



Aloe vera (L.) Burm: A Review of its Pharmacological and Therapeutic Potential

Rula Dahir Al-Jayid^{1*} Huda Jasim M. Altameme^{2*} Ashwak Falih Kaizal^{3*}

¹Biology, College of Science for Women, University of Babylon, ruladhahir@yahoo.com, Babylon, Iraq.

²Biology, College of Science for Women, University of Babylon, Wsci.huda.j@uobabylon.edu.iq, Babylon, Iraq.

³Biology, College of Science for Women, University of Babylon, wsci.ashwak.falih@uobabylon.edu.iq, Babylon, Iraq.

صبارالاوليفيرا :مراجعة لإمكاناته الدوائية والعلاجية

رلى ظاهر الجايد^{1*}، هدى جاسم محمد التميمي²، اشواق فالح خزعل³

¹ كلية العلوم للبنات، جامعة بابل، ruladhahir@yahoo.com، بابل، العراق.

² كلية العلوم للبنات، جامعة بابل، Wsci.huda.j@uobabylon.edu.iq، بابل، العراق.

³ كلية العلوم للبنات، جامعة بابل، wsci.ashwak.falih@uobabylon.edu.iq، بابل، العراق.

Accepted:

2/3/2026

Published:

31/3/2026

ABSTRACT

Aloe vera (*Aloe* (L.) Burm.) is considered a miracle plant. Its thick leaves have been widely recognized for their medicinal and therapeutic uses, both ancient and modern. This review aims to critically evaluate the vitamins, minerals, enzymes, and bioactive compounds in the gel, which exhibits antioxidant, antibacterial, and anti-inflammatory effects. It treats most digestive problems and combats various infections. It also helps stabilize blood sugar levels and improves overall health and appearance. *Aloe vera* is a staple plant with numerous health benefits.

This study, conducted using the databases PubMed, Scopus, Web of Science, and Google Scholar, focused on peer-reviewed publications from 2000 to 2025, examining both traditional and contemporary literature on the botanical description of *aloe vera*, its phytochemicals, pharmacological activity, and medicinal uses. By discussing the mechanisms of action of its bioactive components and their medical applications, this review connects empirical knowledge with scientific research.

Ultimately, understanding the broad pharmacological spectrum of *aloe vera* and its bioactive components contributes to the development of evidence-based herbal medicines. Realizing the full medicinal potential of this plant in modern medicine requires standardization, clinical validation, and the development of innovative pharmaceutical formulations.

Conclusion:

Its various pharmacological activities make *aloe vera* a popular therapeutic plant with many health advantages. Its well-known anti-inflammatory, antimicrobial, immunomodulatory, antidiabetic, anticancer, and wound-healing qualities make it beneficial in traditional and contemporary medicine. Due to advances in analytical chemistry, we now know more about *Aloe vera's* chemical composition, allowing for its safe and effective use in food, cosmetics, and alternative medicine.

Despite extensive *Aloe vera* research, certain areas need further study. *Aloe*-derived products should be standardized and quality-controlled in future research to achieve consistent therapeutic results. Metabolomics, transcriptomics, and proteomics will be required to understand the bioactive chemicals' modes of action. To prove its pharmacological claims and establish long-term safety, bigger and more diversified clinical studies are required. Researchers should create new formulations and medication delivery technologies to improve *Aloe*-based treatments' bioavailability and stability.

Therefore, combining traditional wisdom with contemporary science may reveal novel bioactive compounds and improve *Aloe vera's* medicinal potential. Future herbal medicines will be safer, more effective, and scientifically verified by integrating empirical traditional medicine with evidence-based contemporary pharmacology.

Key words: Liliaceae; *Aloe vera*; therapeutic properties; phytochemical; bioactive compounds; antioxidant.



INTRODUCTION

Aloe vera, scientifically known as *Aloe barbadensis* Miller, *Aloe vera* gel has proven its effectiveness in traditional medicine for centuries in various countries. *Aloe vera* has been used to heal burns, wounds, gastrointestinal issues, and skin conditions in a number of ancient medical systems, such as Ayurveda, Unani, and traditional Chinese medicine. One of the few succulent plants that has always held a significant position in the pharmacopoeias of numerous cultures worldwide is *aloe vera*. It was utilized in mummification ceremonies by the ancient Egyptians, and since 400 BC, it has been used in traditional Chinese and Indian medicine. According to Dioscorides, it is used to treat nearly every illness, including eye irritation and insomnia. *Aloe Vera* is a medicinal plant that is grown for a variety of uses in food, medicine, and health products [1]. *Aloe vera* is a perennial herbaceous plant classified within the Liliaceae family. According to [2], it is a tropical or subtropical perennial with lanceolate leaves with jagged edges and pointed tips. It may reach a height of 60-100 cm and is either stemless or extremely short stemmed, with spreading branches. Some cultivars include thick, meaty leaves that range in color from green to grey-green, as well as white dots on the stem's top and lower surfaces. The plant has a serrated edge and small white teeth. The yellow tubular corolla of each drooping blossoms is 2–3 cm long. Summer sees the production of flowers on a spike that can reach 90 cm in height. *Aloe vera* forms arbuscular mycorrhiza, a symbiotic relationship with other *Aloe* species that improves the plant's access to soil mineral [3]. The leaves of this plant are triangular. The leaves are fleshy and bear fruits that are packed with seeds, along with golden tubular blossoms. The three layers of a leaf are as follows: the innermost, transparent layer, which is 99% water; the middle, latex-containing layer, which contains bitter yellow sap; and the outer, thick, 15–20 cell peel, which protects the leaf from damage and synthesizes carbohydrates and proteins. A network of blood arteries located inside the skin is in charge of carrying materials like starch and water (phloem and xylem) [4].

Aloe vera has numerous therapeutic properties and pharmacological benefits for both humans and animals, making it a very significant and effective herbal plant among many others. *Aloe vera* is also utilized medicinally in a variety of our cultural systems. As an antibacterial, *aloe vera* eliminates or stops the growth and development of microorganisms, including fungi, protozoa, and bacteria. Antimicrobial medications either eliminate and suppress microorganisms or prevent the growth and development of germs (microbiostatic therapy). These plants' many parts helped treat various medical conditions [5].

Many research have looked into *Aloe vera*, however most of them only look at certain pharmacological qualities or isolated bioactive chemicals. There isn't much connection between traditional applications and recent scientific results. Consequently, there is an increasing need for a thorough and current evaluation that integrates data from both traditional and modern sources.

The current study seeks to provide a comprehensive examination of *Aloe vera* by encapsulating its botanical attributes, phytochemical constituents, pharmacological properties, and medicinal uses. This study aims to emphasize contemporary scientific data that substantiates its medical



efficacy, pinpoint research deficiencies, and provide prospective avenues for further investigation and use in pharmaceuticals.

Plant Description

Herbs can grow up to 160 cm in height (Figure 1). Stems are either nonexistent or very short (up to 30 cm), and they readily sucker to create dense clusters. Rhizomes that creep horizontally often multiply at the nodes. The leaves are linear-lanceolate and have 16–20 subbasins. They are slightly spaced in seedlings and new shoots, and they are upright to slightly spreading. They are pale green and may have pale patches in very young plants. The apex is pointy with two or three points, and the edge is swollen with clear, liquid sap. Petiole and stipules are missing [6].

Taxonomical Classification

Kingdom: Plantae

Order: Asparagales

Division: Spermatophyte

Subdivision: Angiospermae

Class: Monocotyledoneae

Genus: *Aloe*

Species: *barbadensis* Mill

Synonyms: *Aloe*, Musabbar, Kumari. [7].

Aloe vera cannot tolerate temperatures too low or too high because it is grown in warm tropical climates. Slowly expanding to 0.8 m, perennial with evergreen foliage. Soil types ranging from sandy to loamy are ideal for plant growth. As long as the soil is good enough, the plants will do quite well in typically poor soil. The plant prefers acidic, neutral, and alkaline soil. It cannot grow in the shadow. It thrives in damp or dry soil and may tolerate dry spells. Xerophytic plants are what they are. It can proliferate through seeds. In the spring, seeds are planted in a warm greenhouse [6]. At 16°C, it usually takes one to six months for the seed to sprout. The seedlings are transferred to pots that contain significantly less soil. They may grow in full sunshine for the first two seasons. A lot of the time, the counterweight will be accessible in the spring. Isolating plants at any time of year that experience a temperature spike high enough to promote new growth and regeneration enables them to generate balance without limitations [8].



(thiamine). The mucilage layer of the plant, which surrounds the inner parenchyma or gel beneath the rind, is where carbohydrates are found. They consist of both polysaccharides and monosaccharides. The most significant were the glucomannans, which are long-chain polysaccharides that include glucose and mannose. Also, there are trace levels of xylose, rhamnose, galactose, and arabinose in addition to the triterpenoid lupeol [11] , Table 1 is a summary Aloe vera's chemical constituents .

Table 1: *Aloe vera* Compounds: Classification and Biological Activities

Compound	Class	Biological Activity
Glucomannan	polysaccharides	Moisturizing, wound healing, immune support
Xylose, Rhamnose, Galactose	Monosaccharides	Structural & metabolic roles
Aloin, Emodin, Aloe-emodin, Barbaloin	Anthraquinones / Anthrones	Antimicrobial, antiviral, analgesic
Essential & non-essential amino acids	Amino Acids	Tissue repair, cell growth
Ca, Mg, Zn, Fe, K	Minerals	Metabolic & enzymatic support
A, B-complex, C, E	Vitamins	Antioxidant, immune & metabolic support
Amylase, Catalase, Lipase	Enzymes	Anti-inflammatory, metabolic functions
β -sitosterol, Lupeol, Campesterol	Sterols	Anti-inflammatory
Lupeol	Triterpenoids	Anti-inflammatory
Salicylic acid, Cinnamic acid ester	Phenolic acids / Esters	Anti-inflammatory, antioxidant
Various neutral lipids	Lipids	Cell protection
Structural proteins in gel	Proteins	Tissue repair
Glucomannan	Polysaccharides	Moisturizing, wound healing, immune support
Xylose, Rhamnose,	Monosaccharides	Structural & metabolic



CONCLUSION

Its various pharmacological activities make *aloe vera* a popular therapeutic plant with many health advantages. Its well-known anti-inflammatory, antimicrobial, immunomodulatory, antidiabetic, anticancer, and wound-healing qualities make it beneficial in traditional and contemporary medicine. Due to advances in analytical chemistry, we now know more about *Aloe vera's* chemical composition, allowing for its safe and effective use in food, cosmetics, and alternative medicine.

Despite extensive *Aloe vera* research, certain areas need further study. Aloe-derived products should be standardized and quality-controlled in future research to achieve consistent therapeutic results. Metabolomics, transcriptomics, and proteomics will be required to understand the bioactive chemicals' modes of action. To prove its pharmacological claims and establish long-term safety, bigger and more diversified clinical studies are required. Researchers should create new formulations and medication delivery technologies to improve Aloe-based treatments' bioavailability and stability.

Therefore, combining traditional wisdom with contemporary science may reveal novel bioactive compounds and improve *Aloe vera's* medicinal potential. Future herbal medicines will be safer, more effective, and scientifically verified by integrating empirical traditional medicine with evidence-based contemporary pharmacology.

Conflict of interests.

There are non-conflicts of interest.

References

- 1- P. Singh, J. Singh Hundal, A. Kumar Patra, M. Wadhwa, and A. Sharma, "Sustainable utilization of Aloe vera waste in the diet of lactating cows for improvement of milk production performance and reduction of carbon footprint", *Journal of Cleaner Production*, vol. 288, p. 125118, 2021.
- 2- M. Safari, M. Chelehmal Dezfouli Nejad, M. Mesbah, and A. Jangaran Nejad, "Effects of Aloe vera extract on growth and some hematological parameters of shirbot, *Tor grypus* (Heckel, 1843)", *Iranian Journal of Fisheries Sciences*, vol. 18, no. 3, pp. 445–456, 2019.
- 3- F. Golmohammadi, "Medical plant of Aloe vera in desert regions of Iran: greenhouses, economic importance, development, extension, processing and marketing", *Black Sea Journal of Agriculture*, vol. 5, no. 1, pp. 1–15, 2022.
- 4- P. Bakewell-Stone, *Aloe vera (true aloe)*, 2024.
- 5- D. Pathak, and R. Sharma, "Review on 'Aloe vera-medicinal plant'", *International Journal of Advance Research and Innovative Ideas in Education*, vol. 3, no. 1, p. 661, 2017.
- 6- A. Avhad, S. Aher, S. Hire, and G. Talele, "Aloe vera: A Wonder Plant with Multiple Activities", *Asian Journal of Pharmaceutical Research and Development*, vol. 12, no. 6, pp. 93–99, 2024.
- 7- K. M. Nadkarni, *Indian plants and drugs*, Ajay Book Service, 2010

الخلاصة

يُعد نبات صبار الاوليفيرا (Aloe (L.) Burm.) نباتاً ذا فوائد عظيمة. وقد اشتهرت أوراقه السميكة بفوائدها الطبية والعلاجية، قديماً وحديثاً. تهدف هذه المراجعة إلى تقييم الفيتامينات والمعادن والإنزيمات والمركبات النشطة بيولوجياً الموجودة في جل الصبار، والذي يتميز بخصائص مضادة للأكسدة والبكتيريا والالتهابات. يُعالج الصبار معظم مشاكل الجهاز الهضمي ويكافح العديد من أنواع العدوى. كما يُساعد على استقرار مستويات السكر في الدم ويحسن الصحة العامة والمظهر. يُعد الصبار نباتاً أساسياً ذا فوائد صحية جمة.

ركزت هذه الدراسة، التي أُجريت باستخدام قواعد بيانات PubMed و Scopus و Web of Science و Google Scholar، على المنشورات المُحكّمة من عام 2000 إلى عام 2025، حيث فحصت الأدبيات التقليدية والمعاصرة حول الوصف النباتي للصبار، ومركباته الكيميائية النباتية، ونشاطه الدوائي، واستخداماته الطبية. ومن خلال مناقشة آليات عمل مكوناته النشطة بيولوجياً وتطبيقاتها الطبية، تربط هذه المراجعة بين المعرفة التجريبية والبحث العلمي.

في نهاية المطاف، يُسهم فهم الطيف الدوائي الواسع لنبات الصبار ومكوناته النشطة بيولوجياً في تطوير أدوية عشبية قائمة على الأدلة. ويتطلب تحقيق الإمكانيات العلاجية الكاملة لهذا النبات في الطب الحديث توحيد المعايير، والتحقق السريري، وتطوير تركيبات صيدلانية مبتكرة.

الاستنتاجات:

بفضل أنشطته الدوائية المتنوعة، يُعد الصبار نباتاً علاجياً شائعاً يتمتع بفوائد صحية عديدة. فخصائصه المعروفة كمضاد للالتهابات، ومضاد للميكروبات، ومُعدّل للمناعة، ومضاد للسكري، ومضاد للسرطان، ومُساعد على التئام الجروح، تجعله مفيداً في الطب التقليدي والمعاصر. وبفضل التقدم في الكيمياء التحليلية، أصبحنا الآن نعرف المزيد عن تركيبه الكيميائي، مما يسمح باستخدامه الآمن والفعال في الأغذية، ومستحضرات التجميل، والطب البديل..

على الرغم من البحوث المكثفة حول الصبار، إلا أن بعض المجالات تحتاج إلى مزيد من الدراسة. ينبغي توحيد معايير المنتجات المشتقة من الصبار ومراقبة جودتها في البحوث المستقبلية لتحقيق نتائج علاجية متسقة. وسيتطلب فهم آليات عمل المواد الكيميائية النشطة بيولوجياً استخدام تقنيات الاستقلاب، والنسخ الجيني، والبروتينات. ولإثبات ادعاءاته الدوائية، وتحقيق سلامته على المدى الطويل، يلزم إجراء دراسات سريرية أوسع وأكثر تنوعاً. وينبغي على الباحثين ابتكار تركيبات وتقنيات جديدة لتوصيل الأدوية لتحسين التوافر البيولوجي واستقرار العلاجات القائمة على الصبار. لذلك، قد يكشف دمج المعرفة التقليدية مع العلم المعاصر عن مركبات حيوية جديدة، ويحسن الإمكانيات العلاجية للصبار. ستصبح الأدوية العشبية المستقبلية أكثر أماناً وفعالية، وأكثر موثوقية علمياً، من خلال دمج الطب التقليدي التجريبي مع علم الأدوية المعاصر القائم على الأدلة.

الكلمات المفتاحية:

الكلمات المفتاحية: الزنق؛ الصبار؛ الخصائص العلاجية؛ الكيميائية النباتية؛ المركبات النشطة بيولوجياً؛ مضاد للأكسدة