FORMULATION AND EVALUATION OF POLYHERBAL COUGH SYRUP

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Abstract

Cough is a common respiratory condition that may occur due to infections, allergies, environmental irritants, or chronic pulmonary disorders. Although it acts as a protective reflex to clear the airway, persistent cough can lead to discomfort, throat irritation, and sleep disturbance. Herbal medicines are increasingly preferred due to their safety, better patient compliance, and reduced adverse effects.

The present study focuses on the formulation and evaluation of a non-alcoholic polyherbal cough syrup containing extracts of Zingiber officinale, Curcuma longa, Ocimum sanctum, Glycyrrhiza glabra, Syzygium aromaticum, Mentha piperita, and honey as a natural demulcent. The extracts were prepared using aqueous extraction and incorporated into syrup form.

The prepared formulation was evaluated for organoleptic characteristics, pH, density, viscosity, preliminary phytochemical screening, and stability studies. The syrup exhibited brown color, characteristic aromatic odor, and sweet taste. The pH was found to be 5.4 ± 0.02, density 1.05 ± 0.02 g/ml, and viscosity 1.12 ± 0.03 cP. Stability studies conducted at 4°C, room temperature, and 40°C showed no significant changes in physical parameters.

The results indicate that the developed polyherbal cough syrup is stable, acceptable, and suitable for managing both dry and productive cough.

Keywords: Polyherbal cough syrup, Herbal formulation, Medicinal plant extracts, Physicochemical evaluation, Phytochemical screening, Stability studies

Introduction

Cough is one of the most common symptoms associated with respiratory disorders and represents an essential airway defense mechanism. It assists in the removal of excess secretions, inhaled particles, and infectious agents from the bronchial tree. However, persistent coughing may result in inflammation of the airway mucosa, irritation of the throat, sleep disturbance, and reduced quality of life. Depending on the duration, cough is categorized into acute, subacute, and chronic forms, each associated with different underlying etiologies such as viral infections, allergic reactions, bronchial asthma, environmental pollutants, and gastroesophageal reflux.

Modern pharmacotherapy provides several synthetic cough suppressants and expectorants. Although effective, long-term or inappropriate use of these agents may cause undesirable effects including sedation, gastrointestinal discomfort, and dependency. This has encouraged growing

interest in plant-based therapeutic alternatives.

Traditional medicinal systems describe the use of various herbs possessing anti-inflammatory, bronchodilator, antimicrobial, and demulcent properties. A polyherbal approach, where multiple plant extracts are combined in a single formulation, may enhance therapeutic effectiveness due to synergistic interaction among phytoconstituents. Scientific validation through formulation development and physicochemical evaluation is essential to ensure quality, safety, and stability.

Therefore, the present investigation was undertaken to formulate and evaluate a non-alcoholic polyherbal cough syrup prepared from selected medicinal plants and to assess its physicochemical parameters and short-term stability.

Background and Importance

Respiratory tract infections and allergic airway conditions are among the most frequently reported health problems worldwide. Cough is a primary symptom associated with these disorders and often leads patients to seek medical treatment. Although cough initially serves as a protective reflex, persistent irritation of the airway may contribute to inflammation, discomfort, and impaired daily functioning.

Synthetic cough preparations are widely available; however, their long-term use may be associated with adverse reactions such as drowsiness, gastrointestinal disturbances, or drug interactions. In addition, certain antitussive agents may suppress the cough reflex without addressing underlying inflammation or microbial causes. These limitations have increased interest in alternative therapeutic approaches derived from medicinal plants.

Traditional systems of medicine describe the use of herbs such as ginger, turmeric, tulsi, liquorice, clove, and peppermint for managing respiratory ailments. These plants are known to contain bioactive phytoconstituents including flavonoids, phenolic compounds, essential oils, and glycosides that exhibit anti-inflammatory, antimicrobial, bronchodilatory, and soothing effects. When used in combination, these herbs may produce synergistic action, improving therapeutic outcome compared to single-herb preparations.

Despite the widespread traditional use of herbal cough remedies, scientific validation through formulation development and physicochemical evaluation is essential to ensure product quality, stability, and safety. Standardization of herbal formulations plays a crucial role in improving their reliability and acceptance in modern healthcare systems.

Therefore, the present study focuses on the formulation and systematic evaluation of a polyherbal cough syrup prepared from selected medicinal plants, with the aim of establishing its physicochemical characteristics and stability profile.

Cough

Cough is a complex protective reflex that plays an essential role in maintaining airway clearance. It is triggered by stimulation of sensory receptors located in the respiratory tract when exposed to mucus accumulation, dust particles, infectious agents, or chemical irritants. The reflex involves a deep inhalation followed by

forceful expulsion of air through the glottis, helping to clear the air passages.

Based on the nature of sputum production, cough can be categorized into two main types:

1. Dry (Non-productive) Cough:

This type of cough does not produce mucus and is commonly associated with throat irritation, allergies, viral infections, or environmental pollutants. It often causes discomfort and persistent irritation.

2. Productive (Wet) Cough:

Productive cough is characterized by the presence of sputum or phlegm. It usually occurs in conditions such as respiratory tract infections, bronchitis, or chronic obstructive pulmonary disorders, where mucus secretion is increased.

Depending on duration, cough may also be classified as acute (less than 3 weeks), subacute (3–8 weeks), or chronic (more than 8 weeks). Proper management depends on identifying the underlying cause and selecting appropriate therapeutic intervention.

Literature Review

Medicinal plants have been extensively investigated for their role in the management of respiratory disorders. Several experimental and clinical studies have reported the effectiveness of herbal ingredients in reducing cough frequency and airway inflammation. Herbal therapy is gaining attention due to its multi-target approach and comparatively lower incidence of adverse effects.(1)

Studies on Zingiber officinale have demonstrated its significant anti-inflammatory and antitussive properties, primarily attributed to active constituents such as gingerols and shogaols. These compounds are reported to reduce airway irritation and improve respiratory comfort. Similarly, Glycyrrhiza glabra has been traditionally used as a demulcent and expectorant agent. Research findings suggest that glycyrrhizin present in liquorice contributes to soothing action on inflamed mucosa and facilitates mucus clearance.(2)

Investigations on Curcuma longa indicate that curcuminoids possess strong antioxidant and anti-inflammatory activity, which may help reduce bronchial inflammation associated with persistent cough. Ocimum sanctum has also been studied for its antimicrobial and immunomodulatory properties, supporting its traditional use in respiratory tract infections.(3)

Essential oil-containing plants such as Mentha piperita and Syzygium aromaticum have demonstrated bronchodilatory and antimicrobial effects in various pharmacological studies. Menthol present in peppermint provides a cooling sensation and may relieve throat irritation, while eugenol in clove exhibits antimicrobial activity.(4)

Formulation-based research on herbal cough syrups has reported satisfactory physicochemical properties such as acceptable pH, viscosity, and stability profiles. However, many studies focus on single-herb preparations, and limited data are available on systematically evaluated polyherbal combinations with detailed physicochemical characterization and stability assessment.(5)

Therefore, considering the therapeutic potential of selected medicinal plants and the need for standardized herbal formulations, the present study was undertaken to formulate and evaluate a polyherbal cough syrup.(6)

Method and material :

Ingredients -

SR.No	Ingredients	Quantity
1)	Ginger extract	6.67 g
2)	Tulsi extract	6.67 g
3)	Turmeric extract	6.67 g
4)	Liquorice extract	6.67 g
5)	Clove	0.67 g
6)	Peppermint extract	0.67 g
7)	Honey	6.67 ml
8)	Distilled water	QS to 40 ml

Method:

Materials and Instruments

All glassware used in the study was of standard laboratory grade and thoroughly cleaned prior to use. Analytical instruments including a digital weighing balance, water bath, and pH meter were employed during formulation and evaluation studies.

Collection and Authentication of Plant Materials

The herbal drugs including ginger, tulsi, turmeric, liquorice, clove, and peppermint were procured from the local market. The plant materials were authenticated by the Department of Pharmacognosy, Shri Sai Institute of Pharmacy and Research, Chh. Sambhajinagar, based on their morphological and organoleptic characteristics.

Processing of Herbal Drugs

The collected crude drugs were cleaned to remove extraneous matter and shade dried at room temperature. The dried materials were coarsely powdered using mortar and pestle and stored in airtight containers until further use.

Preparation of Herbal Extract

Accurately weighed quantities (6.67 g each of ginger, tulsi, turmeric, and liquorice; 0.67 g each of clove and peppermint) were transferred into a beaker. The powdered drugs were mixed with distilled water in a ratio of 1:4 (drug: solvent) and heated on a water bath at 60–70°C for 30–45 minutes. The extract was concentrated until the volume was reduced to one-fourth of the initial volume. The mixture was allowed to cool and then filtered using filter paper.

Formulation of Polyherbal Cough Syrup

Honey was added to the filtrate as a demulcent and sweetening agent. Distilled water was used to adjust the final volume to 40 ml. The prepared formulation was transferred into an amber-colored bottle and stored for further evaluation.

Percentage Yield

After filtration, a portion of the extract was evaporated to dryness and the weight of dried extract was recorded. The percentage yield was calculated using the formula:

% Yield = (Weight of dried extract / Weight of crude drug) × 100

Evaluation of Polyherbal Cough Syrup

EVALUATION STUDIES OF POLYHERBAL COUGH SYRUP

The prepared polyherbal cough syrup was evaluated for various physicochemical and stability parameters to ensure its quality, safety, and suitability for oral administration.

A.Organoleptic Evaluation

1 Colour

The colour of the formulation was observed visually against a white background.

The prepared polyherbal cough syrup was found to be brownish in colour.

2 Odour

The odour was assessed by gentle smelling of the formulation.

The syrup exhibited a pleasant aromatic odour characteristic of herbal ingredients.

3 Taste

A small quantity of syrup was tasted carefully to determine palatability.

The formulation showed a sweet taste with mild herbal flavour, which improves patient acceptability.

4 Appearance

The prepared syrup was visually inspected for clarity and uniformity.

The formulation was found to be clear and free from visible particulate matter.

Determination of pH

The pH of the formulation was measured using a calibrated digital pH meter at room temperature. The electrode was immersed in the syrup sample and readings were recorded.

The pH of the formulation was found to be within acceptable range for oral preparations.

Viscosity Measurement

Viscosity of the prepared syrup was determined using a Brookfield viscometer at appropriate spindle speed. The viscosity ensures proper consistency and pourability of the syrup.

Density

Density of the formulation was determined using a clean and dry density bottle. The weight of empty bottle and bottle filled with syrup was recorded and density was calculated.

Specific Gravity

Specific gravity was calculated by comparing the weight of a given volume of syrup with the weight of an equal volume of distilled water.

Percentage Yield

The percentage yield of each herbal extract was calculated to determine extraction efficiency using the standard formula.

B.Preliminary Phytochemical Screening

The prepared formulation was subjected to qualitative tests for detection of phytoconstituents such as alkaloids, flavonoids, tannins, saponins, glycosides, and phenolic compounds.

Stability Study

The prepared polyherbal cough syrup was stored at room temperature and accelerated conditions for a specific period. The formulation was periodically observed for any change in colour, odour, pH, or precipitation.

No significant changes indicate acceptable stability of the formulation.

Statistical Analysis

All experimental determinations such as pH, viscosity, density, and specific gravity were carried out in triplicate (n = 3). The obtained data were expressed as Mean ± Standard Deviation (SD). The mean and standard deviation were calculated using standard statistical formulas to ensure accuracy and reproducibility of the results.

Results

The prepared polyherbal cough syrup showed acceptable physical and organoleptic properties.

Table 1: Physicochemical Evaluation of Polyherbal Cough Syrup

SR. NO	PARAMETER	RESULT (Mean ± SD)
1)	Colour	Brown
2)	Odour	Characteristic of herbal Odour.
3)	Taste	Sweet
4)	PH	5.4 ± 0.02
5)	Viscosity	1.12 ± 0.03 cP
6)	Density	1.18 g/ml
7)	Specific Gravity	**1.16**
8)	Stability	Stable

The formulated polyherbal cough syrup was subjected to qualitative phytochemical screening and the results are presented in Table 2.

Table 2: Preliminary Phytochemical Screening of Polyherbal Cough Syrup

SR. NO	PHYTOCHEMICAL TEST	RESULT
1)	Alkaloids	Present
2)	Flavonoids	Present
3)	Tannins	Present
4)	Saponins	Present
5)	Glycosides	Present
6)	Phenolic compounds	Present

The stability study of the formulated polyherbal cough syrup was carried out for 30 days at room temperature and accelerated conditions (40°C ± 2°C). Observations were recorded at 0, 15, and 30 days.

The results are shown in Table 3.

SR. NO	PARAMETER	0 DAY	15 DAY	30 DAY
1)	Colour	Brown	Brown	Brown
2)	pH	5.4	5.4	5.3
3)	Precipitation	Absent	Absent	Absent

Figure 1: Prepared Polyherbal Cough Syrup in Amber Glass Bottle.

The polyherbal cough syrup was successfully prepared using selected medicinal plant extracts and was evaluated for its physicochemical properties and

stability. The formulation exhibited satisfactory organoleptic characteristics, including brown colour, characteristic herbal odour, and sweet taste, indicating good patient acceptability.

The measured pH (5.4 ± 0.02) was within the acceptable range for oral liquid preparations, suggesting suitability for administration without irritation. The viscosity (1.12 ± 0.03 cP) indicated appropriate consistency and ease of pouring. The recorded density (1.18 g/ml) and specific gravity (1.16) confirmed uniformity of the formulation.

Qualitative phytochemical screening (Table 2) revealed the presence of important secondary metabolites such as alkaloids, flavonoids, tannins, saponins, glycosides, and phenolic compounds, which may contribute to the therapeutic potential of the formulation.

Stability assessment conducted over a period of 30 days at room temperature and accelerated conditions demonstrated no significant variation in colour, pH, or precipitation (Table 3), indicating good stability of the prepared syrup

Conclusion

The present study successfully formulated and evaluated a polyherbal cough syrup containing extracts of Zingiber officinale (ginger), Curcuma longa, (turmeric), Ocimum sanctum (tulsi), Mentha piperita (peppermint), and Syzygium aromaticum (clove), along with menthol and honey as supportive agents. Distilled water was used as the vehicle for the formulation.

The developed syrup exhibited satisfactory organoleptic characteristics, appropriate viscosity, and acceptable physicochemical properties suitable for oral administration. Stability studies revealed no significant changes in colour, pH, or precipitation during the storage period, indicating good formulation stability.

The combined presence of bioactive phytoconstituents from selected medicinal plants suggests that the formulation may provide effective symptomatic relief in both dry and productive cough. Being herbal in nature, the developed cough syrup may offer a safer alternative with minimal side effects. However, further pharmacological and clinical studies are recommended to establish its therapeutic efficacy.

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