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Review

A Comparative Review of Aloe barbadensis Miller and Aloe arborescens

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Abstract

Muntingia calabura Linn. Belongs to the family Muntingiaceae, commonly known as Jamaican cherry, is a traditionally valued medicinal plant used in folk medicine for the management of headache, fever, gastric ulcers, inflammation and diabetes. The present study was aimed to evaluate the physicochemical parameters, preliminary phytochemical screening, in-vitro antioxidant activity and alpha-amylase inhibitory effect of M. calabura leaves. Physicochemical parameters such as ash values, extractive values and moisture content were determined to assess quality and purity. Preliminary phytochemical screening was carried out using standard qualitative tests. In vitro antioxidant activity was evaluated through established radical scavenging assays, while antidiabetic potential was assessed using the alpha-amylase inhibition method. The extract exhibited significant, concentration-dependent antioxidant activity and α-amylase inhibitory effect, indicating potential to mitigate oxidative stress and postprandial hyperglycemia. Overall, the findings provide scientific validation for the traditional use of M. calabura and support its potential as a promising natural source of antioxidant and antidiabetic agents. Further bioassay-guided isolation and mechanistic studies are recommended.

Keywords: Aloe barbadensis Miller, Aloe arborescens, Phytochemicals, Pharmacological activities, Antioxidant, Anticancer

1. INTRODUCTION

Aloe genus belongs to Asphodelaceae family. Native regions: Africa, Arabian Peninsula. Known for medicinal, cosmetic, and nutritional use. {1}
Two main types discussed:

- Aloe Barbadensis (Aloe Vera) – thick, juicy leaves, high gel content, cosmetic & pharma use.
- Aloe Arborescens – taller plant, narrow pointed leaves, traditional & therapeutic use. {2}
- Aloe Barbadensis → rich in moisturizing polysaccharides → skincare focus
- Aloe Arborescens → more anthraquinones → digestive & multi-purpose medicinal effects

Aloe Vera {Aloe barbadensis Miller} is belonging to the Liliaceae family. Originally native to the arid regions of North Africa, it is now cultivated widely in tropical and subtropical climates. It has been traditionally valued in Ayurveda, Unani, and traditional Chinese medicine for treating burns, wounds, digestive issues, and various skin

conditions.[3]

1.1. History of Aloe barbadensis Miller and Aloe arborescens

Aloe barbadensis Miller (Aloe vera) has been used for over 4,000 years, first recorded in the Ebers Papyrus of ancient Egypt as a remedy for wounds, skin ailments, and embalming. Greek physicians like Hippocrates and Dioscorides described its use for ulcers, burns, and digestive disorders. It later spread to India, China, and the Mediterranean, becoming a key component of Ayurvedic, Unani, and Traditional Chinese Medicine, and eventually cultivated worldwide for pharmaceutical, cosmetic, and nutraceutical uses. [4]

Aloe arborescens, native to South Africa, was traditionally used by indigenous communities for infections, wounds, and digestive problems. It gained attention in Europe, especially Italy, for medicinal use and in Japan as a functional food [5]. Modern research has validated many of its traditional uses, particularly its anticancer and immunomodulatory properties.

Figure 1: *ALOE BARBADADENSIS MILLER*

Phytochemically, Aloe Vera is rich in active compounds such as polysaccharides (e.g.,acemannan), anthraquinones (e.g., aloin, aloe-emodin), vitamins, enzymes, amino acids, and phenolics.[6] These constituents contribute to its anti-inflammatory, antimicrobial, antioxidant, immunomodulatory, antidiabetic, and wound healing activities. Both the inner leaf gel and the outer latex have distinct medicinal applications. {[7]

The pharmaceutical industry increasingly uses Aloe vera in topical products, oral supplements, and wound dressings because of its safety profile and therapeutic value.[8]However, challenges such as extract standardization, dose optimization, and strong clinical evidence still need to be addressed.[10]

Figure 2: *Phytochemical Constituents Of Aloe Barbadadensis Miller And Aloe Arborescens.*

1.2. Botanical and Phytochemical Overview

Aloe vera (Aloe barbadensis Miller), belonging to the Asphodelaceae family, is a perennial succulent known for its medicinal and therapeutic advantages. It grows well in warm climates and is cultivated extensively in India, China, Mexico, and the United States. The plant has thick, pointed leaves arranged in a rosette, with serrated edges. Each leaf consists of three layers :{ 12}

- Outer green rind – protective layer
- Middle yellow latex – rich in anthraquinones
- Inner clear gel – widely used for medicinal purposes.

Aloe vera's pharmacological potential arises from its complex phytochemical composition. More than 75 biologically active compounds have been identified, including polysaccharides, anthraquinones, glycoproteins, enzymes, amino acids, sterols, saponins, vitamins, and minerals (Choi S, 2003).{32}

1.2.1. Polysaccharides

The gel mainly contains water and complex carbohydrates. The most important polysaccharide is acemannan, a β-(1, 4)-acetylated polymannose known for its wound healing, immune-modulating, and anti-inflammatory properties {35}. Other sugars—such as arabinose, galactose, glucose, and xylose—also aid in hydration, cell growth, and tissue repair {37}.

1.2.2. Anthraquinones

The yellow latex beneath the leaf rind contains anthraquinones like aloin, barbaloin, aloe- emodin, and isobarbaloin. These compounds exhibit strong laxative, antimicrobial, and anti- inflammatory effects and have shown potential anticancer activity in experimental studies. {40}

1.2.3. Enzymes

Aloe vera gel contains several enzymes—including amylase, cellulase, lipase, peroxidase, bradykinase, and carboxypeptidase. Among them, bradykinase is particularly important for reducing inflammation when applied to damaged skin (Rajeswari R, 2012) (25).

Lignins enhance skin penetration of active compounds. Plant sterols such as lupeol, campesterol, and β-sitosterol exhibit anti-inflammatory and analgesic actions.

Figure 3: *Aloe Arborescens*

1.2.4. Vernacular Names

Aloe arborescens is commonly known as Krantz aloe, Kidachi aloe, mountain bush aloe, candelabra aloe, octopus plant, and torch plant in English. In French, it is referred to as Aloès arborescent. {38}

2. METHODOLOGY

This review is based on literature published between 1976 and 2015. Information was collected from textbooks, scientific journals, and online databases including PubMed, Google Scholar, SpringerLink, ScienceDirect, JSTOR, ISI Web of Knowledge, BioMed Central, SwetsWise, and Web of Science. A total of 54 research articles describing various biological activities of Aloe arborescens were analyzed. Both abstracts and full-text articles were reviewed in detail. Most of the studies focused on evaluating antitumor effects, particularly against liver and colon cancers. {39
}

2.1. Traditional Chinese medicine (TCM)

In Traditional Chinese Medicine (TCM), Aloe arborescens is valued for its heat-clearing and detoxifying properties and is traditionally used to

promote digestion and eliminate accumulated toxins from the body. Preparations of aloe are believed to regulate bowel function, relieve constipation, and support liver health. In TCM practice, Aloe arborescens is also used externally for wound healing and skin disorders, owing to its cooling and anti-inflammatory nature. These traditional applications align with modern findings that support its digestive, hepatoprotective, and anti-inflammatory activities.

2.1.1. Pharmacological activities

Figure 4: *Pharmacological Activities of Aloe Arborescens.*

Aloe arborescens exhibits a wide range of pharmacological activities supported by experimental studies. It possesses notable anticancer activity against liver, colon, skin, pancreatic, intestinal, lung, and kidney cancers, mainly through inhibition of tumor growth, angiogenesis, and DNA damage. The plant also shows strong anti-inflammatory and antioxidant properties, helping to reduce oxidative stress and inflammation. In addition, Aloe arborescens demonstrates immunomodulatory effects by enhancing immune cell responses, along with wound-healing and hepatoprotective activities. These diverse biological actions are attributed to its bioactive constituents such as anthraquinones, phenolic compounds, and polysaccharides, highlighting its potential therapeutic value. {40}

2.1.2. Biological Characterization

Anticancer Activity

Liver Cancer

Studies using animal models demonstrated that freeze-dried powdered leaves of Aloe arborescens inhibited the formation of glutathione S-transferase-positive (GST-P) preneoplastic hepatocyte foci. A 30% aloe extract was shown to suppress both the promotion phase and possibly the initiation phase of liver carcinogenesis (Tsuda et al., 1993).{41} Earlier reports by Zago (1954) suggested that an aloe-based preparation containing A.

Arborescens, honey, and a distillate produced beneficial effects in several diseases, including cancers of the skin, bladder, prostate, and liver. Traditional use of this formulation reportedly improved the health of patients suffering from melanoma and bladder cancer. Based on this background, Anwar et al. (2009) further investigated the effects of this preparation on liver health using a rat model with dimethylnitrosamine-induced liver fibrosis. The supplement exhibited antifibrotic activity, increased $CD4^+$ T-cell proportions in the spleen, and enhanced interferon-γ production after 21 days. Conversely, methanolic extracts and their fractions showed no cytotoxicity against human hepatoma cell lines after 72 hours of treatment (Bisi-Johnson et al., 2011).

2.1.3. Colon Cancer

Aloe leaf extract significantly reduced azoxymethane (AOM)-induced aberrant crypt foci formation in the rat colon and enhanced hepatic cytosolic quinone reductase activity. These findings suggest a chemopreventive role of aloe during the initiation stage of colon cancer (Shimpo et al., 2001).

Further studies revealed that freeze-dried whole-leaf extract and crude aloin inhibited AOM- induced DNA adduct formation, particularly O^6-methylguanine, with reductions of approximately 50% and 30%, respectively (Shimpo et al., 2003). Additional investigations in ICR mice demonstrated that aloe supplementation decreased both the incidence and number of colorectal lesions induced by 1,2-dimethylhydrazine, especially adenomatous hyperplasia.{42}

2.1.4. Duodenal Cancer

Chihara et al. (2000) studied the effect of freeze-dried whole-leaf aloe on N-ethyl-N-nitro nitrosoguanidine-induced duodenal tumor formation in C57BL/6 mice. The results indicated that dietary inclusion of aloe, particularly at a concentration of 10%, significantly

suppressed duodenal tumor development.

2.1.5. Skin Cancer

The acetone-soluble fraction obtained from the ethyl acetate extract of aloe was shown to inhibit 12-O tetradecanoylphorbol-13-acetate-induced ear edema, suggesting anti-inflammatory and anti-tumor-promoting effects (Shimpo et al., 2002).

2.1.6. Pancreatic Cancer

Furukawa et al. (2002) evaluated the effect of freeze-dried powdered aloe leaves during the initiation stage of pancreatic carcinogenesis in hamsters treated with N-nitrosobis(2-oxopropyl)amine. Histopathological analysis revealed that aloe intake reduced pancreatic neoplastic changes, likely through decreased DNA adduct formation.

2.1.7. Intestinal Cancer

Shimpo et al. (2006) investigated the influence of aloe leaf extract on AOM-induced intestinal carcinogenesis. The findings suggested that low doses of aloe produced a mild inhibitory effect on tumor growth without causing adverse side effects.

2.1.8. Lung and Kidney Cancer

According to Skopiński et al. (2013), aloe exhibited anti-angiogenic properties in vivo. Their study demonstrated that aloe inhibited tumor-induced angiogenesis following intradermal injection of both syngeneic sarcoma cells and xenogeneic human lung and kidney cancer cells.{42}

2.2. Mechanisms of Antitumor Action

Only a limited number of studies have explored the molecular mechanisms underlying the antitumor activity of aloe. Di Luccia et al. (2013) demonstrated the antiproliferative and prodifferentiation effects of aloe leaf extract on various human cell lines, including primary and immortalized keratinocytes, using proteomic and cellular approaches.{43} Proteomic analysis revealed the induction of proteins with strong antiproliferative effects. Chromatographic and spectroscopic analyses identified key active compounds, including a phenylpyrone derivative and three C-glucosyl anthrones—aloenin A, aloin A, and aloin B.

Further observations showed that aloe treatment altered the microtubule cytoskeleton by disrupting microtubule organization, displacing the microtubule-organizing center, and increasing diffuse cytoplasmic fluorescence, likely due to free, unpolymerized tubulin. These effects were associated with loss of mitochondrial membrane potential and cell membrane integrity, indicating a mitochondrial-dependent apoptotic pathway as a possible mechanism for the antiproliferative activity. {45}

2.3. Pharmacological Properties

Aloe vera is well known for its wide range of therapeutic actions, owing to its rich composition of bioactive phytochemicals. Over many years, both experimental and clinical research has evaluated its usefulness in treating various health conditions. The plant exhibits multiple pharmacological effects, including anti-inflammatory, antioxidant, antimicrobial, wound-healing, antidiabetic, immunomodulatory, hepatoprotective, and anticancer activities. These actions arise from the combined effects of its polysaccharides, anthraquinones, phenolic compounds, sterols, and enzymes found in both the gel and latex portions of the leaf (Hamman JH, 2008) [14].{48}

2.3.1. Anti-inflammatory Activity

Aloe vera's anti-inflammatory potential has been strongly supported in both topical and systemic studies. Important constituents such as bradykinase reduce levels of bradykinin—a major inflammatory mediator—while lupeol, β-sitosterol, and campesterol inhibit prostaglandin synthesis and interfere with the COX pathways. {49}

Vazquez and colleagues reported that applying Aloe vera gel reduced swelling in carrageenan- induced paw edema in rats. Bradykinase helped diminish skin inflammation, and lupeol was shown to suppress COX-2 activity and nitric oxide release (Yagi et al., 2003). The anthraquinone aloe-emodin also inhibits NF-κB activation, a central pathway in inflammation. {50}

2.3.2. Antioxidant Activity

Aloe vera gel contains several potent antioxidants, including vitamins C and E, β-carotene, polyphenols, and flavonoids. These compounds help neutralize free radicals, lower oxidative stress, and protect cells from lipid peroxidation and DNA damage (RL, 2005) [56]. Research has shown that Aloe vera gel extracts exhibit dose-dependent free-radical scavenging effects in DPPH and ABTS assays. Acemannan is also known to boost the body's own antioxidant enzymes such as SOD, catalase, and glutathione peroxidase (Yongchaiyudha S, 1996) [57].

2.3.3. Antimicrobial Activity

Aloe vera demonstrates strong antimicrobial effects against a wide variety of bacteria, fungi, and viruses. Its anthraquinones—especially aloin and emodin—along with saponins and phenolic constituents, damage microbial membranes, block DNA synthesis, and inhibit microbial growth (Bunyapraphatsara N, 1996) [64]. Studies have shown that Aloe vera extracts significantly inhibit pathogens such as E.

Coli, Staphylococcus aureus, Pseudomonas aeruginosa, and Candida albicans. Aloe-emodin also reduces replication of herpes simplex virus (HSV-1 and HSV-2) by interfering with viral DNA polymerase (Hirat T, 1983) [67].

2.3.4. Wound-healing Activity

Aloe vera is most widely recognized for its role in accelerating wound healing and promoting tissue repair. Aloe vera promotes fibroblast growth, stimulates collagen production, and enhances new blood vessel formation. It also helps maintain a moist environment at the wound site, which supports faster epithelial repair (Rabe T & Staden JV, 1997). A randomized clinical study by Hekmatpou demonstrated that Aloe vera gel markedly improved

the healing rate of burn injuries and decreased pain compared to standard therapy. Microscopic examinations revealed increased granulation tissue, better re-epithelialization, and reduced scar formation (Steenkamp V., 2007).

2.3.5. Antidiabetic Activity

Aloe vera exhibits significant antidiabetic potential in both preclinical and clinical research. Its blood glucose–lowering effect is believed to occur through improved insulin responsiveness, enhanced cellular glucose uptake, and protection of pancreatic β-cells from oxidative stress (Dat AD, 2012). In a clinical trial by Yongchaiyudha, consuming Aloe vera juice resulted in a notable decline in fasting blood sugar and HbA1c levels among type 2 diabetic patients. Compounds like glucomannan and phytosterols are thought to play a key role in these benefits (Eshun K., 2004). {66}

2.3.6. Immunomodulatory Effects

Acemannan, a major polysaccharide found in Aloe vera gel, boosts immune activity by stimulating macrophages, increasing cytokine release (IL-1, IL-6, TNF-α), and promoting dendritic cell maturation (He Q, 2005). Further investigations showed that acemannan enhanced macrophage phagocytic function and improved antigen presentation in vitro, supporting its therapeutic potential as a natural immune modulator in infections and inflammatory disorders (Ani GK, 2007).

2.3.7. Hepatoprotective and Gastroprotective Properties

Aloe vera demonstrates protective effects on the liver by reducing inflammation and oxidative stress. It also contributes to gastric health by strengthening mucosal defenses, increasing mucin secretion, and lowering gastric acid output. In experimental models, Aloe vera extract significantly reduced CCl_4-induced liver damage by lowering ALT, AST, and lipid peroxidation. It also showed notable anti-ulcer activity in ethanol-induced gastric lesions (Turner CE, 2004).

2.3.8. Anticancer Activity

Laboratory studies indicate that Aloe vera components such as aloe-emodin and acemannan exhibit anticancer effects by inhibiting cell proliferation, inducing apoptosis, blocking angiogenesis, and modulating oncogenic pathways in several cancer cell types, including breast, colon, liver, and leukemia. Although animal and in vitro findings are encouraging, clinical evidence in humans is still limited, highlighting the need for further research before Aloe can be recommended as an adjunct in cancer therapy (Atherton P, 1998).{42}

2.4.Extraction and Processing Methods of Aloe arborescens and Aloe barbadensis Miller

- **Collection and Preparation of Plant Material**

Fresh, mature leaves of Aloe arborescens and Aloe barbadensis Miller are collected, thoroughly washed to remove dirt, and allowed to drain. The spiny margins are trimmed off, and the outer rind is carefully removed to separate the inner leaf material. In Aloe barbadensis Miller, the inner gel is mainly used, whereas in Aloe arborescens, the whole leaf or leaf exudate is often utilized due to its higher anthraquinone content. {67}

- **Gel Extraction Method**

In Aloe barbadensis Miller, the clear mucilaginous gel is scooped out manually or using mechanical filleting. The gel is homogenized and filtered to remove fibers and impurities. This method preserves polysaccharides such as acemannan and is commonly used for cosmetic, food, and pharmaceutical products.

- **Leaf Exudate (Latex) Extraction**

For Aloe arborescens, the yellow bitter latex present beneath the leaf rind is collected by cutting the leaf and allowing the exudate to drain. The latex is then dried to obtain a concentrated extract rich in anthraquinones such as aloin A and B, which are responsible for its medicinal effects.

- **Solvent Extraction**

Dried leaf powder of both species can be extracted using solvents such as methanol, ethanol, acetone, or water through maceration, Soxhlet extraction, or reflux methods. Solvent extraction is mainly used for isolating phenolic compounds, flavonoids, and anthraquinones for pharmacological studies.

- **Drying and Concentration**

Extracts are concentrated under reduced pressure using a rotary evaporator. Drying methods include freeze-drying (lyophilization) to preserve bioactivity, spray drying for commercial-scale production, and oven drying for crude extracts. Freeze-drying is preferred for maintaining stability of heat-sensitive compounds. {68}

- **Stabilization and Preservation**

Fresh aloe gel is highly perishable and prone to microbial contamination. Stabilization methods include pasteurization, pH adjustment, addition of natural preservatives, and cold storage.

Enzyme inactivation is essential to prevent degradation of polysaccharides.

- **Quality Control and Standardization**

Extracts are standardized by estimating marker compounds such as acemannan (for Aloe barbadensis Miller) and aloin content (for Aloe arborescens). Physicochemical tests, chromatographic techniques (HPLC, TLC), and microbial load analysis are used to ensure quality, purity, and safety. {58}

2.5. Cosmetic and Industrial Applications of Aloe

Aloe species, particularly Aloe barbadensis Miller and Aloe arborescens, are widely used in cosmetic and industrial sectors due to their moisturizing, soothing, healing, and protective properties. In the cosmetic industry, aloe gel is a key ingredient in skin care products such as creams, lotions, gels, sunscreens, face packs, and anti-aging formulations, where it helps hydrate the skin, reduce inflammation, promote wound healing, and protect against UV-induced damage. Aloe is also commonly incorporated into hair care products

including shampoos, conditioners, hair masks, and scalp treatments to nourish hair, reduce dandruff, and improve scalp health.

In the industrial sector, aloe is extensively used in the pharmaceutical industry for the formulation of ointments, gels, tablets, and syrups due to its anti-inflammatory, antimicrobial, and wound-healing effects. The food and beverage industry utilizes aloe gel in health drinks, juices, and functional foods for its digestive and detoxifying benefits. Aloe extracts are also used in the nutraceutical industry as dietary supplements to support immunity and gut health. Additionally, aloe-derived compounds find applications in textiles, packaging, and biotechnology, where they are explored for their antimicrobial and preservative properties. Overall, aloe remains an important natural resource with broad cosmetic and industrial value. {52}

2.6. Toxicity and Safety Profile of Aloe arborescens and Aloe barbadensis Miller

Aloe barbadensis Miller (Aloe vera) is generally considered safe, especially when used topically.

Aloe gel applied to the skin is well tolerated and rarely causes adverse effects, though mild irritation or allergic reactions may occur in sensitive individuals. Oral consumption of purified aloe gel is usually safe in moderate amounts; however, the latex (yellow exudate) contains anthraquinones such as aloin, which can cause abdominal cramps, diarrhea, electrolyte imbalance, and laxative dependence when used excessively or for long periods. Therefore, long- term oral use of aloe latex is not recommended. Aloe vera should be used with caution in pregnant and lactating women and in individuals with kidney disorders. {38}

Figure 5: *Comparative Study of Aloe Arborescens and Aloe Barbadadensis Miller*

2.7. Traditional and Ayurvedic Uses

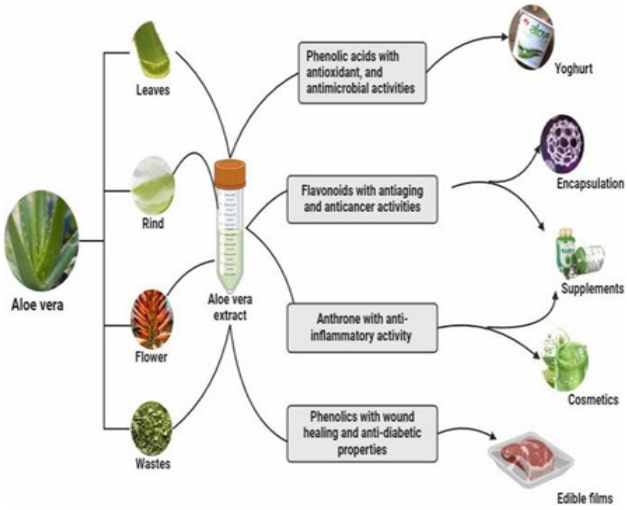
Aloe vera (Aloe barbadensis Miller), traditionally known as "Kumari" in Ayurveda, has been valued for centuries in various healing systems such as Ayurveda, Siddha, Unani, Traditional Chinese Medicine, and numerous folk traditions. Its historical use continues to guide modern herbal medicine and integrative therapeutic practices. {68}

2.8. Traditional Chinese Medicine (TCM)

In Traditional Chinese Medicine, Aloe vera, referred to as Lu Hui, is valued for its ability to eliminate internal heat, reduce excess fire, and promote gastrointestinal activity. It is traditionally used in the management of conditions such as liver qi stagnation, constipation, epileptic disorders, and parasitic infections. {69}

2.9. Folk Medicine and Ethnobotanical Applications

Across various traditional medical systems worldwide, Aloe vera has been widely utilized for its therapeutic properties. In African traditional medicine, it is employed in the treatment of malaria, asthma, dermatological infections, and is also taken as a general health tonic. In Mexican folk practices, Aloe vera juice is commonly consumed to help manage diabetes mellitus and digestive ailments. Indigenous tribal populations in India apply Aloe gel externally to alleviate joint pain, promote burn healing, and provide protection against sun exposure as a natural sunscreen. In the Caribbean region, Aloe gel is traditionally used for body detoxification and to enhance vitality and energy levels. {70}



3. Future Prospects and Research Gaps of Aloe Vera

Although Aloe vera is extensively used in traditional medicine and commercial products, it continues to offer significant opportunities for future research. There is considerable potential for its expanded application in the pharmaceutical, nutraceutical, and cosmeceutical industries. Ongoing multidisciplinary scientific investigations are essential to discover novel therapeutic uses and to enhance the **safety, efficacy. {48}

3.1.Applications

Cosmetic: creams, lotions, sunscreen gels Pharmaceutical: oral gels, capsules, topical ointments Food & Beverage: Aloe juice, health drinks Traditional medicine: burns, wounds, digestive aidIndustrial: extraction for nutraceuticals{35}

3.2. Future Prospects and Research Gaps of Aloe arborescens

Aloe arborescens has promising potential for pharmaceutical, nutraceutical, and cosmeceutical applications due to its anticancer, antioxidant, anti-inflammatory, immunomodulatory, and wound-healing properties. Its bioactive constituents such as aloin, aloenin, anthraquinones, and polysaccharides support the development of standardized herbal formulations, functional foods, and topical products. Advances in biotechnology and improved extraction techniques may further enhance its therapeutic value and commercial use. {27}

3.3. Clinical Applications of Aloe arborescens and Aloe barbadensis Miller

Aloe barbadensis Miller (Aloe vera) and Aloe arborescens have been widely used in clinical and supportive healthcare due to their diverse therapeutic properties. Aloe barbadensis Miller is commonly applied in dermatological conditions, including burns, wounds, sunburn, psoriasis, acne, and eczema, owing to its wound-healing, moisturizing, anti-inflammatory, and antimicrobial effects.Clinically, it is also used to support gastrointestinal health, helping in the management of constipation, gastritis, peptic ulcers, and irritable bowel syndrome. Its antioxidant and immunomodulatory properties further contribute to its use in managing metabolic disorders and improving overall immunity. {24}

4.Conclusion

Aloe barbadensis Miller and Aloe arborescens are two pharmacologically important species of the genus Aloe with wide therapeutic relevance. Aloe barbadensis Miller is extensively used in pharmaceutical, cosmetic, and food industries due to its wound-healing, anti-inflammatory, antioxidant, and moisturizing properties, while Aloe arborescens is recognized for its potent bioactive constituents and notable anticancer and immunomodulatory activities. Experimental studies support their roles in managing inflammatory conditions, oxidative stress, and chronic diseases. Despite their long history of traditional use and promising preclinical evidence, further clinical studies, standardization of extracts, and mechanistic investigations are necessary to ensure their safe and effective application. Overall, both species hold significant potential for future development as natural therapeutic agents and continue to attract scientific and commercial interest. {69}

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