *A. vera* gel[12]. Emodin of aloe and the anthraquinone glycosides Aloin A and B are among the principal active ingredients from *A. vera* juice, which are hydroxy-anthracenic products, which make up 15 to 40% of the overall constituents[13]. Furthermore, it has been discovered that the components Al, B, Ba, Fe, Ca, Na, P, Mg, Si, etc are available in *A. vera* gel[14,15].

The inner layers of the leaf

In the center district of the leaf, which is a clear, delicate, soggy, and tricky tissue, huge, slight walled parenchyma cells hold water as tacky adhesive[16,17].The inward layer of the leaf gel contains up to close to 100% water, with amino acids, glucomannan, lipids, and sterols[18], vitamins (B1, B2, B6, and C)[19], many mono- and polysaccharides, a number of inorganic substances, enzymes (lactate dehydrogenase, amylase, lipase, acid and alkaline phosphatase), and organic substances (barbaloin, aloin, and emodin)[20]. A lengthy chain of acetylated mannose serves as *A. vera* is primary functional component[21,22].

The polysaccharides in the parenchymatous tissue of the inward leaf of aloe plants have been linked to several of the therapeutic benefits of extracts from aloe leaves[23,24], is thought that rather than being attributed to a single chemical component, these processes in biology ought to be attributed to the synergistic activity of the chemicals included within[25].

***A. vera* root**

Certain phenolic chemicals, particularly naphtha-quinones and anthraquinones, have also been found in the case of *A. vera* root[26-28].

Uses of ethnopharmacology

Historically, *A. vera* gel has been utilized topically to small burns, heal wounds, and skin irritations as well as orally to treat immune system deficiencies, coughing, constipation, ulcers, migraines, diabetes, and arthritis[29]. For millennia, *A. vera* has been treated medicinally in a several nations, including: Egypt, Greece, India, Japan, Mexico, and China[30].

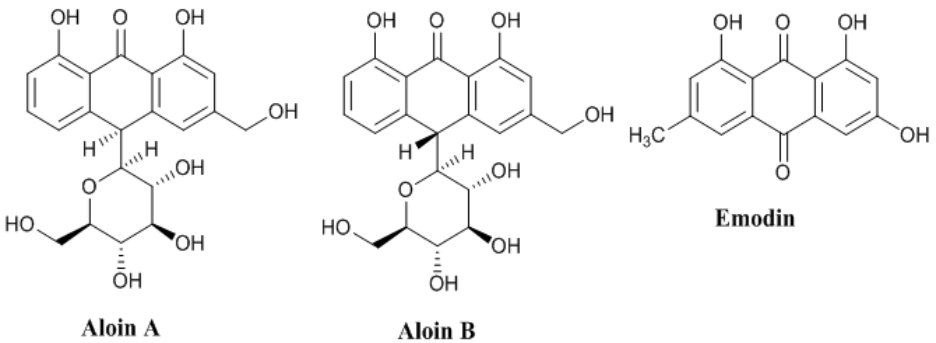

Figure 1: Potential active anthraquinone components of *A. vera*.

A. vera had been applied by the Egyptians to make papyrus-like scrolls and treat tuberculosis[31]. Nadkerni,[32] mentioned that a variety of *A. barbadensis* formulations, including lotions, confections, and juices, are effective treatments for a range of illnesses. Aloin, a combination of glucosides found in aloe, is the active ingredient in several medications. This plant is used to make Elio, an anthelmintic, purgative, and emmenagogue used to treat paediatric helminthiasis. Gel is helpful for pressure ulcers and ulcerative colitis [33]. The properties of *A. vera* include emmenagogue, deobstruent, stomachic, carminative, aperient, depurative, and diuretic effects. For almost 3,000 years, traditional medicine has made use of edible coating gels derived from the *A. vera* plant[9].

MEDICAL AND THERAPEUTIC USES

The present investigation aims to showcase the advantages and applications of leaf gel that have recently been identified. We shall provide a quick overview of *A. vera* known biological functions. According to certain claims, the polysaccharides present in the gel of *A. vera* have antibacterial, anti-inflammatory, radiation damage repair, antifungal, wound healing, immunostimulation, antiviral, antidiabetic, and antitumor activities, as well as antioxidant and hematopoiesis-stimulating effects**.** Furthermore, significant medicinal uses will be described, including the application of powdered dry *A. vera* gel as an excipient in measurements formulations for medications with prolonged release[34,35]**.**

Anti-aging agent

The skin is capacity for moisture retention is attributed to muco-polysaccharides. Amino acids additionally mellow hard skin cells, and zinc goes about as an astringent to fix pores. Studies has demonstrated that using *A. vera* gel gloves to treat dry skin caused by industrial exposure can improve skin uprightness, decrease erythema, and lessen the emergence of acne-related wrinkles. *A. vera* gel hydrates and feels refreshing on the skin. It also contributes to skin regeneration and gerontology. Aloe is biogenic nature gives rise to this trait. In the cosmetics business, *A. vera* is used as a skin tonic[1].

Antibacterial activity

According to earlier research, using *A. vera* gel as an edible covering helps to minimize microbial spoiling and fruit deterioration. Nabigol and Asghari, discovered that *A. vera* gel repressed the development of mycelium (*Aspergillus niger* and *Penicillium digitatum*)[36]. It was discovered that *A. vera* gel at a dosage of 500 mL/L completely inhibited *P. digitatum* and 64% inhibited *A. niger*. In an alternative investigation[37], *Shigella flexneri* and *Streptococcus progenies, S. aureus, P. aeruginosa, E. coli*, and *S. typhi* were reported to be inhibited in growth by *A. vera* leaf gel. There have likewise been reports of *A. vera* gel antibacterial properties against *Helicobacter pylori*[38]. Agarry *et al*.,[39] revealed that *Trichophyton mentagrophytes*' (20.0 mm) development was suppressed by the aloe gel. Conversely, *A. vera* extracts did not demonstrate any antimicrobial activity against *Xanthomonas* species[40].

Benitez *et al*.,[41] found that *A. vera* gel works better than chitosan and alginate to inhibit mesophilic bacteria, yeasts, and molds on kiwifruit slices. An *A. vera* gel covering was found to expand the timeframe of realistic usability of guava by approximately one week in a different study. This is because the edible covering inhibits the growth of microorganisms[42]. They were not knowing the precise method of action, but acemannan saponins, and anthraquinone derivatives found in *A. vera* are known to have antibacterial activity[43]. *A. vera* gel has inhibited two micro-organisms: *S. pyogenes* and *S. faecalis*[44].

Antidiabetic effects

An evaluation of the medical advantages of medicinal plants, including *A. vera*, focused on the function of active macromolecules with antidiabetic action. In mice with type-2 diabetes, the phytosterols and polysaccharides of *A. vera* increased insulin levels, which had anti-diabetic effects[45-47]. Clinical and experimental studies on *A. vera* sap have demonstrated a noteworthy hypoglycemic impact when consumed for 4-14 weeks[48].

While some studies indicated that there may be no change in glucose levels, several preclinical (in animals) and clinical (in people) formulations have shown that *A. gelatinifera* formulations. *A. vera* in various structures (for example juice or as ingredients in baking, *etc*.) shows a reduction in the level of glucose in the blood. Different techniques for extracting and separating mucous *A. vera* gel from secretory anthraquinone may account for variations in the outcomes of these *in vivo* investigations. Furthermore, it can be challenging to connect the effect or lack of to the product in question because it isn't always evident which portion of an aloe leaf was assessed in a particular study. Through oral administration in rats of alcohol insoluble residue (gel of *A. vera*) extract led to a considerable reduction in hepatic transaminases, plasma and tissue cholesterol, triglycerides, free unsaturated fats, phospholipids, and fasting blood glucose, in addition to a noteworthy increase in plasma insulin levels. Following administration of the gel extract, mice treated with streptozotocin exhibited normal an increase in low-density lipoprotein cholesterol and high-density lipoprotein cholesterol levels in the plasma[49]**.**

Antifungal activity

A. vera was tested for its antifungal properties on the mycelium development of *F. oxysporum*, *C. coccodes*, and *R. solani*. *F. oxysporum* was inhibited by the pulp at 104 µl L^{-1}, whereas *F. oxysporum, R. solani*, and *C. coccodes* showed lower colony growth rates in the liquid fraction at a concentration of 105 µl L^{-1}[50]. Sitara *et al.* [51], stated that, *A. niger, A. alternata, A. flavus, D. hawaiensis*, and *P. digitatum* are the five plant pathogenic fungi that were the subject of a thorough investigation of the three separate doses of the antifungal ability of *A. vera* gel. It has been found that *D. hawaiensis* and *A. alternata* growth is entirely inhibited by the maximum test dosage of *A. vera* gel (0.35%). As per an alternative investigation, the base

fungicidal groupings of *A. vera* against *P. gladioli, F. oxysporum, H. pruneti,* and *B. gladiolorum* varied based on the kind of fungus species and ranged from 80 to 100 µL/mL[52].

Additionally, prior research has demonstrated that combining *A. vera* gel with various homogenizers, including 0.15 g of glycerol starch, enhances the effectiveness of preventing fungal rot and weight reduction in cherry tomatoes[53]. Navarro *et al*.[54], led a concentrate on nectarines using *A. vera* gel on alone or in conjunction with thymol, and saw that as the *A. vera* gel alone is more powerful at preventing the decay brought on by *P. digitatum*, *B. cinerea*, and *R. stolonifer*. In a prior study, *A. vera* gel coatings were examined for their ability to prevent deterioration and were found to dramatically reduce the amounts of yeast, mould, and mesophilic bacteria in a variety of vegetables and fruits, including tomatoes[55,56], citrus fruits[57], berries fruits[58], blueberry[59], strawberry[60], and ready-to-eat pomegranate seeds[61]. A prepared *A. vera* gel slowed the growth of the *C. albicans* fungus[62].

Anti-inflammatory Action

Bradykinase activity has been employed in research conducted *in vitro* and *in vivo* that demonstrate the gel of *A. vera* has beneficial anti-inflammatory properties[63]. Bradykinin is a fiery compound that causes torment, and the peptidase bradykinase that was segregated from aloe has been shown to separate it[64,65]. The active components of *A. vera* include sterols (*β*-sitosterol, campesterol, lupeol, and cholesterol) and mannose-6-phosphate[65] which have anti-inflammatory properties, assist in lowering pain and serving as a natural painkiller. Aloe has additional aspirin-like substance that gives it antibacterial and anti-inflammatory qualities**.** *A. vera* diminishes the union of prostaglandin E2 from arachidonic corrosive and hinders the cyclo-oxygenase pathway. Rats with carrageenin-induced paw oedema showed a substantial reduction in acute inflammation when treated with fresh *A. vera* gel, but not in chronic inflammation[66].

The oedema generation was observed to be inhibited by *A. vera* aqueous and chloroform extracts in a manner comparable to those of popular anti-inflammatory medications (i.e. dexamethasone and indomethacin). Additionally, there was a strong correlation observed between the counter oedema properties of these two concentrates and their ability to diminish the number of neutrophils that move into the peritoneal depression[67]. An adjuvant-induced rat model of arthritic inflammation showed a 48% reduction in inflammation with adding 5.0% leaf homogenate from *A. vera* leave[68]. Potential exists for using *A. vera* to treat the inflammatory response of the stomach mucosa brought on by an *H. pylori* infection[69].

Antioxidant effects

Several authors have reported that the unfractionated entire gel and the fractions of *A. vera* contain antioxidant properties. The cell reinforcement properties of *A. vera* gel might be because of the presence of phenolic cancer prevention agents, superoxide dismutase catalysts, and glutathione peroxidase movement. *A. vera* gel dose dependent antioxidant activity was shown by incubating inflammatory colon mucosal biopsies and employing two cell-free *in vitro* techniques. This study evaluated the scavenging of peroxyl and superoxide radicals using cell-free methodologies. *A. vera* gel likewise inhibited the production of prostaglandin E2 from inflammatory colorectal biopsies at a dosage of 1 in 50, while thromboxane B2 release remained unaltered[70].

Antiseptic properties

Six germ-free specialists called lupeol, urea nitrogen, salicylic corrosive, cinnamonic corrosive, sulfur and phenols are what give *A. vera* its antiseptic properties. These substances inhibit the growth of bacteria, viruses, and fungus. Even though the majority of these applications are intriguing, more research is necessary to evaluate its efficacy across all illnesses[71].

Anti-stress effect

A. vera juice is helpful for the legitimate working of the body frameworks[72]. It reduces the process of cells being damaged under stress and lessens the body physiological and biochemical alterations[73]. Synthetic responses that change a compounds oxidative state are alluded to as oxidative pressure. Certain cancer prevention agents are tracked down in the body normal administrative device, though dietary cell reinforcements come from food sources. *A. vera* is a prime example of a useful food that helps protect against oxidative stress[74].

Antitumor activity

The primary purposes of *A. vera* gel are defence, hydration, insulation, and complement activation associated with polysaccharides. *In vitro* application of fresh gel induced both growth and adhesion of normal human cells, while a settled gel planning demonstrated cytotoxic to growth and typical human cells. The additional chemicals introduced to the gel during processing were blamed for this cytotoxicity[75].

The anticancer and antiulcer properties of *A. vera* gel glycoproteins have additionally been displayed to support the development of solid human skin cells. Research indicates that benzopyrene cannot bind to primary rat hepatocytes due to the presence of the polysaccharide fraction, which inhibits the production of benzopyrene-DNA adducts that may cause cancer. There have also been reports of myristicphorbol acetate's tumor-promoting properties being inhibited and glutathione S-transferase being increased, which suggests that *A. vera* gel might be helpful in the chemoprevention of cancer[76]. Anthraquinone *A. vera* emodin has antineoplastic qualities since it can stop or slow the proliferation of malignant cancer cells. Nevertheless, the usefulness of *A. vera* gel on human health has been the subject of incredibly few and often contradicting statistically significant clinical trials[77].

Antiviral Activity

Many researchers have also been interested in *A. vera* is antiviral properties because of its purported beneficial effects against strains of the HSV type 2 herpes simplex virus by Keivan *et al*.[78], as well as against influenza A virus spreads by Li *et al*.,[79]. It has been shown that a few parts of *A. vera* gel are strong antiviral specialists. Herpes simplex contamination was diminished in two developed target cell lines by acemannan[80]. Parts of *A. vera* gel called lectins straight

forwardly kept the cytomegalovirus from multiplying in cell culture, perhaps by blocking the blend of proteins[81]. Pure aloe emodin has been shown to be effective against all viruses, including the influenza, varicella, and pseudorabies viruses, as well as herpes simplex viruses of Type I and Type II. Electron microscopy study of the herpes simplex virus treated with anthroquinone revealed signs of partially torn envelopes. According to these results, anthraquinones that have been isolated from a variety of plants directly inhibit viruses that are enclosed. These actions may be due to indirect effect due to stimulation of the immune system. Numerous enveloped viruses, including varicella zoster, herpes simplex virus, and influenza, are similarly rendered inactive by anthraquinone aloin[82,83].

Application of cosmetic and skin protection

A. vera is widely used as cosmetics and nutritional medicines[84], as well as a protection against skin damage caused by radiation[85]. The skin releases the antioxidant protein metallothionein after applying *A. vera* gel. This protein absorbs hydroxyl radicals and prevents the skin from producing glutathione peroxidase and superoxide dismutase. Suppressive of the immune system cytokines, as interleukin-10 (IL-10), are produced when skin keratinocytes are inhibited. This terminates the inhibition of delayed type hypersensitivity caused by the UV[86]. *A. vera* gel has been applied topically to dermabraded skin, and various researchers have reported occurrences of burning skin sensations and contact dermatitis. It seems that these reactions were related to the anthraquinone pollutants present in this mixture[87]. Aloin and its gel are applied topically as a skin tonic for acne. Additionally, aloe sugars are utilised in moisturising formulas. Blended with specific essential oils, it creates a fantastic moisturiser that smoothes the skin, a sunscreen lotion that blocks UV rays, and a variety of other cosmetic items. *A. vera* concentrates might be helpful in the treatment of benign skin cysts, boils, and other minor skin disorders since it has been demonstrated that they suppress the development of organisms that cause fungus[88].

Effect on the secretion of gastric acid and ulcers

Animal and human stomach ulcers have reportedly been treated or prevented with *A. vera* gel. Additionally, it was shown that ethanol-induced stomach ulcers in rats could not be stopped by aloe gel. Numerous possible mechanisms, such as those that lower inflammation, encourage healing, increase mucus production, and control stomach secretions, have been connected to *A. vera* anti-ulcer properties[89].

It was shown that either direct collaboration with the corrosive producing cells or conceivable connection with H2-receptors on the parietal cells was responsible for the concentration-dependent decrease of stomach acid discharges observed in the *A. vera* water-based extract made with ethanol. Gestural protective effect was only shown at the lowest tested dose. Some ideas suggest that at this low concentration, the *A. vera* extract has a cytoprotective effect, mitigating mucosal damage by a different mechanism than stomach acid neutralisation and inhibition. The mechanism of cytoprotection has been the subject of numerous theories, some of which include increased mucus production, further developed mucosal blood stream, and expanded phospholipid content in the mucosal layer[90].

Hepatoprotective activities

Aqueous extract from *A. vera* aerial dried parts reversed some biochemical parameters and dramatically decreased the liver damage caused by carbon tetrachloride in mice. Histopathological examinations verified the healing effectiveness of *A. vera* water extract against liver damage caused by carbon tetrachloride, as demonstrated by the relapse of centrilobular rot, full scale vascular greasy modifications, and scattered lymphomononuclear cell penetration in the hepatic parenchyma. Additionally, a rise in bile solids and bile flow indicates that the extract therapy appears to boost the secretary function from liver cells. The antioxidant activity of the hepato-protective function was also linked to the preservation of the liver metabolising enzymes[91].

Immunomodulatory Effects

The immunomodulatory properties of the sugars in *A. vera* gel, namely acemannan, have been shown in a number of studies. These studies suggest that activation of macrophage cells, characterized by cell surface markers and cytokine release (TNF-α, IL-1, IL-6, interleukin-1 or IL-1, and interferon-γ or INF-γ), is what causes these actions[92-94]. Numerous low-molecular-weight human activated neutrophils can also be prevented from releasing reactive oxygen free radicals by substances[95]. Certain immune-modulatory effects have been demonstrated to be associated with aloe gel's glycoproteins, specifically lectins. Alprogen prevents calcium from entering mast cells, which prevents mast cell production of leukotriene and histamine through the action of antigen-antibody complexes[96].

It was shown that applying aloe gel after UV exposure can avoid the reduction of both local and systemic immunity as well as postpone certain types of hypersensitivity reactions to alloantigens and *Candida albicans*. The polysaccharides in the gel have an immune-protective impact, although the mechanism is different from that of antioxidants, anti-inflammatories, and DNA-repair enzymes. *A. vera* has demonstrated anti-inflammatory characteristics compounds, but the polysaccharides did not successfully lessen UV-induced edema and inflammation or speed up the removal and repair of UV-induced cyclo-butyl pyrimidine dimmers. Furthermore, the effectiveness of antioxidants requires their presence in the skin prior to UV radiation, whereas aloe polysaccharides continue to work even 24 hours after UV exposure. Therefore, the immunological defense mechanism acts downstream of DNA damage and repair, potentially through modifying signal transduction pathways that are triggered by DNA damage. Therefore, the component of activity of sugars was made sense of through their impact on antigen-introducing cells and the cytokine series[97].

Laxative effects

Anthraquinone, a potent laxative included in latex, is known to increment digestive water content, actuate bodily fluid discharge, and work with gastrointestinal peristalsis[98]. The 1, 8-dihydroxy-anthracene glycosides, or aloin A and B, were originally known as barbaloin and are mainly responsible for the aloe[63]. The dynamic metabolites (aloe-emodin 9-anthrone being the prevalent dynamic metabolite) are produced in the colon by intestinal bacteria hydrolyzing aloins A and B, which are not caught up in the upper digestive tract, following oral medication[66], similar to senna, it both stimulates and irritates the digestive tract. *A. vera* plastic is commonly known for its purgative properties. Seldom does aloe work as a laxative until six hours after oral use, and perhaps not at all. It can take up to 24 hours to complete this.

Moisturizing and skin hydration effects

The moisturizing properties of *A. vera* gel demonstrated that the only formulations that raised the stratum corneum's water content after just one application were those with more noteworthy focuses (0.25% w/w and 0.5% w/w). All of the formulations, including those with concentrations of 0.1% w/w, 0.25% w/w, and 0.5% w/w of gel *A. vera* powder, showed the same results after two weeks of application twice daily. Comparing the *A. vera* gel formulations to the vehicle employed in the formulations, however, revealed no difference in the trans epidermal water loss. It was suggested that the items containing *A. vera* gel further developed skin hydration conceivably through a humectant system[99].

Wound healing effects

The powerful course of wound mending happens in three phases. The main stage was portrayed by aggravation, hyperemia, and leukocyte invasion. The subsequent step requires the expulsion of dead tissue. The third phase of multiplication is described by the development of stringy tissue and epithelial recovery[100]. As indicated by a later assessment, body of evidence favours using *A. vera* to treat burns that are between the first and second degree[101].

Acemannan[21,22], glucomannan, mannose-6-phosphate**,** glycoprotein[102] gibberellins and plant growth hormone are the main functional constituents of *A. vera*, which accelerate wound healing, interact with fibroblast growth factor receptors, and reduce radiation-induced skin reactions[103]**,** promote the fibrogenic cytokines to be released[98], and encourage prolonged granulation tissue stimulation**.** Aloe extract treatment affects collagen cross-linking and composition (more type III), which improves breaking strength and wound contraction[18]. In the granulation tissue of the healing wound, it also promotes the synthesis of dermatan sulphate and hyaluronic acid[104].

Aloe gel has been utilized to treat radiation consumes and radiation ulcers; two radiation consume patients have shown full recuperation subsequent to utilizing this therapy. When contrasted with consumes treated with oil jam cloth (18.2 days), sores treated with new aloe gel recuperated quicker (11.8 days) than those treated with cream[105,106]. A widely available product is powdered *A. vera* concentrate. To balance the dynamic cutaneous ischemia brought about by consumes, frostbite, electrical shocks, and intra-blood vessel drug use, aloe gel is utilized topically. These gel capabilities as an inhibitor of thromboxane A2, a middle person of improved tissue harm, as per an *in vivo* assessment of these wounds[107].

Adverse reactions

An overdose might result in colicky stomach spasms and discomfort, as well as the creation of thin, watery faeces, stomach spasms and pain can happen even after just one dose. Chronic overuse of laxatives containing anthraquinone stimulants can result in hepatitis[108] as well as abnormalities related to electrolytes, malabsorption, loss of weight, albuminuria, metabolic acidosis, and haemorrhage[109]. Recurring usage of stimulant laxatives may aggravate older individual's weakness and orthostatic hypotension. Following an increase in dosage, renal tubular injury may result in secondary aldosteronism. There have also been reports of osteomalacia of the vertebral column, increased discharge of calcium in the stools, and protein-losing gastroenteropathy with hypoalbuminemia and diarrhoea. People who use anthraquinone laxatives for prolonged periods of time have been seen to have pseudomelanotic colouring of the intestinal mucosa (*Pseudomelanosis coli*). When the medication is stopped, the pigmentation is normally reversible within 4 to 12 months and is clinically harmless[110].

Uses in the food industries

It has been employed in the food manufacturing industry to make useful food sources, as a fixing in other food items, and to make gel-based wellbeing beverages and refreshments[35]. Edible coatings leave a thin film on the fruit's surface that keeps moisture and gases from the atmosphere at bay [111,112]. Aloe gels serve in food preservation by reducing fresh produce's respiration and transpiration and delaying the deterioration of food after harvest[113]. Many researchers have been done on the utilization of *A. vera* gel after harvest to date[9].

Uses in pharmaceutical industries

A. vera has been utilized in the pharmaceutical industry to produce tablets and cases as well as skin prescriptions including salves and gel plans[114]. Recently, significant medicinal effects of *A. vera* gel and entire leaf remove were viewed as ready to build the bioavailability of co-regulated nutrients in human subjects[115]. Because of the ways in which *A. vera* gel enhances absorption, it can be used to efficiently provide medications that are not well absorbed orally. Moreover, direct compressible matrix type tablets were effectively made using the dehydrated powder that was extracted from *A. vera* gel. Due to their ability to discharge a model compound slowly over a drawn out timeframe, these grid style tablets have shown potential for use as an excipient in changed discharge dose structures[116].

Other uses

A. vera extracts can also be used to dilute semen for artificially fertilizing sheep and as a preservative for fresh food[43] and applied in small farms to conserve water. The gel of *A. vera* contains compounds called soapy saponins that have antibacterial and cleaning

qualities. Strong anti-microbial activity of the saponins is demonstrated against bacteria, viruses, fungi, and yeasts[117].

Usage risks

Patients with incendiary gut conditions, like diverticulitis, Crohn's illness, ulcerative colitis, peevish inside disorder, or a ruptured appendix, shouldn't accept aloe; Aloe should also not be taken by children under the age of ten. After weighing the benefits and risks, *A. vera* should only be used under medical supervision during pregnancy or nursing. People encountering cramps, colic, hemorrhoids, nephritis, or other unexplained gastrointestinal side effects like uneasiness, sickness, or retching ought to try not to utilize aloe[118].

CONCLUSIONS

A. vera is beneficial to humans in daily life because it relieves a range of skin conditions, including minor cuts, bug stings, wounds, poison ivy, and dermatitis. It also moisturizes and prevents ageing of the skin, supports the health of the digestive system, blood and lymphatic circulation, and supports the function of the liver, kidney, and gall bladder. *A. vera* is known as the "wonder plant" for a variety of uses, counting as an antibacterial, a calming, a therapy for diabetes and disease, and a restorative. Increased research effort on the plant is necessary to improve its utility for human use. Without a doubt, *A. vera* is a gift from nature to humans that may be used for therapeutic, cosmetic, and burn purposes. It is up to us to learn more about this plant and to give thanks to the natural world for its endless supply.

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AUTHORS’ CONTRIBUTIONS

Ahmed FA: writing original draft, conceptualization,. **Al El-Bassossy T:** supervision, editing. **Abdelgawad AAM:** writing, review, and editing. The final manuscript was read and approved by all authors.

DATA AVAILABILITY

The data supporting the findings of this study are not currently available in a public repository but can be made available upon request to the corresponding author.

CONFLICT OF INTEREST

None to declare.

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