A Review on Medicinal Plants with Potential Wound Healing Activity

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ABSTRACT

The traditional Indian medicine - Ayurveda, describes various herbs, fats, oils and minerals with anti-aging as well as wound healing properties. Wounds are the result of injuries to the skin that disrupt the soft tissue. Wound healing can be defined as a complex dynamic process results in the restoration of anatomic continuity and function. Various plant products have been used in treatment of wounds over the years. Wound healing herbal extracts promote blood clotting, fight infection, and accelerate the healing of wounds. Hence in the current review a list of the plants used in traditional medicine for the treatment of wounds were screened. It is a beneficial work for researchers to provide many details about the wound healing herbs and development of safe and effective and globally accepted herbal drugs for cuts and wounds.

Keywords: Cuts, Wounds, angiogenesis, wound healing, Indian medicinal plants, Ayurveda

INTRODUCTION

Wounds are major case of physical disabilities [1]. A wound which is disturbed state of tissue caused by physical, chemical, microbial (or) immunological insults (or) typically associated with loss function. According to the wound healing society wounds are physical injuries that results in an opening (or) break of the skin that cause disturbance in the normal skin anatomy and function [2]. Wound healing is an interaction of complex cascade of cellular and bio chemical actions healing to the restoration of structural and functional integrity with regain of strength of injured tissues. Involves continuous cell – cell interaction and cell matrix interactions that allow the process to proceed in different overlapping phases and process including inflammation, wound contraction, Re epithelialization tissue, re modeling, & formation of granulation tissue with angiogenesis [3]. Several factors delay (or) reduce the wound healing process including bacterial infection, necrotic tissue, & interference with blood supply, lymphatic blockage & diabetes mellitus, generally if the above factors could be altered by any agent, an increased healing rate could be achieved [4]. Many Ayurvedic plants have a very important role in the process of wound healing. Plants are more potent healers because they promote the repair mechanisms in the natural way [5].

Plant based therapy not only accelerate healing process and also maintains the aesthetics [9]. More than 70% of wound healing pharma products are plant based, 20% are mineral based and remaining containing animal products as their base material. The plant base materials are used first aid – antiseptic coagulants and wound wash [6]. In recent times, focus on plant researchers has increased all over the world and large body of evidence has collected to show immense potential of medicinal plants used in various traditional systems. More than 13,000 plants have been studied during the last five years period [7]. Probably these reviews used to findings for wound healing activity of some medicinal plants are highlighted here.

1. Allum Cepa Linn. (Liliaceae)
Allium cepa Linn belongs to the family of Liliaceae. It contains kampferol, β-sitosterol, ferulic acid, myricic acid, prostaglandins. These constituents used as abortifacient and bulb extract shown to have ecobolic effect in rats. Allium cepa Linn is proved that anti diabetic [8] Anti oxidant, anti hypertensive, anti thromboic, hypoglycemic & hyper lipidemic Activities [9]. Phytochemical screening of Allium cepa Linn revealed the presence of tannins, flavonoids, alkaloids, proteins & other important constituents. Flavonoids have been documented which is believed to be one of the most important components of wound healing. The enhanced wound healing may be due to free radical scavenging action and the antibacterial property of the Phytoconstituents present in it which either due to their individual or additive effect fastens the process of wound healing. This could be the reason for prohealing activity of Allium cepa Linn.

2. Alternanthera sessilis Linn.(Amaranthaceae)

Alternanthera sessilis Linn.(Amaranthaceae)is an annual (or) perennial prostate weed , found throughout the hottest part of India [10]. The plant has been scientifically proven to consist of chemical constituents like α & β spinosterols [11] lupeal isolated from roots [12] the plant has been reported as galactagogue, chologague, abortificant, febrifuge & indigestion [13]. The leaves used in eye diseases, in cuts & wounds, antidote for snake bite & scorpion sting and skin diseases. The wound healing property of Alternanthera sessilis Linn attributed to phytoconstituents present in the plant. Sterols were the major constituents and it is the responsible for wound healing activity.

3. Aspila Africana (compositae)

Aspila Africana C.D. Adams (compositae) an herb about 1m tall covered with bristles & commonly known as ‘Hemorrhage plant’ due this ability to stop bleeding from fresh wounds [14]. The bruised leaves and flowers of Aspila Africana are used to clean the surface of sores which subsequently heal [15]. The plant is widespread in Africa. It is used for the treatment of rheumatic pain & it has been reported to posses’ haemostatic [16], anti bacterial, membrane stabilization & anti inflammatory activities. Phytochemical analysis of the plant extracts revealed the presence of terpenoid, saponins & tannins [17].

4. Mussaenda frondosa. Linn (Rubiaceae)

M.Frondosa commonly called as Nagavalli reported possesses number of medicinal properties. It is used as a folk medicine for the treatment of wound in different part of the world [18].The leaves are traditionally used for the treatment of jaundice, asthma, hyperacidity, fever, ulcer, leprosy, and diuretic, wound & swells .This plant has been investigated by several workers .Antimicrobial [19], Diuretic activity [20], Hepatoprotective activity [21], activity on fever, asthma & cough [22] was reported in the leaf extract. The leaves of mussaenda frondosa Linn possess presence of various secondary metabolites like steroids, glycosides, saponins, Resins, mucilage & flavonoid [23].

5. Heliotropium Indicum (Boraginaceae)

Heliotropium Indicum commonly called as Indian turnsole. It is an herb slightly woody at base. It is distributed in the topical and temperature region of the world and found throughout in India. In ayurveda the juice of leaves applied on pimples, sores, ulcers & wound to cure. The leaf extract used for the treatment of ophthalmic disorders, erysipelas, pharyngodynia, & anti – tumor. The extracts of leaves were proved to be against schward’s leukemia & anti inflammatory activities [24].

6. Aristolochia bracteata (Aristolochiaceae) & Cassia tora (Leguminosae)

http://ijps.aizeonpublishers.net/content/2012/4/ijps105-111.pdf
The process of wound healing involves a variety of biological responses, such as an acute inflammation, cellular proliferation and a contraction of collagen lattice formed [25]. *Aristolochia bracteata* belongs to the family *Aristolochiaceae*. *Cassia tora* (Leguminosae) is used in traditional medicine as a gastric stimulant and in the treatment of cancer, lung inflammation; dysentery and snake bite [26]. It is a wild crop plant and grows in most parts of India as a weed. According to Ayurveda the leaves & seeds are acrid [27] laxatives, antiperiodic, nanthelmintic, ophthalmic, liver tonic, cardiotonic & expectorant. The leaves & seeds are useful in leprosy, ringworm, flatulence, colic, dyspepsia, constipation, cough, bronchitis, cardiac disorders [28]. Chemical component of *Cassia tora* are anthraquinones, chrysophanol, emodin, obtusifolin,obtusin, chryso-obtusin, aurantio-obtusin, & their glycosides [29]. Mis.jayasudha concludes that the wound contracting ability of the extracts were significantly greater than that of the control, which was comparable to that of the reference standard nitro furazone ointment [30].

7. **Mimosa pudica** (Mimosaceae)

*Mimosa pudica*, commonly known as Lajjalu (Hindi), is called as a sensitive plant/touch-me-not in English. It is an annual or perennial herb belonging to family *Mimosaceae*, it is used in folklore medicine in arresting bleeding and in skin diseases. *Mimosa pudica* has been reported to contain mimosine (an alkaloid), free amino acids, sitosterol, linoleic acid & oleic acid. The drug is also found to be rich in tannins and the total tannin content was reported to be 10% (w/w) [31]. The root is also stated to have anti-convulsant activity [32]. Successive extracts of the whole plant are reported to have antibacterial activity [33]. In preliminary screening of *Mimosa pudica* extract was found to exhibit anti-venom activity against common sea snake (*Enhydrina schistosa*) poisoning [34]. It was found that the root of *Mimosa pudica* have acetylcholine esterase inhibitory activity. Ayurveda reports utility of *Mimosa pudica* in arresting bleeding and enhancing wound healing activity. The wound healing studies on roots of *Mimosa pudica* indicate that phenols constituents/tannins play an important role in wound healing process [35]. The methanolic and aqueous extract of *Mimosa pudica* exhibited good wound healing activity probably due to phenols constituents. The result of excision wound model is indicating that significant increase in wound contraction compared with standard group, revealing that the extract has ability to induce cellular proliferation. The increase in tensile strength of wounded skin indicates the promotion of collagen fibers.

8. **Tecomaria capensis** (Bignoniaceae)

*Tecomaria capensis* (Bignoniaceae), also known as Cape-honeysuckle [36], a fast growing, scrambling shrub which may grow up to 2−3 m high and spread more than 2.5 m. *Tecomaria capensis* is an evergreen plant in warm climate areas but loses its leaves in colder areas. Flowers are orange in color & are tubular and bird pollinated, attracting nectar-feeding birds, especially sunbirds. The plant is used as a traditional medicine to relieve pain & sleeplessness [37]. Dried & powdered bark infusions are taken for sleeplessness [38]. It is included in the list of African plants evaluated for *in vitro* antiplasmodial activity against *Plasmodium falciparum* [39]. Previously methanol extract of *Tecomaria capensis* leaves reported as antimicrobial [40] and antioxidant. *Tecomaria capensis* known to promote the wound healing process mainly due to their astringent, anti-microbial & free radical scavenging activities *Tecomaria capensis* significantly stimulated wound contraction. The breaking strength of the treated incision wounds increased in *Tecomaria capensis* extract when treated groups compared with the control group. These findings support wound healing activity of this plant [41].

9. **Anthocephalus Cadamba** (Rubiaceae)
10. Anthocephalus Cadamba (Roxb.) Miq. Syn A. chinensis (Lamk) A. Rich (Rubiaceae) is ethno medicinally widely used in the form of paste by tribe in western Ghats for treating skin diseases and it is widely distributed throughout the greater part of India & is used as a folk medicine in the treatment of fever, anemia, uterine complaints, blood diseases, skin diseases, leprosy, dysentery, and for improvement of semen quality. The leaves are recommended as a gargle in cases of stomatitis .Some scientific studies have been carried out to reveal its antimalarial & anti hepato toxic activities [42]. The major constituents of bark are triterpenes, tripernoid glycosides, saponins, indole alkaloids cadambine, and 3α dihydrocadambine, cadamine, isocadamine & iso dihydrocadambine [43]. The plant showed significant antibacterial & antifungal activity against almost all the organisms & especially good activity was found against the dermatophytes. Preliminary phytochemical screening of A. cadamba showed the presence of saponins, terpenes, sesquiterpenes glycosides, alkaloids & absence of anthraquinones and flavonoids. The antimicrobial activity could be due to the presence of terpenes [44]. The crude extract of Anthocephalus cadamba significantly stimulated wound contraction. Thus, the plant extract might be useful as a wound healing agent. The potent wound healing capacity of Anthocephalus cadamba as shown from the wound contraction and increased tensile strength has thus validated the ethno therapeutic claim [45].

11. Lantana camara L. (Verbenaceae)

Lantana camara L. (Verbenaceae) is listed as one of the important medicinal plants in the world. It has been reported to possess a number of medicinal properties [46]. It has several uses like antimicrobial, fungicidal, insecticidal, hematoctial activity & also immuno suppressive, antitumor activities. It was introduced in India as an ornamental plant but entirely naturalized & found throughout India. The leaves are useful in fistula, pustules, tumors & rheumatism. The essential oil of Lantana camara showed a wide spectrum of antibacterial, antimicrobial & antifungal activity [47]. The phytochemical analysis of the leaf extract showed the presence Tri terpenoid, flavonoid & the absence of volatile oils, tannins, alkaloids & saponins [48]. The wound treated with alcoholic extract of Lantana camara showed considerable signs of dermal healing and significantly decrease mean wound healing time & reduced scarring at the wound enclosure [49].

12. Ageratum conyzoides (Asteraceae)

Ageratum conyzoides is a common weed found everywhere in India & commonly known as goat weed, white weed, in various parts of India. The leaves are applied to the wounds act as septic & heal them quickly [50]. The juice of the fresh plant and extract of dried plant are used to cure allergic conditions. The ethanolic extract of Ageratum conyzoides showed the presence of alkaloids, terpenoids, saponins, glycosides, tannins [51]. Several Phytoconstituents like alkaloids & saponins [52] are known to promote wound healing process due to their antioxidant action. The wound healing property of Ageratum conyzoides appears to be due to the presence of its active principles, which accelerate the healing process & confers breaking strength to the healed wound [53].

13. Moringa oleifera Linn. (Moringaceae)

Moringa oleifera Linn. (Moringaceae) has been an ingredient of Indian diet since centuries. The root bark of the plant contain two alkaloids, viz moringin, moriningine & pterygospermin. It has anti inflammatory antibacterial & counter irritant action, which helps in wound healing [54]. The leaves of the plant have also been reported for its anti tumor, hypotensive, & antioxidant, radioprotective, anti-inflammatory & diuretic properties. It is
mainly used for the bowel disorders, including arthritis, atherosclerosis, bladder infections, boils, burns, cancer, chronic fatigue syndrome, circulatory weakness, cold, congestion, constipation, diabetes, eye inflammations, fever, fractures, gastric ulcers, gingivitis, headaches, heart diseases, hypertension, immune weakness, indigestion, intestinal parasites, kidney disease, malaria, menstrual cramps, mouth sores, respiratory disorders, ringworms, sinusitis, sprains, stroke, skin inflammation & wounds [55]. The aqueous extract was studied and it was found that there was significant increase in wound closure rate, skin-breaking strength, granuloma breaking strength, hydroxyproline content, granuloma dry weight and decrease in scar area was observed [56].

**13. Mimusops Elengi Linn (Sapotaceae)**

*Mimusops elengi* Linn (Sapotaceae) commonly known as Bakul, is a small to large evergreen tree found all over the different parts of India. It is cultivated in gardens as an ornamental tree. It has been used in the indigenous system of medicine for the treatment of various ailments. Several therapeutic uses as cardiotonic, alexipharmic, stomachic, anthelmintic & astringent have been ascribed to the bark of *Mimusops elengi* [57]. It has been reported as dantarogahara (treats and prevent tooth decay & tooth disease) in Ayurveda [58]. A decoction of the bark is used as a gargle in salivation in weak & spongy gums, pyorrhea, stomatitis & ulcerated throat [59]. Compound powder made of the bark is recommended as toothpowder in cases of spongy gums [60]. Phytochemical review shows the presence of taraxerol, taraxerone, ursolic acid, betulinic acid, V-spinosterol, W-sitosterol, lupeol, alkaloid isoretronecyl tiglate & mixture of triterpenoid saponins in the bark of *Mimusops elengi* [61]. The methanolic extract ointment of *Mimusops elengi* effectively stimulated wound contraction; increase tensile strength of incision & dead space wounds as compared to control group [62].

**14. Carapa guianensis (Meliaceae)**

*Carapa guianensis* is also called as andiroba. The leaves have been used for fever. The tea made from this plant is applied externally for ulcers, Skin parasites & other skin problems. Brazilian apply andiroba oil externally to wound and bruises, use it as a massage oil , natural insects repellent , & employ it topically for many skin diseases [63]. The phytochemical analysis of the leaf extract by qualitative method showed the presence of alkaloids, essential oil, saponins, tannins & absence of tri terpenoid & flavonoid. The ethanolic leaf extract of *Carapa guianensis* showed increase in the rate of wound contraction, skin breaking strength, the rate of epithelialization [64].

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

*Curcuma longa* Linn belonging to family Zingiberaceae, commonly known as turmeric and haldi in Hindi. It has been reported to possess antibacterial, anti-fungal and anti-inflammatory activities [65]. The part used are rhizomes and it contains curumin (diferuloyl methane), turmeric oil or turmerol & 1, 7-bis, 6-hepta-diene-3, 5-Dione. Curcumin has potent anti-inflammatory and analgesic activities [66]. Volatile oil isolated from *C. longa* also exhibits antibacterial & potent anti-inflammatory activity. *Curcuma longa* also contains protein, fats, vitamins (A, B, C etc) all of which have an important role in wound healing and regeneration. Turmeric has been used for treating the wounds in the rats’ [67]. The presence of vitamin A & proteins in turmeric result in the early synthesis of collagen fibers by mimicking fibroblastic activity. Juice of the fresh rhizome is commonly applied to recent wounds, bruises & leech bites. A paste of turmeric & leaves of *Justica adhatoda* with cow urine is rubbed on skin affected with prurigo & eczema. It can also be mixed with ginger oil to prevent skin eruptions [68].

**CONCLUSION**

Plants are more potent healers because they promote the repair mechanism in the natural way. This study exposed that traditional medicines are still used by tribal peoples & it is established the value of a great number of plants used in tribal medicine especially for wound healing. Seemingly much still unknown information about plants to treat various disease including wounds. So far, very few studies have been carried out on medicinal plants which present the wound healing activity. The aim of the review is to list out the medicinal plants which is reported already. The focus is to provide information on the medicinal
properties, ethno medicinal uses & pharmacological activities of Indian medicinal plants and suggest practices regarding the conservation of these species taking recommended for healing of wounds.

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