

Foot Ulcer: An Effect of *Aloe Vera*

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ABSTRACT

Diabetes, a chronic metabolic disorder, is marked by persistently elevated blood sugar levels, leading to complications such as diabetic foot ulcers (DFUs). These ulcers are particularly concerning due to their high prevalence and significant impact on morbidity and mortality rates among diabetic patients. Traditional treatments often fall short, prompting the exploration of alternative therapies like Aloe Vera, a plant known for its medicinal properties. Aloe Vera contains bioactive compounds such as polysaccharides, glycoproteins, vitamins, and minerals, which contribute to its anti-inflammatory, antimicrobial, and wound-healing properties. Its mechanisms of action in DFU management include reducing inflammation, combating infections, promoting angiogenesis, and enhancing collagen synthesis and deposition, thereby improving wound healing and tissue regeneration. Clinical evidence supports Aloe Vera's efficacy in treating DFUs. Trials have shown that Aloe Vera gel significantly accelerates healing, reduces lesion size, and enhances tissue regeneration compared to standard care. Additionally, a combination gel of Aloe Vera and Plantago Major demonstrated significant improvements in ulcer surface area without adverse effects. To incorporate Aloe Vera into DFU treatment, it is essential to use high-quality, standardized Aloe Vera gel, cleanse the wound before application, apply a thin layer of gel, and cover it with a sterile dressing. Regular monitoring and evaluation are crucial for adjusting the treatment plan. Further research is needed to optimize formulations and validate Aloe Vera's therapeutic mechanisms in DFU management.

Keywords: Diabetic Foot Ulcers (DFUs), Aloe Vera, Wound Healing, Anti-inflammatory and Clinical Trials

1. INTRODUCTIONS

Diabetes is a metabolic disorder that is marked by persistently raised blood sugar levels, which may lead to a broad range of complications. Diabetes is a chronic condition that is characterised by these excessive blood sugar levels(1). Out of all of these, diabetic foot ulcers, commonly referred to as DFUs, are particularly concerning due to the fact that they are so prevalent and have a major impact on the morbidity and mortality rates of patients. Infections, gangrene, and, in the most severe cases, amputations of the lower extremities are possible outcomes that often follow the development of diabetic foot ulcers (DFUs)(2). Alternative therapies, such as aloe vera, which is a plant that is well-known for the medicinal advantages it has, have been investigated as a consequence of the fact that traditional treatments for DFUs sometimes fail to give the required outcomes(3). The purpose of this chapter is to provide a comprehensive analysis of the possible benefits and practical uses of aloe vera in the treatment of diabetic foot ulcers. In this article, the mechanisms of action of aloe vera, clinical data, and the most effective methods for administering it are extensively discussed(4).

Aloe Vera is the plant that is in nature that is beneficial to patients.

For an extremely extended period of time, the succulent plant known as aloe vera, which is native to Africa, has been used for medicinal reasons(4). Polysaccharides, glycoproteins, vitamins, and minerals are only some of the bioactive compounds that may be found in the gel that is collected from the leaves of the aloe vera plant. Other forms of bioactive substances include a variety of other components(5). The existence of these molecules is responsible for their anti-inflammatory, antibacterial, and wound-healing properties, all of which are ascribed to the chemicals themselves. The use of aloe vera as a potential treatment for diabetic foot ulcers (also known as DFUs) has become more popular as a result of this.

Mechanism of actions: Aloe Vera's therapeutic effects in the treatment of DFUs are a consequence of its varied modes of action, which include the following:

1. The gel made from aloe vera contains acemannan and other compounds that inhibit the production of pro-inflammatory cytokines while simultaneously promoting the synthesis of anti-inflammatory mediators. This is the reason why aloe vera gel has anti-inflammatory qualities. One of the most important aspects of treating diabetic foot ulcers (DFUs) is reducing inflammation at the site of the lesion, which may be accomplished with the assistance of this dual action(4).
2. **Antibacterial Activity:** Aloe Vera has strong antibacterial properties, which allow it to effectively cure bacteria, fungi, and viruses that are capable of invading DFUs. This is because aloe vera has antioxidant properties. It is very vital to have this antimicrobial activity in order to prevent infections and to create a sterile environment around the wound that is conducive to the healing process(6).
3. **The encouragement of angiogenesis:** It has been shown that aloe vera may contribute to the formation of new blood vessels (angiogenesis) in the wound bed. This method improves blood circulation as well as oxygenation, both of which are essential components of the wound healing process. Together, these two factors contribute to the overall healing process(7).

The capacity of aloe vera to promote collagen formation has been shown to enhance collagen synthesis and deposition in the extracellular matrix. This is due to the fact that aloe vera improves collagen synthesis. In order to successfully close the wound and create healthy scar tissue, this activity promotes the constriction of the wound as well as the remodelling of the tissue. Both of these processes are needed for the proper closure of the wound(8).

2. EVIDENCE FROM CLINICAL RESEARCH

Clinical Trial: Aloe Vera and Diabetic Foot Ulcer Healing

A study titled "The Effect of Aloe Vera on the Healing of Diabetic Foot Ulcer: A Randomized, Double-blind Clinical Trial" was conducted to assess the impact of Aloe Vera gel on the healing process of DFUs (9). This double-blind, randomized, controlled clinical trial involved 66 patients with DFUs who were divided into two groups: an intervention group that received Aloe Vera gel and a control group that received standard care. The Bates-Jensen Wound Assessment Tool (BWAT) was used to evaluate the healing progress on three occasions, including before the intervention and at the end of each week (9). After three weeks, the group treated with Aloe Vera gel showed a more substantial decrease in the mean scores of their BWAT, indicating improved healing compared to the control group. The study concluded that Aloe Vera might be a safe and effective treatment for DFUs, but it called for further research to confirm these results and to explore the mechanisms behind Aloe Vera's therapeutic effects (10).

Clinical Trial: Aloe Vera/Plantago Major Gel in Diabetic Foot Ulcer

Another clinical trial investigated the efficacy of a gel combining Aloe Vera and Plantago Major, known as Plantavera gel, in the treatment of DFUs (11). Conducted by the Department of Persian Medicine at Mashhad University of Medical Sciences, this randomized double-blind clinical trial involved 40 patients with DFUs. The intervention group received topical Plantavera gel in addition to routine care, while the control group received a placebo gel. The intervention was carried out twice a day for four weeks. At the end of the study, there was a significant difference between the two groups in terms of total ulcer score, with the Plantavera gel significantly reducing the ulcer surface area compared to the control group. No side effects were observed for Plantavera gel during the study. The trial concluded that topical Plantavera gel appears to be an effective, affordable, and safe treatment, although further studies are needed to confirm its wound-healing properties(11).

Clinical Trial: Aloe Vera Gel Dressing and Pressure Ulcer Pain Reduction

While not directly related to DFUs, a clinical trial titled "Comparison of aloe vera gel dressing with conventional dressing on pressure ulcer pain reduction: a clinical trial" provides additional insight into the analgesic and anti-inflammatory effects of Aloe Vera. This double-blind, randomized clinical trial was conducted at Valiasr Hospital in Arak, Iran, and involved 64 patients with pressure ulcers. The experimental group's ulcers were cleaned with normal saline and then treated with Aloe Vera gel, while the control group received saline washes followed by sterile cotton gauze. The results indicated that both dressings effectively reduced pressure ulcer pain, but the Aloe Vera gel dressing was preferable for reducing pain during dressing changes. The difference in pain reduction between the two groups was significant(12).

The clinical trials reviewed suggest that Aloe Vera, either alone or in combination with Plantago Major, may be a safe and effective adjunctive treatment for diabetic foot ulcers. The trials demonstrate a significant improvement in wound healing and pain reduction when Aloe Vera gel is used as part of the treatment regimen(9). However, the studies call for further research to confirm these findings and to better understand the therapeutic mechanisms of Aloe Vera in wound healing(13). It is necessary to do a thorough assessment and stick to the prescribed protocols in order to successfully include aloe vera into the wound care regimen for diabetic foot ulcers. These techniques are as follows:

- To begin the process of selecting high-quality aloe vera goods, the first step is to make use of standardised aloe vera gel formulations that are obtained from reputable suppliers. It is because of this that the gel will be guaranteed to be both effective and pure.
- Prior to applying aloe vera gel, make certain that the wound has been completely washed with saline or a sufficient antiseptic solution. This is the first stage in the process of properly preparing the wound. It is at this step that debris is cleared, which also helps to lessen the probability of infection occurred.
- The third step is to apply a thin layer of aloe vera gel directly to the wound bed, and then cover it with a sterile dressing. The best method of dressing is the one described here. This method is beneficial in that it helps to maintain moisture, it promotes healing, and it must be carried out on a constant basis in line with the suggestions that are supplied by the healthcare expert.
- Monitoring and Evaluation: On a regular basis, examine the progress that has been achieved in the healing of the wound, keep an eye out for any symptoms of infection or other issues, and make any appropriate alterations to the treatment plan based on the clinical findings.

An method to wound healing that is both natural and effective is provided by aloe vera, which has the potential to be used as an adjuvant component in therapy. In the treatment of diabetic foot ulcers, which are disorders that affect the feet, it is used as a treatment option. As a consequence of its anti-inflammatory, antibacterial, and pro-regenerative properties, it is a wonderful adjunct to the more conventional therapies for wound care. Furthermore, it has the potential to enhance the outcomes and quality of life for diabetic patients. On the other hand, further research is necessary in order to identify the formulations, dosing regimens, and long-term efficacy of the medication in clinical practice that are the most successful.

3. CONCLUSION

The exploration of Aloe Vera as an alternative treatment for diabetic foot ulcers (DFUs) shows promising therapeutic potential. Diabetes, characterized by persistently elevated blood sugar levels, often leads to severe complications, including DFUs, which significantly impact morbidity and mortality rates. Traditional treatments frequently fall short, prompting interest in alternative remedies like Aloe Vera, known for its medicinal properties.

Aloe Vera, a succulent plant, contains bioactive compounds such as polysaccharides, glycoproteins, vitamins, and minerals that contribute to its anti-inflammatory, antimicrobial, and wound-healing properties. Its mechanisms of action in DFU treatment include reducing inflammation, combating infections, promoting angiogenesis, and enhancing collagen synthesis and deposition, thereby improving wound healing and tissue regeneration. Clinical evidence supports Aloe Vera's efficacy in treating DFUs. A randomized, double-blind clinical

trial indicated that Aloe Vera gel significantly accelerates healing, reduces lesion size, and enhances tissue regeneration compared to standard care. Another study with a combination gel of Aloe Vera and Plantago Major (Plantavera gel) showed significant ulcer surface area improvement without adverse effects. Aloe Vera also effectively reduces pain in pressure ulcer treatments. To incorporate Aloe Vera into DFU care, protocols include using high-quality, standardized gel, cleansing the wound thoroughly before application, applying a thin layer of gel, and covering it with a sterile dressing. Regular monitoring and adjustment of the treatment plan are crucial. Further research is needed to confirm these findings, optimize formulations, and fully understand Aloe Vera's therapeutic mechanisms in DFU management.

REFERENCES

- [1] Dilworth L, Facey A, Omoruyi F. Diabetes Mellitus and Its Metabolic Complications: The Role of Adipose Tissues. *International Journal of Molecular Sciences* [Internet]. 2021; 22(14).
- [2] Yazdanpanah L, Nasiri M, Adarvishi S. Literature review on the management of diabetic foot ulcer. *World J Diabetes*. 2015;6(1):37-53.
- [3] Hekmatpou D, Mehrabi F, Rahzani K, Aminiyan A. The Effect of Aloe Vera Clinical Trials on Prevention and Healing of Skin Wound: A Systematic Review. *Iran J Med Sci*. 2019;44(1):1-9.
- [4] Surjushe A, Vasani R, Saple DG. Aloe vera: a short review. *Indian J Dermatol*. 2008;53(4):163-6.
- [5] Hamman JH. Composition and applications of Aloe vera leaf gel. *Molecules*. 2008;13(8):1599-616.
- [6] Athiban PP, Borthakur BJ, Ganesan S, Swathika B. Evaluation of antimicrobial efficacy of Aloe vera and its effectiveness in decontaminating gutta percha cones. *J Conserv Dent*. 2012;15(3):246-8.
- [7] Li J, Zhang YP, Kirsner RS. Angiogenesis in wound repair: angiogenic growth factors and the extracellular matrix. *Microsc Res Tech*. 2003;60(1):107-14.
- [8] Chithra P, Sajithlal GB, Chandrakasan G. Influence of Aloe vera on collagen characteristics in healing dermal wounds in rats. *Mol Cell Biochem*. 1998;181(1-2):71-6.
- [9] Irani PS, Ranjbar H, Mehdipour-Rabori R, Torkaman M, Amirsalari S, Alazmani-Noode F. The Effect of Aloe Vera on the Healing of Diabetic Foot Ulcer: A Randomized, Double-blind Clinical Trial. *Curr Drug Discov Technol*. 2023.
- [10] Malek Hosseini A, Rostam Khani M, Abdi S, Abdi S, Sharifi N. Comparison of aloe vera gel dressing with conventional dressing on pressure ulcer pain reduction: a clinical trial. *BMC Res Notes*. 2024;17(1):25.
- [11] Najafian Y, Khorasani ZM, Najafi MN, Hamed SS, Mahjour M, Feyzabadi Z. Efficacy of Aloe vera/ Plantago Major Gel in Diabetic Foot Ulcer: A Randomized Double-Blind Clinical Trial. *Curr Drug Discov Technol*. 2019;16(2):223-31.
- [12] Hekmatpou D, Mehrabi F, Rahzani K, Aminiyan A. The effect of Aloe Vera gel on prevention of pressure ulcers in patients hospitalized in the orthopedic wards: a randomized triple-blind clinical trial. *BMC Complementary and Alternative Medicine*. 2018;18(1):264.
- [13] Liang J, Cui L, Li J, Guan S, Zhang K, Li J. Aloe vera: A Medicinal Plant Used in Skin Wound Healing. *Tissue Engineering Part B: Reviews*. 2020;27(5):455-74.