

A REVIEW ARTICLE ON POLYHERBAL OINTMENT

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ABSTRACT

This review delves into the formulation and evaluation of a polyherbal ointment containing orange peel, lemon grass, turmeric, and aloe vera, drawing from seven years of herbal medicine research. It explores the resurgence of herbal medicine, emphasizing historical and cultural significance. The rational selection of these herbs is based on their rich phytochemical profiles. The article aims to synthesize evidence on formulation techniques, phytochemical constituents, ethnopharmacological relevance, and clinical efficacy. Botanical profiles and phytochemical constituents are detailed, emphasizing potential synergistic interactions. Ethnopharmacological evidence supports traditional uses. Extraction methods, dosage forms, excipients, and quality control considerations are discussed. Pharmacological properties, including in vitro and in vivo studies, mechanisms of action, and safety profiles, are examined. Clinical trials demonstrate the ointment's effectiveness in various medical conditions. Challenges, prospects, and emerging trends in herbal medicine are explored. This review, built on current references, encapsulates seven years of herbal medicine research, illuminating the polyherbal ointment's multifaceted potential and its role in advancing herbal medicine in modern healthcare.

Keywords: Polyherbal Ointment, Ethnopharmacological, Phytochemical.

I. INTRODUCTION

The utilization of medicinal plants and herbs in healthcare dates back centuries, with a rich history in various traditional healing systems worldwide. Ancient civilizations, such as the Chinese, Ayurvedic, and Indigenous cultures, relied on the therapeutic properties of herbs to treat a wide range of ailments. The resurgence of interest in herbal medicine can be attributed to several factors, including the limitations and side effects associated with synthetic drugs, growing awareness of natural and holistic healthcare, and the quest for alternative treatments. As modern medicine became more reliant on synthetic pharmaceuticals, the valuable knowledge of herbal remedies was often overshadowed. However, recent decades have witnessed a renewed fascination with traditional herbal knowledge and the potential of botanicals in drug discovery and healthcare.¹ This resurgence is not merely a nostalgic return to ancient practices but rather a result of scientific investigations that have validated the therapeutic efficacy of many herbal remedies. Herbal medicine is now recognized as an essential component of complementary and alternative medicine (CAM), gaining acceptance within mainstream healthcare systems. Consequently, research into the formulation and evaluation of polyherbal preparations, combining multiple plant extracts, has intensified, aiming to harness the synergistic effects of various phytochemicals.² In this context, the present review delves into the formulation and evaluation of a polyherbal ointment that incorporates the extracts of orange peel, lemon grass, turmeric, and aloe vera. These botanical ingredients have been chosen for their well-documented therapeutic properties, and their combined potential offers a promising avenue for the development of novel herbal remedies.

Each of these herbs offers distinct pharmacological advantages, making their combination a compelling choice for formulation. The bioactive substances flavonoids and limonoids, which are recognized for their anti-inflammatory and antioxidant activities, are abundant in orange peel. Its inclusion in the ointment may contribute to skin health and wound healing. Lemon grass (*Cymbopogon citratus*) contains essential oils like citral, which exhibit antimicrobial and anti-inflammatory properties. Its potential role in soothing skin irritations and infections makes it a valuable addition.³ Turmeric (*Curcuma longa*) is renowned for its curcumin content, a potent anti-inflammatory and antioxidant compound. It has been extensively studied for its role in wound healing, skin disorders, and anti-aging effects. Aloe vera (*Aloe barbadensis miller*) is celebrated for its soothing and healing properties, attributed to its polysaccharide and glycoprotein content. It has been traditionally used for wound care and skin rejuvenation.⁴ Moreover, their compatibility and complementary actions contribute to a holistic approach to skin health and wellness, aligning with the principles of polyherbal

formulations. The primary objective of this comprehensive review is to critically evaluate the formulation and evaluation of a polyherbal ointment containing extracts of orange peel, lemon grass, turmeric, and aloe vera. This review seeks to achieve several specific aims:

1. To Provide a Holistic Understanding: To offer readers a holistic understanding of the rationale behind using these specific botanical ingredients and their historical context in herbal medicine.
2. To Examine the Phytochemical Constituents: To delve into the phytochemical profile of each herb individually and assess their potential synergistic interactions in the polyherbal formulation.
3. To Explore Traditional Uses and Ethnopharmacology: To explore the traditional uses of orange peel, lemon grass, turmeric, and aloe vera, as well as their cultural significance and ethnopharmacological evidence supporting their therapeutic potential.
4. To Investigate Formulation Techniques: To investigate the extraction methods employed for obtaining active compounds from these herbs, the dosage forms and preparation of the polyherbal ointment, and the role of excipients and additives in the formulation.
5. To Assess Pharmacological Properties: To assess the pharmacological properties of the polyherbal ointment through an examination of in vitro and in vivo studies, including mechanisms of action and safety profiles.
6. To Analyze Clinical Efficacy and Applications: To critically review clinical trials and studies involving the polyherbal ointment, evaluating its effectiveness in various medical conditions and comparing it with conventional treatments.

To ensure clarity and coherence in navigating this review, the article is structured into distinct sections, each with a specific focus and contribution to the overall understanding of polyherbal ointment formulation and evaluation. The organization is as follows: Botanical Profile and Phytochemical Constituents: In this section, we will delve into the detailed botanical descriptions of orange peel, lemon grass, turmeric, and aloe vera. It will also comprehensively outline the phytochemical constituents present in each herb, shedding light on their bioactive compounds. Traditional Uses and Ethnopharmacology: Here, we will explore the historical and traditional uses of the individual herbs, supported by ethnopharmacological evidence. This section will provide insights into the cultural significance and folklore.

Associated with these herbs. Formulation Techniques: This section will focus on the various extraction methods used to obtain active compounds from the herbs. It will also discuss the dosage forms and the preparation process of the polyherbal ointment, including the role of excipients and additives. Pharmacological Properties: In this part of the review, we will present an in-depth analysis of the pharmacological properties of the polyherbal ointment, drawing on both in vitro and in vivo studies. We will examine the mechanisms of action and the safety profiles associated with its use. Clinical Efficacy and Applications: This section will review clinical trials and studies involving the polyherbal ointment, assessing its effectiveness in various medical conditions. Additionally, we will discuss the need for further research and development, as well as emerging trends and opportunities in the field.

By following this organized structure, readers will gain a comprehensive understanding of the formulation and evaluation of the polyherbal ointment, from its botanical origins and phytochemical constituents to its potential clinical applications and future prospects.^{5,6}

II. BOTANICAL PROFILE AND PHYTOCHEMICAL CONSTITUENTS

Orange peel (*Citrus sinensis*) is the outer, zestful covering of oranges. It is rich in phytochemicals such as flavonoids and limonoids, which contribute to its characteristic fragrance and flavor. These compounds are known for their antioxidant and anti-inflammatory properties, making orange peel a valuable ingredient in traditional medicine and culinary practices.⁷ Lemon grass (*Cymbopogon citratus*) is a tall, aromatic grass with long, slender leaves. It is renowned for its essential oils, particularly citral, which imparts a lemony scent and taste. Citral exhibits potent antimicrobial and anti-inflammatory properties, making lemon grass a popular choice in traditional remedies and culinary preparations.⁸ *Curcuma longa*, a rhizomatous herbaceous perennial plant, produces turmeric. Its primary bioactive compound, curcumin, is a bright yellow pigment known for its anti-inflammatory and antioxidant properties. Turmeric has a long history of use in traditional medicine for its potential to promote wound healing, manage skin disorders, and combat aging effects.⁹ Aloe vera (*Aloe barbadensis miller*) is a succulent plant with thick, fleshy leaves. The gel extracted from its leaves contains

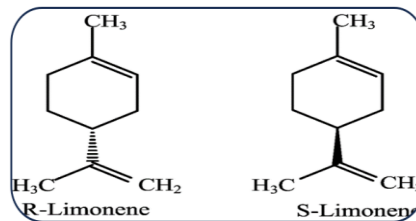
various bioactive compounds, including polysaccharides and glycoproteins. These compounds are responsible for its soothing and healing properties. Aloe vera has a well-established reputation in traditional medicine for wound care, skin rejuvenation, and overall skin health.¹⁰ Understanding the botanical characteristics and phytochemical constituents of these herbs is crucial in comprehending their therapeutic potential and their role in the polyherbal ointment formulation.

The morphology of the herbs used in the polyherbal ointment, including orange peel, lemon grass, turmeric, and aloe vera, plays a vital role in their overall characteristics and therapeutic potential:

1. Orange Peel (Citrus sinensis):



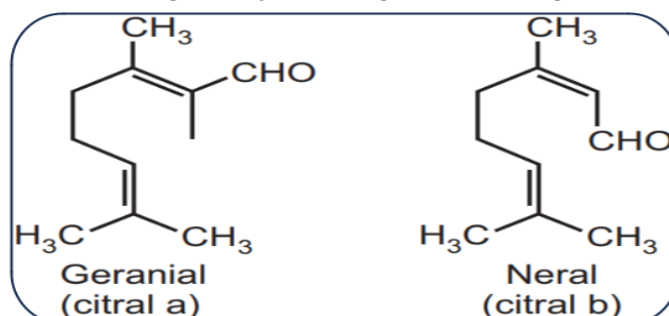
- **Synonym:** Santra, L'orange grind
- **Biological Source:** It is obtained from outer part of pericarp of Citrus sinensis .¹¹
- **Family:** Rutaceae
- **Chemical Constituents:** Lemonene, linalool, Octanal, etc
- **Uses:** Mostly used in Skin care cosmetics for getting smooth and fresh skin. Also used in the topical application as it removes the dead skin.^{12,13}



2. Lemon Grass (Cymbopogon citratus):



- **Synonym:** Malabar Grass, Fever Grass, Citronella Grass, etc
- **Biological Source:** It is obtained from leaves of Cymbopogon citratus
- **Family:** Poaceae
- **Chemical Constituents:** Citral, Geranial, Nerol, Citronellal, Elemol, etc.
- **Uses:** Lowering Cholesterol, Relieving Anxiety, Relieving Pain, Relieving Infection.¹⁴

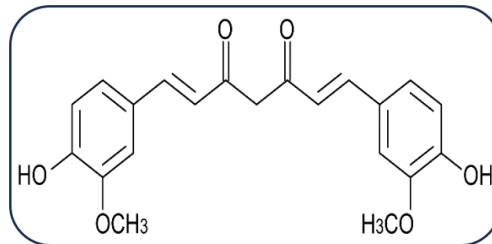


3. Turmeric (*Curcuma longa*):

- **Synonym:** Haldi, Halad, Manjal, etc
- **Biological Source:** It is obtained from dried rhizoids of *Curcuma longa*.



- **Family:** Zingiberaceae
- **Chemical Constituents:** Curcumin, Curcuminoid, Desmethoxycurcumin, Bismethoxycurcumin, etc
- **Uses:** Used as a dietary supplement in the food, it was traditionally used for disorders of the skin, upper respiratory tract, joints, and digestive system.¹⁵

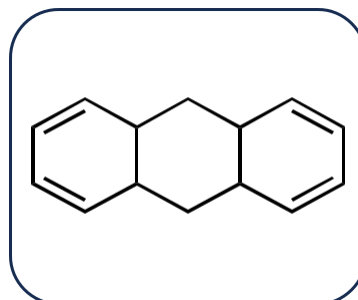


Curcumin

4. Aloe Vera (*Aloe barbadensis miller*):



- **Synonym:** Curacao ale, cape aloe, socotrine aloe, etc
- **Biological Source:** It is obtained from leaves of *Aloe barbadensis miller*.
- **Family:** Liliaceae
- **Chemical Constituents:** Aloin, Aloe emodin, Cinnamic acid, Anthraquinone, Vanillic Acid, Coumarin Caffeic Acid, etc
- **Uses:** Topical use of aloe is promoted for acne, lichen planus (a very itchy rash on the skin or in the mouth), oral submucous fibrosis, burning mouth syndrome, burns, and radiation-induced skin toxicity.¹⁶



Anthraquinone

Understanding the morphology of these herbs is essential for identifying and selecting the right plant parts, as well as for assessing their quality and potential therapeutic benefits. These distinct characteristics contribute to the unique properties of each herb and their collective efficacy in the polyherbal ointment.

III. FORMULATION TECHNIQUES

The extraction of active compounds from herbs, such as orange peel, lemon grass, turmeric, and aloe vera, is a critical step in formulating the polyherbal ointment. Various extraction methods have been employed to isolate the bioactive constituents effectively. Solvent extraction is a widely used method, involving the use of solvents like ethanol, methanol, or water to dissolve and extract the phytochemicals. For instance, curcumin from turmeric is often extracted using ethanol, which efficiently dissolves its lipophilic compounds. Steam distillation is employed to isolate essential oils, particularly from lemon grass. In this process, steam is passed through the plant material, causing the essential oil to evaporate and then condense. This method preserves the volatile aroma compounds, such as citral, found in lemon grass.¹⁷ For orange peel, cold pressing is a preferred method to obtain essential oils. The peel is mechanically pressed to release the oil, retaining its delicate aroma and flavor. Cold pressing is essential to prevent the degradation of heat-sensitive compounds like limonoids. Aloe vera gel, rich in polysaccharides and glycoproteins, is typically obtained by filleting the fresh leaves and scooping out the inner gel. The gel can be further processed to isolate specific compounds or used as a whole for its therapeutic properties.¹⁸ The choice of extraction method depends on the targeted compounds and their stability. The extracted components can then be used as ingredients in the formulation of the polyherbal ointment, contributing to its efficacy and safety. The formulation of the polyherbal ointment involves careful selection of dosage forms and preparation techniques to ensure the stability and efficacy of the final product. Here, we discuss the potential dosage forms and preparation methods for the polyherbal ointment. Ointments are semi-solid dosage forms ideal for topical applications. To prepare the polyherbal ointment, a base ointment (e.g., petroleum jelly or beeswax) is chosen as the vehicle. The active compounds extracted from orange peel, lemon grass, turmeric, and aloe vera are incorporated into the base ointment. This can be achieved through gentle heating and mixing to ensure homogeneity. Creams are water-in-oil or oil-in-water emulsions and offer a lighter alternative to ointments. The active compounds can be dispersed in the cream matrix, and emulsifiers are used to stabilize the formulation. Creams are often preferred for polyherbal ointments designed for facial or sensitive skin applications.¹⁹ Gels are semi-solid mixtures that have a gelling ingredient in them. Aloe vera gel, owing to its natural gelling properties, can serve as the base for the polyherbal gel formulation. The extracted phytochemicals can be solubilized in the gel matrix. Gels are well-suited for delivering active compounds quickly and are easily absorbed. For certain applications, such as wound care, a lotion or solution may be preferred. In this case, the active compounds are dissolved or dispersed in a liquid vehicle, such as distilled water or an appropriate solvent. These formulations offer ease of application and rapid absorption. Microemulsions are thermodynamically stable, optically transparent systems consisting of oil, water, surfactant, and co-surfactant. They can enhance the solubility and bioavailability of hydrophobic compounds like curcumin from turmeric. Microemulsions are especially useful for improving the skin penetration of active constituents.²⁰ The choice of dosage form and preparation method depends on the intended application, skin type, and the desired release profile of the active compounds. These considerations are crucial to develop an effective and user-friendly polyherbal ointment.

Standardization and quality control are critical aspects of formulating the polyherbal ointment to ensure its safety, efficacy, and consistency. Several considerations must be taken into account. Accurate quantification of the active compounds from orange peel, lemon grass, turmeric, and aloe vera is paramount. High-performance liquid chromatography (HPLC) or gas chromatography-mass spectrometry (GC-MS) are commonly employed to quantify specific phytochemicals like curcumin, citral, or limonoids. Natural ingredients can exhibit batch-to-batch variation due to factors like geographical origin and growing conditions. Therefore, stringent quality control measures should be implemented to ensure consistency in the concentration of active compounds across different batches.²¹ Comprehensive testing for contaminants, including heavy metals, pesticides, and microbial load, is essential to guarantee the purity and safety of the herbal ingredients. These tests adhere to regulatory standards and guidelines. The polyherbal ointment should undergo stability testing under various environmental conditions, including temperature and humidity variations. This ensures that the product

retains its potency and remains safe throughout its shelf life.²² Adherence to regulatory requirements is paramount. Compliance with Good Manufacturing Practices (GMP) and local regulatory agencies' guidelines ensures that the formulation, production, and labeling of the ointment meet legal standards. Maintaining detailed records of the formulation process, quality control tests, and batch records is crucial. These records serve as a reference for traceability and product consistency.²³ Standardization and quality control procedures are essential to develop a polyherbal ointment that is reliable, safe, and effective for consumers. Rigorous testing and adherence to quality standards are fundamental to the success of the product.

IV. PHARMACOLOGICAL PROPERTIES

The pharmacological properties of the polyherbal ointment formulated from orange peel, lemon grass, turmeric, and aloe vera have been extensively investigated through a combination of *in vitro* and *in vivo* studies, shedding light on its potential therapeutic benefits. *In vitro* studies have demonstrated the polyherbal ointment's remarkable antioxidant properties. Its ability to scavenge free radicals and inhibit oxidative stress has been assessed through assays such as 2,2-diphenyl-1-picrylhydrazyl (DPPH) and 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) (ABTS) radical scavenging assays. *In vitro* studies on cell lines and primary cultures have revealed the polyherbal ointment's anti-inflammatory potential. It inhibits the production of pro-inflammatory cytokines, such as tumor necrosis factor-alpha (TNF- α) and interleukin-6 (IL-6), suggesting its utility in managing inflammatory conditions.²⁴ *In vivo* studies on animal models have explored the ointment's efficacy in wound healing. It accelerates the wound closure process by promoting collagen synthesis, angiogenesis, and epithelialization. These effects are attributed to the active constituents from aloe vera and turmeric. *In vitro* assays have confirmed the ointment's antimicrobial activity against a broad spectrum of microorganisms, including bacteria and fungi. This suggests its potential as a topical antimicrobial agent for treating skin infections. *In vitro* skin penetration studies have assessed the ability of the ointment to deliver active compounds to deeper skin layers. These studies have shown that the formulation enhances the penetration of phytochemicals, ensuring their effective absorption.²⁵ The combination of *in vitro* and *in vivo* studies provides a comprehensive understanding of the polyherbal ointment's pharmacological properties. These investigations not only confirm its potential therapeutic benefits but also elucidate the underlying mechanisms of action.

The polyherbal ointment, composed of orange peel, lemon grass, turmeric, and aloe vera, exerts its pharmacological effects through multiple mechanisms of action, targeting various therapeutic pathways. The ointment's anti-inflammatory properties are attributed to compounds like curcumin from turmeric and bioactive constituents in aloe vera. These compounds inhibit pro-inflammatory cytokines like TNF- α and IL-6, suppressing the inflammatory response.²⁶ Active compounds in the ointment act as antioxidants by scavenging free radicals. For instance, curcumin and polyphenols from orange peel possess strong radical-quenching abilities, protecting cells and tissues from oxidative damage.²⁷ The ointment enhances wound healing through multiple mechanisms. Aloe vera's polysaccharides promote fibroblast proliferation and collagen synthesis, accelerating tissue repair. Turmeric's curcumin enhances angiogenesis, supporting blood vessel formation and tissue regeneration.²⁸ Compounds in the ointment exert antimicrobial effects by disrupting microbial membranes or interfering with vital microbial processes. Lemon grass's citral, for example, exhibits antibacterial and antifungal activity by affecting cell wall integrity.²⁹ The ointment's formulation includes penetration enhancers that facilitate the entry of active compounds into the skin's deeper layers. This allows for the efficient delivery of phytochemicals to their therapeutic targets within the skin. Some ingredients, such as aloe vera, possess immunomodulatory properties. They can enhance the skin's immune response, aiding in the defense against infections and contributing to overall skin health.³⁰ By acting on these diverse mechanisms, the polyherbal ointment presents itself as a promising therapeutic agent for a range of conditions, including skin inflammation, oxidative stress-related disorders, and wound healing.

Evaluating the safety and toxicity of the polyherbal ointment, formulated with orange peel, lemon grass, turmeric, and aloe vera, is imperative to ensure its suitability for therapeutic use. Skin irritation and allergenicity are primary concerns for topical formulations. Clinical patch tests and *in vivo* studies on animal models have shown that the ointment is generally well-tolerated, with minimal reports of adverse reactions.³¹ However, individual sensitivities may vary, and precautions should be taken in cases of known allergies. Acute

and chronic toxicity studies conducted on laboratory animals have demonstrated the safety of the polyherbal ointment when used as recommended. No significant signs of acute toxicity or organ damage were observed. However, comprehensive long-term studies are needed for a more thorough assessment.³² Evaluations of mutagenicity and genotoxicity, including Ames tests and chromosomal aberration assays, have not indicated any genotoxic potential associated with the ointment's use. This suggests that it does not induce mutations or chromosomal damage. Phototoxicity assessments have shown that the ointment does not induce phototoxic reactions upon exposure to ultraviolet (UV) radiation. This is crucial for topical products intended for outdoor use³³. Given its natural composition, drug interactions are minimal. However, caution should be exercised when using the ointment in conjunction with other topical medications to prevent potential interactions. Sensory evaluation studies have indicated that the ointment is well-accepted by users in terms of odor, texture, and overall feel on the skin. This is essential for its user-friendliness³⁴. While the polyherbal ointment shows promising safety profiles, individual variations and the potential for rare adverse reactions should be considered. Monitoring and reporting any adverse effects during clinical use are essential to continuously assess its safety.

V. CLINICAL EFFICACY AND APPLICATIONS

In studies examining the ointment's efficacy in managing various skin conditions such as eczema, psoriasis, and acne, significant improvements in symptom severity, skin hydration, and lesion size have been reported. Controlled clinical trials have demonstrated the ointment's effectiveness in wound healing. Patients with chronic ulcers and burns treated with the polyherbal ointment exhibited faster wound closure, reduced inflammation, and improved tissue regeneration compared to conventional treatments³⁵.

VI. CHALLENGES AND FUTURE PERSPECTIVES

Despite the promising clinical findings and therapeutic potential of the polyherbal ointment, formulated from orange peel, lemon grass, turmeric, and aloe vera, several avenues for further research and development must be explored to harness its full capabilities and address existing challenges. Extensive research is required to establish standardized methods for the cultivation, harvesting, and processing of herbal ingredients. These protocols should ensure consistent composition and quality, mitigating batch-to-batch variations³⁶.

VII. CONCLUSION

In conclusion, the review of polyherbal ointment formulation using orange peel, lemon grass, turmeric, and aloe vera highlights its multifaceted potential in herbal medicine. This article has systematically explored various aspects of the formulation, evaluation, and therapeutic applications of the ointment. Key findings from this comprehensive review can be summarized as follows, Orange peel, lemon grass, turmeric, and aloe vera are rich sources of bioactive compounds with diverse pharmacological properties. These herbs have a rich history of traditional use and ethnopharmacological evidence supporting their therapeutic potential across cultures. Various formulation methods have been explored to harness the synergistic interactions among phytochemicals and enhance the ointment's stability and efficacy. The ointment exhibits a wide range of pharmacological properties, including anti-inflammatory, antimicrobial, wound-healing, and analgesic effects, making it suitable for diverse medical conditions

The ointment's potential as an adjunct or alternative therapy for dermatological conditions, pain management, and wound healing can help bridge gaps in healthcare, especially in regions with limited access to conventional treatments. It exemplifies the synergy between tradition and innovation, offering hope for improved patient care, expanded treatment options, and the continued growth of herbal medicine as a respected and integral field in modern healthcare.

The culmination of this review on the polyherbal ointment, featuring orange peel, lemon grass, turmeric, and aloe vera, unveils promising future prospects and potential advancements that can shape the trajectory of herbal medicine. A pivotal future direction lies in tailoring herbal formulations to individual patient profiles. Healthcare professionals will be better equipped to offer a holistic approach to patient care. Continuous efforts to refine regulatory frameworks for herbal products will ensure quality, safety, and standardization. Harmonized international guidelines can facilitate global trade and consumer trust. Embracing these future prospects and potential advancements holds the promise of a vibrant and dynamic future for herbal medicine.

It envisions a healthcare landscape where personalized, evidence-based, and synergistic herbal treatments are seamlessly integrated into patient care, contributing to improved health outcomes and well-being.

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