



Wound healing activity of some medicinal plants

Nikita Shishodia, Shalini Sharma, Monika Singh Saxena, Lavika Chauhan, Mohit Kumar, Ankit Sharma,
Ashu Sharma

Gmail id – shishodianikita12@gmail.com

Sunder Deep Pharmacy College, NH-9, Delhi-Meerut expressway, Dasna, Ghaziabad 201001 (U.P)

1. ABSTRACT

A wound which is disturbed state of tissue caused by microbes, physical or chemical, substance generally associated with loss of function. Wound healing is a normal biological response to the damage that set right into a motion in a sequences of events. The wound-healing process include four phases: Homeostatis, inflammation, proliferation and tissue remodelling. Consequently in the current review a rundown of the plants utilized in conventional medication for the treatment of wounds were screened. It is a valuable work for specialists to give numerous insights regarding the wound healing herbs and improvement of protected and compelling and worldwide acknowledged herbal drugs for cuts and wounds.

Key words: Homeostatis, Inflammation, Proliferation, Tissue remodelling, Cuts, Wounds.

2. INTRODUCTION

Wound -A wound which is disturbed state of tissue caused by microbes, physical or chemical substance generally associated with loss of 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 (1). Wounds are major case of physical disabilities (2). Wounds that show weakened mending, including delayed acute injury and chronic injury, generally have failed to progress through the normal phases of mending. Such injuries oftentimes enter a condition of pathologic aggravation due to a delayed, fragmented, or uncoordinate healing measure. Most chronic wounds are ulcers that are related with ischemia, diabetes mellitus, venous balance infection, or pressing factor. Non-healing wounds influence around 3 to 6 million individuals in the United States, with people 65 years and more established representing 85% of these occasions. Non-healing wounds bring about colossal medical services consumptions, with the absolute expense assessed at more than \$3 billion every year (3,4).

Wound healing- Wound healing is a normal biological response to the damage that set right into a motion in a sequences of events. The wound-healing process include four phases: Homeostatis, inflammation, proliferation and tissue remodelling(5). Various natural products such as plant products which contains active principles, such as alkaloids & flavonoids and biomolecules have been reported to promote the wound healing. Several growth factors such as Transforming Growth Factor Beta (TGF- β), Platelet Activation Factor (PAF), Epidermal Growth Factor (EGF), and Platelet-Derived Growth Factors (PDGF) seem to be necessary for the initiation and promotion of wound healing(6). Thermal burns to the skin produce a surprisingly unique mending reaction because of their consequences for the suitability of cells and tissue. Thermal burns makes an extensive zone of frank necrosis that incorporate dead cells and denatured connective tissue. Beyond the area of total destruction, a zone of coagulation necrosis exists, in which denaturation of plasma and cells proteins leads to the blockage of blood vessels and lymphatics. This impact, in turn, induces nutrient starvation of involved tissue (7). Natural medication has become an essential part of standard medical services, based on the combination of respected conventional utilization and continuous logical exploration. The restorative

properties of plants have been examined in the light of recent scientific development throughout the world because of their powerful pharmacological exercises and low harmfulness. (8)

Factors affecting wound healing - There are the several factors which affect the wound healing activity some are discussed below-

- **Alcohol** - Clinical evidence and animals experiments have shown that alcohol consumptions impairs wound healing and expands the incidence of infection (9).
- **Smoking** - Smoking increases the risk of heart and vascular disease, stroke, chronic lung disease, and many kinds of cancers. Similarly, the negative effects of smoking on wound-healing have been found (10).
- **Vitamins** – Vitamin A, Vitamin C, Vitamin E having anti-oxidant and anti-inflammatory effects. Vitamin C plays an significant role in wound healing. Vitamin C lacks caused impaired healing and have been connected to diminished collagen synthesis and fibroblast proliferation, diminished angiogenesis, and expanded capillary fragility (11). Topical vitamin E has been generally advanced as an anti-scarring agent. However, clinical investigations have not yet demonstrated a job for skin nutrient E treatment in working on recuperating results (12).
- **Micronutrients**- Several micronutrients have been shown to be important for optimal repair. Magnesium functions as a co-factor for many enzymes associated with protein and collagen synthesis, while copper is a necessary co-factor for cytochrome oxidase, for cytosolic anti-oxidant superoxide dismutase, and for the ideal cross-linking of collagen. (13)
- **Trace elements**- Zinc is a co-factor for both RNA and DNA polymerase, and a zinc deficiency causes a significant impairment in wound healing. Iron is needed for the hydroxylation of proline and lysine, and, subsequently, severe iron insufficiency can result in impaired collagen production (13,14).

3. SOME PLANTS HAVING WOUND HEALING ACTIVITY

Allium cepa Linn.



Allium cepa linn. belonging to the famiy Liliaceae. Prostaglandins, Kampferol, ferulic acid, and myritic acid, sitosterol are all found in the bulb. It has anti-diabetic, anti-thrombotic, anti-hypertensive, hypoglycemic, anti-oxidant, properties. It has healing properties in rats. The excision wound, incision wound and dead space wound models used to evaluate its wound healing activity in wistar albino rats. Ether, chloroform, alcohol and chloroform water extract of Tubers of *Allium cepa* adminstered at dose 300 mg/k.g. B.W. by oral route. The alcoholic extract-treated group exhibited full healing process with virtually typical reticulin and collagen structure. The improvement in tensile strength of a group tretaed injury might be attributed to the higher in collagen content, as ethanolic extracts stimulates collagen production. As a result, it has been established that ethanolic extracts has healing action (15).

Adhatoda vasica Linn.



Adhatoda vasica Linn. belonging to the family Acanthaceae. Alkaloids, polyphenolics, phytosterols, were identified as a prominent class of drugs in phytochemical investigations of different sections. The main components are quinazoline alkaloid, with vasicine being the most important alkaloid. The plant contains

carotene and Vitamin C and produce an essential oil. The hyperglycaemic, anti-diarrheal, anti-convulsant, and cytotoxic activity make it useful. The methanol extract, diethyl ether, chloroform, and extract ointment (10% w/w) show considerable tissue repair action. In the wound contraction, the ointment exhibited a significant impact as compared to a reference medication(nitrofurazone)and another two extracts (16).

Aloe vera Linn.



Aloe vera Linn. belonging to the family Liliaceae. It's includes vitamins E and C, as well as amino acids, that are necessary for tissue repair. It's being used to treat wounds, dermatitis, and burns. The addition of gel to a lesion increased tissue repair and indicated healing. The excision wound model was used to evaluate the wound healing activity of aloe-vera gel in Female Sprague Dawley rats. The effect of gel on biological studies showed a significant increase in collagen as well as a decrease in hexosamine level and malondialdehyde levels (17).

Curcuma longa Linn



It known as turmeric family Zingiberaceae. Curumin, turmeric oil, or turmerol, and 1,7-bis, 6-hepta-diene-3, 5-dione are found in the rhizomes. This has anti-inflammatory and analgesic properties. Separated oil has anti-inflammatory properties. It includes protein, lipids, and vitamin (A, B, C), the whole of them aids in wound healing systems. It was used to heal wounds in mice (18). Turmeric contains vit. A and protein, which cause early production of fibers by imitating epithelial action. Fresh juice is often used to open wounds, injuries, and leech stings. A mixture of turmeric and *Justica adhatoda* leaf mixed by urine of cow is applied on prurigo and eczema-affected skin. For avoid skin outbreaks, and it can be used with ginger extract (19).

Catharanthus roseus Linn.



It is a part of Apocyanaceae family, widely known as Vinca. It contains over 400 alkaloid, which are authorized as anti-neoplastic medicines to treat leukemia, Hodgkin's disease, malignant lymphomas, neuroblastoma, rhabdomyosarcoma, Wilms' tumor, as well as other malignancies. The vasodilatory and memory-boosting effects have been observed to help with vascular dementia and Alzheimer's disease. Healing action was measured in rat following administration of such an ethanolic extracts of flowers (100 mg kg-1 day-1) utilizing excision, incision, and dead space models. When compared with controls, the extracts considerably improved the bending stiffness throughout the model (20).

Carica papaya Linn.



Carica papaya Linn belonging to the family Caricaceae. It has antibacterial, oxidant, and anti-inflammatory properties, and it has been shown to cure chronic ulcer. In streptozotocin-induced diabetic rat, the hydrated activity was evaluated for healing activities utilizing dead space and excision models. In comparison with controls, set of treated rats with such an aqueous leaf extract exhibited a 77% decrease in injury site and quicker re-epithelialization. As compared with controls, dry and wet granulation tissue weights and hydroxyproline level increased remarkably (21).

Carapa guianensis



It is known as andiroba, family Meliaceae. Brazilians utilize andiroba oil directly to wounds and bruising, as a lotion, as a mosquito repellent, and also to treat a variety of skin ailments. The preliminary phytochemical examination of a leaves extract revealed the existence of alkaloids, tannins, saponins, essential oil, and the lack of terpene and flavonoids (22). The ethanolic extract of *C. guianensis* leaf was investigated for its wound healing activity using excision, incision and dead space wound models in rats. In the excision wound model test group animals were treated locally with the leaf extract (250 mg kg⁻¹ body weight) on the other hand, control animals were treated with petroleum jelly. In the incision and dead space wound models, the test group animals were treated with extract (250 mg kg⁻¹ day⁻¹) orally by mixing in drinking water and the control group animals were maintained with plain drinking water. Skin breaking strength wet and dry granulation tissue and hydroxyproline content were significantly higher in extract treated animals. (23).

***Lanata camara* linn**



Lantana camara Linn. belongs to the family Verbanaceae, as just an attractive plant, a tropical American shrub is totally colonized in many states of India. The herb is abortifacient, antimalarial, anti-inflammatory, and wound healing (24). The phytochemical examination of a leaves extract indicated the formation of diterpenoids, flavonoids, and the lack of oxalic acid (25). Burn wound model used to evaluate wound healing activity of ethanolic extract of the leaves lanata camara. The extracted treated wound were healed in about 21 days which was similar to control group. Hence, the result suggest that the lanata camara has not wound healing activity on burn wound model (26).

***Lawsonia inermis* Linn.**



The leaves of *Lawsonia inermis* Linn commonly called as henna belonging the family Lythraceae, the leaf has antibacterial, antifungal, and inflammatory properties, and they are particularly efficacious in the prevention of burns, wounds, and ulcers. The leaf consists of naphthaquinone, lawsone, which would be a natural color. This was discovered that both topically treatment of ethanolic extracts of henna leaf with lawsone resulted in a substantial healing action (27).

***Mimosa pudica*,**

In English, this is commonly referred to as touch-me-not. This is an annual plant plant of the Mimosaceae family. According to phytochemical research, contains mimosine, amino acids, linoleic acid, and oleic acid. The medication also was discovered to also be high in tannin, with a total concentration of 10% tannin (w/w) (28). The healing action of extract was evaluated using an excision model, which revealed a significant rise in contraction comparison to the control group, showing that extract does have the potential to promote cell growth (29).

Mimusops elengi Linn

Mimusops elengi linn commonly known as Bakul, belonging to the family Sapotaceae. The bark of *Mimusops elengi* having cardiotoxic, alexipharmic, stomachic, anthelmintic & astringent properties(30). 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* (31). In the incision wound model and dead space wound model the methanolic extract ointment of *Mimusops elengi* effectively stimulated wound contraction and increase tensile strength of as compared to control group (32).

Ocimum sanctum Linn.

Tulsi is a member of the Labiatae family. The anti-inflammatory, analgesic, and immunomodulatory effects were discovered. In incision model, the extraction considerably improved the injury ultimate strength. When compared with the control, treated wound epithelialized quicker and contracted at such a considerably greater rate. In dead space model, there was a considerable rise in dry and wet granulation tissue mass, tissue breaking strength, and hydroxyproline concentration. (33).

Sesamum indicum Linn.

Sesamum indicum Linn. belonging to the family Pedaliaceae. It is one of the most established developed plants on the planet that is predominantly developed for its oil rich palatable seeds. The seeds have intense cell reinforcement impact because of the presence of sesamol. Generally, sesame seeds are utilized in the treatment of wounds. Seeds and oil treatment in dead space wound model, created a huge expansion in the breaking

strength, dry weight and hydroxyproline content of the granulation tissue. The outcomes recommend that *Sesamum indicum* seeds and oil applied topically or managed orally has wound healing activity (34).

***Terminalia bellirica* Roxb.**



Terminalia bellirica Roxb. belonging to the family Combretaceae. The fruits possess antidiarrhoeal, antitussive, antipyretic, antileprotic activity. It also has been used for the treatment of skin diseases as antiseptic and on all types of wounds. The ethanolic extract of the fruit of *Terminalia bellirica* fasten wound healing activity as compared to control. Excision and incision wound model was used to evaluate its wound healing activity (35).

TABLE 1: List of herbal drug used in wound healing

S.no	Botanical name/ Family	Common Name	Part	Extract	Route	Model	Animals	Ref
1.	<i>Allium cepa</i> L. (liliaceae)	Onion	Tubers	Alcoholic, Choroform, Chloroform water, Ether extract.	Orally	Excision wound model Incision wound model Dead space wound model	Wistar albino rats	36
2.	<i>Adhatoda vasica</i> (Acanthaceae)	Vasaka	Leaves	Methanol Diethyl ether Chloroform	Topically	Excision wound model	Wistar albino rats	37
3.	<i>Aloe-vera</i> L. (liliaceae)	Aloe-vera	Gel	-	Topically	Excision wound model	Sprague Dawley rats	38
4	<i>Catharanthus roseus</i> L. (Apocyanaceae)	Vinca	Flowers	Ethanolic extract	Orally	Excision wound model Incision wound model Dead space wound model	Sprague Dawley rats	39
5	<i>Carica papaya</i> L. (Caricaceae)	Papaya	Leaves	Aqueous extract	Topically	Excision wound model Dead space wound model	Streptozocin induced Diabetic rats	40
6.	<i>Carapa guianensis</i> (Meliaceae)	Adiroba	Leaves	Ethanolic extract	Topically Orally	Excision wound model Incision wound model	Sprague Dawley rats	41

						Dead space wound model		
7.	<i>Lanata Camara L.</i> (Verbanaceae)	Big sage	Leaves	Ethanollic extract	Topically	Burn wound model	Sprague Dawley rats	42
8.	<i>Lawsonia inermis Linn</i> (Lythraceae)	Henna	Leaves	Ethanollic extract	Topically Orally	Excision wound model Incision wound model	Wistar albino rats	43
9.	<i>Mimusops elengi linn</i> (Sapotaceae)	Bakul	Bark	Methanollic extract	Topically	Incision wound model Dead space wound model	Wistar albino rats	44
10.	<i>Occium sanctum</i> (Labiatae)	Tulsi	Leaves	Ethanollic extract	Orally	Excision wound model Incision wound model Dead space wound model	Albino rats	45
11.	<i>Sesamum indicum Linn</i> (Pedaliaceae)	Benne	Seeds and oil	-	Topically Orally	Dead space wound model	Wistar albino rats	46
12.	<i>Terminalia bellirica Roxb</i> (Combretaceae)	Bahera	Fruit	Ethanollic extract	Topically	Excision wound model Incision wound model	Wistar albino rat	47
13.	<i>Jatropha curcas L.</i> (Euphorbiaceae)	Bubble bush	Bark exudates	Ethanollic extract	Orally	Excision wound model Incision wound model Dead space wound model	Wistar albino rats	53
14.	<i>Nerium indicum Mill</i> (Apocyanaceae)	Indian Oleander	Juice of leaves	-	Topically	Incision wound model	-	52
15.	<i>Pothos scandens L.</i> (Araceae)	Pothos	Leaves	Ethanollic extract	Topically	Burn wound model	Wistar albino rats	51
16.	<i>Sida acuta Burm.F.</i> (Malvaceae)	Wireweed	Leaves paste with albumin applied	Methanollic extract	Topically	Excision wound model Incision wound model	Wistar albino rat	47

			as plaster					
17.	<i>Bryophyllum calycinum</i> (Crassulaceae)	Miracle leaf	Leaves	-	Topically	Excision wound model	-	36

5. CONCLUSION

Plants are more powerful healers since they advance the repair mechanism in the natural way. This investigation covered that conventional drugs are as yet utilized by ancestral people groups and it is set up the worth of an extraordinary number of plants utilized in tribal medication particularly for wound healing. The aim of the aim is to rattle off the medicinal plants which is accounted for as of now. The spotlight is to give data on the therapeutic properties, ethnomedicinal uses and pharmacological activities of Indian medicinal plants and propose works on with respect to the conservation of these species taking suggested healing of wounds.

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