

REVIEW ARTICLE

## Herbal advancements in the treatment to accelerate wound healing

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### Abstract

An injury or a wound is an anatomical and functional disturbance to the tissue. Wound healing is a complicated mechanism of tissue regeneration or remodelling that occurs in response to an injury. Plants and plant-derived constituents have long been used to heal and handle various forms of wounds. Currently, various forms of biopolymers are being studied in order to create a cost-effective, long-lasting, durable, and reliable delivery mechanism for the treatment of wounds.

Wound treatment providers have revisited ancient healing practices by using conventional and complementary medicine in wound recovery due to the rise of multi-resistant pathogens and a decline in modern antibiotics. People's attitudes toward alternative medicine have shifted as well, which is very positive. The idea of moist wound healing has gained a lot of attraction, and conventional medicine has begun to use it to speed up the healing process. In wound care treatment, several experiments using herbal and conventional medicine from various continents have been published.

**Keywords:** Alternative medicine, complementary medicine, traditional medicine, wound healing, wound management, medicinal plants, persian medicine, wound healing, Hemostasis, indigenous medicine, inflammation, traditional medicine

### Introduction

Sensing the environment, sustaining physicochemical and thermal homeostasis, serving as a source of vital nutrients, providing passive and active protection, and reacting to trauma and injury are all important functions of our skin (Xu et al. 2015).

Protecting the skin from pain, as well as repairing and replacing essential skin functions when they are damaged or lost requires rigorous and reliable mechanisms. For centuries, humans have been treating their wounds (Talbot 1962).

Traditional wound care is constrained by what is readily available or can be obtained locally, such as water, soil, and plant & animal products, and is often supplemented with ceremony and ritual as the last option.

Traditional medicine is described by the World Health Organization (WHO) as "health traditions, methods, skills, and values that include plant, animal, and mineral-based medications, spiritual treatments, manual methods, and exercises, used singly or in combination

to cure, diagnose, and prevent illnesses or sustain well-being."

Any healing procedure that "does not fall within the realm of traditional medicine" is referred to as alternative medicine. Rather than scientific facts, it may be based on historical or cultural beliefs. In certain nations, the words "complementary medicine" or "alternative medicine" are interchangeable with "traditional medicine."

The majority of chronic wounds are ulcers caused by ischemia, diabetes, venous stasis disease, or pressure. 70% to 80% of people in developing countries, especially in Africa and Asia, depend on herbal medicine for their health needs, such as wounds, infectious diseases, and metabolic diseases. Thus, Traditional medicines derived from local plants, animals, and natural products are the major part of wound care for millions of people across globe (W.H.O. 2013).

### Traditional Healthcare Practices using Herbal Medicines

Traditional medicine is sometimes characterised

as “alternative,” “non-conventional,” “indigenous,” and “complementary” by practitioners of “modern” (western) medicine, when many of the methods and procedures of “modern” medicine are no different from traditional practises when it comes to wounds. Traditional methods mainly rely on land and resources including water, plants, animals, and minerals, and are still highly regarded and commonly used by the most of the people worldwide (W.H.O. 2013).

Traditional Chinese Medicine (TCM) is based on the Five-Phase principle, TCM makes full use through plants with most, although not all, cases, ensuring that it is reliable, inexpensive, and available (Han et al. 2016).

Herbal remedies are made up of spices, herbal ingredients, herbal formulations, and finished herbal products that contain an active ingredient, plant parts, or other plant materials, or a mixture of the three. People from all continents have used plant-based remedies since prehistoric times before the introduction of modern medicine.

Natural ingredients developed within the plant provide pharmacological efficacy to many conventional medicines, as a result, the efficacy of Chinese medicine preparations varies widely and is evaluated by the genetic background, ecological, and growth environmental conditions by each part of the plants (Qi et al. 2014).

### Characteristics of a Good Herbal or Natural Agents in Wound Healing

Agents that promote fibroblast proliferation, trigger keratinocyte protein expression, improve collagen formation, and have antibacterial activity, antioxidant, and anti-inflammatory effects are known as wound healing agents (Enoch and Leaper 2005). In most cases, an agent derived from medicinal plants or a natural product must possess two or more of the properties identified in order to be considered as a good wound healing agent (Eming et al. 2014).

### Traditional Treatment of Wounds Improves with Medical Plants

India is one of the world’s twelve super-diversity countries and is the eighth major center of origin and diversification of domesticated taxa due to its glorious part in the traditional medicinal scheme.

As a result, it has a wealth of conventional wound care and recovery expertise dating back thousands of years. The use of Himalayan plant medicine to treat Lord Rama’s brother Lakshman in the Lankan battlefield was mentioned in the Indian holy book “Ramayana.” Herbal

products are in high demand in developing countries as well, owing to the unfavourable side effects of pharmaceutical products and the relatively stable criteria of herbal products (Tab. 1).

**Table 1.** Plants used for would healing activity.

Botanical name/ Common name (Family)	Part used	Extract used	Wound healing model used
<i>Acorus calamus</i> /Bach plant (Acoraceae)	Green leaves	Ethanollic	Excision and incision
<i>Allium sativum</i> L./Garlic (Liliaceae)	Bulb	Aqueous and Ethanollic	Excision, incision and dead space
<i>Adhatoda vasica</i> N. /Adalsa (Acanthaceae)	Leaves	Methanollic, chloroform and diethyl ether	Excision
<i>Alternanthera brasiliana</i> Kuntz./ Gudaari saag (Amaranthaceae)	Leaves	Methanollic	Excision, incision and chorioallantoic membrane
<i>Andrographis paniculata</i> / Kalmegh (Acanthaceae)	Whole plant	Pet ether and Ethanollic	Excision

### Aloe vera

Aloe vera has been used as a first-line remedy for burns, ulcers, and surgical wounds by Persians, Egyptians, and indigenous populations of Africa, Eastern Europe, and the Central America for over 5000 years (Garcia-Orue et al. 2017). Acetone derivatives from Aloe leave outperform alcohol and aqueous extracts in terms of antimicrobial activity. Gram-positive bacteria appear to be more sensitive to Aloe vera than Gram-negative bacteria (Lawrence et al. 2009).

Acemannan, a significant mucopolysaccharide (mesoglycan) found in Aloe vera, is a master regulator of macrophage and T-cell function, inducing the expression of pro-inflammatory mRNAs (such as IL-1, IL-1, IL-6, TNF-, PGE<sub>2</sub>, and nitrous oxide) (Ali et al. 2014). In a rat wound healing model, topically applied acemannan was found to significantly reduce the time to wound closure. Thus Aloe vera glycans have also been shown to enhance de novo granulation tissue development (Jettanacheawchankit et al. 2009).

### Artctim lappa

Burdock, also known as *Arctium lappa*, is a commonly planted perennial herb. In North America, Europe, and Asia, *Arctium lappa* is used to treat sore throats and skin disorders including swelling, itchy skin, and wrinkles. *Arctium lappa* has protective, anti-inflammatory, anti-diabetic, antimicrobial, and antiviral effects, according to scientific studies (Knott et al. 2008).

Burns and Wounds topical ointment, a commercial

preparation containing *Arctium lappa*, was shown to relieve pain and healing of first and second-degree burns in humans more effectively than the control treatment in a pilot study (Amish Et al. 2014).

#### ***Astragalus propinquus* and *Rehmannia glutinosa***

Urinary retention and edema were treated with the root of *Astragalus propinquus* in TCM. The origin of *Rehmannia glutinosa* has a long history of use in hemorheology and diabetes. The root of *Astragalus propinquus* and the root of *Rehmannia glutinosa* were first stated to be clinically useful for the treatment of diabetic foot ulcers (Chiu et al. 2018). This finding has since been confirmed in diabetic rats. Studies shows, the roots of *Astragalus propinquus* and *Rehmannia glutinosa* improve angiogenesis and reduce tissue oxidative stress in diabetic rats, promoting diabetic wound healing and postischemic neovascularization (Tam et al. 2014).

#### ***Ampelopsis japonica***

The roots of *Ampelopsis japonica*, which grow in eastern Asia and eastern North America, are used as a traditional treatment for burns and ulcers, among other things. *Ampelopsis japonica* has been shown to have a variety of pharmacological functions, including neuroprotective, antimicrobial, and anticancer properties, ethanol extracts from dried roots of *Ampelopsis japonica* have been shown to speed up the healing of cutaneous scald injury in rats. The levels of tumor necrosis factor-alpha and Tumor Growth Factor-1 (TGF-1) were found to be higher two days after the injury and to decrease as healing progressed. Interleukin-10 (IL-10), on the other hand, was found to be elevated after 14 days, coinciding with wound closure. Topical treatment with ethanolic *Ampelopsis japonica* enhanced re-epithelialization, granulation tissue formation, vascularization, and collagen deposition as compared to wounds treated with Vaseline (petroleum jelly) or silver sulfadiazine (Lee et al. 2015).

#### ***Bryophyllum pinnatum* (Lam.) Kurz. (Crassulaceae)**

*Bryophyllum pinnatum*, also known as *Bryophyllum calycinum*, is a perennial herb used in India and other countries as folk medicine. Phenols, flavonoids, alkaloids, tannins, glycosides, saponins, coumarins, and sitosterols are the key phytochemical constituents contained in plants.

The plant's leaves are disinfectant and antibacterial, and are used to treat boils, swelling, insect bites, burns and wounds (Khare 2009).

#### ***Calotropis gigantea* (L.) R. Br. (Asclepiadaceae)**

*Calotropis gigantea* is known as "Sweta Arka" in ancient Ayurvedic medicine. It can be found in India, China,

Malaysia and a number of other countries. Flavonoids, triterpenoids, phenolic compounds, tannins, alkaloids, hormones, glycosides, saponins, terpenes, carbohydrates, alcohol, resin, fatty acids, and esters of calotropeols are the most active phytoconstituents derived from plants. Test of the wound healing efficacy of *Calotropis gigantea* topical application in an excision wound model. The percentage of wound contraction was observed to be higher in incision wound and dead space wound model due to increased hydroxyproline content (Nalwaya et al. 2009).

#### ***Curcuma longa* Linn. (Zingiberaceae)**

*Curcuma longa* is an ancient spice and an essential Ayurvedic herb. Thousands of years have passed since it was first seen in India. Turmeric and Indian saffron are other names for it. Curcuminoids, which include curcumin (diferuloyl methane), demethoxycurcumin, and bisdemethoxycurcumin, are the key components of turmeric (Naz et al. 2010).

#### ***Elephantopus scaber* Linn. (Asteraceae)**

Scaber is a kind of weed that grows in shady areas. Sesquiterpene lactones such as elescaberin, iso-deoxyelephantopin, deoxyelephantopin, isoscabertopin, and scabertopin are the most bioactive compounds extracted from the ethanolic extract of the plant looked at the wound-healing properties of aqueous leaf extract and deoxyelephantopin, a drug isolated from an ethanolic leaf extract. In animals treated with deoxyelephantopin, wound healing was found to be more successful (Singh et al. 2005).

#### ***Ficus racemosa* Linn. (Moraceae)**

*Ficus racemosa* Fi Linn. large deciduous tree found throughout India, particularly in the north. Tested the wound healing efficacy of an aqueous and an ethanolic extract of *F. racemosa* roots on an incision and an excision wound model. Due to improved epithelialization and collagen synthesis, aqueous extract of root increased the percentage closure (Murti and Kumar 2012).

### **Plants with Wound-Healing Properties and its Pharmacological Activities**

#### **Anti-inflammatory activity**

The inflammation step of the wound healing process is critical because it produces neutrophils, which are responsible for microbial clearance in the wound area (phagocytosis) and antigen presentation. Inflammatory cytokines and growth factors are also produced during this process. Because of the net destruction of soluble growth factors and matrix elements, any pathological process that interferes with this self-limited physiological

process will result in a non-healing wound. Plant extract has anti-inflammatory properties, according to various traditional texts and animal tests, and thus can be used as wound healer drugs (Akihisa et al. 1996).

#### Antioxidant activity

To live, plants develop a variety of anti-oxidative compounds to combat reactive oxygen species, which involve free radicals like superoxide anion radicals and hydroxyl radicals, as well as non-radical species like hydrogen peroxide, are aggravating factors in the ageing process. Various antioxidant natural remedies extracted from plants, such as *Angelica sinensis* polysaccharides, Aloe vera gel, and *Eucommia ulmoides* Oliver leaf extract, promote wound healing by scavenging free radicals and facilitating collagen synthesis (Sen et al. 2002).

#### Analgesic activity

Patients with wounds sometimes feel pain. Wound pain is caused by tissue damage or nervous system dysfunction (neuropathic pain) on a physiological basis. Pain can cause a delay in wound healing by disrupting neuroendocrine and immune functions, both of which are important in the wound healing process. As a result, herbal preparations with analgesic and anti-inflammatory properties can be used to treat wound pain (McGuire et al. 2006).

#### Antimicrobial activity

Microorganisms are thought to play a part in the slow healing of chronic wounds and the emergence of infection-related complications. Sepsis, which obstructs the healing process, may be caused by bacterial infection. A variety of polyherbal preparations with antimicrobial activity have been scientifically proven to have wound healing activity, such as a polyherbal gel made from *Terminalia arjuna*, *Centella asiatica*, and *Curcuma longa* that has antimicrobial and wound healing properties (Patel et al. 2011).

### Functions of Phytoconstituents in the Role of Wound Healing

Phytoconstituents present in plant extracts can interfere with one or more phases of the wound healing process in a positive way in the proper sequence and at the right time to improve efficacy. Plants have developed a variety of wound-healing substances, including tannins from *Terminalia arjuna*, polysaccharides from *Opuntia ficus-indica*, asiaticoside, asiatic acid, and madecassic acid from *Centella asiatica*, and curcumin from *Curcuma longa*, among others (Ghosh and Gaba 2013).

### Clinical Problem

Acute and chronic wounds are a common health problem, particularly as obesity and diabetes become more prevalent. A delay in wound healing will raise the risk of infection and exacerbate scarring, resulting in higher morbidity and costs for ongoing medical treatment. While wound dressings can avoid desiccation and provide a protective shield, many other statements about improved wound healing are often unsubstantiated. With the advent of “natural ingredients” into the wound healing arena, it is now possible to use specific chemicals and compounds that can have many wound healing benefits at the same time (Vermeulen et al. 2004).

These “natural goods,” according to popular belief, would have fewer side effects. Since this area is still in its early stages, experimental testing of naturally generated compounds, such as plant-derived products (phytochemicals), and how these products can be incorporated into wound treatment is essential.

### Future Developments

The use of phytochemicals and naturally derived substances in wound healing is a promising development. To evaluate the importance of these naturally derived products in wound treatment, more prospective, well-controlled studies are required. The effect of the extraction technique on the final composition of the extract needs to be better defined, and the importance of this information is currently under appreciated. Naturopathic medicine, Ayurvedic medicine, and homoeopathy, unlike allopathic medicine, make extensive use of plant/herbal extracts and naturally extracted substances. Future systematic and thoughtful studies into the role of naturally derived products for wound healing would require collaborative efforts.

#### Need of innovative research

Phytochemical and other naturally derived drug research is only in its early stages, with even more findings to come. Many herbs and plants have yet to be investigated for their medicinal value in medical systems that focus on phytochemicals, such as traditional Chinese medicine, Ayurveda, and naturopathy. Increased study and use of phytochemicals and other biologically derived compounds suggests that the science is heading toward a more complex approach to wound care, which has a complicated physiology and pathophysiology.

### Conclusion

Since plants are essential for human existence, their use for medicinal purposes in India has been known in

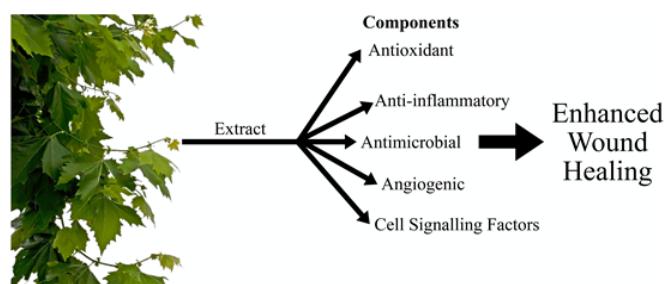


ancient literature for a long time. In India, the traditional medicinal scheme is commonly used. For their different health needs, a large percentage of the population, especially in rural areas, is already reliant on conventional medicine. It is self-evident that every healthcare organisation would be unable to meet the public's health-care needs on its own. As a result, conventional and cultural medical awareness serves as a catalyst for addressing health-care demands. Due to the presence of beneficial phytoconstituents, a variety of plants have been confirmed to have wound-healing properties.

The majority of these trials include screening plants or extracts for wound healing action on a random basis. Since all of the plant products included in the table have proven efficacy in real trials and use, there is a greater need to isolate and analyse each active ingredient that plays a positive role in the healing process. Combining conventional and new experience will result in more effective wound-healing medications and less side effects. Modern plant expertise can be used to develop clinical, medical, pharmacological, and innovative drug delivery systems for wound healing.

## Illustration

The proposed benefit of extracting natural resources is depicted in this diagram. Multiple compounds in an extract can have a variety of properties that aid in wound healing (Fig. 1).



**Figure 1.** Several properties of a plant helpful in wound healing process.

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