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Review Article

Antimicrobial Efficacy of Polyherbal Creams: A Review on Standardization, Formulation, and Evaluation

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ABSTRACT

Polyherbal formulations have gained significant attention in recent years due to their synergistic therapeutic potential and reduced side effects compared to synthetic agents. This review focuses on the antimicrobial efficacy of polyherbal creams, emphasizing their standardization, formulation development, and evaluation. Various medicinal plant extracts with proven antibacterial, antifungal, and antiseptic properties are discussed, highlighting their potential in topical applications. The importance of standardization in ensuring batch-to-batch consistency and product quality is also reviewed. Furthermore, formulation parameters such as stability, pH, spreadability, and microbial effectiveness are analyzed to ensure optimal therapeutic performance. The review concludes that polyherbal creams represent a promising alternative for managing skin infections, offering an effective, safe, and natural approach to antimicrobial therapy.

Keywords: Polyherbal formulation; Antimicrobial activity; Cream formulation; Standardization; Herbal medicine

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1. Introduction

The rapid emergence of antibiotic-resistant microorganisms has become a critical challenge in modern medicine, significantly reducing the effectiveness of existing antimicrobial drugs. This alarming trend has intensified the global search for new, safe, and effective antimicrobial agents, particularly those derived from natural sources. Medicinal plants have long been recognized for their therapeutic potential and have been extensively utilized in traditional systems of medicine such as Ayurveda, Unani, and Siddha. The use of plant-based formulations provides an alternative strategy to combat microbial infections due to their rich content of bioactive phytoconstituents with proven antibacterial, antifungal, and anti-inflammatory properties [1,2].

In recent years, polyherbal formulations—which combine two or more plant extracts—have attracted growing scientific interest. The rationale behind using multiple herbs lies in the principle of synergism, where the combined therapeutic effects of various phytochemicals enhance efficacy, reduce toxicity, and minimize the development of microbial resistance. Polyherbal creams, designed for topical administration, represent an innovative approach for the treatment and prevention of skin infections. Such formulations offer advantages like direct drug delivery to the affected site, reduced systemic side effects, improved patient compliance, and enhanced stability of active ingredients [3].

The development of a polyherbal cream involves several crucial stages, including the selection of appropriate plant materials, extraction of active constituents, standardization of raw materials, and formulation optimization to achieve desirable physicochemical properties. Parameters such as pH, viscosity, spreadability, homogeneity, stability, and microbial efficacy are vital to ensure a consistent and effective product. Equally important is the process of standardization, which ensures batch-to-batch uniformity, quality assurance, and reproducibility of therapeutic effects [4].

Given the growing demand for herbal-based skin care and therapeutic products, a comprehensive understanding of formulation science and quality control of polyherbal creams is essential. This review aims to provide an in-depth overview of the antimicrobial efficacy of polyherbal creams, focusing on their standardization, formulation development, and evaluation. It also discusses the significance of polyherbal synergy in enhancing antimicrobial potential and highlights recent advances in the field. Ultimately, this review underscores the promise of polyherbal creams as effective, safe, and sustainable alternatives to conventional antimicrobial agents for managing various dermatological infections [5].

2. Literature Review

The therapeutic use of medicinal plants in treating infectious diseases is as old as human civilization. Over the past few decades, numerous studies have confirmed the antimicrobial potential of herbal extracts, leading to renewed interest in plant-based formulations. The literature provides substantial evidence that various plant species contain phytochemicals capable of inhibiting the growth of bacteria, fungi, and other pathogenic microorganisms responsible for skin and soft-tissue infections [6].

Polyherbal formulations are based on the synergistic combination of multiple herbs, where the bioactive constituents interact to enhance overall efficacy. Several studies have demonstrated that polyherbal preparations exhibit stronger antimicrobial activity compared to single-plant extracts. For example,

combinations of Azadirachta indica (Neem), Curcuma longa (Turmeric), and Aloe vera have shown broad-spectrum antibacterial and wound-healing effects. Similarly, formulations incorporating Ocimum sanctum (Tulsi), Lawsonia inermis (Henna), and Emblica officinalis (Amla) have demonstrated significant antifungal and antiseptic properties. These findings suggest that combining herbs with complementary actions enhances antimicrobial potency while minimizing the emergence of resistance [7].

Several researchers have formulated and evaluated polyherbal creams for their antimicrobial activity. Patel et al. (2018) reported that a cream containing extracts of Neem, Tulsi, and Turmeric exhibited remarkable inhibition against Staphylococcus aureus and Escherichia coli. Kumar and colleagues (2020) formulated a polyherbal topical cream using Aloe vera, Turmeric, and Lemon extract, which showed effective antifungal activity against Candida albicans. In another study, Sharma et al. (2021) developed a standardized polyherbal cream that demonstrated superior wound-healing and antimicrobial effects compared to conventional synthetic creams. These studies highlight the potential of polyherbal creams in providing safe, effective, and affordable alternatives to chemical-based topical formulations [7].

Standardization plays a pivotal role in the development of reliable herbal formulations. Literature emphasizes that variations in raw materials, extraction methods, and formulation processes can significantly influence the efficacy of the final product. Advanced analytical techniques such as High-Performance Thin Layer Chromatography (HPTLC), UV-Visible spectrophotometry, and Fourier Transform Infrared Spectroscopy (FTIR) are commonly employed to ensure consistency, purity, and reproducibility of polyherbal creams [8].

Overall, the literature underscores that polyherbal creams not only exhibit excellent antimicrobial activity but also provide additional therapeutic benefits such as wound healing, antioxidant protection, and anti-inflammatory effects. However, despite promising laboratory results, large-scale clinical validations and regulatory standardizations remain limited. Further research focusing on optimized formulation design, stability testing, and mechanistic studies is essential to establish the therapeutic reliability of these products in modern healthcare [9].

3. Materials and Methods

In a review-based study, the materials and methods section primarily outlines the process of literature collection, selection criteria, and analysis of published data. The present review was conducted by collecting relevant research and review articles related to the antimicrobial activity, standardization, formulation, and evaluation of polyherbal creams. Data were retrieved from scientific databases such as PubMed, ScienceDirect, Scopus, Google Scholar, and ResearchGate. Keywords including “polyherbal formulation,” “antimicrobial cream,” “herbal standardization,” and “topical herbal preparations” were used to identify appropriate literature. Publications from 2005 to 2025 were considered to ensure the inclusion of both classical and contemporary findings [10].

Studies were selected based on their relevance to polyherbal formulations intended for topical application and those that provided experimental evidence of antimicrobial activity. Articles focusing solely on single-herb formulations or non-topical preparations were excluded. The selection process emphasized peer-reviewed journals, dissertations,

and conference proceedings to ensure reliability and scientific accuracy.

Information from the selected studies was critically analyzed to understand the composition, preparation techniques, evaluation parameters, and antimicrobial testing methods of polyherbal creams. The review also compared various formulation bases, such as oil-in-water and water-in-oil emulsions, and their influence on the stability and efficacy of herbal actives. Furthermore, data regarding standardization parameters—including physicochemical properties, phytochemical screening, and analytical profiling techniques like HPTLC, FTIR, and UV–Vis spectroscopy—were reviewed to understand their role in ensuring quality and reproducibility.

By synthesizing information from multiple credible sources, this review aims to present a comprehensive understanding of how polyherbal creams are developed, standardized, and evaluated for antimicrobial efficacy. The method adopted for this review ensures a balanced representation of both traditional knowledge and modern scientific advancements in the field of herbal formulation research [11-12].

4. Discussion

Polyherbal formulations have gained significant attention in recent years due to their combined therapeutic effects, safety, and affordability. Numerous studies reviewed in this article emphasize the potential of polyherbal creams as effective antimicrobial agents for topical application. These formulations utilize the synergistic interaction of multiple plant extracts, each contributing specific bioactive compounds such as alkaloids, flavonoids, tannins, terpenoids, and phenolic acids, which exhibit broad-spectrum antimicrobial activity. The combined effect of these constituents often enhances efficacy beyond that of single-herb formulations [13].

Research reports consistently demonstrate that polyherbal creams show remarkable inhibitory activity against various pathogenic microorganisms, including Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Candida albicans. The antimicrobial effects are often attributed to the ability of phytochemicals to disrupt microbial cell walls, interfere with protein synthesis, and inhibit enzymatic activity. Studies involving combinations such as Azadirachta indica (Neem), Curcuma longa (Turmeric), Aloe vera, and Ocimum sanctum (Tulsi) reveal significant antibacterial and antifungal activity, confirming the benefits of synergistic plant interactions [14].

The discussion of formulation parameters in the literature reveals that the type of base used in cream preparation—oil-in-water or water-in-oil—strongly influences the stability and skin absorption of active constituents. Creams prepared using natural emulsifiers and humectants such as beeswax, cetyl alcohol, and glycerin were found to enhance the physical stability and moisturizing effect, making them suitable for dermal application. Physicochemical properties such as pH, viscosity, spreadability, and homogeneity are critical indicators of quality and directly impact user acceptability and product performance.

Another important aspect identified across studies is standardization, which ensures consistency, reproducibility, and therapeutic reliability of herbal formulations. Many researchers have emphasized the use of advanced analytical techniques such as High-Performance Thin Layer Chromatography (HPTLC), Fourier Transform Infrared Spectroscopy (FTIR), and UV–Visible spectrophotometry to identify and quantify key phytoconstituents.

Standardization not only validates the identity and purity of herbal ingredients but also minimizes variations arising from environmental and processing factors [15].

Moreover, the reviewed studies highlight that polyherbal creams offer multiple therapeutic benefits beyond antimicrobial activity. They possess wound-healing, anti-inflammatory, antioxidant, and skin-regenerative properties, which make them ideal for managing infections, burns, and minor cuts. Despite these promising outcomes, it is evident that most investigations remain confined to laboratory or small-scale evaluations. Large-scale clinical trials and regulatory standardization are still lacking, which limits the commercial and medical application of these formulations.

Overall, the available literature supports the conclusion that polyherbal creams represent a potent, natural alternative to synthetic antimicrobial agents. Their development requires careful attention to formulation design, ingredient compatibility, and standardization processes to ensure consistent efficacy and safety. Future research should focus on mechanistic studies, advanced delivery systems, and clinical validation to fully establish their therapeutic potential in modern dermatological applications.

5. Conclusion

Polyherbal creams represent a promising approach in the management of microbial skin infections, combining the therapeutic potential of multiple plant extracts with minimal side effects. The reviewed literature highlights that these formulations exhibit significant antimicrobial activity, enhanced by the synergistic effects of bioactive phytochemicals. Proper formulation techniques, including the choice of base, emulsifiers, and excipients, are crucial in ensuring stability, efficacy, and user acceptability. Standardization of polyherbal creams using analytical techniques such as HPTLC, FTIR, and spectrophotometry is essential to maintain consistency, quality, and reproducibility of therapeutic effects. Although numerous studies demonstrate the antimicrobial, wound-healing, and anti-inflammatory properties of polyherbal creams, further clinical validation and regulatory standardization are required to fully integrate these formulations into mainstream dermatological practice. Overall, polyherbal creams offer a safe, effective, and natural alternative to conventional antimicrobial therapies, underscoring the growing importance of herbal medicine in modern healthcare.

Conflict of Interest

The authors declare no conflict of interest.

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