

## Herbal Therapy for Burn Wound Infections

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**ABSTRACT**

**Background and Objectives:** Burns are a major global public health problem, accounting for an estimated 180,000 deaths annually. The majority of burn-related deaths occur in low- and middle-income countries. Considering the importance of treating infected burn wounds with the least adverse effects, we aimed to search the literature to find new treatments for infected wounds using medicinal plants.

**Methods:** The search process was carried out using various databases including Google Scholar, ScienceDirect, Web of Science, MEDLINE, PubMed, Scopus, and the Cochrane Library. We searched for relevant original and review articles (published in English or Persian) using the following keywords: herbal extract, herbal medicine, burn infection, and wound infection.

**Results:** Overall, we found approximately 100 articles related to the use of medicinal plants for treatment of wounds or infections. According to these studies, main constituents of plant extracts were carvacrol, flavonoids, terpenoids, phenolic diterpenes, and phenolic acids. Most studies assessed the antimicrobial activity by determining minimum inhibitory concentration and minimum bactericidal concentration using the disc diffusion method.

**Conclusion:** Given the favorable antimicrobial activity of medicinal plants, it is recommended to use them for treatment of burn wound infections.

**Keywords:** Herbal Medicine, Wound Infection, Herbal Extract.

## INTRODUCTION

Skin is an effective barrier against microorganisms and harmful substances. However, wounds in this layer allow normal flora and other bacteria that live on the skin to cause infection, which can spread to the bloodstream (1). Therefore, finding therapeutic agents for the faster repair of the epidermis after skin injury is extremely important. Antibacterial treatment of wounds can prevent infections. Recently, medicinal plants have been proposed as suitable alternatives to chemical antibiotics (2).

A burn is damage caused by heat, electricity, chemicals, friction, or radiation. There are three types of burns: first-degree burns (superficial), second-degree burns (partial thickness burns), third-degree burns (full thickness burns) (3).

According to the World Health Organization, an estimated 180,000 deaths every year are caused by burns, which predominantly occur in low- and middle-income countries. In these countries, burn death rates in children are over seven times higher than in high-income countries. Burns are also among the leading causes of disability-adjusted life years (DALYs) lost in low- and middle-income countries (4-6).

Considering the importance of treating infected wounds with the least adverse effects, we aimed to search the literature to find new treatments for infected wounds using medicinal plants.

## MATERIALS AND METHODS

The search process was carried out using various databases including Google Scholar, ScienceDirect, Web of Science, MEDLINE, PubMed, Scopus, and the Cochrane Library. Original and review articles published in English or Persian were searched using the following keywords: herbal extract, herbal medicine, burn infection, and wound infection. Persian databases including Magiran, Irandoc, Scientific Information Database, and Iranmedex were also searched with similar strategy and equivalent keywords in Persian.

## RESULTS

We found approximately 100 articles on aqueous, methanolic and ethanolic extracts of different plants such as *Avicennia marina*,

*Scrophularia striata*, *Thymus vulgaris* L., *Achillea Santolina*, *Mentha piperita*, *Rosmarinus officinalis*, *Glycyrrhiza glabra*, *Mentha piperata*, *Satureja khuzestanica Bunge*, *Satureja khuzistanica jamzad*, *Satureja rechingeri Jamzad*, *Satureja hortensis*, etc. All of these plants are native to Iran and had been collected from various part of the country. In the articles, antimicrobial activity was assessed by determining minimum inhibitory concentration and minimum bactericidal concentration using the disc diffusion method. In some instances, studies had utilized nanoparticles to evaluate the antibacterial properties of plant extracts. Antimicrobial activity of the extracts have been usually assessed against *E. coli*, *Shigella dysenteriae*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Streptococcus pyogenes*, *Staphylococcus aureus*, *Bacillus subtilis*, and *Candida albicans*.

## DISCUSSION

Essential oils and extracts of medicinal plants have been used for thousands of years in traditional medicine. Recently, the use of compounds that are generally regarded as safe (GRAS) has attracted much attention. Plants are one of the most important sources of natural GRAS compounds that have antimicrobial and food preservative properties (7, 8).

Gas chromatography/mass spectrometry (GC/MS) was the most common method of characterizing the chemical composition of plant essential oils and extracts (12). Carvacrol is the main constituent of *Satureja khuzistanica jamzad* and *Satureja hortensis* extracts (9, 10). Camphor is a major component in *Achillea Santolina* essential oil (11). Flavonoids and terpenoids are the main components of *Mentha piperita* (12), and phenolic diterpenes and phenolic acids were frequently found in *Rosmarinus officinalis* (13).

We found that nanoparticles of medicinal plants have strong antibacterial properties. For example, nanoparticles of *Glycyrrhiza glabra* extract exhibits greater bactericidal activity compared to the *Glycyrrhiza glabra* extract (14).

## CONCLUSION

Given the favorable antimicrobial activity of medicinal plants such as *Avicennia marina*, *Scrophularia striata*, *Thymus vulgaris* L., *Achillea Santolina*, *Mentha piperita*, *Rosmarinus officinalis*, *Glycyrrhiza glabra*, *Mentha piperata*, *Satureja khuzestanica* Bunge, *Satureja khuzistanica jamzad*, *Satureja rechingeri* Jamzad, and *Satureja hortensis* against some gram-negative and -positive bacteria as well as fungi such as *Candida albicans*, it is recommended to use such

extracts for treatment of burn wound infections.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

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