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Aloe Vera: A Systematic Review from the Perspectives of the Food Industries and Medicinal Applications

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doi: [10.33472/AFJBS.6.6.2024.8198-8215](https://doi.org/10.33472/AFJBS.6.6.2024.8198-8215)**ABSTRACT:**

The oldest and most well-known therapeutic plant is Aloe vera. It belongs to the Asphodelaceae subfamily of the Liliaceae. It is the oldest medicinal herb and has been utilised for therapeutic and vitality-boosting reasons since the Rigvedic period. It is applied in the treatment of burns, the healing of wounds, the prevention of various skin illnesses, digestive issues, sexual viability, and AIDS conditions. The plant includes 75 different active substances, including vitamins, minerals, enzymes, carbohydrates, lignin, amino acids, polysaccharides, glycoproteins, sterols, and anthraquinones or phenolic compounds. Aloin, a naturally occurring anthraquinone, is the major one found in aloe leaves. The most recent study on aloin's effects on a human breast cancer cell line was conducted in 2006 [A. Y. Esmat, C. Tomasetti]. Saponin are triterpenoid or steroid aglycone glycosides that can produce a soapy foam. It possesses many different biological characteristics, such as antibacterial, anticancer, anti-inflammatory, immunostimulant, antioxidant, neuroprotective, antidiarrheal, antiulcerogenic, and antihepatotoxic activity. It contains 19 of the 20 amino acids required by human body. Aloe vera is being utilised as a liver tonic. Aloe vera is currently used by several pharmaceutical businesses to make tablets as well as topical medicines like ointments and gel preparations. It benefits several illnesses and health risks because of its bioactive active components. It contains antioxidant and antibacterial properties. Constipation and tooth plaque are both reduced. It treats psoriasis and eases arthritis symptoms. aloe vera is being used to treat a variety of illnesses, such as Alzheimer's disease, alopecia, congenital heart failure, glaucoma, haemorrhoids, hepatitis, sclerosis, and varicose veins are all conditions that can be used in therapeutically as an orally treatment. Synonyms: Aloe barbadensis Miller, Aloe vera Ghritkumari, Kumari.

Keywords: Aloe vera; Commercial usage; medicinal value; and a bioactive component

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1. Introduction

People have known and used Aloe vera plants for their advantages to their health, attractiveness, and skin for thousands of years. Many civilizations have used Aloe vera for centuries as a medicinal plant. Products made from both gel and leaves are used to create laxatives, skin treatments, nutritious foods, and remedies for a number of ailments. (2007) V. Steenkamp. When translated from Arabic, the term "aloe" means "shining bitter substance," while "vera" is a Latin word that meaning "true." These two words combine to form Aloe vera, also called Ghrith Kumari. It is a semitropical, xerophytic, succulent plant with lanceolate shaped, pea-green, thick, meaty, perennial leaves and hermaphrodite flowers. It belongs to the Liliaceae (Asphodelaceae) family. It thrives predominantly in arid parts of Africa, Asia, Europe, and America. It is found in several Indian states, including Tamil Nadu, Gujarat, Maharashtra, Rajasthan, and Andhra Pradesh. Aloe vera is a monocot with unusual inflorescence clusters, succulent leaves, and liliform flowers as morphological traits. The gel contains acemannan, glucomannans, and other necessary substances. There are many elements, flavonoids, c-glucosyl chromone, alprogen, tannic acid, and other substances. According to Aken N. and Can Ayse (1999), aloe vera contains the anti-inflammatory compound C-glycosyl chromone as well as the anti-allergic glycol protein alpragen. Recent publications cover a wide range of topics, including the clinical management of sepsis, effects of aloe vera extract consumption on gastric ulcer, variations in stomach microcirculation, anti-inflammatory benefits, and hepatoprotective properties. Aloe vera is currently widely used in a number of goods, including functional and nutraceutical foods, cosmetics, food supplements, medications, and conventional treatments, according to M. A. Gabdegesin (2010), L. Langmead (2004), and K. Emalaknam (2006). Contrary to popular belief, aloes may thrive in a variety of climates, including desert, grassland, coastal, and even alpine regions. N. Das and RN Chattopadhyay, 2004. Aloe barbadensis has 200 different chemicals, around 75 of which have biological effects. Aloe vera has a wide range of applications, but the two most common ones are food and drug preservation. The Aloe plant is used to make cream, pills, liquids, sprays, ointments, lotions, and liquid drinks for sale. "Hosseini N." was published in 1999. Many studies have revealed that Aloe vera leaves have a wide range of therapeutic advantages. Including antibacterial, anticancer, antioxidant, anti-diabetic, anti-ulcer, hepatoprotective, immunomodulatory, and many more.

Ethano-Botany of Aloe Vera

Aloe is known as Kumari, or "Young Girl" in Ayurveda. Since it supposedly restores youth and femininity. The health of the female reproductive system is preserved by Aloe. According to Ayurveda, it has alliterative, tonic, revitalising, purgative, and vulnerary properties. According to Ayurveda the three main constitutions —Vata, Pitta, and Kapha—are thought to be toned by aloe. Indian medicine has historically utilised aloe to treat a number of illnesses, such as infections, worm infestations, cholic, skin conditions, and constipation. Uterine stimulation (regulating menstruation), laxative, anthelmintics, and haemorrhoid therapy are only a few of the internal uses of Aloe. It is used in conjunction with licorice root to treat psoriasis or eczema. S. A. Ghazanfer (1994) is mentioned.

Plant Description and Cytology

Aloe vera is a perennial plant of the family Liliaceae (Asphodelaceae) that is xerophytic, pea-green, shrubby, or arborescent. The plant has triangular, fleshy leaves It has spikes on the edges and can grow up to 20 inches long and 5 inches wide. The middle of the leaf's fresh parenchymal gel is translucent. The leaf's pericyclic tubules, which are yellowish green, secrete the laxative anthraquinones in the form of a sticky latex liquid (schulz V, Hansel R, Tyler VE,

1997; 306). Here are some non-medicinal yellow flowers. $N=x=7$ is the haploid karyotypic formula. There are many diploid species of aloe vera ($2n=2x=14$). The tetraploid *A. Cremanophila* and *A. inrmis* ($2n=4x=28$) found in wild populations in Somalia are particularly noteworthy. Only one naturally occurring autotriploid *Aloe vera* L. plant ($2n=3x=21$) has been discovered so far in the southern region of India (Adamas et al., 2000).

Biochemical Properties of Aloe Vera

Up to 200 different types of chemicals have been found in Aloe vera. Water makes up 98 percent of leaf gel. It has 0.66% of the solids and 0.56% of the soluble solids in Aloe vera gel are solids, with significant seasonal variation. In Aloe gel, polysaccharides make up the majority of the dry matter (55%) that are followed by phenolic chemicals (1%), minerals (16%), proteins (7%) lipids (4%) and carbohydrates (17%). Aloe vera gel contains a variety of vitamins, including vitamins A, C, and E. As a crucial antioxidant, there are many bio components like vitamins B1 (thiamine), Niacin, choline, folic acid, and B12 (riboflavin) are all present. Cynacobalamin, a form of vitamin B12 that is usually derived from animal sources, is present in trace amounts (Coats BC 1979). Both monosaccharides and polysaccharides are components of carbohydrates. The long-chain glucomanns [(1, 4) - linked acetylated mannan], which are composed of glucose and mannose, are the most significant polysaccharides. There are also trace levels of xylose, rhamnose, galactose, and arabinose, as well as the triterpenoid lupeol, Cholesterol, campesterol, and -sitosterol are all examples of lipids. According to polysaccharides present in the gel, aloe vera contains at least four different partly acetylated glucomanns, each of which is a linear polymer not with branches and 1, 4 glycosidic connections in between the glucose as well as mannose. When consumed orally, certain sugars undergo hydrolysis, establish a barrier by connecting to receptor receptors lining to the stomach and prevent "leaky gut syndrome." In 2007, P. Aterton.

Structure

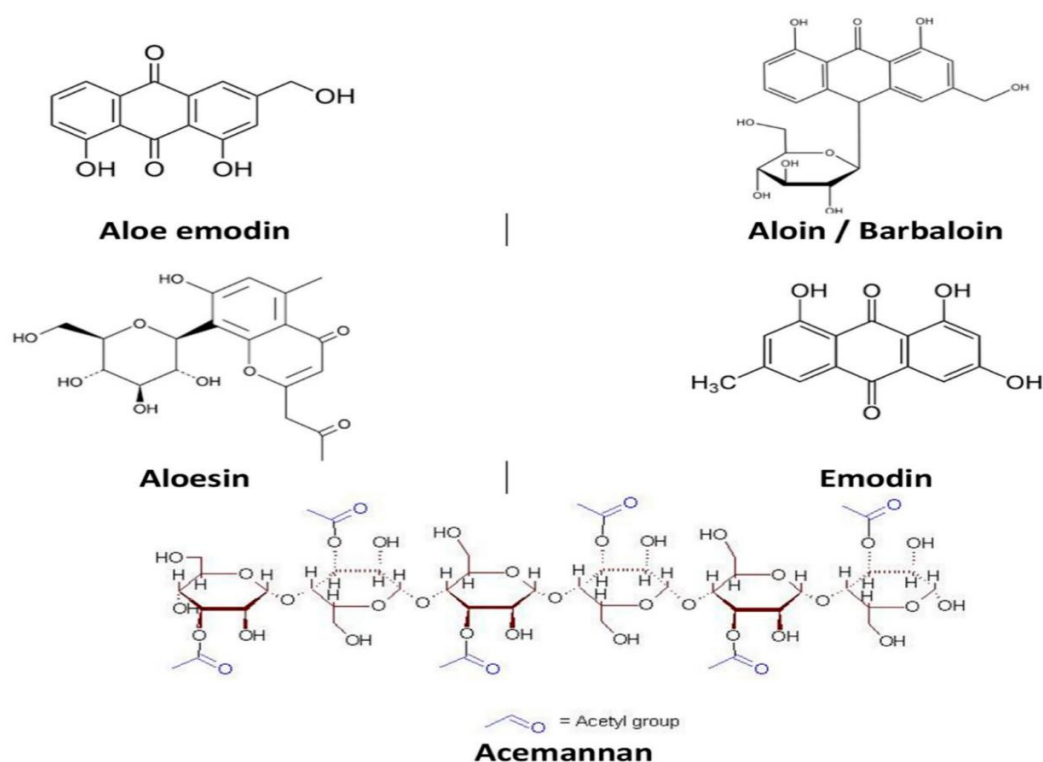


Table 1. Active compounds and their properties

class	Compounds	Properties
1. Enzymes	It contains eight separate enzymes: brady kinase, alkaline, amylase, cellulose, catalase, peroxidase, lipase, and carboxypeptidase.	They all help with the digestion of fats and sugars, and brady kinase, when apply to the skin topically, it relieves excessive inflammation
2. Vitamins	Vitamins B1, B2, B6, and A, as well as choline, C, beta-carotene, folic acid, and alpha-tocopherol.	Antioxidants, such as vitamins A, C, and E, fight free radicals.
3. Minerals	Zinc, potassium, magnesium, sodium, calcium, chromium, copper, iron, manganese, phosphorous, and manganese.	While few are oxidants, the majority help many Enzymatic functions in various metabolic pathways work.
4. Sugars	Polysaccharides, fructose, and glucose.	It has anti-allergic and anti-inflammatory qualities.
5. Fatty acids	Cholesterol, campesterol, β -sitosterol and lupeol	These all have anti-inflammatory properties.
6. Anthraquinone	Among the constituents are emodin, ester, barbaloin, anthranol, aloe-emodin, aloetic acid, and cinnamic acid.	There are 12 different anthraquinones that can be found. Aloin and emodin both have antibacterial, analgesic, and antiviral activities.
7. Hormones	Gibberellins and Auxins	Both act as a wound healing and anti-inflammatory benefits are supported.

Table 2. Chemical components of Aloe vera with their mechanism of action

Chemical components	Mechanism of action
Acemannan	Increase wound healing speed, antiviral and anticancer effects, and immune system modulation.
Alprogen	Anti-allergic
C-glycosyl chromone	Anti-inflammatory

8. proteins	Amino acids include arginine, aspartic acid, glutamic acid, methionine, tyrosine, leucine, proline, histidine, glycine, valine, hydroxyproline, lectin and lectin-like compounds, and salicylic acid...	It provides around twenty of the 22 essential amino acids for humans are present, as are seven of the other eight. It contains salicylic acid, which has antibacterial and anti-inflammatory properties. It also contains Saponins, which are soapy compounds that make up around 3% of the gel and have cleansing and antibacterial properties, as well as Lignin, which helps the other components penetrate the skin.
9.chromones	Chromones ring is found in several derevaties,8-C-glusol-(2'-O-cinnamoly)8-C-glucosyl-7-O-methylaloediolA, 8-C-glucosyl-(S)-aloesol,8-C-glucosyl-7-O-methylaloediol, and 8-CNeoalasin A, isoaloeresin D, isoabaichromone, and glucosyl-noreugenin	Anti-inflammatory orders that are innovative.
10.carbohydrates	arabinogalactan, galactogalacturan, acetylated mannan, acetylated glucomannan, cellulose, and pectic substances	Alprogen is a novel anti-inflammatory compound and anti-allergic glycoprotein.
11.saccharides	Manose and glucose L-rhamnose, aldopentose	
12.lipids and miscellaneous organic substance	Arachidonic acid, alpha-linolenic acid and steroids(Cholesterol, Campsterol, sisosterol, triglycerides, and triterpenoids)	
Bradykinase	Anti-inflammatory	
Magnesium lactate	Anti-inflammatory	
Salicylic acid	Anti-inflammatory and analgesic	

Food Applications of Aloe Vera Product

Aloe vera is frequently employed in the production of food. Global demand for aloe vera is increasing, and the plant's gel is used to create a wide range of goods, including fresh gel juice, laxative beverages, healthy drinks, and diet drinks. According to Alemdar and Agaoglu (2009), aloe vera juice also exhibits antibacterial activity against Gram-positive bacteria. Aloe vera is claimed to have antiviral and antifungal effects, according to Anonymous (2008).

Table 3. Food products and their applications

Aloe vera products	Food applications
Concentrate	Tea, water, or juice can be mixed with aloe vera concentrate, jam, or jellies.
Gel fillet	Products made with aloe vera include chocolate bars, chewing gum, vitamin sweets, quick aloe vera tea, and fruit smoothies.
Juice	Yoghurts, white bread, electrolyte-containing sports drinks, laxative beverages, soft drinks, and diet beverages.
Powder	yoghurt, curd, and aloe vera laddus

Biological Activities

1. Anti-Inflammatory Activity

Numerous studies have demonstrated Aloe vera gel has anti-inflammatory effects. It can be used as an anti-inflammatory therapy following dental work or brushing, according to Fujita and Teradaira 1976 and Haneley et al. It is understood that the aloe-derived enzyme bradykinase has the potential to break down the pain-inducing analgesic chemical bradykinin (Ito et al. 1993). The enzymes bradykinase and carboxy peptidase, which are both found in aloe, have both been demonstrated to lessen pain and edoema while also lowering inflammation (Duke 1997). The newest research on aloe vera's anti-inflammatory properties focuses on the components' individual mechanisms of action in LPS-exposed mice and murine macrophage RAW264 cells. Aloin may have anti-inflammatory effects because of its capacity to prevent the JAK1-STAT1/3 signalling cascade, the formation of ROS, and cytokinase. The effectiveness of A. vera gel in the treatment of oral lichen planus, a chronic inflammatory condition that can be painful, particularly in the atrophic and erosive kinds, was examined by Choonhakarn et al. in a randomised, double-blind, placebo-controlled trial. They discovered that, even though it posed no significant hazards, A. Vera gel was statistically significantly more effective than a placebo at reducing the symptoms and clinical signs of oral lichen planus.

2. Anticancer and Anti-Tumour Properties

The current review contains in vitro and in vivo studies that use a number of cell lines and animal models to assess cytotoxic and antitumor efficacy against various cancer types. Some of these malignancies include melanoma, osteosarcomas, and pancreatic cancer, oral, oesophagus, and colon cancers. According to recent studies, polysaccharide fractions prevent benzopyrene from attaching to primary rat hepatocytes, preventing the formation of benzopyrene-DNA adducts that may cause cancer. The use of aloe gel in cancer chemoprevention may be advantageous given the previously found activation of glutathione S-transferase and attenuation of the tumor-promoting effects of phorbol myristic acetate. Aloe emodin, which activates caspase 3, releases cytochrome c, and disrupts mitochondrial membrane potential, may hold promise as a potential anticancer therapeutic candidate, claim a number of studies (Amenda Capes-Davis et al. 2011). The most common cell line for breast cancer is MCF-7, which expresses oestrogen receptors, while the most frequent cervical cancer

cell line is HeLa, which has been used for decades (D L Holidey and V Speirs 2011). Comparatively to an untreated group, Macrophages injected with sarcoma 180 cells from ICR mice were activated by acemannan. The evidence is in favour of the theory that in vitro activation of macrophages and in vivo anticancer activity of acemannan are related. Acemannan inhibit CD3-CD25 (+) cells were found in both murine (SpMC) and human (PBMC) cells, as well as a variety of tumoral T lymphocyte cell lines. This illustrated how acemannan can damage both malignant and healthy cells. Normal cell activity is raised whereas cancer cell activation is decreased (X Chang et al. 2016). When used in conjunction with photodynamic treatment, aloe-emodin has been shown to kill human stomach cancer cells, breast cancer cells, and oral mucosa carcinoma (Y Liu et al. 2018 and HD Lin et al. 2017). In vitro and in vivo, aloe-emodin increased cell apoptosis and death. Emodin enhanced the anti-tumor effect of gemcitabine in pancreatic cancer, potentially leading to less chemo-resistance, according to a different study (A Liu et al. 2011). Numerous Aloe species' phytochemical components have been shown to provide therapeutic benefits for a variety of illnesses, most notably cancer. It has been found that specific phytochemical substances from various Aloe species exhibit selective cytotoxic effects on cancer cells, while not harming normal cells. Certain chemicals have been shown to have anticancer properties because of their impact on various signaling cascades and metabolic pathways (Svitina et al. 2021). The chemicals aloin, aloe-emodin, barbaloin, acemannan, and octapeptide are the main sources of the attractive antineoplastic action that carbon nanoparticles linked to certain plant materials, like Aloe vera, have demonstrated. These nanoparticles open up new possibilities as antitumor medicines and the result of this combination is highly used to treatment and prevention of Melanoma (Elidamar Nunes de Carvalho Lima2022).

3. Skin Defence against Gamma and UV Radiation

DB Roberts, EL Travis, and Y Sato et al. (1990, 1995) all. It was discovered that Aloe vera gel helps protect the skin from radiation harm. When exposed to Aloe vera gel, the skin releases metallothionein, an antioxidant protein that scavenges hydroxyl radicals and prevents superoxide dismutase and glutathione peroxidase inhibition. By reducing the creation, it reduces UV-induced suppression of delayed type hypersensitivity by increasing the release of immunosuppressive cytokines generated by skin keratinocytes, such as interleukin-10 (IL-10). The ability of Aloe vera and its active components to heal wounds is the main focus of in vitro research on skin protection. The most commonly employed cell lines are primary normal human epidermal keratinocytes (HEKa), immortalised human keratinocytes (HaCaT), and fibroblasts. These studies reveal that aloe vera and its active ingredients, aloesin, aloin, and emodin, have powerful anti-inflammatory and antioxidant properties. According to M Moriyama et al. (2016), M Hormozi and MB Boroujeni (2017), S Negahadari et al. (2017), E Teplicki et al. (2018), and ACL de Oliveira et al. (2018), this in turn encouraged keratinocyte proliferation and differentiation. Additionally, aloe vera enhanced lysosomal membrane integrity. The most often used methods include in vivo research animal models of UV and X-ray skin injury, as well as genetically altered animals (BALB/c mice, HR-1 hairless mice, and SKH-1 hairless mice). These in vivo studies have used aloe vera extracts and gel in the vast majority of cases. Topical Aloe vera application accelerated wound healing, increased lymphocytes with a CD4+/CD8+ ratio, increased epidermal thickness, and decreased inflammatory cell infiltration in animal models with dermal incisions (M. L. Brandao et al. 2016, A. Oryan et al. 2016, and N. Takzarce, A. H. adjikhondi 2016). Furthermore, human studies have demonstrated that aloe vera can accelerate tissue epithelialization and granulation in burns, as well as wound healing in split-thickness skin transplant donor sites. (PS Iraai, S Varaie, 2016; Z Molazem et al., 2015). Randomised, double-blind, placebo-controlled trials have also been carried out to investigate the benefits of aloe vera for maintaining good skin. In

order to promote skin elasticity in men under the age of 46 individuals are exposed to sunshine but do not use sunscreen, researchers had them ingest 40 g of Aloe sterol (cycloartenol and lophenol) every day for at least 12 weeks. (M Tanaka et al. 2016) Japanese women over 40 exhibited greater face creases, whereas those between 30 and 59 had increased gross elasticity, net elasticity, and biological elasticity, according to studies on the effects of hyaluronic acid and collagen formation. (M Tanaka et al. 2015; M Tanaka et al. 2017).

4. Antioxidant Properties

Due to the abundance of phenolic substances, flavonoids, saponin glycosides, alkaloids, and glycosides the antioxidant activity of Northern Indian species was higher than that of Southern Indian species (Kumar et al. 2017). Additionally, Aloe vera ethanol extract protected human microvascular endothelial cells from toxicity caused by hydrogen peroxide and 4-hydroxynonenal by lowering ROS generation and the development of HNE-protein adducts (V. Cesar et al.). Aloe Vera's antioxidant action is at least in part attributed to anthraquinones and related chemicals, which have the capacity to scavenge and decrease peroxy radicals (HC Wang and JL Brumaghim 2011). One of the therapeutic qualities of A. Vera that was the focus of a study was antineoplastic activity induced by numerous of the active components. Acemannan, aloin, and aloe-emodin are a few examples. A. Vera has antioxidant capabilities, according to both in vitro and in vivo experiments (Eli Harlev, 2012).

5. Antiseptic Effect

Lupeol, salicylic acid, urea nitrogen, cinnamomic acid, phenols, and sulphur are all antiseptic substances found in aloe vera. They are all antifungal, antibacterial, and antiviral. Antioxidant activities of A. Vera have been demonstrated to exist both in vitro and in vivo (Eli Harlev, 2012).

6. Anti-Ageing and Moisturizing Effects

Aloe stimulates the formation of collagen and elastin fibres; they increase skin suppleness and decrease wrinkles. It also has cohesive properties that soften the skin by uniting the flaky surface epidermal cells together. Furthermore, amino acids soften previously rigid skin cells, while zinc acts as an astringent to close pores. Thanks to its moisturising properties, they increase skin suppleness and decrease wrinkles. It also has cohesive properties that soften the skin by uniting the flaky surface epidermal cells together. Furthermore, amino acids soften previously rigid skin cells, while zinc acts as an astringent to close pores.

7. Wound Healing Properties

Aloe vera is frequently used to heal skin inflammation and wounds. According to Saleem et al. (1997), Aloe vera is well known for its ability to heal. Wounds in general as well as burns and chronic wounds. Davis et al. found in 1989 that aloe vera gel increased blood flow, oxygenation, fibroblast activity, and collagen synthesis to promote wound healing. According to V Visuthikosol et al., J P Hegggers et al. performed an experiment on 27 individuals who had partial thickness burn wounds and discovered that the lesion treated with aloe vera gel healed more quickly than the region treated with vaseline gauze. Aloe gel reportedly altered in addition to enhancing wound collagen levels, collagen composition (more type III) and cross-linking strength were improved. According to J. P. Hegggers et al. Constriction of the incision was expedited as a result, and the ensuing scar tissue's breaking strength was increased. Hyaluronic acid and dermatan sulphate were found to be produced in greater amounts in the granulation tissue of a healed lesion by P. Chithara et al. in 1998. Aloe vera have such a unique wound healing properties and due to this Hydrogels based on aloe vera have shown promise as delivery systems for therapeutic medicines in wound dressings (Mariana Chelu et al. 2023). Through

the activation of growth factors, Acemannan has been demonstrated in earlier research to enhance the proliferation of fibroblasts and epithelial cells. Additionally, studies on animals have shown that Acemannan can control immunological response and hasten oral wound healing (S jettanacheawchankit et al. 2009).

8. Anti-Diabetic Effect

Diabetes is a chronic condition marked by high blood sugar levels brought on by inadequate or resistant insulin. Aloe vera methanol extract has the ability to relieve AGE-related diabetic issues since it decreases the development of AGE and may inhibit the increase in postprandial glucose. Because higher insulin sensitivity is associated with increased body fat, blocking pancreatic lipase may be a method to reduce fat absorption. Understanding how AVM decreases AGEs is crucial. The BSA/glucose system is efficiently suppressed by aloe vera methanol extract, most likely as a result of fructosamine oxidation. Ramirez and the 2020 presidency. Using streptozotocin-induced animal models, aloe vera's impact on diabetes and associated illnesses has mostly been studied. Oxidative stress has a substantial impact on the development and progression of diabetes-related problems, particularly nephropathies and neuropathies. *Molecules* 2020, Aloe vera has demonstrated in this experimental model the capacity to raise insulin levels, increase the number, volume, area, and diameter of pancreatic islets, and lower blood glucose levels. Additionally, this medicinal plant offered defence against depressive and anxious emotions as well as oxidative stress-induced diabetic nephropathy. Aloe vera extract improves glucose tolerance in both diabetic and healthy rats, according to research by AL-Awadi and Gumma from 1987. It has been demonstrated that aloe vera extract lowers blood glucose levels in diabetics (Yongchaiyudh et al., 1993; Bunyaphatsara et al., 1996). A study (Bourdreau et al. 2006) found that aloe vera extract may aid in the control of diabetes. In order to determine whether aloe vera gel is beneficial in decreasing blood sugar, Huseini et al. gave 35 patients with type 2 diabetes 300 mg of aloe vera gel capsules (AC) orally every 12 hours. The findings demonstrated that aloe leaf gel considerably lowered fasting blood glucose and glycosylated hemoglobin levels when compared to the placebo group. It had no discernible effect on blood lipid levels, liver function tests, or kidney function tests.

9. Bone Protection

Aloin has also been shown to be useful in treating osteopenia and osteoporosis-related disorders, according to Yutthana Pengjam et al. (2016).

10. Anti-Bacterial, Anti-Fungal And Anti-Viral Effects

Natural anthraquinones discovered in Aloe vera has been associated with the plant's antibacterial properties in the following biocomponent of aloe emodin, aloetic acid, aloin, anthracene, anthranol, barbaloin, chrysophanic acid, and ethereal oil, ester of cinnamonic acid, isobarbaloin, and resistannol. These anthraquinones have analgesic, antibacterial, antifungal, and antiviral effects when mixed with the gel fraction in tiny concentrations. While some substances Anthraquinones and saponin, which are found in aloe vera gel, have direct antibacterial activity. Others, like acemannan, have been hypothesised to have an indirect bactericidal effect via phagocytosis stimulation. Sarah Asif and Shamimul Hasan (2014). Numerous studies have been undertaken to evaluate the antibacterial effects of aloe vera and its constituents numerous studies have been undertaken to evaluate the antibacterial effects of aloe vera and its constituents. 2018 saw the filing of the complaint by A A Saddiq and H Al-Ghamadi. The majority of these studies are conducted in vitro and focus on antibacterial activity. *Staphylococcus aureus* and *Pseudomonas aeruginosa* are two of the microbes that have been investigated the most. Aloe vera aqueous extract consequently inhibited the development and generation of methicillin-resistant *Staphylococcus aureus* and biofilms. In a

second investigation, the bacteria *Enterococcus faecalis*, which causes dental root canal infections, was inhibited by an aloe vera hydroalcoholic extract with inhibitory zones of 13 mm (saturated) and 9.6 mm (diluted) (SR Karkare et al. 2015). *Mycobacterium TB*, the organism that causes one of the worst infectious diseases in the world, was likewise unable to grow in aqueous extracts of aloe vera at concentrations as high as 1 mg/mL (M Arjomandzadegan et al. 2016). Last but not least, a clinical study involving 53 healthy volunteers revealed that regular usage of Aloe vera gel extract reduced the amount of *Lactobacillus* spp. (T Prueksrisakul, S Chantarangsu 2015). The ability of aloe vera to combat the type 1 herpes simplex virus and influenza A H1N1 subtype has been studied. Proliferation of Herpes simplex virus type 1 on Vero cells was suppressed by aloe vera extract gel at concentrations ranging from 0.2% to 5% (F Rezazaden et al. 2016). In vitro investigations, however, have revealed that the H1N1 subtype of influenza virus interacts with Aloe polysaccharides to reduce the period that it multiplies and adheres to cells. In vivo investigations using PR8(H1N1)-infected SPF BALB/c mice also reduced clinical symptoms and lung damage (Z sun et al. 2018). Anthraquinone aloin suppresses the replication of enveloped viruses such as the flu, varicella zoster, and herpes simplex. R. J. Sydiskis and colleagues' 1991 study. Malaria is caused by the harmful and aggressive parasite *Plasmodium falciparum*. S Kumar et al. (2017) evaluated the efficacy of crude aqueous Aloe vera extracts against a chloroquine-sensitive strain of *Plasmodium falciparum* in six different climate locations of India (highland, semi-arid, desert, humid subtropical, tropical wet and dry, and humid subtropical environment). Due to its highest concentrations of aloin and aloe-emodin (EC₅₀ value of 0.289 g/mL), aloe vera was found to have the most antiplasmodial effects in this experiment at lower temperatures. Prebiotic potential, which is defined as "a substrate used by host microorganisms selectively conferring a health benefit," may also be present in aloe vera. Acemannan-rich aloe vera mucilage may promote digestive health by increasing short chain fatty acids and altering bacteria composition. According to B Gullon et al. (2015). According to MP Quezads et al. (2017), the acemannan and fructans in aloe vera, specifically *Bifidobacterium* spp., encouraged bacterial development. Anti-arthritic, anti-inflammatory, antibacterial, and hypoglycemic activities are all present in aloe juice. *Streptococcus* and *Shigella* species have been demonstrated to grow more slowly in vitro when exposed to Aloe vera inner-leaf gel (MT Olaleye and CO Bello-Michael 2005). Aloe vera contains saponins as well, claims A Peter from 2005. These are the hygienic and antibacterial compounds found in the gel that resembles soap. Saponins have strong anti-microbial characteristics and can be used to treat bacteria, viruses, fungi, and yeasts. In M. Shilpa and others, the growth of *Candida albicans* was halted in 2020 by a specially formulated aloe vera gel using a rat model, it was claimed that the in vivo antibacterial activity of aloe vera gel could promote wound healing by removing the bacteria that induced inflammation. The aloe extract effectively eliminated the three *Mycobacterium* strains, *M. fortuitum*, *M. smegmatis*, and *M. kansasii*, *M. TB Pseudomonas aeruginosa*, *E. coli*, *Staphylococcus aureus*, and *Staphylococcus typhi*. The original phytochemistry led to the discovery of tanning agents, flavonoids, and terpenoids. Aloe secundiflora may therefore be a valuable source of antibacterial compounds, justifying the plant's widespread use by locals. Certain aloe compounds, such as acemannan and emodin, have the potential to be employed as immunomodulators and antiviral medications to treat viral diseases (Erica Espana et al. 2022).

11. Anti-Obesity Effects

Motamedi et al. (2018) claim that obesity is a huge global public health issue with a variety of adverse effects. Obesity is the medical term for being overweight, and it can be calculated using the body mass index (BMI). According to AL-Goblan, AL-ALfi, and Khan (2014), energy imbalance in obesity is regarded to be the root cause of a number of metabolic illnesses, including insulin resistance, type-2 diabetes mellitus, retinopathy, neuropathy, nephropathy,

and cardiopathy. Aloe vera has been shown in numerous trials to be helpful for lowering obesity and hyperlipidemia (Kim et al., 2018; Reynolds & Dweck, 1999).

12. Immunomodulation Activities

Alprogen restricts by blocking calcium from entering mast cells, which in turn prevents to the release of histamine and leukotriene from mast cells, which is mediated by antigen-antibody interactions. Acemannan promotes the synthesis and release of interleukin-1 (IL-1) and tumour necrosis factor from macrophages, leading to an immunological response that results in cancerous cells' retreat and necrosis, the results of a study on mice implanted with murine sarcoma cells. When specific low-molecular-weight chemicals are present, activated human neutrophils are unable to form reactive oxygen free radicals (PH Nibbering et al. 1990). Several immune system processes are impacted by A. Vera, along with serum immunoglobulin levels and the diversity of lymphocyte subsets, which could enhance cellular and humoral immunity reactions to vaccination. It was applied to benefit from the gel that is produced by the immunomodulatory action of A. Vera attainable by substances like acemannan and aloctinA (SY Peng et al. 1991). The powerful immunostimulant acemannan has been shown in numerous in vitro and in vivo investigations to improve lymphocyte responsiveness to alloantigen. HS Na et al. (2016) hypothesise that the mechanism may include organised nuclear cells protected by alloantigens releasing IL-1.

13. Dentistry

According to recent studies, periodontal disease may be treated with plants. Acemannan has been used in dental research by many teams (AA Alshatwi and P Subhash-Babu 2016). Aloe vera is particularly effective at treating the gum disorders gingivitis and periodontitis. Gum bleeding, pain, and swelling have significantly decreased. In locations where routine cleaning is impractical, it serves as a potent antibacterial agent. The antibacterial characteristics of aloe vera tooth gel was more effective against *Streptococcus mitis*. Due to the bacteria that cause tooth decay, aloe vera acts as an anti-caries agent (Shamimul Hasan et al. 2015). According to uzma et al., vulval lichen planus, a persistent inflammatory condition of the mucosal surface, can be successfully and safely treated with aloe vera gel. Acemannan can also play an important role in the therapy of periodontal disease, including periodontal tissue healing (Yingjie Bai et al. 2023).

Other Activities

Gastric and Intestinal Activity

In order to cure gastrointestinal conditions including inflammatory bowel disease and ulcers, aloe vera is frequently recommended. Short chain fatty acids are produced by fermentation when *Lactobacillus* and *Bifidobacterium* species develop more quickly in the colon as a result of utilising probiotics. Beneficial fermentation byproducts can lower the risk of developing certain cancers, such as colorectal cancer, and other non-communicable chronic diseases, according to T Chihara et al. (2015).

Neuroprotective Activity

Galactomannan and glucomannan, non-starch polysaccharides produced by bacteria and plants, respectively, they perform direct as well as indirect biological effects. Including the control of the immune system, antioxidant and anti-diabetic qualities, as well as gastrointestinal and probiotic capabilities. Consuming glucomannans, galactomannans, and acemannans improved cognitive function in middle-aged persons with mental fatigue.

Nutritional Aspect of Aloe Vera

Any dietary supplement should work to optimize food's positive impacts on growth, function, and health while regulating digestion. One such dietary supplement is aloe vera. Its anti-inflammatory, antioxidant, antibacterial, antiviral, anti-parasitic, and anti-fungal qualities have boosted its usage in nutrition and veterinary care. Lignin, amino acids, enzymes, anthraquinones or phenolic compounds, minerals, vitamins, carbohydrates, saponins, and sterols are only a few examples of the physiologically active molecules that lead to these effects.

Industry Applications of Aloe Vera as a Commodity

Aloe is present in 20% of market products (cosmetics), 95% of juice, 50% of beverages, 10% of beverages, and 5-15% of capsules. The gel from the plant has historically been used in a variety of products. Today's growing food sector produces fresh gel juice from gel. Green salads often contain fresh leaf pods. Are effective in treating a range of conditions, including indigestion, constipation, diabetes, ulcers, and heart disease. Aloe vera juice is increasingly being marketed as a means to boost immunity against a variety of ailments. Moisturisers, shaving cream, shampoo, detergent, cosmetics, and other cosmetic goods are all made with aloe vera. Aloe vera has been used for treating urine for a very long time in medicine.

2. Conclusion

Aloe vera is a plant renowned for its therapeutic and nutritional properties. Further comprehensive scientific study of this medicinal herb is necessary, as is its promotion. Therefore, it is wider use due to the fact that it includes a significant number of chemically active components. It has historically been used to treat a wide range of ailments, including skin burn, eczema, and stomach problems, due to its anti-inflammatory, antibacterial, and wound healing properties. Research has validated both its primary biochemically active constituents and its traditional applications. It is possible to create antitumor, anti-cancer, and anti-diabetic drugs using aloe vera and its components. Aloe vera is particularly advantageous to the food and pharmaceutical industries, according to the majority of in vitro and in vivo pharmacological investigations conducted in the last six years. The cardio-protective effect was one of the in vivo study goals, along with cytotoxic and anticancer properties. Aloe vera serves a variety of biological purposes and frequently used in pharmaceutical goods and functional meals. Its succulent leaves contain potent compounds that have a number of relaxing benefits on human life and health. It is a plant with numerous useful uses, such as the cure of small wounds, bruising, poison ivy, and dermatitis as well as moisturising and delaying the ageing of the skin, blood and lymphatic flow, kidney, liver, gallbladder function, and digestive system health. This plant is referred regarded as a "wonder plant" since it not only has antibacterial and anti-inflammatory qualities, but also heals ailments like diabetes and cancer. To use the plant more successfully, more research needs to be done on it.

3. References

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