EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 11
Issue: 1
277-284
Year: 2024

ALOEVERA AND ITS BIOLOGICAL APPLICATIONS

Anshika Bathla* and Mrs. Deepika Deopa

*Six Sigma Institute of Technology and Science, Rudrapur, Uttarakhand.
Associate Professor Pharmacology.

***Corresponding Author: Anshika Bathla**

Six Sigma Institute of Technology and Science, Rudrapur, Uttarakhand.

Article Received on 21/11/2023 **Article Revised on 11/12/2023** **Article Accepted on 01/01/2024**

ABSTRACT
Aloe vera, a succulent plant renowned for its therapeutic properties, has been an integral component of traditional medicine for centuries. This review article systematically explores the multifaceted biological effects of Aloe vera, encompassing its diverse chemical constituents and their potential impacts on human health. The investigation delves into the plant's anti-inflammatory, antioxidant, antimicrobial, and immunomodulatory properties, shedding light on the underlying molecular mechanisms. Additionally, the article examines the implications of Aloe vera in wound healing, skin health, and gastrointestinal disorders. The synthesis of scientific evidence provides a holistic perspective on the plant's medicinal potential, offering valuable insights for researchers, healthcare professionals, and consumers alike. As Aloe vera continues to captivate scientific interest, this comprehensive review aims to consolidate existing knowledge and stimulate further research avenues for harnessing the therapeutic benefits of this natural wonder.

KEYWORDS: Aloe Vera, Therapeutic, Immunomodulatory, Implications, Gastrointestinal.

INTRODUCTION

Aloe vera (AV), a plant that resembles a cactus, thrives in hot, dry climates. It belongs to the Liliaceae family, which has roughly 360 species in total. The only species grown for commerce are Aloe arborescence and Aloe barbadense Miller. Aloe vera gel, which is a colorless, mucilaginous gel, is produced by parenchymatous cells found in fresh aloe vera leaves. The majority of this gel's ingredients are active compounds (1%–2%) and water (98–99%).[1]

Fig. 1: Aloe vera.[4]

The primary components of aloe vera fluid include aloin, emodin, gum, and other components including essential oils. Aloin is an active component with antibacterial and antiseptic properties.[2]

The Liliaceae family of plants includes the Aloe vera plant. The entire earth is covered by distribution areas. More than 350 different plant species are found in aloe vera alone.[3]

The health, beauty, medical and skin care benefits of the aloe vera plant are well known and widely used. The name of aloe vera comes from the Arabic words "Alloeh" meaning "shiny substance" and the Latin word "vera" meaning "true". Aloe vera was recognized by Greek scientists as early as 2000. Ancient Egyptians called aloe vera "the plant of eternity". Today, aloe vera plant is used in many medicines in dermatology.[5]

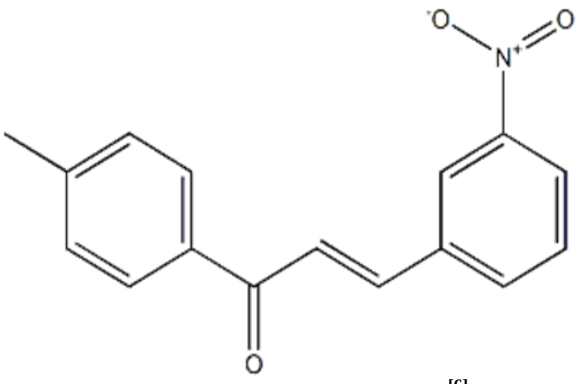

Fig. 2: Structure of Aloe vera.[6]

Active ingredients of aloe Vera and Their functions

Aloe vera has many natural properties that are beneficial to the body, such as vitamins, saccharides, anthraquinones, enzymes, lignin, saponins, salicylic acid, minerals and amino acids.[6,7,8] Additionally, aloe vera contains substances such as carotenoids, steroids and enzymes.

Aloe vera is a useful plant used in the treatment of diseases in alternative and traditional medicine because it affects different functions in the body.[7]-[8]-[9]-[10]

Mechanism of action in disease prevention

Aloe vera has many benefits that can help prevent and treat diseases by changing many functions in the body. Aloe vera works in certain ways; -

1. Aloe vera and its products such as aloe-emodin (AE), aloin (barbaloin), anthracene and emodin may help prevent cancer by affecting certain molecules in the body.
2. Aloe vera acts as an antioxidant, removing harmful molecules from the body and reducing inflammation by stopping certain chemicals.
3. Aloe vera can kill bacteria by destroying their cell walls. Previous research has shown that aloe vera gel helps reduce inflammation and fight infection.[11]-[12]

Botanical description

Aloe vera, sometimes known as Aloe barbadense miller, is a succulent plant of the Asphodelus family. Although it originated in dry parts of North Africa, it is now grown all over the world for its therapeutic and beauty benefits. Rosettes of thick, fleshy leaves with a clear, gel-like liquid inside are what define aloe vera plants. Usually green or gray-green in colour, these leaves can reach a maximum length of 18 to 24 inches.[13]

Chemical composition

The bioactive substances included in aloe vera gel include polysaccharides, glycoproteins, vitamins (like C and E), minerals (including zinc and magnesium), enzymes (like catalase and lipase), anthraquinones, and amino acids.[14]

Pharmacological properties

Many pharmacological characteristics of aloe vera are demonstrated, such as its anti-inflammatory, antioxidant, antibacterial, analgesic, and immunomodulatory qualities. Its potential for therapeutic use is enhanced by these qualities.[15]

Aloe vera is often used on the skin to treat sunburns, burns, wounds, psoriasis, and acne.

It can help cuts and injuries heal and the body repair damaged tissue.[14]

Gastrointestinal benefits

Aloe vera has been studied as an ingredient that may have beneficial effects on the gastrointestinal tract, such as helping treat irritable bowel syndrome (IBS) and regulating digestion. Thanks to medications such as aloin, it will make you go to the toilet more often.

It was investigated whether aloe vera could help treat stomach disorders such as irritable bowel syndrome and constipation. The reason it helps you go to the toilet is because latex contains some chemicals.[16]

Safety and Precautions

Aloe vera is usually safe to use on your skin or in small amounts, but too much of aloe latex, which has aloin in it, can cause problems.

It's important to take the right amount of aloe vera and talk to a doctor before using it inside your body.[3]

Cosmetic and Personal care products

Aloe vera is often used in makeup and skincare products like lotion, sunscreen, and shampoo because it helps keep your skin and hair hydrated and calm.[14]

Pharmacological effects of aloe vera

1. Anti-Fungal

Aloe vera and its derivatives are used to kill bacteria.

Aloe vera gel may help prevent the growth and spread of certain types of fungi. These include Rhizoctonia solani, Fusarium oxysporum and Colletotrichum anthracis. Aloe vera has natural properties against fungi. Studies show that aloe vera gel can help kill many bacteria and fungi, such as Penicillium expanses, Botrytis cinerea, Aspergillus niger, Alternaria alternata, and Penicillium digitalata.[17]

It can prevent the growth of some bacteria and fungi. Its maximum amount can inhibit the growth of Staphylococcus aureus.[18]

2. Anti diabetic

Aloe vera juice/gel might decrease blood sugar. Aloe vera gel greatly reduces blood sugar, liver enzymes, cholesterol, triglycerides and other fats in the blood. Aloe vera contains substances that can lower blood sugar and produce more insulin in the body.[19]

However, the results may not be the same due to changes in the way the mucus layer separates from the anthraquinones. Something. It reduces liver enzymes, cholesterol in the blood and body tissues, and fat in the blood.[20]

People with diabetes seem to be less able to combat harmful chemicals in their bodies. Because levels of some vitamins are low, their bodies cannot protect them from damage. Aloe vera polysaccharides help control blood sugar and reduce cholesterol in diabetics. They also support the body's production of antioxidants, which

reduces the risk of diabetes. Aloe vera juice improves digestion and helps control blood sugar by helping the body absorb nutrients better. It may make insulin medications work better for people with diabetes.[21]

Some animal and human studies have shown that aloe vera gel can significantly reduce blood sugar levels. as an ingredient in juice or bread and other foods. In a study on diabetic rats, oral administration of aloe vera gel helped lower blood sugar, cholesterol, and fatty acids. It also increases insulin levels. The mice had low cholesterol and high cholesterol, but after they were given the gel extract, their cholesterol returned to normal. Another study found that aloe vera extract could reduce blood sugar in diabetic rats by improving the way the body processes sugar. It has also been shown that the hypoglycemic effect may be due to its role as an antioxidant, protecting the brain of mice and the kidneys of mice from damage caused by high sugar levels.[22]

3. Anti-Viral

Around the world, viral diseases have caused by serious threats to the health of people. The viral infection has ability to cause economic and pandemic loss. Several natural compounds have anti-viral properties. The Aloe vera plant has anti-viral activity against a variety of viruses, including the coronavirus SARS-CoV-1, Herpes simplex virus type 1, Herpes simplex virus type 2, Influenza virus, Varicella-Zoster virus, Human immunodeficiency virus, poliovirus, Human papillomavirus, Cytomegalovirus. Aloe vera can be eaten in a variety of ways and is completely safe. The compounds in Aloe are they have been demonstrated to be effective against other viruses through processes such as virus enzyme interaction, viral envelope destruction etc. Minerals like Zinc, which have been demonstrated to have an effect on SARS-CoV-1, could be implicated in Aloe vera's anti-viral activity.[23]

Acemannan is used against HIV infection and also used with combination of azido thymidine (AZT) and acyclovir to inhibit the virus of AIDS from replicating.[24]

Derivatives of anthraquinone including aloin, chrysophanol and emodin in found Aloe vera gel exhibited high anti-viral activity against different viral infections such as poliovirus, herpes simplex virus type-2, and human cyto megalovirus. Anti-viral compounds aloin and Aloe-emodin exhibits particularly high anti-viral potential. DNA- and RNA-containing enveloped viruses are directly affected by Aloe emodin, which prevent adsorption and replication of viruses. Except adenovirus and rhinovirus, Aloe emodin inactivated all enclosed viruses. Aloe-emodin exhibited maximum medicinal ratio in case of HL-CZ cells too, operating through IFN (Interferon) signaling responses towards encephalitis virus and enterovirus (Japanese) and also have potent virus inhibitory capacity.[25]-[26]

4. Anti-Ulcer

GERD (gastroesophageal reflux disease) is a digestive system disease characterized by symptoms such as chest pain, heartburn, acid reflux, ulcer, etc. Gastric ulcers caused by several factors including food ingredients, smoking, stress, NSAIDs, Helicobacter pylori, and drugs as shown in Fig 3. Aloe vera constituents like polysaccharides, anthraquinones, and other useful components, can help to prevent peptic ulcers by regulating gastric secretion. In the ulcer groups, Aloe vera treatment resulted in decreased stomach inflammation, increased cellular growth, scratched gastric glands, and smaller ulcers.[27]-[21]

Ulcers are one of the most common oral diseases, and they can be very painful. It can also assist prevent dental diseases and oral mucosal illnesses, as well as protect oral habitats, in the cure of mouth diseases.[28]

Oral ulcer wound healing is a multi-step process that involves diverse cell types migrating, proliferating, differentiating, removing wounded tissue, and building extracellular matrices to protect the oral cavity.[29]

Aloe vera gel has the capacity to treat or avoid the formation of gastric ulcers in animals and humans. The anti-ulcer properties of Aloe vera have been linked to a variety of processes, including its anti inflammatory activity, healing benefits, mucus-stimulating action, stomach secretion regulation, and lectin synthesis. Antipyrine absorption by the parietal cells is blocked by lectins. Aloe vera gel have ability to decrease stomach acid production could be due to direct effect on acid-producing cells and also maintain.[30]

Juice of Aloe vera prevent and cure gastric ulcers through its anti-inflammatory, wound healing, mucus stimulation and regulation of gastric secretion actions.[31] And also, it can be successfully used for treatment of skin ulcers, mouth ulcers, cold sores and leg ulcers (including diabetic ulcers).[32]

5. Anti inflammatory

Aggravation is the body's common reaction to an harm, which is uncovered by torment, redness, swelling, and warm, that causes the method of mending to be moderate. In aphthous stomatitis patients, Aloe vera gel has been appeared to be useful in decreasing seriousness of torment and wound development.

Due to the anti-inflammatory properties of aloe vera, it is very useful in reducing joint pain. Its gel speeds up the healing process and also reduces pain. It also has anti-inflammatory properties that may be helpful in treating H. Pylori infection.[33]

Sterols are helpful inflammatory ingredients found in aloe vera gel. The use of Aloe polysaccharide has been shown to reduce cerebral ischemia and reperfusion injury as well as improve the phagocytic and proliferative

activities of the reticuloendothelial system. The anthraquinones and chromones present in aloe vera gel have inflammatory properties. Brady kinase and C-glucosylchromone are enzymes found in Aloe Vera that have anti-inflammatory activity. Because it contains the brady kinase enzyme found in aloe vera gel, which is helpful in breaking down bradykinin and reducing inflammation.[34]

Aloe vera gel has a stronger anti-inflammatory effect due to prostaglandin formation and leukocyte infiltration, but is less effective in fighting allergic inflammation. Sterols present in aloe vera are used as an analgesic, which also reduces pain and plays an important role in anti-inflammatory activity.[1]

Aloe vera inhibits cyclooxygenase activity and reduces prostaglandin E2 production from arachidonic acid. C-glucosylchoromone is obtained from aloe vera gel, which has anti-inflammatory effects.[35]

Inflammation is the body's response to injury and is characterized by swelling, pain, redness, heat, and loss of function.

This natural response can delay wound healing, but it can also be detrimental to inhibiting inflammation before its goal is achieved. The anti-inflammatory activity of mannose-6-phosphate is believed to be similar to that observed for acetylated mannan in aloe vera gel. Aloe vera gel reduces agent-induced inflammation by promoting prostaglandin synthesis as well as increasing leukocyte infiltration, but is less effective in counteracting agent-induced inflammation allergy.[13]

The effects of aqueous, chloroform, and ethanolic extracts of A. vera were studied on rat paw edema as well as neutrophil migration into the peritoneal cavity induced by carrageenan. Aqueous and chloroform extracts are thought to inhibit edema formation in a manner similar to well-documented anti-inflammatory agents (e. g, indomethacin and dexamethasone). Furthermore, the antiedema effects of these two extracts were strongly correlated with their ability to reduce the number of neutrophils migrating into the peritoneal cavity. Ethanol extract had no effect on reducing edema but reduced the number of migrating neutrophils. Further experiments on the mechanism of action revealed that the anti-inflammatory activity of A. vera likely occurs through its inhibitory effect on the arachidonic acid pathway via cyclooxygenase.[36]

A study in mice infected with Helicobacter pylori found that treatment with A. vera significantly reduced leukocyte adhesion and tumor necrosis factor-α (TNF-α) levels. Therefore, the results show that A. vera has the potential to treat the inflammatory response of the gastric mucosa caused by H. pylori infection.[37]

Aloe vera works better to reduce inflammation because it has Anthraquinones and Chromone in it. So it reduces the amount of pain and makes the wound smaller. Additionally, it helps to reduce pain in the joints.[38] Aloe vera helps to reduce swelling in the body by blocking a substance called bradykinin. It works best for reducing swelling caused by the body making too much prostaglandin or by white blood cells moving into the swollen area. It doesn't work as well for swelling caused by allergies.[39]

6. Immuno-Modulatory effect

Several research has proven that the polysaccharides in A can change how the immune system works. Research has found that aloe vera gel can boost the immune system in the body and make chemicals like nitric oxide and cytokines.[40][41][42]

Acetylmannan is different from other types of sugars because it may help reduce inflammation in the body. It also seems to make the immune system stronger in humans and helps mice produce different kinds of white blood cells. Some things in aloe vera gel called glycoproteins, particularly lectins, can affect the immune system.[13]

Researchers have looked at how A impacts the body's defense system. Vera, we discovered that using the entire aloe plant requires a large amount of acetylmannan to make the macrophages work more effectively. Vera juice also has other things that help start macrophages. More research shows that aloe vera can still stimulate macrophages even when it's processed, just like in its natural state. Vera juice is a healthy drink made from the Vera plant.[43]

Researchers discovered that aloe vera gel can boost the immune system to fight off drugs and diseases, especially after being exposed to UV light. The gel's polysaccharides help protect the immune system in a unique way, unlike antioxidants, anti-inflammatory agents, and DNA repair enzymes. Certain drugs can help decrease swelling in A. Vera is too sweet and does not help reduce redness and pain from sunburn or heal sunburned skin. Also, antioxidants need to be in the skin before it is exposed to UV rays for them to be effective. Aloe polysaccharides can still be used after being in the sun for 24 hours. After the DNA is fixed, the immune system changes how it signals when the DNA is damaged. Polysaccharides stop cells in the body from talking to each other.[44]

Aloe vera helps the immune system because it has important nutrients and substances that make white blood cells and T cells. The immune system works by making special white blood cells release chemicals and signals to help fight off infections.[45][46]

7. Wound healing

When the skin is hurt, the body fixes it quickly. The ongoing process has four stages:

1) Clotting and Stopping bleeding, 2) Swelling and White blood cells going into the wound, 3) Growth of new structure, and 4) creation of scar tissue.[47]

The healing process likely starts to speed up in the second stage of healing, called inflammation.[48] Having more neutrophils can help to clean the wound by removing germs and dead cells. But they also create substances that can hurt the body. At the same time, when the cut starts to get better, macrophages help the body respond to the injury by releasing certain chemicals and getting rid of dead cells like neutrophils.[49]

In 1996, a research found that the thick liquid helped mice heal their wounds.[50] Glucomannan and gibberellin help skin cells grow and make more collagen when used on the skin or taken by mouth.[51]

A burn is when the skin gets hurt from things like chemicals, heat, electricity, or an explosion. Aloe vera has things in it that keep infections away and help cuts and burns heal quickly. Aloe vera was first found to help heal cuts and burns about 4,100 years ago. In the 1930s, it was used to help heal burns and cuts, and also to treat sick animals.[52]

It makes cuts and scrapes heal faster by producing more collagen, keeping the wound wet, decreasing swelling, and helping cells reach the wound.[53]

Tanins and sugar can help to heal cuts and wounds, as well as help with healing soft tissues. Glucomannan is a type of sugar that has mannose and a growth hormone called gibberellin. It helps fibroblast growth factor receptors to grow and multiply. Aloe vera makes more collagen when you take it as a supplement or put it on your skin.[54]

"Aloe vera can help improve some things. " It also helps the body make more antibodies and fight infection by using hormones like gibberellin, auxin, and mannose phosphate. Mannose is a part of aloe vera that helps make macrophages stronger and helps wounds to heal. Macrophages help tissue to grow by making fibroblasts grow quickly. Aloe Vera Mannose 6-Phosphate helps to make collagen which can heal cuts and wounds. Collagen is needed to make strong fibers in a wound and it helps the wound heal by making proteins and enzymes. Aloe vera helps wounds get more oxygen, which helps blood flow and skin movement, making wounds heal faster. It makes the skin look better and reduces wrinkles.

Acemannan is a substance in Aloe vera that makes bones grow and become stronger by making them denser, bigger, and having more surface area.[55]

Some scientists believe that tannic acid and a certain type of sugar can help wounds heal.[56][57]

Some researchers discovered that glucomannan and gibberellin can help cells grow and produce more collagen. When you put aloe vera on your skin or swallow it, this is what happens.[58]

Aloe gel not only made the wound stronger by adding more collagen, but also improved how the collagen was put together. Aloe gel not only helped the wound get stronger by adding more collagen, but also made the collagen come together better. As a result, it helped wounds to heal more quickly and made the scars stronger.[51]

More of two substances called hyaluronic acid and dermatan sulfate are produced in a healing wound when medicine is applied on the skin or taken by mouth.[59]

Aloe vera has special building blocks that can help wounds get better.[60]

Additionally, minerals such as iron, potassium, magnesium, chromium, copper, sodium, calcium and zinc are necessary for helping wounds to heal. They assist the body in producing antibodies and aid in the healing of wounds by releasing substances that promote growth.[61]

8. Anti-Bacterial

Aloe vera gel has sugars that help fight against both types of bacteria. Natural substances in aloe vera, called saponins and anthraquinones, can help to get rid of bacteria.[17] Aloe Vera Gel can kill harmful bacteria like Shigella flexneri, Streptococcus pyogenes, and Streptococcus faecalis. It keeps Pseudomonas aeruginosa from sticking to lung cells and kills it.[19][62] Aloe vera latex has natural substances like flavonoids, alkaloids, terpenoids, and anthraquinones that are similar to antibiotics.[63]

Acetylmannan is a substance in aloe that can kill germs and stop a specific type of bacteria from sticking to human lung cells. Aloe vera can kill certain bacteria like Streptococcus pyogenes and Streptococcus faecalis.[64]

Cosmetics

They put Aloe gel in beauty products like cleansers, moisturizers, shampoos, suntan lotions, and sunburn screens. Aloesin can change the way skin color is made by competing with tyrosinase. This might make it useful for changing skin color for cosmetics or medical reasons.[65][66]

Food supplements

Aloe is a popular health supplement that is sold in health food stores. It is used to help with obesity, high cholesterol, and acne.[67]

The gel is used inside the body as a type of supplement for eating in the USA and Europe. The juice and outer layer of leaves of the A plant are being used. Vera and A. are writing a document together. Eating ferox is not allowed in Japan.[68]

A coating you can eat made from A. Aloe vera gel helps grapes last longer in the fridge and on the shelf. It also helps kill germs on the grapes.[69]

CONCLUSION

Aloe vera bulk as well as extracts are widely used in food, cosmetic, healthcare, skincare and medical industry as active ingredients for extra therapeutic, hygienical, rejuvenating, health enhance effectives. Although, Aloe vera has wide spectrum of the propertiess and uses. Food and Drug Administration of USA has already approved the developmental study of Aloe vera in the treatment of Cancer and AIDS. In future, controlled studies are requied to prove the effectiveness of Alove vera under the various conditions.

ACKNOWLEDGEMENT

It is my priviledge to express my sincere thanks to all those who gave me the opportunity to complete this article. I would like to thank my supervisor Mrs. Deepika Deopa as well with whose help, stimulating suggestions and encouragement helped me in all the time of fabrication process and in writing this report on the topic 'Aloe vera and Its Applications'. I am thankful to my parents who supported and motivated me in completing this article. I would also like to thank my friends for spending their time and supporting. I am overwhelmed by all humbleness and grateful to acknowledge my depth to all those who have helped me implement my ideas, with simplicity and into something concrete.

REFERENCES

1. Gopakumar Ramachandran Nair,1 Giridhar Seetharam Naidu,2 Supreet Jain,3 Ravleen Nagi, corresponding author4 Ramanpal Singh Makkad,5 and Abhishek Jha6.
2. Hamman J H Composition and Applications of Aloe vera Leaf Gel Molecules, 2008; 13: 1599.
3. Boudreau M D and Beland F A An evaluation of the biological and toxicological properties of Aloe barbadensis (miller), Aloe vera J. Environ Sci Health C, 2006; 24: 103–54.
4. https://trustherb.com/aloevera-gwarpatha-aloe-barbadensis/
5. Clinical Effectiveness of Aloe Vera in the Management of Oral Mucosal Diseases- A Systematic Review
6. https://www.chemicalbook.com/ChemicalProductProperty_EN_CB3484483.htm
7. Shelton RW. *Aloe vera*. Its chemical and therapeutic properties. *Int J Dermatol*, 1991; 30: 679–83. [PubMed] [Google Scholar]
8. Atherton P. *Aloe vera* revisited. *Br J Phytother,* 1998; 18: 76–83. [Google Scholar]
9. Atherton P. The Essential Aloe Vera: The Actions and the Evidence. *Mill Enterprises, 1997;* 2. [Google Scholar]
10. Samman S. Lipid metabolism. In: Kuchel PW, Ralston GB, editors. *Schaum's Outlines of Theory and Problems of Biochemistry.* New York: McGraw Hill Book Company, 1998; 362–401. [Google Scholar]
11. Ndhlala AR, Amoo SO, Stafford GI, Finnie JF, Van Staden J. Antimicrobial, anti-inflammatory and mutagenic investigation of the South African tree aloe (Aloe barberae) *J Ethnopharmacol*, 2009; 124: 404–8. [PubMed] [Google Scholar]
12. Athiban PP, Borthakur BJ, Ganesan S, Swathika B. Evaluation of antimicrobial efficacy of Aloe vera and its effectiveness in decontaminating guttapercha cones. *J Conserv Dent*, 2012; 15: 246–8. [PMC free article] [PubMed] [Google Scholar]
13. Reynolds, T. Aloe vera leaf gel: a review update. Journal of Ethnopharmacology, 2004; 90(2-3): 33-37.
14. Surjushe, A., Vasani, R., & Saple, D. G. Aloe vera: a short review. Indian Journal of Dermatology, 2008; 53(4): 163-166.
15. Foster, M., & Hunter, D. Samman S. Evaluation of the Nutritional and Metabolic Effects of Aloe vera. In Benzie IFF, Wachtel-Galor S, editors. Herbal Medicine: Biomolecular and Clinical Aspects. CRC Press/Taylor & Francis, 2011.
16. Vogler, B. K., & Ernst, E. Aloe vera: a systematic review of its clinical effectiveness. British Journal of General Practice, 1999; 49(447): 823-828.
17. Sarker, A. and T. E. Grift. Bioactive properties and potential applications of Aloe vera gel edible coating on fresh and minimally processed fruits and vegetables: a review. J. Food Measur. Charac, 2021; 15: 2119-2134.
18. Kantam, J.C., K. Rai and N. Nandan. Aloe Vera–Nature's Power. J. Ayurveda Integ. Medical Sci, 2016; 1: 43-49.
19. Riaz, S., S. Hussain, S.K. Syedand R. Anwar. Chemical Characteristics and Therapeutic Potentials of Aloe vera. RADS J. Biol. Res. Applied Sci, 2021; 12: 39-50.
20. Afrin, F., M. Hossain, M. Amin, M. Islam, R. Bjjosr. Soluble Dietary Fiber from Aloe Vera and Lady's Finger; Effect on Glucose Absorption in Type-2 Diabetic Model Rats, 2021; 13: 669- 78.
21. Sharma, N., Minocha, N. And Kushwaha, N., A review on the activities of Aloe vera and curry leaves. J. Food Measur. Charac, 2020; 13: 1119-1134.
22. Rajasekaran S, Ravi K, Sivagnanam K, Subramanian S. Beneficial effects of Aloe vera leaf gel extract on lipid profile status in rats with streptozotocin diabetes. Clin. Exp. Pharmacol. Physiol, 2006; 33: 232-237.
23. Mpiana, P.T., K. N. Ngbolua, D.S.T. Tshibangu, J.T. Kilembe, B.Z. Gbolo, D.T.Mwanangombo, C. L. Inkoto, E.M. Lengbiye, C.M. Mbadiko, A.

Matondoand G.N. Bongo. Aloe vera (L.) Burm. F. As a potential anti-COVID-19 plant: a mini-review of its antiviral activity. Eur. J. Med. Plants, 2020; 31: 86-93.
24. Kumar, S., D.S. Jakhar and R. Singh. Evaluating antimicrobial activity of Aloe vera plant extract in human life. Diabetes, 2017; 26: 1277-1294.
25. Lin, C.W., C.F. Wu, N.W. Hsiao, C.Y. Chang, S.W. Li, L. Wan, Y. J. Linand W.Y. Lin. Aloe-emodin is an interferon-inducing agent with antiviral activity against Japanese encephalitis virus and enterovirus 71. Int. J. Antimicro. Agents, 2008; 32: 355-359.
26. Gansukh, E., J.Gopal, D.Paul, M.Muthu, D.H.Kim, J.W. Oh and S.Chun. Ultrasound mediated accelerated Anti-influenza activity of Aloe vera. Scientific Reports, 2018; 8: 1-10.
27. Rahmani, A.H., Y. H. Aldebasi, S. Srikar, A.A. Khan S. M. and Aly. Aloe vera: Potential candidate in health management via modulation of biological activities. Pharmacog. Rev, 2015; 9: 120-134.
28. Nair, G. R., G.S. Naidu, S. Jain, R. Nagi, S. Makkad, and A. Jha. Clinical effectiveness of Aloe vera in the management of oral mucosal diseases- a systematic review. J. Clinical Diagnostic Res, 2016; 10: 01–07.
29. Davis, F.M., A. Kimball, A. dendekker, A.D. Joshi, A.E. Boniakowski, D. Nysz, R.M. Allen, A. Obi, K. Singer and P.K Henke. Histone Methylation Directs Myeloid TLR4 Expression and Regulates Wound Healing following Cutaneous Tissue Injury. J. Immunol, 2019; 202: 1777–1785.
30. Kumar, S., D.S. Jakhar and R. Singh. Evaluating antimicrobial activity of Aloe vera plant extract in human life. Diabetes, 2017; 26: 1277-1294.
31. Suvitayavat W, Sumrongkit C, Thirawarapan SS, Bunyapraphatsara N. Effects of Aloe preparation on the histamine-induced gastric secretion in rats. Journal of Ethnopharmacology, 2004; 90(1): 239-247.
32. Sims RM, Zimmermann ER. Effect of Aloe vera on Herpes Simplex and Herpes Virus. Aloe vera of American Archives, 1971; 1(1): 239-240.
33. Saleem, A., I. Naureen, M. Naeem, H. S. Murad, S. Maqsood and G. Tasleem. Aloe Vera Gel Effect on Skin and Pharmacological Properties. Int. J. Anat. Physiol, 2022; 5: 1-8.
34. Heng H.C, M. H. Zulfakar and N. Py. Pharmaceutical applications of Aloe vera. Indones. J Pharm, 2018; 29: 101-113.
35. Sharma, N., Minocha, N. And Kushwaha, N., A review on the activities of Aloe vera and curry leaves. J. Food Measur. Charac, 2020; 13: 1119-1134.
36. Vazquez, B.; Avila, G.; Segura, D.; Escalante, B. Antiinflammatory activity of extracts from Aloe vera gel. J. Ethnopharmacol, 1996; 55: 69-75.
37. Prabjone, R.; Thong-Ngam, D.; Wisedopas, N.; Chatsuwan, T.; Patumraj, S. Anti-inflammatory effects of Aloe vera on leukocyte-endothelium interaction in the gastric microcirculation of Helicobacter pylori-infected rats. Clin. Hemorheol. Microcirc, 2006; 35: 359-366.
38. Peng SY, Norman J, Curtin G, Corrier D, McDaniel HR, Busbee D. Decreased mortality of Norman murine sarcoma in mice treated with the immunomodulator, 1991; 3(2): 79-87.
39. Gunarathnage Upul Anuruddha Kumara, Wadimuna Mudiyanselage Dharmasenage Ruvinika Wirajani Wadimuna and WLA Rajini Saroja Pushpakumari Pharmaceutical, nutritional and cosmetic applications of Aloe vera plant, 2021; 33.
40. Zhang, L.; Tizard, I.R. Activation of a mouse macrophage cell line by acemannan: The major carbohydrate fraction from Aloe vera. Immunopharmacology, 1996; 35: 119-128.
41. Chow, J.T-N.; Williamson, D.A.; Yates, K.M.; Goux, W.J. Chemical characterisation of the immunomodulating polysaccharide of Aloe vera L. Carbohydr. Res, 2005; 340: 1131-1142.
42. Im, S-A.; Oh, S-T.; Song, S.; Kim, M-R.; Kim, D-S.; Woo, S-S.; Jo, T.H.; Park, Y.I; Lee, C-K. Identification of optimal molecular size of modified Aloe polysaccharides with maximum immunomodulatory activity. Int. Immunopharmacol, 2005; 5: 271-279.
43. Pugh, N.; Ross, S.A.; ElSohly, M.A.; Pasco, D.S. Characterisation of aloeride, a new highmolecular-weight polysaccharide from Aloe vera with potent immunostimulatory activity. J. Agric. Food Chem, 2001; 49: 1030-1034.
44. Strickland, F.M. Immune regulation by polysaccharides: implications for skin cancer. J. Photochem. Photobiol. B, 2001; 63: 132-140.
45. J. Tai-Nin Chow, D. A. Williamson, K. M. Yates, and W. J. Goux, "Chemical characterization of the immunomodulating polysaccharide of Aloe vera L," Carbohydrate Research, 2005; 340, 6: 1131–1142.
46. S. A. Im, S. T. Oh, S. Song et al., "Identification of optimal molecular size of modified Aloe polysaccharides with maximum immunomodulatory activity," International Immunopharmacology, 2005; 5: 271–279.
47. Velnar T, Bailey T, Smrkolj V. The wound healing process: an overview of the cellular and molecular mechanisms. Journal of International Medical Research, 2009; 37(5): 1528-42.
48. Guo Sa, DiPietro LA. Factors affecting wound healing. Journal of Dental Research, 2010; 89(3): 219-29.
49. Huay Chin Heng, Mohd Hanif Zulfakar*, Pei Yuen Ng Pharmaceutical Applications of Aloe vera, 2018; 6-7.
50. R. H. Davis, J. J. Donato, G. M. Hartman, and R. C. Haas, "Anti-inflammatory and wound healing activity of a growth substance in Aloe vera," Journal of the American Podiatric Medical Association, 1994; 84, 2: 77–81.
51. J. P. Heggers, A. Kucukcelebi, D. Listengarten et al., "Beneficial effect of Aloe on wound healing in an

excisional wound model," Journal of Alternative and Complementary Medicine, 1996; 2, 2: 271–277.
52. Hashemi, S.A., S.A. Madani and S. Abediankenari. The review on properties of Aloe vera in healing of cutaneous wounds. Biomed Res. Int, 2015; 1-6.
53. Komatsu, D., D.V. Mistura, A. Motta, J.A. Domingues, M. A. Hausen and E. Duek. Development of a membrane of poly (L-cod, L lactic acid-cotrimethylene carbonate) with Aloe vera: An alternative biomaterial designed to improve skin healing. J.Biomat. Appli, 2017; 32: 311-320.
54. Jamil M, M. Mansoor, N. Latif, R. Naz, F. Anwar, M. Arshad. Review effect of Aloe vera on Wound Healing, 2020; 63: 48-61.
55. Liu, C., Y. Cui, F. Pi, Y. Cheng, Y. Guo and H. Qian. Extraction, purification, structural characteristics, biological activities and pharmacological applications of acemannan, a polysaccharide from Aloe vera: A review. Molecules, 2019; 24: 1554-1558.
56. Freytag A. Suggested role of tarumatic acid in Aloe wound healing. Pharmiz, 1954; 9: 705 (PUBMED) (INFORMATION)
57. Kameyama S. Wound healing composition from Aloe arborescens extracts. Jap. Patent, 1979; 785-6995.
58. Chitra R Sajithal GB, Chandrakasan G. Influnece of alove vera on collagen characteristics in healimg dermal wounds in rats. Mol Cell Biochem, 1998; 181: 71-6.
59. Chitra P, Sajithal G, Chandrakasan G. Influence of alove on the glycosaminoglycans in the matrix of healing dermal wounds in rats. J Ethanopharmacol, 1998; 59: 179-186.
60. Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and Pharmacobiotechnology. 9th ed. Williams & Wilkins, the University of Michigan, Michigan, USA, 1996.
61. Bozzi A, Perrin C, Austin S, Vera AF. Quality and authenticity of commercial Aloe vera gel powders. Journal of Food Chemistry, 2007; 103(1): 22-30.
62. Ahmad, N., Jan, S.A., Sajjad, W., Faisal, S. And Gao, B.X., In vitro antimicrobial activity of Aloe vera L. Extracts against pathogenic bacteria and fungi. Mycopath, 2018; 23: 14-35.
63. Akinduti, P.Y.D. Obafemi, P.O.Isibor, R.Ishola, O.A.Ayodele, O.S.Oduleye, O. Oziegbe, andO.M. Onagbesan, Antibacterial kinetics and phylogenetic analysis of Aloe vera plants. Maced. J. Medical Sci, 2021; 9: 946- 954.
64. Kantam, J.C., K. Rai and N. Nandan. Aloe Vera–Nature's Power. J. Ayurveda Integ. Medical Sci, 2016; 1: 43-49.
65. Jones K, Hughes J, Hong M, Jia Q, Orndorff S: Modulation of melanogenesis by aloesin: A competitive inhibitor of tyrosinase. Pigment Cell Res, 2002; 15: 335–340
66. Yagi A, Takeo S: Anti-inflammatory constituents, aloesin and aloemannan in Aloe species and effects of tanshinon VI in Salvia miltiorrhiza on heart. Yakugaku Zasshi, 2003; 123: 517–532.
67. Wang ZW, Wang Y, Huang ZS: The radio-protective effect of Aloe polysaccharides on irradiated mice. Chin Trad Herb Drugs, 2002; 33: 251–254.
68. Shioda H, Satoh K, Nagai F, Okubo T, Seto T, Hamano T, Kamimura H, Kano I Identification of Aloe species by random amplified polymorphic DNA (RAPD) analysis. Shokuhin Eiseigaku Zasshi, 203; 44: 203–207.
69. Valverde JM, Valero D, Martinez-Romera D, Guillen F, Castillo S, Serrano M Novel edible coating based on Aloe vera gel to maintain table grape quality and safety. J Agric Food Chem, 2005; 53: 7807–7813.