



## Research Article

# Formulation, Standardization and Evaluation of a Polyherbal Cough Syrup Containing *Cyperus Rotundus*, *Piper Longum*, *Glycyrrhiza Glabra*, *Zingiber Officinale* and *Emblica Officinalis*

Mohit Dhilan<sup>1</sup>, Mohit Saini<sup>1</sup>, Pushendra Kumar Saini\*<sup>2</sup>, Dinesh Jindal<sup>2</sup>, Vishal Garg<sup>3</sup>

<sup>1</sup>Scholars, Jaipur School of Pharmacy, Maharaj Vinayak Global University, Jaipur.

<sup>2</sup>Professor, Jaipur School of Pharmacy, Maharaj Vinayak Global University, Jaipur.

<sup>3</sup>Principal, Jaipur School of Pharmacy, Maharaj Vinayak Global University, Jaipur

**Background** Respiratory tract disorders, including cough, remain among the most prevalent health problems worldwide. Herbal medicines have gained increasing acceptance as safer alternatives to synthetic cough remedies due to their lower incidence of adverse effects and multiple therapeutic activities. Polyherbal formulations containing medicinal plants with expectorant, antimicrobial, antioxidant, and anti-inflammatory properties may offer effective management of cough and throat irritation. **Objective** The present study aimed to formulate, standardize, and evaluate a polyherbal cough syrup containing *Cyperus rotundus* (Nagarmotha), *Piper longum* (Pippali), *Glycyrrhiza glabra* (Liquorice), *Zingiber officinale* (Ginger), *Emblica officinalis* (Amla), honey, and lemon oil. **Methods** The herbal extracts were incorporated into a syrup base prepared using purified water, sugar, and honey. The formulation was evaluated for organoleptic characteristics, physicochemical properties, phytochemical constituents, microbial load, antioxidant activity, antimicrobial activity, heavy metal contamination, and accelerated stability according to standard pharmaceutical procedures. **Results** The prepared syrup exhibited acceptable physicochemical properties with a pH of 5.5, specific gravity of  $1.24 \pm 0.02$ , good viscosity, pleasant odor, and acceptable taste. Phytochemical screening revealed the presence of alkaloids, flavonoids, tannins, phenolics, glycosides, terpenoids, and saponins. The formulation demonstrated significant antioxidant activity with 78.5% DPPH radical scavenging at 100  $\mu\text{g/mL}$  and showed antimicrobial activity against selected respiratory pathogens. Stability studies indicated no significant changes in physicochemical characteristics during storage. **Conclusion** The developed polyherbal cough syrup demonstrated satisfactory quality, stability, safety, and potential therapeutic activity. The formulation may serve as a promising herbal alternative for cough management and warrants further pharmacological and clinical investigations.

**Keywords:** Polyherbal syrup, Herbal cough syrup, *Piper longum*, *Glycyrrhiza glabra*, Antioxidant activity, Stability studies, Herbal medicine.

## INTRODUCTION

Cough is a protective physiological reflex that facilitates the removal of mucus, foreign particles, and irritants from the respiratory tract. Although cough serves an essential protective function, persistent coughing can adversely affect quality of life and may indicate underlying respiratory disorders. Conventional cough medications frequently produce

adverse effects such as drowsiness, dizziness, gastrointestinal discomfort, and dependency. Medicinal plants have been employed for centuries in traditional systems of medicine, including Ayurveda, Siddha, and Unani, for the treatment of respiratory disorders. Recent interest in herbal medicines has increased due to their natural origin, affordability, accessibility, and lower risk of adverse reactions.

*Piper longum* possesses expectorant and bronchodilator activities, while *Glycyrrhiza glabra* exhibits demulcent and anti-inflammatory properties. *Zingiber officinale* contains bioactive compounds such as gingerols and shogaols that provide antimicrobial and anti-inflammatory effects. *Emblica officinalis* is rich in vitamin C and antioxidant compounds that enhance immunity and protect against oxidative stress. *Cyperus rotundus* contributes antimicrobial and anti-inflammatory activities. Honey serves as a natural preservative and soothing agent,

whereas lemon oil improves flavor and aroma. The present investigation was undertaken to develop and evaluate a stable polyherbal cough syrup utilizing these medicinal herbs.

## MATERIALS AND METHODS

### MATERIALS

The ingredients used in the formulation are listed below.

**Table 1. Composition of Polyherbal Cough Syrup**

Ingredient	Quantity (mL)
Nagarmotha ( <i>Cyperus rotundus</i> )	10
Pippali ( <i>Piper longum</i> )	10
Liquorice ( <i>Glycyrrhiza glabra</i> )	6
Ginger ( <i>Zingiber officinale</i> )	6
Amla ( <i>Emblica officinalis</i> )	5
Honey	9
Lemon Oil	4

### 2.2 Preparation of Herbal Extracts

The plant materials were collected, authenticated, cleaned, shade-dried, and powdered. Suitable aqueous extraction procedures were employed for each herb. The extracts were filtered and stored under refrigerated conditions until further use.

### 2.3 Preparation of Syrup Base

A syrup base was prepared by dissolving sugar in purified water under controlled heating with continuous stirring. After cooling, honey was added to preserve its bioactive constituents.

### 2.4 Formulation of Polyherbal Syrup

The measured herbal extracts were gradually incorporated into the syrup base under continuous stirring. Lemon oil was added at the final stage. The resulting formulation was filtered and packed in amber-colored bottles.

## 3. Evaluation Parameters

### 3.1 Organoleptic Evaluation

The formulation was evaluated for:

- Color
- Appearance
- Odor
- Taste
- Homogeneity

### 3.2 Physicochemical Evaluation

The following parameters were determined:

- pH
- Viscosity
- Specific gravity
- Total solid content
- Stability

### 3.3 Preliminary Phytochemical Screening

Qualitative tests were performed for the detection of various phytochemical constituents.

**Table 2. Phytochemical Screening**

Constituent	Result
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Alkaloids	Present
Flavonoids	Present
Glycosides	Present
Tannins	Present
Saponins	Present
Phenolics	Present
Terpenoids	Present
Steroids	Present

### 3.4 Determination of Specific Gravity

Specific gravity was measured using a pycnometer.

**Table 3. Specific Gravity**

Parameter	Result
Specific Gravity	1.24 ± 0.02

### 3.5 Total Solid Content

**Table 4. Total Solid Content**

Parameter	Result
Total Solid Content	63.4 ± 1.1 %

### 3.6 Microbial Load Analysis

Microbial testing was conducted according to WHO recommendations.

**Table 5. Microbial Evaluation**

Test	Result
Total Bacterial Count	<10 <sup>2</sup> CFU/mL
Total Fungal Count	<10 <sup>1</sup> CFU/mL
E. coli	Absent
Salmonella spp.	Absent
Pathogenic Organisms	Absent

### 3.7 Antioxidant Activity (DPPH Assay)

**Table 6. DPPH Radical Scavenging Activity**

Concentration (µg/mL)	% Inhibition
25	32.4
50	48.7
75	63.1
100	78.5

**Table 7. IC<sub>50</sub> Values**

Sample	IC <sub>50</sub> (µg/mL)
Herbal Syrup	54.8
Ascorbic Acid	21.3

### 3.8 Antimicrobial Activity

The antimicrobial activity was evaluated by agar well diffusion method.

**Table 8. Zone of Inhibition**

Microorganism	Zone of Inhibition (mm)
<i>Staphylococcus aureus</i>	15.8 ± 0.5
<i>Streptococcus pyogenes</i>	14.2 ± 0.6
<i>Escherichia coli</i>	11.5 ± 0.4
<i>Candida albicans</i>	10.7 ± 0.3

### 3.9 Heavy Metal Analysis

**Table 9. Heavy Metal Content**

Heavy Metal	Result (ppm)
Lead	0.38
Arsenic	0.11
Cadmium	0.04
Mercury	Not Detected

### 3.10 Accelerated Stability Studies

- Temperature: 40 ± 2°C
- Relative Humidity: 75 ± 5%
- Duration: 3 Months

Storage conditions:

**Table 10. Stability Study**

Parameter	Initial	1 Month	2 Months	3 Months
Color	Brown	Brown	Brown	Brown
Odor	Pleasant	Pleasant	Pleasant	Pleasant
pH	5.5	5.4	5.4	5.3
Viscosity (cP)	1180	1175	1168	1162
Appearance	Clear	Clear	Clear	Clear
Precipitation	Absent	Absent	Absent	Absent

## RESULTS

**Table 11. Physicochemical Evaluation of Herbal Syrup**

Parameter	Observation
Color	Brown
Appearance	Clear and Uniform
Odor	Pleasant and Characteristic
Taste	Sweet and Acceptable
pH	5.5
Viscosity	Good Consistency
Stability	Stable

The syrup exhibited desirable organoleptic physicochemical properties throughout the study characteristics and maintained acceptable period.

## DISCUSSION

The formulation demonstrated satisfactory pharmaceutical characteristics. The pH remained within an acceptable range for oral administration and contributed to product stability. Suitable viscosity facilitated ease of administration while enhancing throat-coating action. The phytochemical profile confirmed the presence of bioactive compounds associated with antimicrobial, antioxidant, and anti-inflammatory activities. The antioxidant activity observed in the DPPH assay may be attributed to the high phenolic and flavonoid content derived from Amla, Ginger, and Honey. Antimicrobial evaluation revealed appreciable inhibitory activity against respiratory pathogens, supporting the traditional use of the selected medicinal herbs. Stability studies demonstrated that the formulation maintained its quality during storage without significant changes in appearance, pH, odor, or viscosity. Heavy metal analysis confirmed compliance with WHO safety limits, while microbial testing established microbiological safety of the formulation.

## CONCLUSION

The present investigation successfully developed a stable and acceptable polyherbal cough syrup containing *Cyperus rotundus*, *Piper longum*, *Glycyrrhiza glabra*, *Zingiber officinale*, *Embllica officinalis*, honey, and lemon oil.

The formulation exhibited:

- Acceptable physicochemical properties
- Good organoleptic characteristics
- Significant antioxidant activity
- Appreciable antimicrobial activity
- Microbial safety
- Compliance with heavy metal standards

- Stability under accelerated storage conditions

These findings suggest that the developed formulation has potential as a natural therapeutic option for cough and throat irritation. Further studies involving HPTLC fingerprinting, HPLC standardization, in-vivo antitussive evaluation, toxicity assessment, and randomized clinical trials are recommended to establish efficacy and support commercial development.

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