



Pharmaceutical, Therapeutically and Nutraceutical Potential of Aloe Vera: A Mini-review

Md. Mizanur Rahman¹, Ruhul Amin^{2*}, Tahmina Afroz¹ and Jayita Das²

¹Pharmacy Department, Daffodil International University, Dhaka, Bangladesh.

²Faculty of Pharmaceutical Science, Assam Down Town University, Panikhaiti, Guwahati, Assam, India.

Authors' contributions

This work was carried out in collaboration between all authors. Authors MR and RA designed the study, wrote the protocol, managed the analyses of the study and prepared the draft of the manuscript. Authors TA and JD managed the literature searches. Author RA and MR reviewed the scientific contents of the manuscript and updated it. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i37A31986

Editor(s):

(1) Dr. S. Prabhu, Sri Venkateswara College of Engineering, India.

Reviewers:

(1) Renata Nunes Oliveira, Federal Rural University of Rio de Janeiro, Brazil.

(2) Saiyed Musaratfrin Sabirali, Gujarat Technological University, India.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/70696>

Mini-review Article

Received 02 May 2021

Accepted 07 July 2021

Published 15 July 2021

ABSTRACT

Aloe vera belongs to the family of Asphodelaceae, the oldest medicinal herb ever found and the world's most common medicinal plant. It is known as Ghritkumari, is used in medicine sources of homeopathy, ayurvedic, and allopathy. The species is a good source of repository of chemical ingredients that shows a precise range of biological activities such as wound healing, burn treatment, mitigating frost bite damage, defense against, lung cancer, intestinal problems, x-ray damage to the body, raising and decreasing high density and low lipoprotein content, reduction of diabetic blood sugar, battle against acquired immune deficiency syndrome (AIDS), and strengthening of the immune system. Aloe vera leaves are used to create drinks, perfume, skin lotion, cosmetics, or ointments. The plant's key ingredients are different kinds of vitamins, proteins, carbohydrates, minerals, saponins, amino acids, and salicylic acids. The plant is a good source of antioxidants. It also contains folic acid and vitamin A, C, E and B12. Aloe vera gel includes important ingredients, including the essential amino acids required by the human body. The plant can be used in the pharmaceutical and cosmetics industry. This research article is an effort towards Aloe Vera's industrial and ethnobotanical characteristics.

Keywords: Aloe vera; nutraceutical; ethnobotanical; ghritkumari; antioxidants; anticancer.

ABBREVIATIONS

AIDS : Acquired Immune Deficiency Syndrome

AZT : Azido Thymidine

DNA : Deoxyribonucleic acid

WHO : World Health Organisation

1. INTRODUCTION

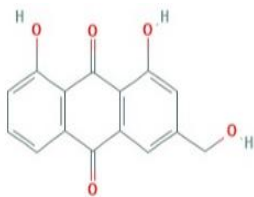
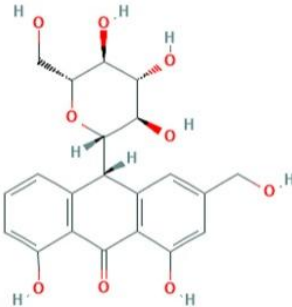
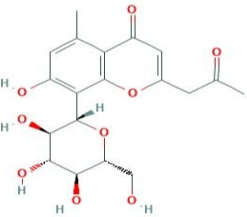
Herbs have been used as an effective treatment in medicine for thousands of years. As per the WHO assessment, up to 80 percent of the population still relies on conventional therapy [1]. Aloe Vera (syn. Aloe barbadensis Miller) botanical family Xanthorrhoeaceae (include in Aloiaceae and Asphodelaceae). Aloe vera plays a fundamental role in pharmaceutical and cosmetic approaches and the most applicable homeopathic plant worldwide [2]. This plant is believed to be begun in the African continent, precisely in Egypt [3]. Aloe Vera is traditionally used digestive disorders, including constipation, weak appetite, irritable bowel syndrome, diabetes, peptic ulcers and also used in immune booster [4]. The plant is also used in the various topical medicine for better effects on skin sensitivity to radiation, anti-inflammatory, antiviral and antitumor, anti-aging, antiseptic, immune enhancement, hypoglycemic, cytotoxic, anti-ulcer and anti-diabetic, anti-bacterial, antioxidant, cardiovascular effects [5-7]. In Sanskrit, Aloe Vera gel is known as Ghrit Kumari. Ayurveda has been described as a multifunctional herb, such as a blood detoxification, diuretic, spermatogenic, laxative, anti-inflammatory and fever reliever. It also used in traditional medicine & Ayurveda for purgative, appetite-stimulating and coughing, cold, piles, fatigue, dyspnea, asthma and jaundice [8]. Currently, Aloe Vera gel broadly used for both commercial and medicinal properties of plants. In 2008, Americans spent almost \$40 billion on functional foods, beverages and supplements to improve their manifestations and provide dynamism and energy to tackle metabolic health problems such as diabetes, Hypertension and hyperlipidemia. Aloe Vera containing herbal products are most popular for these applications [9]. Nowadays, the Aloe Vera usages is growing as industry are booming, and gel is used in many herbal products such as fresh gel, juice, and other formulations for nutritional, medicinal, and cosmetic purposes [10]. Therefore, it is essential to explain the

mechanism of action of the lead components of Aloe Vera to identify the maximum efficient way of utilizing and improving the applications of these active species effectively. Now Aloe Vera is promoted in large quantities because of its high requirement in pharmaceutical, cosmetics and industrial sector. The present analysis therefore discusses the following aspects: (a) the research deals primarily with botany; (b) the lead active composition of the gel of Aloe; (c) the pharmacological function of Aloe Vera gel; (d) the concluding remarks. The purpose of the analysis is to include a brief overview of the information on Aloe Vera to act as a guide for further investigation into this possible ingredient in order to establish an efficient method for the discovery of Aloe Vera leaf.

Botany: Aloe Vera looks like a xerophyte with a fiery cactus. It is a perennial clump, which forms a plant with a strong fibrous root; it produces about 12 to 16 basal leaves per plant, which, when mature, weight about 1500gm. If the plant is about 4 years old, it's mature, it has 12 years as its life span. The length of the leaves is about 0.5m long and 8 to 10 cm wide, with a saw-like tooth across its margins. The plant flowers stalk grown to about 1.5m in height, while the fruits contain many seeds in a triangular capsule shape [11]. Aloe Vera is virtually free from infections, but often there is a black spot on the plant due to fungal disease, which can kill the whole plant. Soft rotting is typically caused by bacterial infection; So, Aloe Vera is frost-free since it can't survive in frost-free environments. Most Aloe Vera is not poisonous, but some contain hemlock like a toxic substance [11].

Chemical constituents: Herbal medicine and Cosmetics products are made from aloe vera leaf mucilaginous tissue also called Aloe Vera gel. Aloe Vera peripheral bundle cells develop highly bitter, yellow color latex due to aloe-emodin chemical and its related compounds. Many compounds of around 200 different types of molecules with diverse structures have been synthesized from Aloe Vera leaves' central parenchyma tissue and the exudate produced by cells adjacent to the vascular bundles [12,13]. The active constituents of Aloe Vera leaf, including the gel and exudate, are given in Table-1 and Table 2 [13-21].

Table 1. Anthraquinone compounds Structure of aloe vera

SI. No.	Name	Molecular formula	IUPAC name	Chemical structure
1	Aloe-emodin	C ₁₅ H ₁₀ O ₅	1,8-dihydroxy-3-(hydroxymethyl)anthracene-9,10-dione	
2	Barbaloin/Aloin	C ₂₁ H ₂₂ O ₉	(10S)-1,8-dihydroxy-3-(hydroxymethyl)-10-[(2S,3R,4R,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]-10H-anthracen-9-one	
3	Aloesin/Aloeresin	C ₁₉ H ₂₂ O ₉	7-hydroxy-5-methyl-2-(2-oxopropyl)-8-[(2S,3R,4R,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]chromen-4-one	

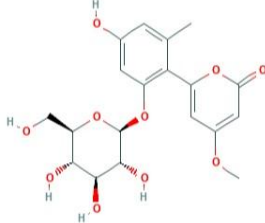
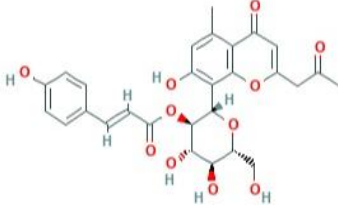
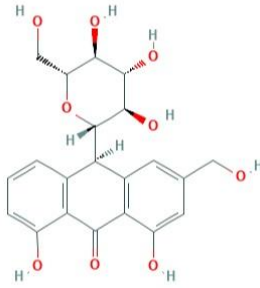
SI. No.	Name	Molecular formula	IUPAC name	Chemical structure
4	Aloenin	C ₁₉ H ₂₂ O ₁₀	6-[4-hydroxy-2-methyl-6-[(2S,3R,4S,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]oxyphenyl]-4-methoxy-pyran-2-one	
5	Aloeresin A	C ₂₈ H ₂₈ O ₁₁	[(2S,3R,4S,5S,6R)-4,5-dihydroxy-6-(hydroxymethyl)-2-[7-hydroxy-5-methyl-4-oxo-2-(2-oxopropyl)chromen-8-yl]oxan-3-yl] (E)-3-(4-hydroxyphenyl)prop-2-enoate	
6	Aloin B/ Isobarbaloin	C ₂₁ H ₂₂ O ₉	10R)-1,8-dihydroxy-3-(hydroxymethyl)-10-[(2S,3R,4R,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]-10H-anthracen-9-one	

Table 2. Summary of the bioactive compound in Aloe Vera [14-22]

Name	Chemical Compounds	Use
Anthraquinones/anthrones	Aloe-emodin, aloetic-acid, ethanol, barbaloin, isobarbaloin , emodin, cinnamic acid ester	Aloin and emodin act as anti-bacterial and antiviral analgesics
Carbohydrates	Pure mannan, acetylated mannan, acetylated glucomannan, glucogalactomannan, galactan, galactogalacturan, arabinogalactan, galactoglucoarabinomannan, pectic material, xylene, cellulose	Glycoprotein with anti-allergic properties, called alprogen and novel anti-inflammatory agent.
Chromones	8-C-glucosyl-(2'-O-cinnamoyl)-7-O-methylaloediol A, 8-C-glucosyl-(S)-aloesol, 8-C-glucosyl-7-O-methylaloediol A, 8-C-glucosyl-7-O-methylaloediol, 8-C-glucosyl-noreugenin, isoaloesin D, isorabaichromone, neosalosin A	The novel anti-inflammatory orders.
Enzymes	Alkaline phosphatase, amylase, bradykinase, carboxypeptidase, catalase, cyclooxygenase, cyclooxygenase, lipase, oxidase, phosphoenolpyruvate, carboxylase, superoxide dismutase	Bradykinase helps to reduce excessive inflammation when applied to the skin topically, while others help in the breakdown of sugars and fats.
Inorganic compounds	Calcium, chlorine, chromium, copper, iron, magnesium, manganese, potassium, phosphorous, sodium, Zinc	They are essential for the proper functioning of various enzymes systems in different metabolic pathways and few are antioxidants
Miscellaneous including organic compounds and lipids	Arachidonic acid, γ -linolenic acid, steroids (campesterol, cholesterol, Bsitosterol), triglycerides, triterpenoid, gibberillin, lignins, potassium sorbate, salicylic acid, uric acid	
Proteins	Lectins, lectin-like substance	It also contains salicylic acid that possesses anti-inflammatory and anti-bacterial properties. Lignin, an inert substance, when included in topical preparations, enhances penetrative effect of the other ingredients into skin. Saponins that are the soapy substances from about 3% of the gel and have cleansing and antiseptic properties.
Saccharides	Mannose, glucose, L-rhamnose, aldopentose	
Vitamins	Vitamin A, B12, C, E, choline and folic acid	Vitamin A, C and E are antioxidants and antioxidant neutralize free radicals.
Hormones	Auxins and gibberellins	That helps in wound healing and have antiinflammatory action.

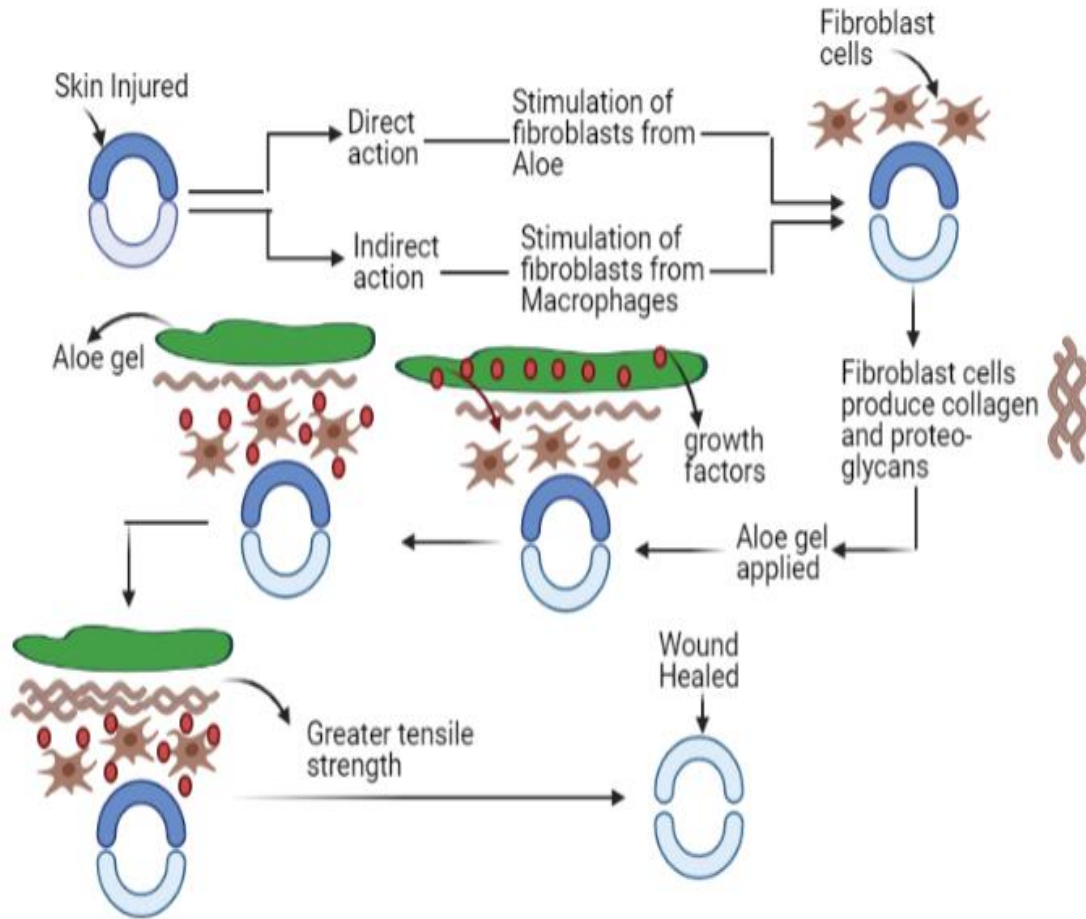


Fig. 1. The use of Aloe gel causes fibroblast cells to migrate and proliferate in the injured region. Aloe's growth factors bind to fibroblast IGF receptors and draw them to the wound. This boosts collagen content and cross-linking even more. As a result, the wound's tensile strength is increased

1.1 Pharmacological Function

Burn and wound healing property: Scientific studies indicated that tannic acid [21] and the form of polysaccharide could be effective constituents for wound healing and tissue repair activity [22]. Other researchers have reported that glucomannan, a polysaccharide containing high mannose and gibberellin growth hormone interacts with fibroblast growth factor receptors, thereby stimulating its development and proliferation, significantly improve the collagen synthesis after oral and topical use of Aloe Vera [23]. Aloe gel improved the quality of the wound collagen and modified the structure of the collagen and improved the degree of cross-linking of the collagen. This intensified the wound's constriction and increased the resulting scar tissue's breaking strength [24]. Increased

dermatan sulfate and hyaluronic acid synthesis in the healing wound's granulation tissue improved the healing process has been identified (Fig. 1) [23,25-27].

Moisturizing and anti-ageing effect: Aloe Vera manufacturing usages increased to 95% of dermatologically products in recent year. This is because it has incredible moisturizing properties. It improves the skin's ability to hydrate itself and helps in the removal of dead skin cells [28]. It does so by producing collagen and elastin fibres, making the skin more elastic and less wrinkled, thereby reversing the degenerative skin changes. It softens the skin by its lubricating properties on superficial epidermal cells of skins and also by the action with amino acids [18,29]. For such incredible usages of it, Aloe vera also used as an ideal herbs in cosmetics industry.

Immune System Restoration: Aloe Vera gel studied suggest that its highly protective for skin damage and improve skin cells repair process [30,31]. The precise function is unknown, however after applying Aloe Vera gel to the skin, metallothionein, a powerful antioxidant protein that scavenges hydroxyl radicals and protects the skin's superoxide dismutase and glutathione peroxidase from being suppressed, is produced. It prevents UV-induced reduction of delayed hypersensitivity by inhibiting the production and release of immunosuppressive cytokines generated from keratinocytes, such as interleukin-10 [32,33].

Antimicrobial: Aloe vera has various antimicrobial properties due it contains various chemical like phenols, urea nitrogen, Lupeol, salicylic acid, cinnamonic acid, and sulfur. They all have properties of inhibitory effect on fungi, bacteria, and viruses. Acemannan works individually on HIV disease management and he used herbs with azido thymidine (AZT) and acyclovir to prevent the replication of the AIDS virus [34]. Antifungal Aloe vera extract in study of guinea pig legs contaminated with trichophyton mentagrophytes resulted in a 70% growth inhibition relative to untreated animals [35]. In recent research, the polysaccharide fraction has been shown to inhibit benzopyrene binding to hepatocytes cells of rat, thus preventing the development of potentially cancer-inducing benzopyrene-DNA adducts. Induction of glutathione S-transferase resulting inhibition of the tumor protecting effects of phorbol myristic acetate have also been reported suggesting the possible advantage of the use of aloe gel in chemoprevention in cancer disease [18,36-38].

Antitumor and Anticancer Activity: Various aloe Vera studies reported that antitumor and anti-ulcer effects is due to present of various glycoproteins and it also help normalized human carcinogenic cells. None, less, statistically relevant clinical trials on Aloe Vera gel's effectiveness in human health, are minimal and mostly inconclusive [36]. The polysaccharide fraction has been found to block benzopyrene binding to primary rat hepatocytes, reducing the formation of possibly cancer-causing benzopyrene-DNA adducts, according to current study. Induction of glutathione S-transferase and suppression of phorbol myristic acetate's tumor-promoting action have also been reported, indicating that Aloe gel may be useful in cancer chemoprevention [37,39]. Aloe's carcinogenicity hasn't been well investigated. Chronic misuse of

anthranoid containing laxatives has been believed to play a role in colorectal cancer but there has been no proof of a causal association between anthranoid laxative misuse and colorectal cancer [40]. Some report on cancer prevention is done by aloe vera [41,42]. Aloe Vera juice helps the body to cure itself of cancer and the damage done by radiotherapy and chemotherapy that kills healthy immune cells essential to recovery. Aloe Vera emodin, an anthraquinone, can suppress or prevent cancer cells' development, rendering it anti-neoplastic [11,43].

Laxative effects: Aloe Vera gel is one of the most potent laxative compounds and is commonly used to treat constipation [19]. If taken at doses of 0.25mg, laxative effects begin within 6-12 h, resulting in loose bowel movements. It is healthy for nursing mothers as there are no laxative effects in their infants [44,45].

Effect on gastric acid secretion and ulcers: In both animals and humans, aloe vera gel has the ability to cure or prevent the development of stomach ulcers. Many possible pathways have been connected to Aloe vera's anti-ulcer action, including its anti-inflammatory characteristics, healing benefits, mucus-stimulating effects, stomach secretion regulation, and lectin synthesis [19]. Lectins block the absorption of antipyrine by the parietal cells. This unusual capacity of the extract to inhibit gastric acid production may be the product of direct action on the acid-producing cells [46].

Anti-diabetic effects: Aloe Vera gel is well known for maintaining the blood sugar levels low. However, the results may not constant based on differences in the separation of a mucilaginous layer from anthraquinones [47]. It decreases blood glucose levels and reduces hepatic transaminases, plasma and tissue cholesterol, triglycerides, free fatty acids, and phospholipids [19,48].

2. CONCLUSION

Aloe vera has been utilized worldwide for its therapeutic activities in the pharmaceutical, cosmetic, and food sectors as an ethno-medicinal potential plant. It is well-known for its therapeutic properties. Aloe vera is known as a "wonder plant" for its antibacterial and anti-inflammatory properties, as well as its usage in the treatment of cancer and diabetes. It is also used in the beauty industry. A number of

research on the bioactivity of this plant in people and animals have been published, and it has been proven to be suitable for medical, cosmetic, and food uses. The plant requires more study focus in order to be used more effectively for humankind. Aloe vera is unquestionably nature's gift to humanity for beauty, burns, and medicine, and it is up to us to use it and appreciate nature for her never-ending gift. This study comprises a researcher study on Aloe Vera, with the goal of explaining the different therapeutic uses of medicinal plants. The development research of Aloe vera in the treatment of cancer and AIDS has already been approved by the US Food and Drug Administration. Controlled research will be required in the future to demonstrate the efficacy of Aloe vera under diverse situations.

CONSENT

It's not applicable.

ETHICAL APPROVAL

It's not applicable.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. N. N. Dutta (CMD, AdtU), Prof.(Dr.) Biplab Kumar Dey,(Dean, FPS, AdtU), Dr. Mrinmoy Basak (Dean, International Affairs), Prof. (Dr.) Muniruddin Ahmed (HoD, DIU) and Dr. Sharifa Sultan (Assoc. Prof. DIU) for their valuable support and contribution towards collaborative this research. The authors are also grateful to the daffodil International University and Assam down town university for all kinds of library, computer and internet facilities.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Guide Y. Harper Collins Australia; 2002. Available:<https://Yates-Garden-Guide/dp/0207198209>.
2. Gantait S, Sinniah UR, Das PKJAAS, Section B-Soil, Science P. Aloe vera: A review update on advancement of in vitro culture. 2014;64(1):1-12.
3. Ayodele S, Ilondu EJAJob. Fungi associated with base rot disease of Aloe vera (Aloe barbadensis). 2008;7(24).
4. Brusick D, Mengs UJE, mutagenesis m. Assessment of the genotoxic risk from laxative senna products. 1997;29(1):1-9.
5. Drury R, Wallington EJNYCL. Carleton's histological technique 5th ed; 1980.
6. Ghannam N, Kingston M, Al-Meshaal IA, Tariq M, Parman NS, Woodhouse NJHRIP. The antidiabetic activity of aloes: Preliminary clinical and experimental observations. 1986;24(4):288-94.
7. Gilmar G, Rall W, Nies S, Taylor PJEEH- HIEMS. Pharmacological Basisogy Therapeutics, II; 1992.
8. Joseph B. Raj SJJJPSRR. Pharmacognostic and phytochemical properties of Aloe vera linn an overview. 2010;4(2):106-10.
9. Ahlawat KS, Khatkar BSJJofs, technology. Processing, food applications and safety of aloe vera products: A review. 2011;48(5):525-33.
10. Eshun K, He QJCrifs, nutrition. Aloe vera: a valuable ingredient for the food, pharmaceutical and cosmetic industries—a review. 2004;44(2):91-6.
11. Sahu PK, Giri DD, Singh R, Pandey P, Gupta S, Shrivastava AK, et al. Therapeutic and medicinal uses of Aloe vera: A review. 2013;4(08):599.
12. Davis RH, Leitner M, Russo JJASapbVPN. Aloe vera. 1997;3-5.
13. Ni Y, Tizard IR. Analytical methodology: The gel-analysis of aloe pulp and its derivatives: CRC Press: Boca Raton; 2004.
14. Dagne E, Bisrat D, Viljoen A, Van Wyk BJCO. Chemistry of Aloe Species. 2000;4(10):1055-78.
15. Panel C, Toxicology CIREPJIJo. Final report on the safety assessment of Aloe andongensis extract, Aloe andongensis leaf juice, Aloe arborescens leaf extract, Aloe arborescens leaf juice, Aloe arborescens leaf protoplasts, Aloe barbadensis flower extract, Aloe barbadensis leaf, Aloe barbadensis leaf extract, Aloe barbadensis leaf juice, Aloe barbadensis leaf polysaccharides, Aloe barbadensis leaf water, Aloe ferox leaf extract, Aloe ferox leaf juice and Aloe ferox leaf juice extract. 2007;26(2):1-50.
16. Femenia A, Sánchez ES, Simal S, Rosselló CJCP. Compositional features of polysaccharides from Aloe vera (Aloe

- barbadensis Miller) plant tissues. 1999;39(2):109-17.
17. Choi S, Chung M-H, editors. A review on the relationship between Aloe vera components and their biologic effects. *Seminars in integrative medicine*, Elsevier; 2003.
 18. Surjushe A, Vasani R, Saple DJI. *Aloe vera: A short review*. 2008;53(4):163.
 19. Hamman JHJM. Composition and applications of Aloe vera leaf gel. 2008;13(8):1599-616.
 20. Suga T, Hirata TJC, toiletries. The efficacy of the aloe plants chemical-constituents and biological-activities. 1983;98(6):105-8.
 21. Freytag AJP. Suggested role of traumatic acid in Aloe wound healing. 1954;9:705.
 22. Kameyama S, Shinho M, editors. Wound healing compositions from Aloe arborescens extracts. *Japanese patent 79,151,113*. *Chemical Abstracts*; 1980.
 23. Jamil M, Mansoor M, Latif N, Naz R, Anwar F, Arshad M, et al. Review effect of Aloe vera on Wound Healing. 2020;63(1):48-61.
 24. Hegggers JP, Kucukcelebi A, Listengarten D, Stabenau J, Ko F, Broemeling LD, et al. Beneficial effect of Aloe on wound healing in an excisional wound model. 1996;2(2):271-7.
 25. Sharrif Moghaddasi M, Res MJIBMR. Aloe vera their chemicals composition and applications: A review. 2011;2(1):466-71.
 26. Chithra P, Sajithlal G, Chandrakasan GJJoe. Influence of Aloe vera on the glycosaminoglycans in the matrix of healing dermal wounds in rats. 1998;59(3):179-86.
 27. Liang J, Cui L, Li J, Guan S, Zhang K, Li JJTEPBR. Aloe vera: a medicinal plant used in skin wound healing; 2020.
 28. Singh A, Ansari V, Haider F, Akhtar J, Ahsan FJRJoP, *Pharmacodynamics*. A Review on Topical preparation of Herbal Drugs used in Liposomal delivery against Ageing. 2020;12(1):5-11.
 29. West DP, Zhu YFJAJoIC. Evaluation of aloe vera gel gloves in the treatment of dry skin associated with occupational exposure. 2003;31(1):40-2.
 30. Roberts DB, Travis ELJIJoROBP. Acemannan-containing wound dressing gel reduces radiation-induced skin reactions in C3H mice. 1995;32(4):1047-52.
 31. Sato Y, Ohta S, Shinoda MJYzJotPSoJ. Studies on chemical protectors against radiation. XXXI. Protection effects of Aloe arborescens on skin injury induced by X-irradiation. 1990;110(11):876-84.
 32. Byeon SW, Pelley RP, Ullrich SE, Waller TA, Bucana CD, Strickland FMJJoid. Aloe barbadensis extracts reduce the production of interleukin-10 after exposure to ultraviolet radiation. 1998;110(5):811-7.
 33. Nirala RKJJoP, *Phytochemistry*. A review on immunomodulatory activity of amla and Aloe vera. 2020;9(5):2014-6.
 34. Kahlon J, Kemp M, Carpenter R, McAnalley B, McDaniel H, Shannon WJMb. Inhibition of AIDS virus replication by acemannan in vitro. 1991;3(3):127-35.
 35. Kawai K, Beppu H, Shimpo K, Chihara T, Yamamoto N, Nagatsu T, et al. In vivo effects of Aloe arborescens Miller var. natalensis Berger (Kidachi aloe) on experimental tinea pedis in guinea-pig feet. 1998;12(3):178-82.
 36. Kim HS, Lee BMJC. Inhibition of benzo [a] pyrene-DNA adduct formation by Aloe barbadensis Miller. 1997;18(4):771-6.
 37. Kim HS, Kacew S, Lee BMJC. In vitro chemopreventive effects of plant polysaccharides (Aloe barbadensis Miller, *Lentinus edodes*, *Ganoderma lucidum* and *Coriolus versicolor*). 1999;20(8):1637-40.
 38. Kupnik K, Primožič M, Knez Ž, Leitgeb MJP. Antimicrobial Efficiency of Aloe arborescens and Aloe barbadensis Natural and Commercial Products. 2021;10(1):92.
 39. Siegers C, von Hertzberg-Lottin E, Otte M, Schneider BJG. Anthranoid laxative abuse-a risk for colorectal cancer? 1993;34(8):1099-101.
 40. Siegers C-PJTips. Anthranoid laxatives colorectal cancer. 1992;13:229-31.
 41. Sydiskis R, Owen D, Lohr J, Rosler K, Blomster RJAa, chemotherapy. Inactivation of enveloped viruses by anthraquinones extracted from plants. 1991;35(12):2463-6.
 42. Fenig E, Nordenberg J, Beery E, Sulkes J, Wasserman LJO. Combined effect of aloe-emodin and chemotherapeutic agents on the proliferation of an adherent variant cell line of Merkel cell carcinoma. 2004;11(1):213-7.
 43. Majumder R, Das CK, Mandal MJPr. Lead bioactive compounds of Aloe vera as potential anticancer agent. 2019;148:104416.
 44. Maan AA, Nazir A, Khan MKI, Ahmad T, Zia R, Murid M, et al. The therapeutic properties and applications of Aloe vera: A review. 2018;12:1-10.

45. Maan AA, Nazir A, Khan MKI, Ahmad T, Zia R, Murid M, et al. Journal of Herbal Medicine.
46. KB B, NG H, T PATIL RJIJ. Review on Aloe Vera. 2014;2(3):677-91.
47. Reynolds T, Dweck AJJoe. Aloe vera leaf gel: A review update. 1999;68(1-3):3-37.
48. Afrin F, Hossain M, Amin M, Islam M, Rokeya BJJJoSR. Soluble Dietary Fiber from Aloe Vera and Lady's Finger; Effect on Glucose Absorption in Type-2 Diabetic Model Rats. 2021;13(2):669-78.

© 2021 Rahman et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<https://www.sdiarticle4.com/review-history/70696>