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Research Article

Research Article on Formulation and Evaluation of Herbal Bronchodilator Syrup for Asthma

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ABSTRACT

Asthma is a chronic airway inflammatory disorder marked by wheezing, breathlessness, chest tightness, and coughing. While conventional treatments are effective, they often cause side effects with long-term use, highlighting the need for safer, natural alternatives. This study aims to formulate and evaluate a polyherbal bronchodilator syrup using *Osmium sanctum* (Tulsi), *Adhatoda vasica* (Vasaka), *Glycyrrhiza glabra* (Licorice), *Zingiber officinale* (Ginger), honey, and lemon juice—ingredients known for their synergistic bronchodilatory, anti-inflammatory, and soothing effects. The syrup was prepared with aqueous herbal extracts, blended with honey and lemon for taste and stability. It underwent physicochemical tests (pH, viscosity, specific gravity, microbial load), organoleptic evaluation (taste, color, odor, consistency), stability, and preliminary in vitro studies. Results showed the syrup met pharmaceutical standards and demonstrated potential as a natural bronchodilator for mild to moderate asthma, with good patient acceptability and minimal side effects. Further in vivo and clinical studies are recommended to validate its efficacy.

INTRODUCTION

Respiratory diseases such as asthma have become increasingly prevalent due to environmental pollution, allergens, lifestyle factors, and genetic predispositions. Asthma is a chronic respiratory condition characterized by inflammation and narrowing of the bronchial airways, leading to wheezing, shortness of breath, coughing, and chest tightness. While conventional medicine offers a

range of bronchodilators and corticosteroids to manage symptoms, these treatments often come with side effects and may not be suitable for long-term use. Hence, there is a growing interest in exploring natural and herbal alternatives for asthma management. Herbal medicine, with roots in traditional systems like Ayurveda, provides a holistic and safer approach to treating chronic conditions. The formulation of a polyherbal

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bronchodilator syrup represents a blend of traditional knowledge and modern pharmaceutical principles. In this project, a syrup is formulated using six potent natural ingredients—*Ocimum sanctum* (Tulsi), *Adhatoda vasica* (Vasaka), *Glycyrrhiza glabra* (Licorice), *Zingiber officinale* (Ginger), *Honey*, and *Lemon juice*. These ingredients are well-documented for their bronchodilatory, anti-inflammatory, antitussive, and mucolytic properties. When combined in a syrup base, they provide a natural and effective solution for managing asthma symptoms, especially in mild to moderate cases. This formulation not only helps in relieving bronchospasm but also improves respiratory function, reduces mucus buildup, and supports the immune system.

Drugs And Excipients profile:

A) Vasaka (*Adhatoda vasica*)

Adhatoda vasica is a medicinal shrub used in Ayurveda for asthma and bronchial issues. Its quinazoline alkaloids act as bronchodilators and expectorants, helping ease breathing and clear airways.

Biological Source: Leaves of *Adhatoda vasica* (Family: Acanthaceae)

Synonyms / Common Names: Malabar Nut, Vasaka, Adulsa, Arusa

Chemical Constituents:

- **Alkaloids:** Vasicine, Vasicinone, Deoxyvasicine (quinazoline alkaloids)
- **Others:** Flavonoids, Saponins

Active Ingredients:

Vasicine, Vasicinone, Deoxyvasicine, Flavonoids

Mechanism of Action:

- **Bronchodilator:** Relaxes bronchial smooth muscles, reducing bronchospasm
- **Mucolytic:** Thins mucus to enhance expectoration
- **Anti-inflammatory:** Inhibits pro-inflammatory mediators, reducing airway inflammation
- **Antimicrobial:** Helps prevent respiratory tract infections



Fig 1: Vasaka

Uses:

- Treats asthma, bronchitis, cough, tuberculosis
- Acts as a bronchodilator, expectorant, antitussive, and anti-inflammatory
- Effective in respiratory tract infections and airway inflammation

B) Licorice (*Glycyrrhiza glabra*)

Glycyrrhiza glabra (Licorice/Mulethi) is a traditional herb used for respiratory and digestive issues. In asthma, it acts as a **demulcent** and **anti-inflammatory**, easing bronchial irritation and improving syrup palatability with its sweet taste.

Biological Source:

Roots of *Glycyrrhiza glabra* (Family: Fabaceae)

Synonyms / Common Names:

Mulethi, Licorice, Sweet Root

Chemical Constituents:

- **Saponins:** Glycyrrhizin (Glycyrrhizic acid)
- **Flavonoids:** Liquiritin, Glabridin
- **Others:** Isoflavones, Antioxidants

Active Ingredients:

Glycyrrhizin, Glabridin, Liquiritin, Flavonoids, Isoflavones

Mechanism of Action:

- **Anti-inflammatory:** Inhibits COX enzymes & prostaglandins (corticosteroid-like)
- **Demulcent:** Soothes irritated mucous membranes
- **Expectorant:** Promotes mucus clearance
- **Antioxidant:** Reduces oxidative stress in airways
- **Antimicrobial:** Helps fight respiratory infections



Fig 2. Licorice

Uses:

- Manages asthma, bronchitis, sore throat, cough
- Also used in gastric ulcers, adrenal insufficiency, skin issues
- Improves taste and palatability in syrups and lozenges

C) Tulsi (*Osmium sanctum*):

Tulsi is a sacred herb with anti-asthmatic and anti-inflammatory properties. It eases breathing and improves the taste and stability of herbal syrups.

Biological Source:

Leaves and aerial parts of *Ocimum sanctum* Linn. (*Ocimum tenuiflorum*)

Family: Lamiaceae

Synonyms / Common Names:

Holy Basil, Sacred Basil, Tulsi, Krishna Tulsi, Green Tulsi

Chemical Constituents:

- **Volatile Oils:** Eugenol, Methyl eugenol, Carvacrol, Linalool
- **Phenolics & Triterpenoids:** Rosmarinic acid, Ursolic acid
- **Others:** Flavonoids (orientin, vicerin), Saponins, Tannins

Active Ingredients:

Eugenol, Ursolic acid, Rosmarinic acid, Carvacrol, Caryophyllene, Flavonoids, Linalool

Mechanism of Action:

- **Bronchodilator:** Opens airways
- **Anti-inflammatory:** Reduces airway inflammation

- **Immunomodulator:** Enhances immune response
- **Antioxidant & Antimicrobial:** Protects lungs and prevents infections
- **Adaptogenic:** Helps manage stress



Fig.no.3: Plant Tulsi

Uses:

- Treats asthma, bronchitis, cough, cold, flu
- Boosts immunity, relieves allergies, supports cardiovascular and metabolic health
- Enhances taste and stability of herbal syrups

D) Ginger (*Zingiber officinale*)

Ginger has anti-inflammatory, antioxidant, and bronchodilatory effects. It reduces airway inflammation, eases breathing, and adds flavor and warmth to herbal respiratory syrups.

Biological Source:

Rhizomes of *Zingiber officinale* Roscoe
Family: Zingiberaceae

Synonyms / Common Names:

Ginger, Adrak, Sunthi (dried), Zanjabil

Chemical Constituents:

- Phenolics: 6-Gingerol, 6-Shogaol, Zingerone, Paradols

- Essential Oils: α -Zingiberene, β -Bisabolene, Camphene
- Others: Resins, Starch, Lipids

Active Ingredients:

Gingerols, Shogaols, Zingerone, Paradols

Mechanism of Action:

- Bronchodilator: Relaxes bronchial muscles
- Anti-inflammatory: Reduces airway inflammation
- Mucolytic: Promotes mucus clearance
- Antioxidant & Soothing: Protects lungs and soothes the throat



Fig.No.4: Ginger Root

Uses:

- Treats asthma, cough, sore throat, bronchitis
- Aids in nausea, indigestion, circulation, and immunity
- Enhances flavor and warmth in herbal syrups

Excipient:

Honey

Honey is a natural product produced by honey bees and has been used since ancient times for its medicinal, nutritional, and soothing properties. In respiratory formulations, it acts as a demulcent, cough suppressant, and natural preservative.

Lemon Juice

Citrus limon (Lemon) is a widely consumed citrus fruit known for its high vitamin C content and immune-boosting properties. In herbal formulations, lemon juice acts as an antioxidant, natural preservative, and flavor enhancer. It helps reduce inflammation and infection in the respiratory tract and improves palatability of herbal syrups. Lemon juice's mucolytic and refreshing nature makes it suitable for treating asthma-related congestion and irritation.

Method:

Extraction: Boil powdered herbs (decoction, 45–60 min) or reflux at 90–95°C (2–3 hrs) to extract water-soluble compounds.

Mucilage Formation: Disperse thickener in warm water, hydrate 30–45 min for syrup viscosity and stability.

Emulsification: Mix essential oils with emulsifier, stir to form stable emulsion, add to syrup.

Syrup Assembly: Combine extracts, sweeteners, flavors; adjust volume with water; stir to mix.

Homogenization: Stir 10–15 min to ensure uniformity and prevent settling.

Filtration: Filter through muslin or fine paper to remove particles before bottling.

➤ Preparation and Procedure

Step 1: Preparation of Herbal Extracts

a. Tulsi Extract:

- Weigh 2.0 g dried Tulsi leaves.
- Add to 20 mL distilled water.

- Heat at 60°C for 30 minutes.
- Cool and filter through muslin cloth.



b. Vasaka Extract:

- Weigh 3.0 g Vasaka leaves.
- Boil in 20 mL water for 45 minutes.
- Cool and filter.



c. Licorice Extract:

- Weigh 2.0 g licorice powder.
- Add 10 mL warm water and macerate 30 minutes.
- Filter and retain.



d. Ginger Extract:

- Crush 1.0 g fresh or powdered ginger.
- Steep in 10 mL warm water for 30 minutes.
- Filter and retain.



Step 2: Mixing of Extracts

- Combine Tulsi, Vasaka, Licorice, and Ginger extracts.
- Stir for uniform blending.

Step 3: Addition of Sweetening Agent

- Add 10 mL honey to the mixture.
- Stir gently to incorporate evenly.

Step 4: Addition of Flavoring and Acidifying Agent

- Add 1 mL fresh lemon juice.
- Stir thoroughly.

Step 5: Emulsification (optional)

- Add 1–2 drops of essential oil emulsified with Tween 80.
- Stir briskly for uniform dispersion.

Step 6: Volume Adjustment

- Add distilled water to adjust final volume to 50 mL.
- Stir continuously for consistent texture.

Step 7: Final Filtration and Bottling

- Filter syrup through muslin or filter paper.
- Transfer to amber glass bottle.

Step 8: Quality Evaluation and Storage

- Check and adjust pH (target: 5.5–7.0).
- Inspect for uniformity and sediment.
- Store in cool, dry place.
- Label: Shake well before use.

4 Evaluation of the Syrup

1. Organoleptic Properties

Parameter	Observation
Appearance	Uniform, dark brown syrup
Odor	Pleasant herbal aroma with citrus and menthol notes
Taste	Sweet and slightly bitter with licorice and ginger undertones
Texture	Smooth, viscous liquid free from grittiness

Clarity	Clear to slightly translucent; no visible particulate matter or phase separation
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2. pH Test

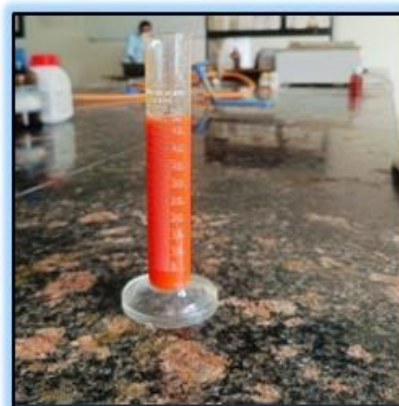
- **Method:** pH measured using a calibrated digital pH meter at room temperature.
- **Observed Range:** pH 6.2 – 6.8 (slightly acidic to neutral)
- **Significance:**
 - Suitable for oral administration
 - Non-irritant to the gastric mucosa
 - Reflects buffering activity from herbal ingredients and lemon juice



3. Sedimentation Volume Test (for evaluation of particulate stability in formulation)

- **Method:**
 - 50 mL of the syrup sample was placed in a graduated measuring cylinder.
 - Allowed to stand undisturbed for 24 hours.
 - The volume of the sediment and the supernatant was observed.
- **Observation:**
 - Very slow sedimentation.
 - Easily redispersible upon gentle shaking.
 - No hard caking observed.

- **Significance:**
 - Confirms the effective role of viscous honey and mucilaginous herbal extracts in maintaining suspension stability.



Evaluation Parameters

Sr. No.	Parameter	Result
1	pH	6.2 – 6.8 (near neutral)
2	Spreadability	Good (easy to pour and spread uniformly)
3	Consistency	Uniform, smooth viscous syrup
4	Colour	Brown to amber (dependent on extract content)
5	Odor	Pleasant, herbal with citrus and mint tones
6	Sedimentation Rate	Very slow; easily redispersible
7	Stability	Stable for 2–3 weeks at room temperature

4. RESULT

Sr. No	Ingredients	Batch 1 (B1)	Batch 2 (B2)	Batch 3 (B3)
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1	Tulsi extract	2.0 ml	2.0 ml	2.0 ml
2	Vasaka extract	3.0 ml	3.0 ml	3.0 ml
3	Licorice extract	2.0 ml	2.0 ml	2.0 ml
4	Ginger juice	1.0 ml	1.0 ml	1.0 ml
5	Honey	10.0 ml	15.0 ml	15.0 ml
6	Lemon juice	1.0 ml	1.0 ml	1.0 ml
7	Distilled water	Q.S. TO 50 ML	Q.S. TO 50 ML	Q.S. TO 50 ML
	Total Volume	50 ml	50 ml	50 ml

Three batches (B1, B2, and B3) of the herbal bronchodilator syrup were formulated with varying quantities of ingredients to optimize the syrup's efficacy, taste, and consistency.

- Batch 1 (B1) served as the initial formulation with standard quantities of all herbal extracts and honey.
- In Batch 2 (B2), the quantity of honey was increased from 10 mL to 15 mL to enhance the syrup's sweetness, viscosity, and soothing effect, while other ingredients remained constant.
- Batch 3 (B3) retained the optimized honey content of 15 mL from Batch 2 with all other ingredients unchanged, confirming the ideal formulation for effective bronchodilation, palatability, and anti-inflammatory benefits.

All batches were diluted with distilled water to reach a total volume of 50 mL.

CONCLUSION

The formulated polyherbal syrup presents a promising, natural therapeutic option for the management of asthma. The combination of *Tulsi*, *Vasaka*, *Licorice*, *Ginger*, *Honey*, and *Lemon juice* provides multi-dimensional relief through bronchodilatory, expectorant, anti-inflammatory, and soothing actions. The syrup demonstrated good physicochemical properties, microbial stability, and acceptable organoleptic characteristics, making it suitable for patient use. Its formulation was optimized across three

batches, with the final version exhibiting the best balance of therapeutic effect, stability, and palatability. This study supports the integration of traditional herbal knowledge with modern formulation techniques to develop safe and effective herbal remedies. Further pharmacological studies and clinical trials are recommended to establish its efficacy on a larger scale and validate its therapeutic potential in asthma and related respiratory conditions.

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