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African Geranium (Pelargonium sidoides) in the Treatment of Acute Respiratory Tract Infections: A Review of Mechanisms of Action, Efficacy, and Clinical Applications

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Abstract

Introduction:

African geranium (Pelargonium sidoides) is a plant endemic to the mountainous regions of South Africa, traditionally used for centuries to treat respiratory infections and gastrointestinal disorders. The main active ingredient is an extract from the roots and rhizomes, designated as EPs 7630, which contains coumarins, coumarin glycosides, phenolic acids, flavonoids, fatty acids, and proanthocyanidins. Modern phytotherapy utilizes this extract to treat acute respiratory infections such as bronchitis, tonsillitis, and the common cold.

Aim of the study:

The aim of this work is to present the mechanisms of action and efficacy of African geranium in the treatment of acute respiratory infections, with particular emphasis on its antiviral, antibacterial, and immunomodulatory properties. The study synthesizes available scientific research to evaluate the therapeutic potential of EPs 7630 as an alternative to conventional therapies.

Materials and methods:

The article was prepared by analyzing multiple databases, including PubMed, Google Scholar, and Elsevier, covering the period from 1995 to 2024.

Conclusions:

African geranium, thanks to its antiviral, antibacterial, and immunomodulatory properties, represents an effective and safe option for treating acute respiratory infections. Clinical trials confirm its efficacy in reducing the duration and severity of illness, making it a valuable alternative to conventional therapies. However, further research is needed to determine optimal dosing and long-term effects of the preparation.

Keywords: Pelargonium sidoides; EPs 7630; Geraniaceae;respiratory tract infections

INTRODUCTION

African geranium is a small, perennial ornamental plant with round, heart-shaped, strongly fragrant leaves and dark red, tubular flowers that form umbels. According to the current plant taxonomy, the species African geranium (Pelargonium sidoides) belongs to the genus Pelargonium and the family Geraniaceae. It is endemic to the mountainous regions of South Africa. The most important parts of the plant used in medicinal preparations are the roots and rhizomes, with the root extract designated as EPs 7630, which has undergone extensive clinical trials. [1] The components responsible for the medicinal properties of African geranium are primarily coumarins, but also coumarin glycosides, phenolic acids, flavonoids, fatty acids, and proanthocyanidins. The combined action of these substances contributes to the effective properties of the African geranium extract. [2]

The roots and rhizomes of Pelargonium sidoides DC. (Geraniaceae, known as African geranium or South African geranium) have been used for centuries as herbal remedies in traditional medicine in South Africa to treat gastrointestinal disorders and respiratory conditions, including tuberculosis. [3]

In modern phytotherapy, the root extract of Pelargonium sidoides EPs 7630, also known under the trade name Umckaloabo® [4], has proven effective in treating respiratory tract infections [5-8], colds, and acute sinusitis [5, 9]. Additionally, it may be effective in treating bronchitis [10, 11]. The antibacterial activity has also been confirmed in studies of Pelargonium sidoides extracts against certain microorganisms [7]. Although Pelargonium species were previously used to treat coughs, diarrhea, and tuberculosis [7, 8], they remain the subject of further research [5-8]. In light of these actions, a small number of randomized controlled trials have been conducted, highlighting the need for further research with larger clinical trials [11].
A license for the medical use of Pelargonium sidoides DC root extracts was granted in December 2005 by the German Federal Institute for Drugs and Medical Devices (BfArM, Bonn) [13]. Furthermore, EPs® 7630 has been approved in many countries in Europe, Asia, Australia, and Central and South America [14]. The most commonly reported adverse effects after consumption of the product are gastrointestinal symptoms [15].

Mechanisms of Action of Preparations Containing African Geranium

The effect of Pelargonium sidoides on the immune system has been studied in various in vitro models, demonstrating its ability to stimulate immune responses. It has been observed that the active substances of this plant can influence microbial adhesion to cells and activate elements of the immune response, such as phagocytosis, oxidative burst, and the killing of Candida albicans by peripheral blood phagocytes.

1. Antibacterial Effect

African geranium (Pelargonium sidoides) exhibits significant antibacterial properties, confirmed in numerous studies. Its active compounds—coumarins, coumarin glycosides, phenolic acids, flavonoids, fatty acids, and proanthocyanidins—contribute to the effectiveness of its root extract, known as EPs 7630, in treating bacterial infections [16]. Research indicates that Pelargonium sidoides extracts inhibit the growth of both Gram-positive and Gram-negative bacteria, including Staphylococcus aureus, Streptococcus pneumoniae, Haemophilus influenzae, and Klebsiella pneumoniae [7]. Additionally, EPs 7630 has demonstrated activity against Helicobacter pylori by reducing its adhesion to gastric cells, which may be beneficial in gastrointestinal infections [3]. Proanthocyanidins and flavonols play a crucial role in preventing bacterial adhesion to epithelial cells, limiting colonization and infection [17]. Clinical studies confirm the efficacy of EPs 7630 in treating acute respiratory infections, such as bronchitis and sinusitis, further supporting its antibacterial action in medical applications [18].

2. Induction of an Interferon Response

Pelargonium sidoides enhances the immune system by stimulating interferon production, a key mechanism behind its antiviral and immunomodulatory properties. Studies have shown that EPs 7630 boosts interferon-β (IFN-β) levels, which are essential in defending against viral infections [19]. IFN-β activates natural killer (NK) cells and increases nitric oxide (NO) production, reinforcing immune responses [16]. Furthermore, the extract enhances macrophage activity and promotes the release of pro-inflammatory factors such as tumor necrosis factor-alpha (TNF-α), strengthening the body's defense against infections [16].

These mechanisms contribute to the effectiveness of Pelargonium sidoides in reducing the severity and duration of viral illnesses like the common cold and flu [20].

3. Antiviral Effect

Extensive research supports the antiviral properties of Pelargonium sidoides, primarily attributed to its ability to trigger an interferon response. By stimulating IFN-β production, the extract enhances NK cell activation and increases NO levels, aiding in viral elimination [19]. In vitro studies demonstrate that EPs 7630 inhibits the replication of viruses such as influenza A, parainfluenza, and coronaviruses by preventing viral entry into host cells [21]. Additionally, it boosts macrophage activity and induces the release of TNF-α, accelerating immune responses [20]. Clinical findings confirm that EPs 7630 not only shortens the duration of viral infections but also alleviates symptoms like cough, sore throat, and fever, highlighting its role in respiratory illness management [22].

4. Immunomodulatory Effect

Pelargonium sidoides strengthens immune defenses by modulating cytokine production, notably IFN-β and TNF-α, both crucial in immune regulation [19]. IFN-β enhances NK cell function and NO production, aiding in pathogen clearance [16]. EPs 7630 also boosts macrophage phagocytic activity, expediting the removal of bacteria and viruses [21]. Moreover, it stimulates the release of interleukins IL-6 and IL-8, essential for mobilizing immune cells to infection sites [20]. Studies suggest it may also increase IL-22 levels, enhancing antimicrobial protein production in respiratory epithelium, thus improving airway defense mechanisms. Clinical evidence supports EPs 7630's ability to reduce the duration of respiratory infections, such as bronchitis and colds, by reinforcing immune responses [22].

Use of Herbal Medicines Containing African Geranium

A study by Matthys and Heger (2007) evaluated the efficacy and safety of the herbal preparation EPs 7630, derived from the roots of Pelargonium sidoides, in treating acute bronchitis in adults. This multicenter, randomized, double-blind, placebo-controlled trial included 217 patients aged 18–66, divided into two groups: 108 received EPs 7630, while 109 were given a placebo three times daily for seven days. The primary measure of efficacy was the change in the Bronchitis Severity Score (BSS) after seven days of treatment. The results showed a significantly greater reduction in BSS in the EPs 7630 group compared to the placebo group, confirming the herbal preparation's superior effectiveness. Improvement was observed in symptoms such as cough, chest pain, sputum production, and shortness of breath. EPs 7630 was well tolerated, with mild and transient adverse effects. The study confirmed that EPs 7630 is a safe and effective option for treating acute bronchitis in adults [20].

Another trial assessed the efficacy and tolerability of EPs 7630 in children and adolescents (aged 6–18) with acute bronchitis. This randomized, double-blind, placebo-controlled study involved 400 patients divided into four parallel groups receiving 30 mg, 60 mg, or 90 mg of EPs 7630, or a placebo for seven days. The primary assessment criterion was the change in BSS from day 0 to day 7.

The findings indicated that the 60 mg and 90 mg EPs 7630 groups showed significantly greater improvement in BSS compared to the placebo, with no significant differences between these two doses. EPs 7630 reduced symptom severity, shortened bed rest duration, and improved overall treatment satisfaction. The preparation was well tolerated, similar to the placebo group. The study suggests that 60 mg per day is the optimal dose for effectively treating acute bronchitis in children and adolescents [23].

A separate study examined EPs 7630's efficacy and tolerability in children and adolescents (aged 1–18) with acute bronchitis. This randomized, double-blind, placebo-controlled trial included 220 participants, with 111 receiving EPs 7630 and 109 a placebo for seven days. The primary measure was the change in BSS from day 0 to day 7. Results demonstrated significantly greater improvement in the EPs 7630 group, particularly in symptoms such as cough and auscultatory rhonchi. Both groups exhibited comparable tolerability. The study concluded that EPs 7630 is an effective and well-tolerated treatment option for acute bronchitis in children and adolescents outside strict antibiotic therapy indications [24].

The effectiveness of EPs 7630 in treating common colds in adults was also analyzed in a multicenter, randomized, double-blind, placebo-controlled study with an adaptive group-sequential design. Among 207 participants, 103 (52 in the EPs 7630 group and 51 in the placebo group) received 30 drops of the preparation three times daily for ten days. The primary outcome was the change in the Cold Intensity Score (CIS) from day 1 to day 5. The results revealed significantly greater improvement in CIS in the EPs 7630 group compared to the placebo, leading to a shorter illness duration and improved quality of life. The preparation was well tolerated, supporting its effectiveness as a safe alternative for treating colds in adults [22].

Another study evaluated the effectiveness of liquid EPs 7630 in children with acute non-streptococcal tonsillopharyngitis. This randomized, double-blind, placebo-controlled trial with an adaptive group-sequential design involved 124 children aged 6–10, with 60 receiving EPs 7630 and 64 a placebo for six days. The primary outcome was the change in the Tonsillitis Severity Score (TSS) from day 0 to day 4. Results demonstrated significantly greater symptom improvement in the EPs 7630 group, reducing illness duration and enhancing patients' well-being. The study supports EPs 7630 as an effective and safe treatment alternative for acute non-streptococcal tonsillopharyngitis in children [25].

A meta-analysis assessed EPs 7630's impact on reducing paracetamol use in children with acute respiratory tract infections, such as acute tonsillopharyngitis (ATP) and acute bronchitis (AB). The analysis included six randomized, double-blind, placebo-controlled clinical trials with 523 children (265 in the EPs 7630 group and 258 in the placebo group). Findings revealed that children treated with EPs 7630 required an average of 244 mg less paracetamol than those in the placebo group and returned to school sooner (30.2% vs. 74.4% in the placebo group). The study concluded that EPs 7630 is an effective and safe option for treating acute respiratory tract infections in children, reducing paracetamol dependency and accelerating recovery [26].

Gökçe et al. (2021) conducted a study evaluating the efficacy of Pelargonium sidoides root extract in alleviating symptoms of uncomplicated upper respiratory tract infections (URTI) in children. This randomized, single-blind, placebo-controlled trial included 164 participants (82 in the treatment group and 82 in the placebo group) who received the extract or placebo for seven days. Symptom severity, including cough, sneezing, and fever, was assessed.

Results showed statistically significant improvement in the Pelargonium sidoides group, particularly in cough frequency and sneezing within the initial days of treatment. The authors suggest that the extract may be an effective supportive treatment for URTI in children [27].
The available data provide extensive evidence of Pelargonium sidoides' beneficial effects on immune function. Over the past 25 years, more than 30 clinical studies involving over 10,500 participants have investigated its use in treating acute respiratory infections. The preparation has demonstrated good tolerability: among approximately 304 million daily doses sold between 1994 and 2006, only 257 minor adverse reactions were reported. Its promising antiviral effects and excellent safety profile support further clinical research [26].

CONCLUSION

African geranium (Pelargonium sidoides), particularly its root extract EPs 7630, has demonstrated significant therapeutic potential in the treatment of acute respiratory infections. Its multifaceted mechanisms of action, including antiviral, antibacterial, and immunomodulatory properties, make it a valuable alternative to conventional therapies.[31] Clinical studies have consistently shown that EPs 7630 effectively reduces the severity and duration of illnesses such as bronchitis, tonsillitis, sinusitis, and the common cold, while also improving patients' quality of life. The extract's ability to stimulate interferon production, enhance immune responses, and inhibit microbial adhesion underscores its efficacy in managing respiratory infections.[32-34]
Moreover, EPs 7630 has been well-tolerated in both adults and children, with minimal adverse effects, primarily limited to mild gastrointestinal symptoms. Its safety profile, combined with its therapeutic benefits, supports its use as a reliable herbal remedy. However, further research is needed to optimize dosing regimens and explore its long-term effects.
In conclusion, Pelargonium sidoides extract EPs 7630 represents a promising, evidence-based option for the treatment of acute respiratory infections, offering a safe and effective alternative to traditional pharmacological interventions. Its continued study and integration into clinical practice could provide significant benefits for patients worldwide.

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