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Implementation of plant extracts in healing materials: an advanced method to promote healing

Implantação de extratos fitoterápicos em materiais cicatrizantes: uma abordagem avançada da promoção da cicatrização

Sarah Maria Lucena Teles Cruz[1] Gislaine Simões Portela Barros[1]
Leane de Fátima Matias do Nascimento[1] Marcos Vinícius Ferreira Fausto[1]
Tharcia Kiara Beserra de Oliveira[1]

[1] Faculdade de Medicina de Olinda. Olinda, Pernambuco, Brazil.

Abstract

Objective: To analyze the effects of plant extracts on wound healing materials, focusing on their physicochemical properties and effectiveness in healing. **Methods:** This integrative review was conducted in PubMed and Lilacs databases using the descriptors “plant medicine” and “wounds” combined with the Boolean operator AND; the publication date encompassed studies from 2018 to 2023. Twelve studies were analyzed. **Results:** Selected studies were characterized by the following information: author, year of publication, population and intervention, objectives, and conclusion. Plant extracts were widely used alone or combined with other healing materials; most studies presented promising results. **Conclusion:** The analyzed studies corroborate the importance of using plant extracts in wound healing associated (or not) with other existing measures, demonstrating their effective therapeutic potential. Despite the progress made, the healing potential of plant extracts still needs further research.

Keywords: Plant extracts; Phytotherapy; Healing; Wounds and injuries.

Corresponding author:
Sarah Maria Lucena Teles Cruz
Email:
Sarahmaria09831@gmail.com
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Resumo

Objetivo: Analisar os efeitos dos extratos fitoterápicos em materiais cicatrizantes de feridas, com foco nas suas propriedades físico-químicas e sua eficácia na cicatrização. **Metodologia:** Tratou-se de uma revisão integrativa realizada nas bases de dados PubMed e Lilacs utilizando os descritores fitoterápico e feridas combinados com o operador booleano AND, considerando artigos incluídos no período de 2018 a 2023. Foram analisadas 12 publicações. **Resultados:** Foi realizada a identificação dos trabalhos selecionados, elencando-se os dados relacionados a autor, ano de publicação, população e intervenção, objetivos e a conclusão do estudo. Foi observada a ampla utilização de fitoterápicos, atuando isoladamente e em conjunto com outros materiais cicatrizantes. Os resultados foram promissores na maioria dos estudos. **Conclusão:** Os estudos analisados corroboram a importância do uso de fitoterápicos no processo de cicatrização de feridas, podendo associar a outras medidas já existentes, evidenciando o eficaz potencial terapêutico. Apesar dos avanços, temos muito a evoluir quanto à utilização e validação do potencial cicatrizante dos fitoterápicos.

Palavras-chave: Extrato vegetal; Fitoterapia; Cicatrização; Ferimentos e lesões.

INTRODUCTION

A wound is a deformity or continuity solution that can reach from the epidermis to deeper structures[1]. Skin diseases, injuries, and burns affect more than 600 million people each year and cost more than $1 billion to health systems worldwide. In Brazil, wounds caused more than 700,000 hospitalizations in 2020, costing about R$850 million to the Unified Health System (SUS), according to the Department of Informatics of the Unified Health System[2]. Several conditions at the wound location must be controlled to ensure efficient healing, such as oxygenation, temperature, and the use of appropriate bandages.

Bandages or coverings are therapeutic means of cleaning and applying material to protect, absorb, and drain a wound, helping in its resolution[4]. Several bandages are commercially available, and the most commonly used are zine, cerium nitrate, hydrocolloid, hydrogel, non-adherent gases, synthetic biological membranes, and dermal regeneration matrix. The choice of bandage should be based on the characteristics of the wound, prioritizing those that cause less pain, are more comfortable for the patient, and are more economically viable[5].

An alternative to wound treatment would be the use of plant extracts. The National Health Surveillance Agency (ANVISA) considers plant extracts those obtained exclusively from raw materials of plant origin with constant and reproducible quality and whose risk and efficacy can be characterized in ethnopharmacological surveys, scientific-technical documentation, publications,

or clinical trials[6].

The use of plant extracts to treat, cure, and prevent diseases is an ancient practice that continues to the present day[7]. Therefore, this integrative review aimed to analyze the effects of plant extracts on wound healing materials, focusing on their physicochemical properties and effectiveness in promoting healing.

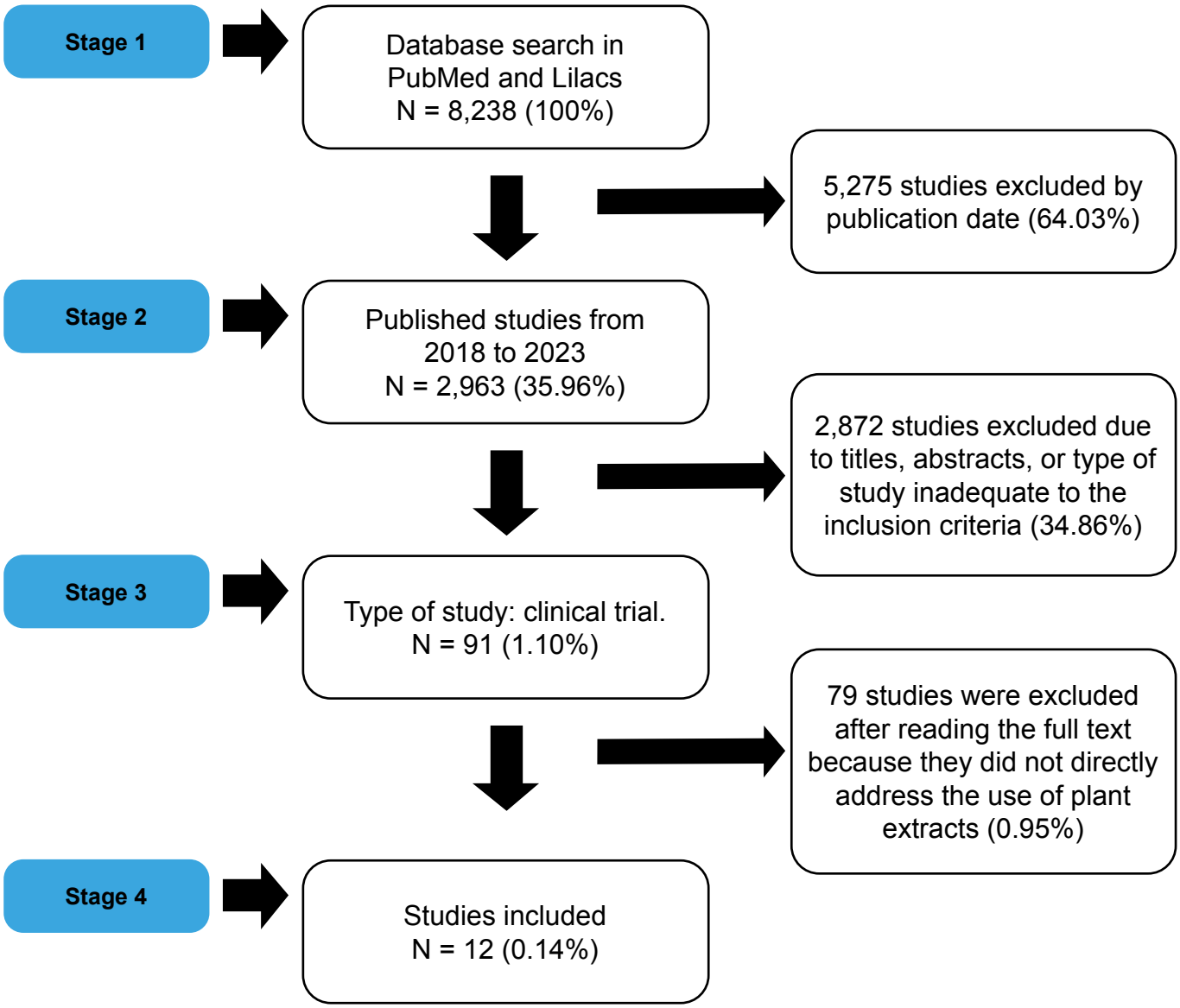
MATERIAL AND METHODS

This integrative literature review analyzed and combined studies with several methodologies, comparing the use of plant extracts as wound healing materials. The study was based on the question: “What are the main plant extracts that are effective in wound healing, and what are their main physicochemical properties?”. The integrative review used a qualitative methodology to collect and summarize the scientific knowledge produced on the theme. The integrative review method adapts the synthesis of knowledge and the applicability of the results, ensuring a care practice based on scientific evidence. This method is considered a unique tool in the health field, as it synthesizes the available research on a theme and guides the practice based on scientific knowledge[8].

The search occurred in October and November 2023 in the PubMed and Lilacs databases, using the terms “plant medicines” and “wounds”; the search terms were combined with the Boolean operator “AND”, and studies published in the last five years were considered. In the initial phase, the titles and abstracts were read, considering the selection criteria. Then, the independent reviewers performed a previous reading of all the selected studies. The results are summarized in the flowchart of Figure 1.

The review had the following inclusion criteria: a) studies; b) available in full text free of charge (original type, clinical trial); c) studies addressing specific themes of plant extracts used in wound healing; d) published from 2018 to 2023; e) availability in Portuguese and English. Reviewers excluded studies that did not address the guiding question of the review.

Figure 1. Flowchart referring to search results.



Source: authors

RESULTS

The integrative review included 12 studies. They were identified based on data related to the title, author, year of publication, population, and study objective (Chart 1).

Chart 1. Summary of studies included (n = 12).

Authors and Year	Population and intervention	Objective	Conclusion
Giostri *et al*., 2021.	Patients with acute hand wounds. *Calendula officinalis L.* Extract.	Photoplanimetry was used to analyze the progression of the healing by second intention in acute hand wounds using the standardized extract of *C. officinalis.*	The *C. officinalis* extract led to faster epithelialization of the hand wounds.
Surakunprapha *et al*., 2020.	Patients with post-sternotomy scarring. Plant extracts in silicone gel.	To determine whether adding plant extracts to the silicone gel would enhance the healing effect on post-sternotomy scarring.	Post-sternotomy scars tend to show better vascularity and pigmentation when treated with silicone gel combined with plant extracts.
Rambe *et al*., 2022.	*In vivo* – rats. Rosella leaf extract gel (*Hibiscus sabdariffa L.).*	To evaluate the effect of rosella leaf extract on wound healing in rats.	The experimental groups presented no differences in wound healing and epithelial thickness compared with the control group.
Hadizadeh-Tal *et al*., 2022.	Primiparous with episiotomy. Rosemary cream.	To determine the effect of rosemary cream on the healing of episiotomy wounds in primiparous women.	Rosemary cream may be effective in healing episiotomy wounds in primiparous women. However, further studies are suggested to confirm the findings.
Faraji *et al*., 2021.	Episiotomized primiparous women. *Commiphora myrrha* (Nees) Engl. and *Boswellia carterii Birds*.	To investigate the efficacy and safety of myrrh and frankincense sitz baths in the healing of episiotomy wounds in primiparous women.	Myrrh was more efficient than frankincense and betadine in healing the episiotomy wound and can be recommended as a safe natural therapy.
Sabando *et al*., 2020.	*In vivo* – rats. Hydrocolloid film based on pectin, starch, *Gunnera tinctoria, and Ugni molinae* plant extracts.	Prepare pectin or starch cross-linked blend-based hydrocolloid films loaded with bioactive extracts of *G. tinctoria* and *U. molinae* leaves with controlled release of bioactive compounds and healing properties.	Licorice root hydroalcoholic extract can accelerate the healing process of second-degree burns.
Garbuio *et al*., 2022.	Breast cancer patients Chitosan-coated chamomile microparticles.	To evaluate the effect of a topical formulation containing microparticles of *Chamomilla recutita (L.) rauschert* coated with chitosan in relation to the incidence, degree, and days of onset of radiodermatitis in women with breast cancer.	Although chamomile presented did not reduce any degree of radiodermatitis, the extract was effective in reducing grade 2 or toxicity, improving skin recovery, and decreasing high-intensity local symptoms.
Liu *et al*., 2020.	Patients with diabetic foot ulcers. Topical composite fluid of the *Phellodendron amurense* cortex.	To analyze the clinical application of the composite fluid of the *P. amurense* cortex in the treatment of diabetic foot ulcers.	The treatment with *P. amurense* cortex can promote ulcer healing and increase the concentration of growth factors, in addition to being safe and reliable.

Soltani *et al*., 2020.	Head and neck cancer patients who had radiation-induced oral mucositis. *Plantago major L* syrup.	To evaluate the efficacy of *P. major* on the symptoms of radiation-induced mucositis in cancer patients.	*P. majo*r syrup effectively reduced the symptoms of radiation-induced mucositis in patients with head and neck cancer.
Mohaghegh *et al*., 2022.	The study involved women who underwent episiotomy during childbirth. *Malva Sylvestris* lotion.	To investigate the effect of *M. sylvestris* lotion on episiotomy pain and healing.	Although *M. sylvestris* presented positive results in wound healing in animal and *in vitro* studies, this extract did not show positive results on wound healing and pain relief from episiotomy.
Zabihi *et al*., 2023.	Patients with burns. Licorice root hydroalcoholic extract.	To investigate the healing effect of licorice root hydroalcoholic extract on the healing process of second-degree burns wounds.	Licorice root hydroalcoholic extract may accelerate the healing process of second-degree burns.
Abbasi *et al*., 2023.	Patients with Aphthous stomatitis Sage (Salvizan gel).	Compare the effects of topical application of sage gels (Salvizan) and triamcinolone acetonide on recurrent aphthous stomatitis.	This study showed that Salvizan gel was very effective for treating recurrent aphthous stomatitis, presenting significantly better outcomes than triamcinolone acetonide in pain recovery and wound healing.

Source: authors

DISCUSSION

The studies showed that plant extracts can benefit wound healing. However, each author developed the intervention based on their clinical experiences, using several plant extracts and different methodologies.

The results evidenced the importance of the diversity of plant extracts used in the healing process of the most varied types of wounds. The association of extracts with other pre-existing formulations presented effective therapeutic potential. Wounds after sternotomy treated with the association of silicone gel with plant extracts obtained better healing than those treated with only silicone gel[9]. Moreover, licorice hydrogel healed wounds related to burns[10].

In another study, a hydrocolloid film composed of pectin, starch, *Gunnera tinctoria,* and extracts from *Ugni molinae* plants was used to treat wounds in rats. This film presented properties suitable for adopting plant extracts with healing properties[11].

The plant extract based on the cortex of *Phellodendri* was also evaluated, considering its efficacy for treating diabetic foot ulcers in 720 patients; 540 from the experimental group were treated with the compound and presented a significantly higher healing rate than the control group[12]. Similarly, the healing and anti-inflammatory activity of *Calendula officinalis* in acute hand wounds decreased exudate and hyperemia. Thus, patients treated with *C. officinalis* had a clear reduction in the inflammatory process and accelerated healing compared with the placebo group[13].

For the healing of recurrent aphthous stomatitis, researchers compared the action of Salvizan gel with triamcinolone acetonide; the former presented better results than the latter (1.5 vs 2.5 days for pain recovery). In addition, Salvizan gel reduced wound healing time by 2.7 days[14]. In contrast, Roselle leaf extract gel (*Hibiscus sabdariffa L.*) used in rats did not provide differences in healing and epithelial thickness between groups. However, this extract presented greater healing properties based on clinical and histological evaluation when used at a concentration of 15%. Thus, further studies must investigate the healing effects of the Roselle leaf[15].

Plant extracts can reduce the severity of side effects of radiation in cancer treatment. For example, *Plantago major L.* syrup was used to treat oral mucositis; the intervention group had significantly less severe mucositis and experienced less pain during radiotherapy than the placebo group[16].

These results corroborate the use of chitosan-coated chamomile microparticle formulation to prevent radiodermatitis in the breast. The study observed that the formulation was effective in reducing grade 2 (or higher) toxicity, improving skin recovery, and preventing radiodermatitis in patients with breast cancer undergoing radiotherapy[17].

Currently, obstetrics also recognize the use of plant extracts due to the healing effects of the body in several ways, providing antibacterial, anti-inflammatory, analgesic, anti-allergic, astringent, and healing effects due to these properties. Plant extracts can be used post-episiotomy, a procedure performed at the time of delivery to expand the passage of the vaginal canal preventing perineal lesions, facilitating and speeding up the expulsion of the baby. The delayed healing of episiotomy wounds may lead to infection, triggering perineal pain and discomfort; thus, improving the healing of the wound resulting from episiotomy is one of the main concerns in the postpartum period[18].

The extracts of *Commiphora myrrha*, *Boswellia carteri,* and *Baccharis dracunculifolia* showed good results in the post-episiotomy healing process[19,20]. In contrast, *Malva sylvestris* failed to demonstrate a positive effect on wound healing and pain relief from episiotomy despite demonstrating efficiency in animal and *in vitro* studies[21].

CONCLUSION

The specific chemical properties of each plant extract contribute to efficiency in tissue repair, offering a less expensive and integrated intervention to health care. The reviewed studies demonstrated that plant extracts can be effectively incorporated into wound treatments, highlighting the importance of continuing to explore and scientifically validate their mechanisms of action and therapeutic benefits. Despite the advances, the healing potential of plant extracts still needs further research.

Therefore, research should be conducted carefully regarding the characterization of the

plant extract used and its mechanism of action to develop plant products of proven quality, serving as an incentive to conduct further studies on the theme.

CONFLICT OF INTEREST

Nothing to declare.

CONTRIBUTIONS OF THE AUTHORS

SMLTC: Conceptualization, data curation, data analysis, research, methodology, project administration, supervision, data and experiment validation, data presentation design, writing – original manuscript and writing - review and editing; **GSPB**: Conceptualization, data curation, data analysis, research, methodology, development, data and experiment validation, writing - original manuscript and writing - review and editing; **LFMN and MVFF**: Research; **TKBO**: Conceptualization, data curation, data analysis, research, methodology, project administration, supervision, data and experiment validation, data presentation design and writing - original manuscript and writing - review and editing. All authors approved the final version to be published.

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