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A REVIEW ON MEDICINAL PLANTS USED IN WOUND HEALING

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ABSTRACT

Wound healing is a dynamic biological process that occurs through a sequence of interrelated cellular and molecular events, including inflammation, cell proliferation, angiogenesis, and tissue remodeling. Since ancient times, medicinal plants have been widely used in the management of wounds due to their antimicrobial, antioxidant, and anti-inflammatory properties. Numerous plant-derived phytoconstituents have been reported to enhance tissue regeneration and promote faster wound closure. This review highlights important medicinal plants, their bioactive compounds, possible mechanisms involved in wound repair, and available scientific evidence supporting their wound healing potential. The integration of herbal medicines into modern wound care practices may provide effective, economical, and safer therapeutic options.

Keywords: Wound Healing, Medicinal Plants, Phytochemicals, Antioxidant, Antimicrobial Activity.

1. INTRODUCTION

Wound healing is a natural physiological process by which damaged tissue repairs itself after injury. It involves a well-coordinated interaction of cells, growth factors, and extracellular matrix components. Conventional wound healing agents may lead to adverse effects and antimicrobial resistance. Therefore, medicinal plants are gaining attention due to their minimal side effects and broad pharmacological actions. Plant-derived bioactive compounds such as flavonoids, alkaloids, tannins, and terpenoids play a significant role in accelerating wound repair [1,2].

2. PHASES OF WOUND HEALING

The wound healing process is divided into four overlapping phases:

- **Hemostasis:** Immediate response involving blood clot formation.
- **Inflammation:** Removal of debris and prevention of infection.
- **Proliferation:** Formation of granulation tissue, collagen synthesis, and angiogenesis.
- **Remodeling:** Maturation and strengthening of newly formed tissue [3].

Proper progression through these phases is essential for effective wound closure.

3. MEDICINAL PLANTS USED IN WOUND HEALING

3.1 Aloe vera

Aloe vera is widely used in wound healing due to its moisturizing, anti-inflammatory, and antimicrobial properties. The presence of polysaccharides, glucomannan, and vitamins promotes fibroblast proliferation and collagen synthesis, leading to faster epithelialization [4].

3.2 Centella asiatica

Centella asiatica enhances wound healing by stimulating collagen production and angiogenesis. Triterpenoids such as asiaticoside improve tensile strength and accelerate tissue regeneration [5].

3.3 Curcuma longa

Curcuma longa (turmeric) contains curcumin, which exhibits strong antioxidant and anti-inflammatory activity. Curcumin reduces oxidative stress, enhances granulation tissue formation, and accelerates wound contraction [6].

3.4 Azadirachta indica

Azadirachta indica (neem) possesses potent antimicrobial and immunomodulatory effects. Compounds such as nimbidin and nimbolide help in preventing wound infection and promote faster healing [7].

3.5 Ocimum sanctum

Ocimum sanctum (Tulsi) has anti-inflammatory and antioxidant properties. Its bioactive constituents enhance collagen deposition and protect wounds from microbial invasion [8].

3.6 Calendula officinalis

Calendula officinalis promotes epithelial regeneration and granulation tissue formation. Flavonoids and triterpenoids present in the plant contribute to its wound healing and antimicrobial activity [9].

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4. MECHANISMS OF WOUND HEALING BY MEDICINAL PLANTS

Medicinal plants promote wound healing through multiple mechanisms:

- **Antimicrobial action** prevents infection at the wound site [10].
- **Anti-inflammatory activity** reduces excessive inflammation [11].
- **Antioxidant effect** protects cells from oxidative damage [12].
- **Enhanced collagen synthesis and cell proliferation** accelerates tissue repair [13].

5. CLINICAL EVIDENCE

Several experimental and clinical studies have validated the wound healing potential of medicinal plants. Aloe vera has shown significant improvement in burn and surgical wound healing [14]. Turmeric-based formulations have demonstrated improved outcomes in chronic wounds and diabetic ulcers [15].

6. SAFETY AND TOXICOLOGICAL CONSIDERATIONS

Although medicinal plants are generally considered safe, improper dosage and lack of standardization may lead to adverse effects. Therefore, toxicity evaluation and quality control are essential before clinical application [16].

7. FUTURE PERSPECTIVES

Future research should focus on:

- Standardization of herbal extracts
- Identification of molecular targets
- Development of herbal wound dressings and topical formulations

Such approaches can enhance the clinical acceptance of medicinal plants in wound management.

8. RESULT AND DISCUSSION

The overall evidence obtained from published preclinical and clinical studies suggests that medicinal plants play an important role in enhancing the wound healing process. Most herbal extracts were found to promote faster wound contraction, improved epithelialization, and better tensile strength of the regenerated tissue when compared with untreated control groups.

Several studies have shown that **Aloe vera** gel reduces healing time in burn and surgical wounds by stimulating fibroblast proliferation and increasing collagen synthesis. Extracts of **Centella asiatica** were reported to enhance angiogenesis and collagen deposition, resulting in stronger and more stable healed tissue. In a similar manner, **Curcuma longa** was observed to accelerate wound closure by minimizing oxidative stress and suppressing excessive inflammation at the wound site.

Medicinal plants such as **Azadirachta indica** and **Ocimum sanctum** demonstrated notable antimicrobial activity against common wound-infecting microorganisms, which helps in preventing secondary infections and supports uninterrupted healing. In addition, **Calendula officinalis** was found to improve granulation tissue formation and epithelial regeneration, thereby contributing to efficient wound repair. Overall, the available literature clearly indicates that medicinal plants possess multiple biological activities, including antioxidant, anti-inflammatory, and antimicrobial effects, which together facilitate effective wound healing.

9. CONCLUSION

Medicinal plants play a vital role in wound healing due to their multifaceted pharmacological properties. Scientific validation of traditional knowledge supports their potential use as effective and safer alternatives to synthetic wound healing agents.

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