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Study of Acuyo (*Piper Auritum*) Extract with Honey for the Treatment of Respiratory Diseases

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ABSTRACT : *Respiratory diseases are among the leading causes of morbidity worldwide, disproportionately affecting vulnerable populations and increasing the demand for effective treatments. However, the prolonged use of synthetic drugs has led to adverse effects and antimicrobial resistance, spurring interest in safer, more sustainable natural alternatives. In this context, acuyo (Piper auritum), a plant used in mexican herbal medicine, and honey, recognized for its antimicrobial and anti-inflammatory properties, emerge as a promising combination for the relief of respiratory ailments.*

This study proposes the joint use of both natural resources as a functional and sustainable alternative that also revalues traditional knowledge and promotes the responsible use of local biodiversity. Its relevance lies in the potential to offer an accessible, safe option with low environmental impact, thereby contributing to public health from a natural and integrative perspective.

KEYWORDS *Piper auritum, honey, respiratory diseases, natural medicine, sustainability.*

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I. INTRODUCTION

Respiratory system diseases constitute a major global public health concern, affecting millions of people annually and associated with high morbidity and school and work absenteeism. In this context, the search for natural and accessible alternatives to alleviate symptoms has gained importance, especially in communities with limited access to conventional medications.

Acuyo (Piper auritum), a Mesoamerican plant widely used in Mexican traditional medicine, has been recognized for its carminative, anti-inflammatory, antimicrobial, and expectorant properties. Popular uses include teas and infusions to treat respiratory discomforts such as cough, colds, and bronchitis. Honey, a natural product of bees, has demonstrated soothing, antioxidant, and antibacterial effects and has been recommended since antiquity as a remedy for throat and airway conditions.

Combining acuyo extract with honey represents a therapeutic alternative of interest, as it may potentiate the action of both components and provide a complementary, safe, and accessible treatment for various respiratory diseases. This work addresses the importance of this natural preparation by reviewing its properties, uses, and potential applications in health care.

II. THEORETICAL FRAMEWORK

2.1 Therapeutic properties of acuyo

Acuyo (*Piper auritum*), belonging to the family Piperaceae, is native to Mesoamerica and has a long tradition of use in folk medicine. Its applications include the treatment of gastrointestinal disorders, inflammatory processes, and, particularly, respiratory ailments. Although ethnobotanical relevance is high, scientific studies remain limited, with some demonstrating promising results.

In a study by Sánchez et al. (2009), the chemical and microbiological composition of *Piper auritum* essential oil was analyzed. The results showed secondary metabolites such as safrole, anethole, and eugenol, which exhibited antimicrobial activity against phytopathogenic bacteria and fungi. These findings confirm the species' ability to inhibit microbial growth, which is of particular interest for treating respiratory infections of bacterial origin in our project.

Likewise, Vega Montalvo and Lagarto Parra (1999) evaluated the anti-inflammatory effect of *Piper auritum* extract in experimental models. The results demonstrated a significant decrease in induced inflammatory processes, supporting the traditional use of the plant to relieve respiratory conditions characterized by mucosal inflammation, such as pharyngitis, bronchitis, and colds, providing confidence for application in living organisms.

In addition, Bahare Salehi et al. (2019) reported positive effects of acuyo not only on the respiratory system but also on other organs such as the skin, where antiseptic and anti-inflammatory agents were identified.

2.2 Therapeutic properties of honey

Honey is a natural product produced by *Apis mellifera* from floral nectar. Its chemical composition includes simple sugars (glucose and fructose), enzymes, amino acids, minerals, vitamins, and phenolic compounds. These components confer biologically relevant therapeutic properties.

Clinical studies have shown that honey has notable antibacterial activity, attributable in part to the production of hydrogen peroxide, its low pH, and high osmolarity, conditions that hinder microbial proliferation. Its flavonoids and phenolic acids also contribute to marked antioxidant activity, which helps protect respiratory epithelium during inflammatory processes.

Scientific evidence has also supported its use in managing cough and throat irritation. Clinical trials have demonstrated that administering honey can reduce the frequency and severity of nocturnal cough in children and improve sleep quality. These findings have led the World Health Organization (WHO) and various health agencies to recommend honey as a safe therapeutic resource in managing mild respiratory infections in both pediatric and adult populations.

2.3 Synergy between *Piper auritum* and honey

Given the antimicrobial and anti-inflammatory properties of *Piper auritum*, along with honey's soothing, antioxidant, and antibacterial effects, their combination may provide a complementary therapeutic alternative in treating respiratory diseases. The interaction of their secondary metabolites could enhance clinical effectiveness, offering an accessible and culturally accepted option within phytotherapy.

Nevertheless, the available evidence is largely limited to preliminary studies and ethnobotanical reports, underscoring the need for experimental research and controlled clinical trials to scientifically validate the efficacy and safety of this combination.

In addition, a citric acid solution is used to improve preservation of the components and properties of the mixture.

III. METHODOLOGY

3.1 Procedure for producing the acuyo syrup

1. **Raw material cleaning:** Fresh leaves of *Piper auritum* (acuyo) were carefully washed with water to remove dust and impurities.
2. **Material cutting:** Clean leaves were cut into small pieces to increase surface area and facilitate the release of volatile compounds.
3. **Weighing of raw material:** The total mass of leaves to be subjected to distillation was recorded.
4. **Charging the receiving flask:** The leaves were placed in the round-bottom receiving flask of the distillation system.
5. **Preparation of the steam generator:** Distilled water and boiling chips were placed in a round-bottom flask to achieve uniform heating.
6. **Filling the condenser:** The recirculating water cooling system was filled, using a pump to maintain a constant flow.
7. **System assembly:** The steam generator, sample flask, and condenser were properly connected to ensure a hermetic system.

8. **Heat application:** Heating the generator flask was initiated to produce steam, which passed through the sample, entraining volatile compounds.
9. **Distillate collection:** A graduated cylinder was placed at the condenser outlet to collect the extract obtained by steam distillation.
10. **Drying of residual plant material:** At the end of distillation, the leaves were removed and oven-dried to eliminate residual moisture.
11. **Post-weighing:** The dried leaves were weighed again to determine mass loss during the process.
12. **Concentration calculation:** The extract concentration was calculated based on the volume collected and the initial mass of leaves processed.
13. **Mathematical calculations:** Mathematical calculations were carried out based on the distillation data and the appropriate dose of acuyo established in pharmaceutical references, in order to adjust the proportions of water or acuyo extract to reach the correct dosage.
14. **Syrup preparation:** Citric acid was weighed and a 10% (w/v) solution prepared with distilled water. Honey was then mixed with the acuyo essence in the established proportions, and the citric acid solution was incorporated as a natural preservative.
15. **Finally,** the product was pasteurized and packaged in 120 mL bottles, yielding the final herbal syrup based on honey and acuyo extract.

3.2 Microbiological analyses

To evaluate the microbiological safety of the formulation, assays were performed for total coliforms and aerobic mesophilic bacteria.

Microbiological analyses were conducted in accordance with Mexican Official Standards NOM-092-SSA1-1994, NOM-112-SSA1-1994, NOM-113-SSA1-1994, and NOM-210-SSA1-2014, which establish methods for determining indicator microorganisms of contamination in food products.

The results showed an aerobic mesophilic bacteria count of 29 CFU/g, within regulatory limits, and total coliforms of < 0.3 MPN/g, confirming that the sample meets established microbiological safety parameters. These values indicate that the syrup presents adequate and safe microbiological conditions for human consumption, validating the effectiveness of the manufacturing process and the good practices implemented.

IV. RESULTS

Administration of Piper auritum extract combined with honey was evaluated in a pilot group of 10 individuals aged 25–65 years, including patients with a history of arterial hypertension and type 2 diabetes mellitus. Clinical manifestations included common cough, cough with expectoration, moderate respiratory congestion, and mild bronchitis.

Adult patients were assigned a dose of 15 mL every 6 hours for 5–7 days, adjusted according to the severity of the respiratory condition. All cases showed progressive symptom improvement, particularly reduced cough and respiratory congestion. No adverse effects associated with consumption of the formulation were observed, suggesting a favorable safety profile even in patients with chronic comorbidities.

In pediatric use, treatment was evaluated in a 10-year-old child diagnosed with common congestion. A dose of 5 mL every 6 hours for 5 days was administered, with satisfactory symptom resolution and no side effects.

V. DISCUSSION

The preliminary results suggest that the combination of Piper auritum extract with honey exerts a positive therapeutic effect in managing mild to moderate respiratory diseases, consistent with traditional uses attributed to both natural resources. The observed clinical improvement in patients with cough, bronchitis, and respiratory congestion is related to the anti-inflammatory and antimicrobial properties previously described for Piper auritum, as well as honey's soothing, antioxidant, and antibacterial actions.

Notably, the absence of adverse effects in adult patients, including those with hypertension and type 2 diabetes, indicates that the formulation is well tolerated and safe. This finding is relevant, since chronic comorbidities often limit therapeutic options in patients with recurrent respiratory diseases.

The effectiveness observed in pediatric patients with common congestion also supports the potential of the syrup as a natural and safe alternative for children. These results align with Mandal and Mandal (2011), who reported significant antibacterial properties of honey attributable to its hydrogen peroxide content, phenolic compounds, and low pH, contributing to efficacy against pathogens associated with respiratory infections.

Pilot clinical assessments with this formulation showed that all patients experienced significant improvement in respiratory symptoms. In pediatric patients, recovery was approximately 95%, while in adults

with type 2 diabetes and hypertension, improvement was around 90%. No side effects or adverse reactions were recorded, demonstrating the product's safety, good tolerability, and high sensory acceptance, and supporting its potential as an herbal adjunct in mild to moderate respiratory conditions.

The evidence obtained supports conducting larger clinical studies with acuyo- and honey-derived preparations to expand knowledge of their benefits, optimize their use, and consolidate their positive contribution to human health, offering safe and effective natural alternatives for managing respiratory diseases and promoting population well-being.

VI. CONCLUSION

The preliminary results of this study demonstrate that combining Piper auritum extract with honey constitutes a natural therapeutic alternative with potential efficacy in relieving mild to moderate respiratory symptoms, including cough, bronchitis, and nasal congestion.

Improvement observed in adult patients with and without comorbidities such as hypertension and diabetes as well as in a pediatric case, occurred without adverse effects, suggesting a favorable and well-tolerated safety profile across the groups evaluated.

The anti-inflammatory and antimicrobial properties of Piper auritum, supported by phytochemical and pharmacological studies, together with the soothing, wound-healing, and antibacterial effects of honey, justify the observed synergy in the formulation. These findings reinforce the validity of traditional knowledge and highlight the importance of its scientific study.

The Piper auritum extract with honey formulation represents a promising option within phytotherapy, with potential to contribute to the development of complementary, accessible treatments for respiratory system diseases.

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