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Authenticity of Turmeric (*Curcuma longa*) Playing Vital Role in Wound Healing

Muhammad Jamil, Noman Latif and Fawad Anwar

PARC Arid Zone Research Centre (AZRC, PARC), Dera Ismail Khan-29050-Pakistan

Abstract: Turmeric is considered beneficial to promote the healing process of skin wounds. Turmeric plays an important function in inhibition of platelet aggregation, myocardial infarction, tumor genesis, inflammatory cytokine production, oxidative process and metastasis.Skin acts a protective barrier of body. It keeps the internal body organs safe from external environmental conditions. These conditions can prove harmful for them. So maintenance of skin integrity is very important for normal functioning of body. In our daily life, body of both animals and humans is encountered to different types of violence. Some of them are of such a severity that they break the skin continuity. This breakage of skin continuity is termed as wound. Whenever the skin continuity is broken, internal organs of body are exposed. This is a dangerous situation and can be fatal for life. Immediate response of skin after wound is the start of wound healing process. This process starts automatically. This process can be assisted in a number of ways by keeping the wound free from bacterial contamination and keeping it free from moisture and dirt. For this purpose a variety of antiseptic dressings are available which when applied topically support wound healing process. They prevent wound to be contaminated by any microorganism and reduce wound healing time. Turmeric possesses significant wound healing properties. The super focus of this review was to summarize the findings of earlier scientists with authentic concluding verse for utilization of herbal medicines (Turmeric) being safe, readily available and cheaper.

Key words: Turmeric · Phytomedicine · Wounds · Healing

INTRODUCTION

A wound is described as a disturbance in the stability of mucosa of the skin with thermal or physical damage. The wound is categorized as acute and chronic due to the interval and nature of healing process [1]. Healing of the wound is necessary for the return of disrupted anatomical stability of skin. Wound healing involves three phases viz. inflammation (0-4days), cellular proliferation (4-12days) and remodeling (3-5month).Healing requires the joint efforts of various tissues and cells like aggregation of platelets, blood clotting, fibrin formation, angiogenesis and re-epithelialization. Healing is completed by tightly uniting the damaged surface by collagen. Proper nourishment, oxygenation and wet wound surroundings are necessary for the restoration of the affected part [2].

Superficial burn, partial thickness burn, deep partial thickness burn and full thickness burn are the categories of burn wound. Superficial burns include only epidermis. They are supposed to be erythematic and painful e.g. sunburn, they heal without scaring in 3-4 days. In partial thickness burn, epidermis is affected. In this condition blisters appear. They are moist, painful and pink in color. They heal in 2-3weeks without scaring. Deep partial thickness wounds are pink and white, dry, painful including the reticular layer of the dermis. This condition heals 2-8 weeks with contraction and severe scaring. Full thickness burns include the dermis and subcutaneous tissue. They are white or black and painless [3].

Turmeric is a yellow substance derived from the rhizomes (roots) of *Curcuma longa*. It has a number of biological activities such as anti inflammatory, anti oxidant, anti cancer and anti microbial effects. It has ability to inhibit carcinogenesis at three stages such as tumor promotion, tumor growth and angiogenesis [4].

Turmeric plays an important function in inhibition of platelet aggregation, myocardial infarction, tumor genesis, inflammatory cytokine production, oxidative process and metastasis. It can decrease the cholesterol level in blood, cystic fibrosis defects, improve wound healing, suppress

Corresponding Author: Muhammad Jamil, PARC Arid Zone Research Centre (AZRC, PARC), Dera Ismail Khan-29050-Pakistan.

diabetes, obstruct human immunodeficiency virus (HIV) replication and increase multiple sclerosis [5]. Turmeric is herbal plant belonging to the ginger family. It has been used as spice and coloring agent in the history of China and India [6].

The valuable part of the plant rhizome (root) is used as traditional medicine. Turmeric is used in the treatment of hepatic disorders, cough, sinusitis, diabetic ulcers and biliary disorders. The paste of turmeric and lime has also been used for the treatment of wound and inflammation [7]. Turmeric has excellent antimicrobial activities against *Staphylococcus aureus, Escherichia coli* and *Pseudomonas aeruginosa* [8]. Turmeric has also the activity against neurological cancer, melanoma, lung cancer, ovarian cancer, breast cancer, gastrointestinal cancer, leukemia and lymphoma [9]. The main aim of this review article is to provide the information regarding medicinal impotance of Turmeric especially in wound healing.

Role of Turmeric in Healing of Wound: Jagetia *et al.* [10] investigated the efficacy of the turmeric on wound healing exposed to the radiation in mice. A full thickness wound was produced on the dorsal region of the mice by 2, 4, 6 and 8 Gy (unit of radiation). Wound contraction was observed intermittently by photographic images. The hexosamine, collagen, nitric oxide, DNA and histopathology were observed in treated and non-treated mice with turmeric at various days. Irradiation produced a huge decline in hexosamine, collagen, nitric oxide and DNA synthesis. Treatment with turmeric increased the synthesis of collagen, rate of wound contraction, DNA, hexosamine and nitric oxide. It improves the vascular densities and fibroblast. It also decreases the wound healing time. This study proves that treatment with turmeric has a favorable effect on irradiated wound. It also enhanced the process of tissue repair.

Chattopadhyay *et al*. [11] highlighted the importance and uses of the turmeric. It is mostly used as coloring agent, food preservative and as a spice in South East Asia, China and India. It is also used as traditional medicine in the treatment of various diseases such as anorexia, diabetic wounds, rheumatism, biliary- disorder, cough, hepatic disorders and sinusitis. Curcumin is the main bioactive component of the turmeric. It has a broad spectrum of biological actions. It includes antioxidant, anti-mutagenic, anti-fertility, anti-bacterial, anti-protozoal, anti-fibrotic, anti-ulcer, anti-inflammatory, hypotensive, anti-carcinogenic, anti-coagulant, anti-diabetic, anti-fungal, anti-viral, anti-venom and hypocholesterolemic activities. Anti-cancer activity of the Curcumin is mediated through the initiation of apoptosis. Curcumin is also used to reduce the post-operative inflammation. Advanced study showed that Curcumin and the turmeric both have no toxic effects at high doses. Thus turmeric and the Curcumin have the ability to improve the modern medicines for the cure of various diseases.

Panchatcharam *et al*. [12] evaluated the capacity of turmeric as cell reinforcement and producing changes in collagen qualities amid wound recuperating. Surgical injuries were made over the fccdorsal area of rodent and turmeric was applied topically. For biochemical examination and obsessive changes, wound tissues were uprooted on 4^{th}, $8^{th}$and 12^{th} days. Turmeric upgraded collagen combination and cell multiplication at the injury site. Histopathological examinations demonstrated injury compression, better re-epithelialization and expanded elasticity. It enhanced the level of catalase (CAT), superoxide dismutase (SOD) and glutathione peroxidase (GPx) while diminished the level of lipid peroxides (LPs) which diminish the cancer prevention agent impact of turmeric in wound recuperating. Prevalent development and the cross connecting of collagen were observed in the turmeric treated rats. These outcomes obviously demonstrated the significant impacts of turmeric in wound healing.

Pandey *et al*. [13] formulated the herbal ointment containing Turmeric, Neem and *Aloe vera* to evaluate the antifungal and antibacterial activity. *Aloe vera* ointment showed the broad spectrum antibacterial and antifungal activities against *Escherichia coli* and *Aspergillus varies*. Turmeric ointment and *Aloe vera* ointment showed more anti-fungal action than *Neem* ointment. It was also found that the ointment containing the mixture of Turmeric, *Neem* and *Aloe vera* showed more antifungal action than antibacterial. It can be used to handle the wounds, burns, rashes, sun burns and other skin infections

Naz *et al*. [14] studied the antibacterial activity of crude extracts and essential oils of turmeric against 4 bacterial strains viz., *Bacillus subtilis, Bacillus licheniformis, Bacillus macerans* and *Azotobacter* by agar well diffusion method. Ethanol and methanol were used as a solvent to determine the antibacterial activity. By hydro distillation essential oil was extracted and diluted in methanol. Both crude extract and essential oils showed region of inhibition zone against the tested strains of the bacteria. Among all the tested bacterial strains the *Bacillussubtilus* was most sensitive to essential oils and the extract of the turmeric.

Damalas *et al.* [15] described the properties of turmeric. In the form of powder it is used as food preservative, spice and food coloring agent. Turmeric has a long history due to its unique and therapeutic properties. It has beneficial therapeutic properties such as anti-inflammatory, anti-bacterial, antioxidant and analgesic. It is also used in the treatment of digestive problems, liver disorder, arthritis, cancer and certain other diseases. Except the medicinal properties, its aqueous extract, juice and oil have the beneficial properties against the insects. It is also used as repellent against the noxious mosquito species. Turmeric has a satisfactory activity as a natural pesticide and protects the crops.

Meriselvam *et al.* [16] determined the properties of the turmeric. It has multi therapeutic properties such as anti-oxidant, anti-microbial, inhibition of the inflammation, tumor inhibiter, diseases of the cardiovascular, angiogenesis and diabetes. It is also used in the treatment of loss of bone and muscles, liver disorder, depression and is effective in the treatment of the neuropathic pain. The efficacy of the Curcumin is restricted by its unique color and insolubility in water. To evaluate the anti-microbial activity of turmeric a study was conduct. In this study turmeric extract was used against ten different bacterial strains. The antimicrobial activity of the turmeric extract was observed by agar well diffusion method. The natural dye showed the weak activity against all the isolated bacterial tests. Turmeric extract with natural dye showed the power full activity against the *Vibrio cholera* and *Escherichia coli* with an inhibition zone range 7-10mm.

Mukhtar *et al.* [17] conducted an experiment to evaluate the anti-microbial efficacy of turmeric, garlic and the cinnamon. Water and ethanol were used as solvent for the preparation of different extracts concentrations. The anti-microbial activity against *Escherichia coli* and *Bacillus subtilus* was tested at different extract concentrations of spices by disc diffusion method. According to results in selected spices the garlic showed the excellent microbial activity against *Bacillus subtilus* and *Escherichia coli* with zone ranging 26mm and 22mm respectively. The ethanolic extract was less effective as compared to the aqueous extract. In case of turmeric and cinnamon, the ethanolic extract was superior as compared to the aqueous. It showed the 17mm zone against *Escherichia coli* and 16mm against *Bacillus subtilus*. It indicates that the ethanolic extract of cinnamon is effective against Gram positive and Gram negative bacteria. The ethanolic extract of turmeric showed the 14mm and 11mm zone respectively against *Bacillus subtilus* and *Escherichia coli*. The result indicates that *Bacillus subtilus* is more sensitive as compared to the *Escherichia coli* to the test spice.

Purohit *et al.* [18] estimated the efficacy of the ethanolic extract of the turmeric (*Curcuma longa*) on wound healing. For this purpose 18 young Albino rats weight 180-200gm were selected. They were divided into three groups A, B and C. In each group 6 rats were assigned. Group A was called test group and treated by ethanolic extract. Group B was control group and remained the untreated. Group C was the standard group and treated with povidone iodine ointment. Animals were anaesthetized by ether and shaved the area to expose. Circular incised wound on the thoracic region was made. Test and standard preparations were applied topically once a day for 16 days until the healing was completed. At 3, 6, 9 and 12 days post incision, wound contraction was measured. The parameters were wound contraction and time of epithelialization. After complete healing the results were compared. Group A treated by ethanolic extract showed the faster healing and the results were significant when compared with standard group treated by povidone iodine ointment.

Nezhad *et al*. [19] estimated the efficiency of turmeric on wound healing with acidic origin. Five rabbits were selected, shaved over the back region and six wounds were produced by acid. Some burns were taken as test and treated with turmeric extract daily while others were taken as control and treated with vaseline. After 14 days of wound formation, epithelium thicknesses in samples treated by vaseline and turmeric powder were 76±3.7 and 97±4.4 micrometers, respectively and *50±3.*2 micrometers in negative control sample. The assessment of mean epithelium thickness, re-epithelialization percentage and crust formation in treated and control samples showed that the speed of restoration in test samples treated by turmeric was 5-10 days faster as compared to control ones.

CONCLUSIONS

Wound healing is an intricate process where the skin or other body tissues repairs themself after the injury but some time healing may fail because of interruption at any stage. There are many factors including diabetes, anaemia, nutritional deficiency, local infections, hematoma etc. can slow the healing process of wound. Many herbal plants like neem, turmeric, *Aloe vera* etc are found useful in treating of wound. The wound healing by turmeric are inexpensive, affordable and safe because having no side

effects. These herbal ointments induce healing and regeneration of the lost tissues by multiple mechanisms. However, there is a need for scientific evaluation, standardization and safety evaluation of these herbal ointments.

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