

A Systematic Review of the Clinical Effectiveness of *Aloe vera* for the Prevention and Treatment of Chronic Wounds

(Suatu Ulasan Sistematik Keberkesanan Klinikal *Aloe vera* untuk Pencegahan dan Rawatan Luka Kronik)

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ABSTRACT

Aloe vera is an herbaceous and perennial plant that belongs to the Liliaceae family and used for many medicinal purposes. *Aloe vera* have been associated with the treatment of skin burns and postoperative wound healing but not many clinical studies have been conducted to evaluate its effectiveness against chronic wounds such as pressure injury. The present study aimed to systematically review clinical trials investigating the effect of *Aloe vera* on the prevention and healing of chronic wounds. To identify all related published studies, Science Direct, Google Scholar, PubMed, and Ovid MEDLINE databases were searched in English language from the year 2015-2022. All clinical trials using *Aloe vera* gel, cream, or derivatives that included a control group with placebo or comparison with other treatments were included in the study according to the PRISMA selection process. In total, 11 trials that met the inclusion criteria were reviewed. The results of the studies showed successful use of *Aloe vera* in the prevention and treatment of chronic wounds including pressure injuries, chronic wound ulcers, diabetic foot ulcers, chronic anal fissures, and traumatic oral ulceration due to orthodontic appliances. Based on its safety and efficacy profile, this review concluded that *Aloe vera* has potential benefits to be used as a complementary or alternative treatment in chronic wounds along with conventional methods. Its ability to retain skin moisture and preservation of skin integrity supports its use in the prevention of ulcers.

Keywords: *Aloe vera*; chronic wound; clinical trial; wound prevention; wound treatment

ABSTRAK

Aloe vera adalah tumbuhan herba dan saka yang tergolong dalam keluarga Liliaceae dan banyak digunakan untuk tujuan perubatan. *Aloe vera* telah dikaitkan dengan rawatan kulit melecur dan penyembuhan luka selepas pembedahan tetapi tidak banyak kajian klinikal yang dijalankan untuk menilai keberkesanannya terhadap luka kronik seperti kecederaan tekanan. Kajian ini bertujuan untuk menilai secara sistematik ujian klinikal yang mengkaji kesan *Aloe vera* terhadap pencegahan dan penyembuhan luka kronik. Untuk mengenal pasti semua kajian berkaitan yang telah diterbitkan, artikel dalam bahasa Inggeris dari tahun 2015-2022 telah dicari di pangkalan data Science Direct, Google Scholar, PubMed dan Ovid MEDLINE. Semua ujian klinikal menggunakan gel *Aloe vera*, krim atau derivatif yang turut melibatkan kumpulan kawalan dengan plasebo atau perbandingan dengan rawatan lain dimasukkan ke dalam kajian mengikut proses pemilihan PRISMA. Eja ujian yang memenuhi kriteria kemasukan telah disemak. Hasil kajian menunjukkan keberkesanan penggunaan *Aloe vera* dalam pencegahan dan rawatan luka kronik termasuk kecederaan tekanan, ulser luka kronik, ulser kaki diabetik, fisur dubur kronik dan ulser mulut traumatik akibat peralatan ortodontik. Kajian ini menyimpulkan bahawa *Aloe vera* mempunyai potensi untuk digunakan sebagai pelengkap atau rawatan alternatif dalam luka kronik bersama-sama dengan kaedah konvensional. Keupayaannya untuk mengekalkan kelembapan kulit dan pemeliharaan integriti kulit menyokong penggunaannya dalam pencegahan ulser.

Kata kunci: *Aloe vera*; luka kronik; pencegahan luka; rawatan luka; ujian klinikal

INTRODUCTION

A wound is a condition that damages the skin and reduces its physical barrier to external substances. As a result, wound healing will occur, which is a normal repair process that restores the skin's physical structure and function. Yet, several variables, including age, nutrition, illness status, and wound type, can influence the healing process (Muangman et al. 2016). Typically, wounds caused by cuts or injuries heal due to a timely sequence of events. Chronic wounds, on the other hand, are those in which the repair process has diverged from the normal physiologic path, hence prolonging the healing process (Dat et al. 2012; Han & Ceilley 2017). Classifying wounds depends on their quality and healing duration. Chronic wounds are a form of wounds that heal slowly and last longer than twelve weeks. Typically, these wounds are the result of underlying disorders, such as malignancies and chronic infections, or physiological abnormalities (Hashemi, Madani & Abediankenari 2015).

Wound healing is a complex and highly controlled process to preserve the barrier function of the skin. Various mechanisms are engaged at the site of a skin cut or injury to remove foreign material and restore the normal structure of the skin, but only about 70% of the original structure may be restored (Han & Ceilley 2017). In most cases, the phases of inflammation, proliferation, and remodelling all occur together throughout the wound healing process. The primary objective of the inflammatory phase of wound healing is to remove germs and foreign matter from the wound and prevent the damage from spreading to other areas. Several days after the initial injury, the proliferative phase will begin to gather fibroblasts and boost the production of collagen and other substances that will serve as the basis of the replacement tissue in the injured area. During this time, endothelial cells enter a rapid development phase and angiogenesis begins within the granulation tissue, forming a network of blood vessels that will supply the active area of healing with essential nutrients. The ultimate step, dubbed the remodelling or maturation phase, occurs after two to three weeks, when the collagen is replaced and the wound tissue grows, resulting in cross-linking and restoration of the skin's normal structure (Han & Ceilley 2017; Shao et al. 2017).

Chronic wounds, such as diabetic foot ulcers, pressure injuries, and arterial or venous ulcers, impose a substantial expense on the healthcare system in addition to hurting patients' quality of life. In recent decades, nanotechnology and polymeric delivery have been used to enhance therapeutic outcomes and patient adherence

while minimising unwanted effects (Shao et al. 2017). Despite breakthroughs in research and development, chronic wounds still take a long time to heal using conventional techniques. Hence, a more recent technique that is cost-effective and could expedite wound healing is required. In recent years, scientists have endeavoured to develop novel dressings that integrate natural substances and have investigated their impact on wound healing. One of these is the Aloe vera plant (Athavale et al. 2017).

The perennial succulent *Aloe barbadensis* Miller (*A. vera*) is a member of the Liliaceae family. It is categorised as a xerophyte, which stores water in its leaves to thrive in arid environments. The deepest portion of the leaf is a transparent, moist tissue composed of big, thin-walled parenchyma cells that store water as viscous mucilage. Cell wall carbohydrates, such as cellulose and hemicellulose, and storage carbohydrates, such as acetylated mannans, are typically present in Aloe plant leaves (Hamman 2008). The leaves of the Aloe plant are tall, triangular, succulent, and spiked along the edges. Fresh parenchymal gel from the leaf's centre is transparent and commonly used to produce a variety of food, cosmetic, and pharmaceutical goods (Dat et al. 2012). Aloe vera has been used for its medicinal and therapeutic capabilities for ages. Aloe vera has numerous phytoconstituents that contribute to its pharmacological actions, which include anti-diabetic, immunomodulatory, anti-inflammatory, antioxidant, antibacterial, and wound-healing properties (Hamman 2008; Hashemi, Madani & Abediankenari 2015). Although approximately 75 active components of the inner gel have been identified, the therapeutic effects of each individual component have not been adequately connected. Aloe vera is believed to get its therapeutic properties from the leaf pulp from which gel or mucilage can be extracted. The gel is rich in nutrient components, including water- and fat-soluble vitamins, amino acids, proteins, minerals, polysaccharides, and organic acids (Hamman 2008).

Mannose-6-phosphate, an Aloe vera component, is theorised to stimulate fibroblast growth when it interacts to fibroblast receptors. This facilitates collagen deposition and tissue remodelling (Hashemi, Madani & Abediankenari 2015). Acemannan, an additional polysaccharide, exerts immunomodulatory effects via stimulation of phagocytosis and anti-inflammatory actions. Its immunomodulatory action may hasten the wound-healing process and boost fibroblast migration, resulting in greater collagen synthesis and reduced scar formation (Shao et al. 2017). In addition to its wound-

healing properties, Aloe vera is also useful for fighting infection. This effect is believed to be caused by an organic substance known as anthraquinones (Dat et al. 2012). Owing to its medicinal potentials, various research has been undertaken to evaluate the clinical efficacy of Aloe vera in treating burns, ulcers, and surgical wounds, among others (Dat et al. 2012; Hashemi, Madani & Abediankenari 2015; Maenthaisong et al. 2007). Although many studies have described the beneficial effects of Aloe vera in wound healing applications such as burn wounds and surgical wounds (Burusapat et al. 2018; Eshghi et al. 2010; Muangman et al. 2016; Shahzad & Ahmed 2013; Singh, Gupta & Gupta 2018), only a small number of studies have examined the effects of Aloe vera on chronic wounds. In light of the multiple recent clinical trials on the use of Aloe vera on chronic wounds, the purpose of this study was to assess and summarise the research undertaken on this topic.

METHODS

SEARCH STRATEGY

Electronic databases such as Ovid MEDLINE, ScienceDirect, PubMed and Google Scholar were used to search for relevant studies regarding the use of Aloe vera in chronic wounds. To ensure only current studies were used, the search was restricted to publications from 2015 to 2022. For the search strategy, the following keywords were used; 'Aloe vera' AND 'chronic wound healing' AND 'chronic wound' OR 'pressure ulcer' OR 'diabetic foot ulcer' AND 'clinical trial'. The title and abstract of all articles were screened individually and duplicate articles were excluded. The references of all retrieved and relevant articles were also reviewed to ensure more thorough findings. The search was restricted to published clinical trials in English language. The keywords and the generated result from each database are shown in Table 1.

DATA EXTRACTION

Data including study characteristics (author's name, date of publication, and study design), patient's characteristics (sample size, age and sex of participants and type of wound), type of interventions (details of treatment given in study group and control group and duration of treatment) and main outcomes such as time to complete wound healing, number of participants which heal completely, change in wound's size, depth and appearance and treatment cost if available. The exclusion and inclusion criteria are given in Table 2.

RESULTS

A total of 550 articles were identified, of which 198 were review articles, 9 were encyclopaedias, 176 were book chapters, 8 were conference abstracts, 2 were case reports, 2 were editorials, 3 were mini-reviews, 4 were practical guidelines, 3 were short communications, and 48 were duplicates that were removed based on the exclusion criteria. After the first screening, 97 research articles remained and were further screened for their relevance to human clinical trials and chronic wound healing. Articles that were non-clinical trials and did not use human subjects were removed, leaving 11 articles for evaluation. These studies were screened for their eligibility according to the PRISMA selection process (illustrated in Figure 1).

Aloe vera has been found to be effective in the treatment of chronic wounds, such as pressure injuries, diabetic ulcers, and chronic anal fissure wounds, using various topical formulations. Panahi et al. (2015) studied the effectiveness of an Aloe vera cream combined with olive oil compared to phenytoin cream. Avijgan, Kamran and Abedini (2016) analysed the effectiveness of Aloe Vera gel in the treatment of chronic wounds and compared it to conventional treatment. The study by Athavale et al. (2017) compared Aloe vera gel dressing with normal saline and povidone iodine dressing. Zany et al. (2017) compared topical Aloe vera with silver sulfadiazine cream, while Hekmatpou et al. (2018) compared pure Aloe Vera gel in the intervention group with a placebo of water and starch gel in the control group. Aqsa et al. (2019) compared Aloe vera dressing with normal saline dressing. Najafian et al. (2019) evaluated the efficacy of Aloe vera/Plantago major gel (Plantavera gel) in the healing of diabetic foot ulcers. Kanlioz et al. (2020) studied the efficacy of 2% Aloe vera cream on chronic anal fissures. Baghdadi et al. (2020) conducted a comparative study between Aloe vera gel and Calendula officinalis ointment to study their effectiveness in preventing pressure injuries. Pinheiro et al. (2020) analysed the use of Aloe vera-based dressings for the healing of pressure injuries in hospitalized patients, and Leiva-Cala et al. (2020) studied the efficacy of Aloe vera gel compared to 0.12% chlorhexidine gel in treating oral pressure ulceration due to fixed orthodontic appliances. Table 3 provides a brief overview of the number of participants, type of clinical study, and other details.

Pressure wounds, also known as chronic ulcers associated with pressure wounds, are injuries to the skin and underlying tissues caused by prolonged pressure on

the wound area. A clinical trial involving 50 patients with chronic wounds less than 10 cm² in size was conducted to assess the efficacy of Aloe vera (Athavale et al. 2017). The effectiveness of interventions and controls was measured using the percentage reduction in wound healing, the change in ulcer surface area, and the rate of wound healing. The ulcer size was measured once a week until the wound healed completely, which could take up to four weeks. The rate of healing was calculated as the difference in wound size between the start of treatment and the end of treatment and is reported in cm²/week. At the end of the 4th week, the mean rate of healing was calculated as 1.57 cm² in the intervention group and 0.9 cm² in control group. The percentage reduction in ulcer surface area was also higher in the test group than in the control group. Another three-week study was conducted at Al-Zahra Hospital, Isfahan, Iran to evaluate the effectiveness of Aloe vera against chronic ulcers for the treatment of chronic ulcers, aloe vera gel was used in addition to conventional treatment. The participants were divided into two groups of 30 each. In one group, conventional treatment was combined with Aloe Vera gel, while in the other, only conventional treatment was used. Aloe vera gel was used twice a day in the Aloe vera group. Patients were followed up with a week after treatment and then monthly for three months. The combination treatment was significantly less expensive ($p < 0.05$) than conventional treatment (Avijgan, Kamran & Abedini 2016), and the hospitalisation time was also shorter. Two additional clinical studies discovered in the literature included participants with various types of chronic ulcers (Panahi et al. 2015) and second-degree pressure ulcers (Zanaty et al. 2017). Both studies assessed treatment efficacy using the Bates-Jensen assessment tool, which includes criteria such as wound size, depth, skin colour, amount of exudates, presence of granulation tissues, and epithelial tissues. Panahi et al. (2015) used a visual analogue scale to assess the severity of pain (VAS). Both studies found a statistically significant difference in wound healing between the intervention and control groups ($p < 0.01$).

For patients hospitalised to intensive care units, a comparative evaluation using Aloe vera gel, *Calendula officinalis* ointment, and simple sacral prophylactic dressing was conducted. Participants were placed into three groups, with each receiving twice-daily therapy. Three patients (10%) who received the basic dressing and two patients (6.6%) who received the dressing with *Calendula officinalis* ointment were injured. Although there was no incidence of pressure damage in individuals who received Aloe vera gel dressing, it was substantially

more effective than plain dressing ($p < 0.05$). There were no statistically significant differences between the Aloe vera gel and *Calendula officinalis* groups, nor between the *Calendula officinalis* group and the control group (Baghdadi et al. 2020). In a public hospital in the southern state of Tocantins, Brazil, a study including 10 volunteers assessed the efficacy of Aloe vera against pressure injuries described in the literature. The study advocated for the use of Aloe gel in hospitalised patients to prevent pressure injuries (Pinheiro & Ribeiro 2020). Another study was undertaken to investigate the clinical efficacy of Aloe vera for pressure ulcer prevention (Hekmatpou et al. 2018). Patients' sacral, hip, and heel pressure ulcer indicators were identified using the Braden risk assessment scale, which includes temperature changes, redness, oedema, or stiffness, pain, and tenderness in the affected areas. The study discovered a statistically significant difference in the incidence of pressure ulcers between the intervention and control groups, with 1 patient suffering from hip sore and 2 patients suffering from sacral pressure ulcer in the intervention group and 3 patients suffering from hip sore, 8 patients suffering from sacral pressure ulcer, and 1 patient suffering from heel pressure sore in the control group.

The diabetic foot ulcer is one of the most prevalent complications of diabetes patients and is linked with pressure wounds that can lead to infection, gangrene, and finally death. A combination of Aloe vera and Plantago major gel was evaluated in another randomised, double-blind clinical research for the treatment of diabetic foot ulcer (Najafian et al. 2019). The intervention group ($n = 20$) received topical Aloe vera/plantago major gel combination in addition to usual cares, while the control group ($n = 20$) received topical placebo gel in addition to routine cares. Both groups received intervention twice daily for four weeks. Compared to the control group, the combination of Aloe vera and plantago major gel considerably ($p < 0.001$) reduced the surface area of diabetic foot ulcers. However, no significant differences in ulcer depth were identified between the two groups (Najafian et al. 2019). In Rawalpindi Medical Hospital, Pakistan, 60 patients with diabetic foot ulcers participated in additional clinical research (Aqsa et al. 2019). The wound was evaluated during the initial and eighth-day visits. The patients' diabetes duration, ulcer severity, body mass index, and therapy efficacy were evaluated. Aloe vera was substantially more successful than usual saline dressing, as 100% of patients in the intervention group had better wounds with granulation

tissue formation (p -value = 0.000) compared to just 53.3% of patients in the control group.

Two other noteworthy clinical studies were undertaken to evaluate the efficacy of Aloe vera against chronic anal fissure (Kanlioz et al. 2020) and mouth ulcers due to orthodontic appliances (Leiva-Cala et al. 2020). Persistent anal fissure is a prevalent condition for which alternate treatment options exist. Among these solutions is the topical application of Aloe vera cream 2%. To determine the efficacy of Aloe vera lotion, four criteria were evaluated: the length of time spent on the toilet after each faeces, the number of defecations per week, the amount of bleeding during defecation, and the pain during defecation as measured by a visual

analogue scale. Aloe vera cream's efficacy was evaluated over a period of four weeks, and the results indicated a substantial change in all four parameters ($p < 0.001$) (Kanlioz et al. 2020). Evaluation of the clinical efficacy of 80% Aloe vera gel versus 0.12% Chlorhexidine gel for the prevention of mouth ulcers caused by fixed orthodontic appliances. A total of 140 participants were randomised and finished the study. Following the cementation operation, treatments were randomly assigned, and a clinical assessment was then undertaken. In terms of relative risk (RRs) and confidence intervals (CIs), aloe vera outperformed CHX with an RR of 0.07 (95%CI 0.03-0.16; $p < 0.001$) (Leiva-Cala et al. 2020).

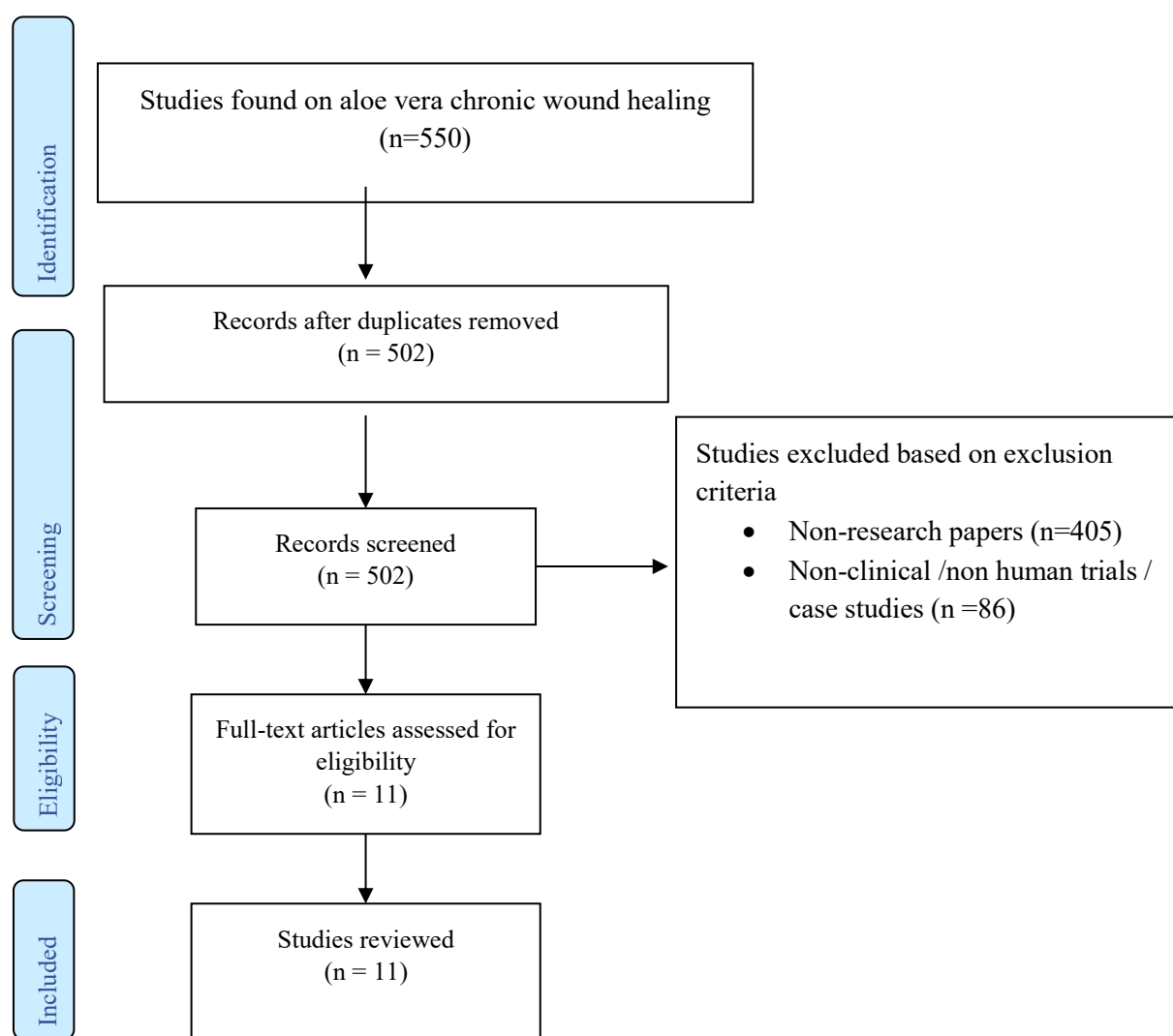


FIGURE 1. PRISMA flowchart of the study selection process

TABLE 1. The keywords and the number results generated by each database

Key words	Science direct	Google Scholar	PubMed	Ovid Medline
Aloe vera wound healing	924	9770	147	4343
Aloe vera and Chronic wound healing	623	366	20	2221
Aloe vera and pressure ulcer	377	291	6	645
Aloe vera and diabetic foot ulcer	137	400	4	435
Aloe vera and Clinical Trial	889	4940	49	4453

TABLE 2. Inclusion and exclusion criteria of the study

Inclusion/Exclusion	Category	Criteria
	Year of publication	2015-2022
Inclusion	Publication type	Full-text articles published in peer-reviewed scientific journals involving human clinical trials
	Language of publication	English
	Region of research	Global
	Methodology	Review of published original research articles in indexed journals
	Topic of research	Aloe vera – based wound dressing on treatment of chronic wound
Exclusion	Publication type	Online articles which are not present in indexed journals, research articles that involved <i>in vitro</i> or <i>in vivo</i> animal studies, review articles, letter to editors, perspectives, commentaries, and news reports
	Publication language	Articles published in languages other than English
	Topic of research	Research articles not focusing on aloe vera influence on chronic wounds

TABLE 3. Clinical studies identified for the review, number of participants, type of clinical study, and the outcome are described

Author	Wound type	Number of participants	Type of clinical study	Outcome
Panahi et al. (2015)	Chronic wound	60	Randomized controlled double-blind trial	Aloe vera/olive oil combination cream significantly accelerates biological healing of chronic wounds
Avijgan, Kamran & Abedini (2016)	Chronic wound	60	Randomized controlled trial	Aloe Vera gel is a beneficial treatment and cost-effective for patients with chronic ulcers.
Athavale et al. (2017)	Chronic wound	50	Randomized clinical trial	The study concluded that Aloe vera gel is highly effective in the treatment of chronic ulcers and stimulates the growth of wound healing.
Zanaty et al. (2017)	Pressure ulcer	60	Quasi-experimental research design	Aloe vera cream is cost-effective in management of pressure ulcers as it stimulates and accelerates the healing process
Hekmatpou et al. (2018)	Pressure ulcer	80	Randomized triple-blind clinical trial	Aloe Vera gel to prevent a rise in temperature, non-blanchable redness, swelling, and pain of the skin of regions under study in hospitalized patients in the orthopaedic ward
Aqsa et al. (2019)	Diabetic foot ulcer	60	Randomized controlled trial	The efficacy of Aloe vera is higher as compared to that of normal saline dressing for treating diabetic foot ulcers
Najafian et al. (2019)	Diabetic foot ulcer	40	Randomized double-blind clinical trial	Aloe vera/ Plantago major gel was cost-effective against diabetic foot ulcer
Kanlioz et al. (2020)	Chronic anal fissure	83	Randomized controlled trial	Significant effectiveness against chronic anal fissures
Baghdadi et al. (2020)	Pressure injury	90	Randomized controlled trial	No significant difference between the Aloe vera gel and Calendula officinalis ointment groups as well as the Calendula officinalis ointment group and the simple dressing
Pinheiro & Ribeiro (2020)	Pressure injury	10	Single-blind clinical study	It should be noted that the gel the base Aloe vera has anti-inflammatory properties promoting faster healing
Leiva-Cala et al. (2020)	Traumatic oral ulcer	140	Double-blind, randomized controlled trial	Aloe Vera gel administration in patients with fixed orthodontic appliances could be important for the effective prevention of oral pressure ulcer

DISCUSSION

The present review generally found positive effects of topical Aloe vera in the treatment and prevention of chronic wounds. Despite this, the cost-effectiveness of Aloe vera dressings, quality of life measures, and incidence of adverse events were not well reported in most trials. However, the results of recent clinical trials on aloe vera's use in human chronic wounds indicate its efficacy in promoting wound healing, particularly in the case of pressure injuries and diabetic foot ulcers. Additionally, aloe vera has been shown to be more effective in chronic wounds compared to acute wounds (Dat et al. 2012).

Aloe vera has a long history of use in treating burn wounds and has been found to be effective in treating various other types of wounds, including surgical wounds, skin grafting, and oral submucosis (Maenthaisong et al. 2007; Muangman et al. 2016; Shahzad & Ahmed 2013). In several studies, Aloe vera has been found to be more effective than conventional treatments, such as 1% silver sulfadiazine (SSD) cream for partial thickness burns (Shahzad & Ahmed 2013) and 0.1% triamcinolone acetonide for plaque psoriasis (Choonhakarn et al. 2010). Aloe vera has also been shown to effectively promote healing of post-operative wounds, such as caesarean wounds, with reduced post-operative pain (Eshghi et al. 2010; Molazem et al. 2015). Additionally, Aloe vera has been found to be effective in oral submucosis fibrosis (Anuradha, Patil & Asha 2017) and split thickness skin graft (Burusapat et al. 2018).

Aloe vera was found to be a safe and effective way to promote wound healing. Creating a moist wound environment, increased epithelial cell migration, accelerated collagen maturation, and reduced inflammatory response have all been linked to aloe vera's wound-healing properties (Hamman 2008). These studies on the use of Aloe vera demonstrate the potential benefits of incorporating this medicinal plant into complementary wound care management. Many studies have shown that specific components of Aloe vera gel can promote wound healing in animal models (Finberg, Muntingh & van Rensburg 2015; Oryan et al. 2016). It was discovered that Aloe vera-containing membranes had a faster healing response than the control group, as measured by faster wound contraction. The author also stated that the antibacterial properties of Aloe vera could be attributed to one of its specific components, aloe emodin, which is an anthraquinone. Because of the positive effects of aloe vera in animal and *in vivo*

studies, many researchers have started a human clinical trial with this plant (Singh, Gupta & Gupta 2018). Aloe vera has also been shown to promote cell proliferation, higher wound area reduction, a greater degree of re-epithelization, significantly faster wound area reduction, and wound maturation (Garcia-Orue et al. 2017; Singh, Gupta & Gupta). The anti-inflammatory, antimicrobial, increased leucocyte activation, and decreased histamine activity properties of Aloe vera may help to speed up the healing process of burn wounds (Finberg, Muntingh & van Rensburg 2015; Garcia-Orue et al. 2017; Oliveira, Soares & Rocha Pde 2010; Oryan et al. 2016). Aloe vera was found to be a safe and effective way to promote wound healing. Aloe vera's wound-healing properties have been attributed to multiple mechanisms, including moist wound environment, increased epithelial cell migration, accelerated collagen maturation, and reduced inflammatory response (Hamman 2008). These studies on the use of Aloe vera demonstrate the potential benefits of incorporating this medicinal plant into complementary wound care management. Many studies have shown that specific components of Aloe vera gel can promote wound healing in animal models (Finberg, Muntingh & van Rensburg 2015; Oryan et al. 2016). It was discovered that Aloe vera-containing membranes had a faster healing response than the control group, as measured by faster wound contraction. The author also stated that the antibacterial properties of Aloe vera could be attributed to one of its specific components, Aloe emodin, which is an anthraquinone. Because of the positive effects of Aloe vera in animal and *in vivo* studies, many researchers have started a human clinical trial with this plant (Singh, Gupta & Gupta 2018). Aloe vera has also been shown to promote cell proliferation, higher wound area reduction, a greater degree of re-epithelization, significantly faster wound area reduction, and wound maturation (Garcia-Orue et al. 2019, 2017; Singh, Gupta & Gupta 2018). The anti-inflammatory, antimicrobial, increased leucocyte activation, and decreased histamine activity properties of Aloe vera may help to speed up the healing process of burn wounds (Finberg, Muntingh & van Rensburg 2015; Garcia-Orue et al. 2017; Oliveira, Soares & Rocha Pde 2010; Oryan et al. 2016).

CONCLUSION

Aloe vera has long been used as a traditional remedy for treating various skin conditions, including wounds. In recent years, several clinical trials have been conducted to assess the efficacy of Aloe vera in the treatment of

chronic wounds. The results of these trials have been overwhelmingly positive, with most studies concluding that Aloe vera is highly effective in promoting wound healing, particularly for pressure injuries and diabetic foot ulcers. In addition to its healing properties, Aloe vera is also cost-effective, making it a popular alternative to conventional wound care treatments. Additionally, Aloe vera has been shown to have a negligible risk of adverse events, making it a safe and well-tolerated option for patients, especially for bed-ridden or hospitalized patients who are at higher risk of developing chronic wounds. The effectiveness of Aloe vera in wound healing has been attributed to its ability to provide a moist wound environment, promote epithelial cell migration, increase collagen maturation, and decrease inflammation reactions. Additionally, the plant contains various components that have antibacterial properties, further enhancing its ability to promote wound healing. However, while the evidence supporting the use of Aloe vera in chronic wound healing is promising, further high-quality clinical trials are needed to fully understand its potential benefits. Currently, most studies have focused on first- and second-degree ulcers, with limited studies conducted on more severe, third-degree ulcers and pressure ulcers. These more severe wounds pose a higher risk of infection and may require longer time for healing, making it imperative that further research be conducted to fully understand the role of Aloe vera in treating these types of wounds. In conclusion, based on the current evidence, Aloe vera has the potential to be an effective and cost-effective alternative or complementary therapy for the treatment of chronic wounds. With its minimal risk of adverse events, its use in wound care should be carefully considered by healthcare professionals, and further research should be conducted to fully understand its benefits and limitations in wound healing.

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