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Formulation and Evaluation of Polyherbal Cough Syrup Using Ashwagandha and Other Herbs

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Abstract: *Herbal remedies are increasingly popular for respiratory ailments due to their natural origin and perceived safety. This study aimed to formulate a polyherbal cough syrup using selected plant extracts (Withania somnifera Ashwagandha, Ocimum sanctum Tulsi, Curcuma longa Turmeric, Mentha piperita Peppermint, Syzygium aromaticum Clove) and to evaluate its properties. The syrup was prepared by first making a simple syrup (Stevia, glycerine, propylene glycol, sorbitol, water) and a herbal decoction (herb heating and filtration), then combining them in a 1:5 ratio. The final product was assessed for appearance, taste, pH, specific gravity, and stability. Results: The syrup was yellow with pleasant odor and sweet taste; pH was ~4.0 and specific gravity ~1.20, consistent with OTC herbal syrups. No separation or color change was observed over 72 hours. Conclusion: The formulation was stable and organoleptically acceptable, indicating potential as a cough remedy. Further work is needed on quantitative active compound assays and clinical efficacy.*

Keywords: Ashwagandha, Withania somnifera, Ayurveda, Rasayana, Adaptogen, Withanolides, Medicinal plant, Phytochemicals, Herbal formulations, Immunomodulatory activity

I. INTRODUCTION

Cough is a common respiratory symptom affecting quality of life, with infectious and non-infectious causes. While many synthetic cough syrups exist, herbal formulations have been used for centuries in traditional medicine to provide relief with fewer side effects. Polyherbal remedies combine multiple plants to achieve synergistic effects. The present project focuses on a polyherbal cough syrup containing Withania somnifera (Ashwagandha), Ocimum sanctum (Tulsi), Curcuma longa (Turmeric), Mentha piperita (Peppermint), and Syzygium aromaticum (Clove), chosen for known respiratory benefits. For example, Ashwagandha (W. somnifera) has anti-inflammatory and immunomodulatory properties and has been reported to help manage lung disorders. Tulsi is traditionally used for cough and has demonstrated antitussive and antimicrobial activity. Turmeric's active curcumin is anti-inflammatory and antioxidant, which may reduce respiratory inflammation. Peppermint provides menthol and cooling effects that soothe airways, and clove oil (rich in eugenol) is antimicrobial and analgesic. Preliminary literature suggests that combining such herbs can enhance efficacy.

Aim: To formulate a palatable, stable polyherbal cough syrup and evaluate its physicochemical properties.

Objectives: Prepare the syrup using standardized herbal extracts; characterize appearance, pH, specific gravity and stability; compare results to accepted criteria; and identify further work .

Literature Review

Ashwagandha (Withania somnifera): A well-known adaptogenic herb, Ashwagandha contains withanolides with anti-inflammatory and immunomodulatory effects. It has been traditionally used in Ayurveda to treat coughs and bronchitis (e.g. strengthening lungs) and recent reviews note its role in managing respiratory conditions.

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Tulsi (Ocimum sanctum): Tulsi is revered as a 'queen of herbs' for respiratory health. Research shows Tulsi has significant antitussive and expectorant activity. In a 2021 experimental study, Tulsi leaf and root extracts markedly suppressed cough reflex in animal models. The combination of Tulsi with other herbs is used in Ayurvedic cough syrups.

Turmeric (Curcuma longa): Turmeric contains curcumin, a potent anti-inflammatory and antioxidant compound. Curcumin has been widely studied for respiratory benefits, reducing airway inflammation and oxidative stress. Traditional medicine uses turmeric for cough and colds (often with honey or ginger), leveraging its anti-inflammatory action (though clinical cough studies are limited).

Peppermint (Mentha piperita): Peppermint contains menthol which is known to alleviate cough by soothing the throat and acting as a mild decongestant. Menthol's cooling sensation can suppress cough reflex; peppermint oil is a common OTC cough remedy (e.g. in lozenges or vapor rubs).

Clove (Syzygium aromaticum): Clove oil's main component eugenol has demonstrated antimicrobial and mild analgesic effects. Clove extracts have been used in herbal syrups to provide warming relief and to inhibit respiratory pathogens.

Polyherbal Synergy: Several studies have found that polyherbal formulations can be more effective than single-herb extracts, due to synergistic phytochemical interactions. Previous formulations (e.g. Entoban and Linkus syrup) show that combining herbs yields syrups with acceptable pH, specific gravity, and stability. The literature supports developing a composite cough syrup using these herbs. Table 1 below (from the PPT) summarizes known properties of the chosen herbs and references.

Methodology

Materials: Plant materials (dried or powdered): Ashwagandha root (10 g), Tulsi leaves (10 g), Turmeric rhizome (10 g), Peppermint leaves (1.5 g), and clove oil (q.s). Excipients: Stevia (41.6 g), glycerine (37.5 mL), propylene glycol (37.5 mL), sorbitol (70 mL), purified water (up to final volume 500 mL).

Preparation of Simple Syrup: In a beaker, dissolve Stevia in 30 mL of water. Add glycerine and propylene glycol, then sorbitol; heat gently (~80 °C) with stirring for 15 minutes to obtain a clear simple syrup.

Preparation of Herbal Decoction: Separately, combine Ashwagandha, Tulsi, Turmeric, and Peppermint in 100 mL water; bring to a boil and simmer for 15–20 minutes. Add 2–3 drops of clove oil towards the end of heating. Cool and filter the mixture through muslin cloth to obtain herbal decoction.

Final Syrup Formulation: Mix the herbal decoction with the simple syrup in a 1:5 ratio (v/v). Add a natural coloring agent (e.g. caramel) for uniform appearance. Stir thoroughly until homogeneous. Adjust volume with water to 500 mL final.

Evaluation: The prepared syrup was evaluated for standard physicochemical parameters:

- Appearance, odor, taste: Recorded qualitatively.
- pH: Measured with a calibrated pH meter at 25 °C.
- Specific gravity: Determined using a pycnometer or density meter.
- Viscosity (optional): Using a viscometer at room temperature.
- Stability: Store a sample at room temperature (25 °C) and accelerated condition (40 °C); observe color, odor, and any precipitation over 1 week.

All tests were performed in triplicate. (Future work: Quantitative assays of active markers by HPLC, microbial load test, and in vivo antitussive testing would strengthen the study.)

Results

The key observations are summarized in Table 1 and described below.

Parameter	Observation
Colour	Yellow
Odour	Pleasant (minty)

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Taste	Mildly sweet
pH	~4.0
Specific Gravity	~1.20 g/mL
Stability (72 h)	No change (stable)

Table 1. Physicochemical properties of the polyherbal cough syrup (mean of three determinations). Note: pH 4.0 and SG 1.20 are within expected ranges for herbal syrups.

The syrup appeared yellow due to turmeric and was sweetened by Stevia. It had a clean, pleasant odor. The pH of 4.0 indicates a mildly acidic product, similar to other OTC cough syrups (which often range from pH 2.5–3.5). The specific gravity (1.20) was higher than water, reflecting the dissolved solids, but comparable to reference herbal formulations (e.g. Entoban syrup SG 1.32). No precipitate or separation was observed over the test period, indicating good physical stability.

Discussion

The results confirm that the formulated syrup meets basic quality criteria. The yellow color and pleasant taste are consistent with the herbs and sweeteners used. The pH of 4 is moderately acidic; this helps inhibit microbial growth but remains palatable, as cited studies note cough syrups are generally acidic. The specific gravity of 1.20 is within the range for syrups (higher than water due to dissolved stevia, glycerine, etc) and similar to published formulations. For comparison, a study by Shakeel et al. found a pH 3.7 and SG 1.324 for a polyherbal syrup; our values are analogous, suggesting proper formulation.

No changes in appearance or odor over 72 hours indicate preliminary stability. For a robust analysis, longer-term stability studies (e.g. 1–3 months) would be needed. The synergy of herbal actives likely contributes to the observed characteristics. For instance, antioxidants from turmeric and menthol from peppermint may help preserve the syrup's quality. Further discussion should relate these findings to other reports (e.g. similar rheological and antimicrobial profiles in herbal syrups).

Limitations include the absence of quantitative bioactivity tests. Future work should measure the concentration of marker compounds (withanolides, curcumin, etc.) and test the syrup's cough-suppressant effect in models. A sensory panel could also quantify taste acceptability.

II. CONCLUSION

A stable polyherbal cough syrup was successfully formulated using Ashwagandha, Tulsi, Turmeric, Peppermint, and Clove. The syrup had acceptable organoleptic properties and physicochemical parameters (pH ~4.0, SG ~1.20) similar to those reported in literature. This suggests its potential as a traditional herbal remedy for cough. Further investigations—such as analytical assays, bioactivity tests, and clinical trials—are recommended to fully validate its therapeutic efficacy and safety. The study demonstrates a proof-of-concept for developing natural cough syrups that align with quality standards.

Ethics:

This study was a secondary analysis based on the currently existing data and did not directly involve with human participants or experimental animals. Therefore, the ethics approval was not required in this paper.

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Conflict of interest:

The author declares that there is no conflict of interest.

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Data Access:

The data that supports the finding of this study are available from the corresponding author upon reasonable individual request.

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