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Review Article

AYURVEDIC HERBAL MEDICINES ON BURN WOUND: A REVIEW

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ABSTRACT

Burn injuries are under-appreciated injuries that are associated with substantial morbidity and mortality. Burn wound healing is a complicated process that includes inflammation, re-epithelialization, granulation, neovascularization, and wound contraction. Initial treatment of burn wounds aims at preventing infection and early wound healing. Properties like antioxidant, anti-inflammatory, antimicrobial, antibacterial are also helps in wound healing. The level of severity of the burn is of the utmost importance. Third degree burns require immediate medical attention while studies suggest that a number of natural remedies may aid in the treatment of first- and second-degree burns. The basic concepts and principles of management of burn injury is described in Ayurveda are very much relevant and useful in this era of modern surgery. There are so many herbs mentioned in Ayurveda classics are found to have properties like *Dagdhahara, Vrana prasamana, Pittahara, Varnaprasadana, Twacya* etc which contributes to burn wound healing. More recently, scientists increasingly rely on modern scientific methods and evidence based medicine to prove efficacy of herbal medicine and focus on better understanding of mechanisms of their action. The purpose of this article is to review the evidence supporting the use of some of the Ayurvedic herbal drugs and formulations as effective and affordable treatments for burn wounds.

KEYWORDS: Burn wound healing, *Kumari, Yashtimadhu, Dadima, Haridra, Nalikera, Candana, Manjistha, Kadali, Tulasi, Tila, Himsra.*

INTRODUCTION

A burn is an injury to the skin or other organic tissue primarily caused by heat or due to radiation, electricity, radio activity, friction or contact with chemicals[1]. It is a prevalent and burdensome critical care problem. During burn trauma, prolonged exposure to high temperatures, leads to tissue damage via thermal denaturation of proteins, and loss of the plasma membrane integrity. These lesions cause cell death and various molecular structural alterations leading to the release of toxic metabolites as well as antigens and immunomodulatory agents[2]. Following the initial tissue damage, an inflammatory response takes place with a massive local influx of inflammatory cells that release various agents which coordinate the action of immuno-competent cells that. The action of these calls is reflected by localized oedema, altered perfusion and systemic inflammatory response[3]. It is estimated that over one million people are moderately or severely burnt every year in India[1]. Burns can be categorized as scald, contact burns and flammable burns. The most common group involved are toddlers (2-4years) for whom scalds are the most common cause and young adults (17-25) usually male, for whom the most common cause is a flammable liquid[4].

So many herbal medicines can help reduce the pain and inflammation caused by burns. In some cases, they also can help promote healing of the skin. These herbs can be used alone or in combination. There are plenty of references of such medicines can be seen in Ayurvedic literature. The properties like *Dagdhaharatva, Twacya, Vrana ropana*, *Seetha, Pitta rakta haratwa* etc helps in healing of burn wound. The main aim of the Ayurvedic researches to prove the efficacy of these herbs mentioned in various text and to find out the mechanism behind their actions.

Studies on Single Herbal Medicines

Kumari (Aloe vera)

Useful part: *Swarasa*

Ayurvedic Properties: *Seetha, Tikta, Madhura, Agnidagdhahara, Pittaraktahara, Twagvikarahara.*

Pharmacological properties: Accelerated effect of *Aloe vera* fermentation on burn injury healing in rat models was evaluated. The results suggests that *Aloe vera* fermentation significantly accelerates burn

injury healing via reduction of the severity of inflammation and through modification of gut microbiota[5]. *Aloe vera* studied in wound healing by evaluating cell proliferation, migration, and viability on normal human primary skin fibroblasts and keratinocytes in growth media with *A.vera* solution and preservatives at various concentrations by invitro analysis and it is found that *Aloe vera* accelerates wound healing by promoting the proliferation and migration of fibroblasts and keratinocytes and by protecting keratinocytes from preservative induced death[6]. Anti-inflammatory activity of aqueous, chloroform, and ethanol extracts from *Aloe vera* gel on carrageenan-induced edema in the rat paw, and neutrophil migration into the peritoneal cavity stimulated by carrageenan are investigated and the results proved anti-inflammatory activity and suggested its inhibitory action on the arachidonic acid pathway via cyclooxygenase[7]. In a study polysaccharide and flavonoid concentrations of two, three, and four year old *Aloe vera* were determined, and their antioxidant activities were evaluated and the results suggested data suggest that the growth stage plays a vital role in the composition and antioxidant activity of *Aloe vera*[8].

***Yashtimadhu* (*Glycyrrhiza glabra*)**

Useful part: Rhizome

Ayurvedic Properties: *Sitavirya, Varnakrut, Vranapaha.*

Pharmacological properties: The effect of *Glycyrrhiza glabra* L. extract on the full-thickness wound healing in Guinea Pig model are investigated and the results suggests that 5% and 10% w/w *G. glabra* creams were effective in acute dermal wound healing[9]. Antimicrobial and antioxidant activities of root methanolic extracts of *Glycyrrhiza glabra* var. *glandulifera* (Waldst. & Kit.) Boiss. (Fabaceae) were proven, these also helps in wound healing[10]. Methanolic and acetonic extracts of *G.glabra* had potential in vitro antibacterial activity against all the studied gram-positive and gram-negative bacterial strains [11].

***Dadima (Punica granatum*)**

Useful part: Fruit, fruit rind

Ayurvedic Properties: *Dahanasanam, Tridoshahara, Kashayanurasa.*

Pharmacological properties: Wound healing process of whole fruit pomegranate extract *(Punica granatum*) standardized with 40% ellagic acid ointment for deep second-degree burn wound of skin in the rat is studied and it concluded that 10% *Punica granatum* extract accelerates the healing of deep second-degree burn wound[12]. Rind extracts of *Punica granatum* applied topically to ex vivo skin reduces the inflammation and pain associated with a range of skin conditions, including cold sores and herpetic stromal keratitis[13]. Arils, juice and rinds of *Punica granatum* fruits and their aqueous and ethyl acetate extracts displayed good antioxidant activity[14]. Antibacterial and antifungal activities of pomegranate peel extract, seed extract, juice and whole fruit on the selected bacteria and fungi and the peel extract has shown highest antimicrobial activity compared to other extracts [15].

Haridra (Curcuma longa)

Ayurvedic Properties*: Kaphapittanut, Tiktarasa, Varnya, Twakdoshahara, Vranapaha.*

Pharmacological properties: The role of topical treatment with curcumin on burn wound healing in rats are investigated and the results are found to be beneficial[16]. Anti-inflammatory effect of rhizome of *Curcuma longa*. Linn, in Albino rats by the method of Carrageenin induced paw oedema are investigated and it found that the ethanolic extract was dose dependent and statistically significant at dose levels of 1000mg/kg and comparable to that of standard drug used Aspirin. antimicrobial and antioxidant activities of *Curcuma longa* are also proven[17]. Antimicrobial activity was studied by applying ethanolic rhizome extract against Staphylococcus aureus and Salmonella typhi using disc and well diffusion methods and antioxidant property determined by measuring 1,1-Diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity. The finding suggested that turmeric rhizome-extract as a good candidate in the search for a natural antimicrobial and antioxidant agent.[18]

Nalikera (Cocos nucifera)

Useful part: Fruit kernel, flower, oil, root, fruit shell

Ayurvedic properties: *Seetha, Vatapittasranut, Dahanut.*

Pharmacological properties: The burn wound healing property of oil of *Cocos nucifera* are evaluated and compared the effect of the combination of oil of *Cocos nucifera* and silver sulphadiazine with silver sulphadiazine alone. It was found that there was significant improvement in burn wound contraction in the group treated with the combination of *Cocos nucifera* and silver sulphadiazine and the period of epithelialization also decreased significantly[19]. Antioxidant activity of *Cocos nucifera* L. on protein fractions has studied (albumin, globulin, prolamine, glutelin-1 and glutelin-2) and it is found that all the fractions except glutelin-2 could effectively protect DNA against oxidative damage. Several peptides containing five to eight amino acids with antioxidant activity were also identified [20]. Anti-inflammatory, antioxidant, and antimicrobial activities of aqueous

extract of *Cocos nucifera* were evaluated. The extract showed an antioxidant potential in vitro as good as standards in their antioxidant activity and it is also exhibits anti-inflammatory property through the inhibition of the cell migration[21].

***Candana* (*Santalum album*)**

Useful part: Heartwood

Ayurvedic properties: *Sitala, Tikta, Ahladana, Dahanut.*

Pharmacological properties: Burn wound healing property of sandalwood paste and sandalwood paste along with honey are evaluated. Honey and Sandalwood combination showed better effect with complete burn wound healing and sandalwood paste alone was effective in reducing the initial damage.[22] Antioxidant, analgesic and anti-inflammatory activities of the wood of *Santalum album* are also studied. The methanolic wood extract was screened for antioxidant and free radical scavenging effects at various doses (100–500µg/ml) by different specific *in vitro* methods and it is found that extract showed maximum antioxidant effect at 500µg/ml. The methanolic extract of wood was also screened for analgesic and anti-inflammatory activities at various doses (100, 250 & 500mg/kg) and compared with Diclofenac sodium (7mg/kg) taken as standard. The extract showed maximum effect at 500mg/kg. All this results were statistically significant[23].

***Manjistha* (*Rubia cordifolia*)**

Ayurvedic properties: *Madhura, Tikta, Kashaya, Varnakrut, Vrananut.*

Useful part: Root

Pharmacological properties: Burn wound healing potential of *Rubia cordifolia* on Wistar albino rats were evaluated and found that test drug has shown significant wound contraction in comparison to normal control group. Histopathological findings with good epithelization of cells are also supported this[24]. The wound healing activity of ethanolic extract and its gel formulation of the roots of *Rubia cordifolia* are demonstrated in animal model and found to be effective in the functional recovery of the healing of wounds and also in histopathological alterations[25]. The antimicrobial effect of *Rubia cordifolia* root water and methanol extracts on various microorganisms using the agar well diffusion method were also evaluated and it showed antibacterial activity against all the three Gram-positive bacteria used in this study and four Gram-negative bacteria[26].

***Kadali* (*Musa paradisiaca*)**

Ayurvedic properties: *Pittasrajit, Dahanut, Seeta*

Part used: Fruit, stem, flower

Pharmacological properties: The methanolic, chloroformic and hexanoic extracts of *Musa paradisiaca* peel evaluated for its wound healing activity and it showed better wound healing activity in comparison with the group treated with chloroformic extract, with an inhibition of DPPH radical bleaching of 89-90% [27]. The ethanol extracts and its fractions of unripe *Musa paradisiaca* were studied against carrageenan induced paw oedema and it showed significant anti-inflammatory activity [28]. Antioxidant activities of the aqueous extracts of unripe *Musa paradisiaca* are evaluated by assessing their inhibitory action on sodium nitroprusside induced lipid peroxidation in rat pancreas in vitro and to characterize the main phenolic constituents of the plantain products using gas chromatography analysis. The results revealed that all the aqueous extracts showed antioxidant activity which is also helpful in wound healing [29].

***Tulasi* (*Ocimum sanctum*)**

Ayurvedic properties: *Tikta, Hrudya*

Part used: Leaves, root, seed.

Pharmacological properties: Burn wound healing properties of Ocimum sanctum by monitoring of period of re-epithelization in rabbits were evaluated and group treated with ointment silver sulfadiazine and *Ocimum sanctum* showed minimum re-epithelization period.[30] The anti-inflammatory activity of aqueous extract of *Ocimum sanctum* was studied using Carrageenan-induced rat paw edema and it showed significant anti-inflammatory property due to inhibition of both cyclooxygenase and lipooxygenase pathways of arachidonic acid metabolism[31]. The in vitro antimicrobial property of ethanolic extracts of *Tulasi* leaves on periodontal pathogens with doxycycline as standard were assessed and it is found that *Tulasi* was effective against A. actinomycetemcomitans[32]. Antioxidant and wound healing effects of alcoholic and aqueous extract of *Ocimum sanctum* Linn in Rats were evaluated. Both the doses of alcoholic and aqueous extract significantly increased wound breaking strength, decreased percentage of wound contraction and it also exhibited antioxidant activity[33].

***Tila* (*Sesamum indicum*)**

Useful part: Seed and oil

Ayurvedic properties: *Seeta, Twacya, Vrananut*

Pharmacological properties: The effects of sesame ointment on the process of second-degree burn wound healing in rat models according to stereological parameters and the results suggests that the mean of reduction in wound areas, volume density of collagen bundles and hair folicules, fibroblast populations, length density of vessels in

sesame ointment group was significantly higher than control group[34]. Wound healing activity of *Sesamum indicum* L seed and oil in rats in the excision and burn wound and animals showed significant reduction in period of epithelization and wound contraction[35].

***Himsra* (*Capparis spinosa*)**

Useful part: Fruit, leaf, petals

Ayurvedic properties: *Tikta rasa, Vatakaphahara*

Pharmacological properties: The effects of *Capparis spinosa* leaves extract (CSLE) cream compared with silver sulfadiazine (SSD) cream to heal burn wounds in rats are evaluated and it is found that 5 and 10% leaf extract cream are more effective to decrease burn wound area compared with other groups[36]. Hydro-ethanolic extract of *Capparis spinosa* leaves by analyzing the content in anti-oxidant compounds such as polyphenols, flavonoids and anthocyanins are studied and results reveals that *C. spinosa* leaves are a potential source of natural antioxidant molecules.[37]

Ayurvedic Compound Formulations

***Chandanadi yamaka*[38]**

The efficacy of *Chandanadi yamaka* was studied in a clinical trial conducted in patients with second degree burn with involvement below 15% of total body surface area (TBSA) and the results showed that *Chandanadi yamaka* is effective in the management of burn wounds.

Crocodile oil [39]

Burn healing efficacies of the crocodile oil burn ointment are studied by employing deep second-degree burns in a Wistar rat model. The anti-inflammatory and analgesic properties of this formulation were also studied to provide some evidences for its further use. After the study it is found that crocodile oil ointment accelerated wound closure, reduced inflammation, and had analgesic effects compared with Silver Sulfadiazine in deep second degree rat burn model.

***Jatyadi taila* [40]**

Jatyadi taila is studied for its effect on partial thickness burn wound in animal model and its comparable effectiveness to silver sulfadiazine in burn wound healing and it is found to have a promising result. Ingredients of *Jatyadi Taila* have been studied extensively for their antimicrobial, anti-inflammatory and antiseptic activity which may be responsible for its efficacy in wound healing..

Plain *Ghritha, Sathadhoutha ghritha, Sahasradhoutha ghritha* [41]

The healing property of plain *Ghritha, Sathadhoutha ghritha, Sahasradhoutha ghritha* in partial thickness burn are evaluated in animal model in comparison with the standard drug Silver sulfadiazine. By analysing results it is found that epithelization has hastened in all drug treated groups compared to control group. The results of plain *Ghritha* and *Sathadhoutha ghritha* treated groups were statistically significant in comparison to the normal control group. Plain *Ghritha* and *Sathadhoutha ghritha* has burn wound healing property compared to Silver sulfadiazine.

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