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Review Article

**“REVIEW ON HERBAL ANTITUSSIVE SYRUPS: ROLE OF  
COMPLEMENTARY MEDICINAL PLANTS”**Miss. Neha S. Padghan<sup>1</sup>, Miss. Priya M. Dandekar<sup>2</sup>, Dr. Ashutosh Kumar Dash<sup>3</sup><sup>1</sup>Gawande College of Pharmacy, Sakharkherda, Tq. Sindakhed Raja, Dist. Buldana – 443202,  
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Sakharkherda, Tq. Sindakhed Raja, Dist. Buldana – 443202, Maharashtra, India**Abstract:**

*Cough is one of the most common respiratory problems faced by people of all ages. Many synthetic cough syrups are available in the market, but they often produce side effects such as drowsiness and constipation. Therefore, herbal cough syrups are gaining attention as safe and effective alternatives. This review mainly focuses on the development, formulation, and evaluation of herbal antitussive syrups. Various medicinal plants such as Vasaka, Tulsi, Liquorice, Ginger, and Clove are used for their natural cough-relieving properties. These herbs contain important phytochemicals that show antitussive, expectorant, and soothing actions. The paper also discusses formulation techniques, evaluation parameters, and recent clinical insights on herbal syrups. Herbal formulations can provide better patient acceptance, fewer side effects, and more holistic treatment for cough.*

**Keywords:** Antitussive Agents; Phytotherapy; Polyherbal Formulations; Expectorants; Bronchodilator Agents; Plant Extracts; Pharmaceutical Stability.

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## INTRODUCTION:

### Overview of Cough and Its Importance

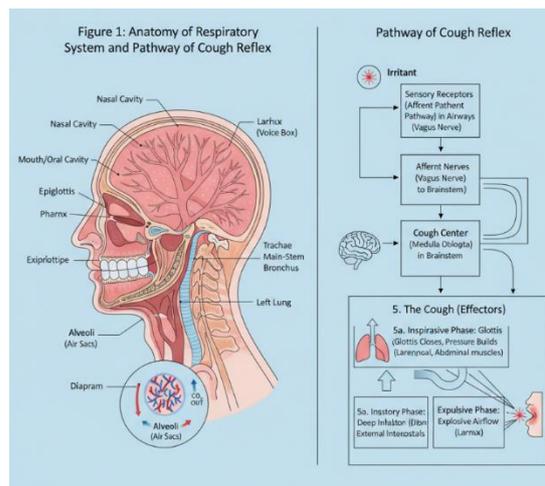
Cough is one of the most common symptoms of respiratory tract disorders, affecting millions of people across the world every year. It is not only a symptom but also a protective mechanism of the body. The main function of cough is to expel mucus, dust, or foreign materials from the airways, keeping the respiratory system clean and healthy. Although cough is beneficial in clearing the air passages, excessive or prolonged coughing can cause irritation, throat pain, chest discomfort, and disturbed sleep. Cough may also lead to complications such as vomiting, fatigue, and even rib fractures in severe cases.[1]

In developing countries like India, cough and cold are very common, especially during weather changes or in areas with high levels of air pollution. According to several health surveys, a significant percentage of patients visiting primary health centers complain of cough-related symptoms. Thus, cough management is one of the most essential aspects of respiratory care in both modern and traditional medicine.

### Anatomy of the Respiratory System

To understand the mechanism of cough and how herbal syrups work, it is important to study the basic anatomy of the respiratory system. The human respiratory system mainly includes the nose, pharynx, larynx, trachea, bronchi, bronchioles, and lungs. The nose and nasal cavity act as the entry points for air and filter dust particles. The pharynx serves as a common passage for air and food. The larynx, also known as the voice box, contains vocal cords and plays a role in sound production and protecting the lower airways.

The trachea or windpipe is a tube that connects the larynx to the bronchi, which further divide into smaller bronchioles within the lungs. The lungs are spongy organs responsible for the exchange of gases such as oxygen and carbon dioxide. Tiny air sacs called alveoli are the functional units where this exchange occurs. The lining of the respiratory tract contains cilia and mucous glands, which trap and remove harmful particles. When these linings get irritated by dust, smoke, or infection, a reflex action called cough is triggered to expel the irritant from the airways.[2]



**Figure 1: Anatomy of Human Respiratory System and Pathway of Cough Reflex Pathophysiology and Mechanism of Cough**

Cough begins when sensory nerve endings present in the lining of the respiratory tract are stimulated by mechanical, chemical, or thermal irritants. These nerve endings send impulses to the cough center located in the medulla oblongata of the brain. The brain then sends signals to the muscles of the diaphragm, chest, and abdomen, causing a sudden expulsion of air through the mouth. This helps to remove mucus or foreign materials.[3]

There are two major types of cough, productive cough and dry cough. Productive cough is associated with mucus or phlegm and helps in clearing the airways, whereas dry cough is non-productive and mainly caused by throat irritation or allergy. Continuous coughing can lead to inflammation and soreness in the throat, which requires proper medication to provide relief and prevent complications.

### Limitations of Synthetic Antitussive Drugs

Modern synthetic cough syrups such as those containing codeine, dextromethorphan, diphenhydramine, or chlorpheniramine are commonly prescribed for cough relief. These medicines either act on the cough center in the brain to suppress the reflex or soothe the throat locally. Although they provide temporary relief, they are associated with several drawbacks. The most common side effects include drowsiness, constipation, nausea, and dependency. Long-term use of codeine-based syrups can even cause addiction, especially in young people.

Moreover, synthetic syrups are not suitable for small children, pregnant women, or elderly patients due to safety concerns. Some may also cause allergic reactions or interact with other medications. Because of these problems, there is a growing need for safer, natural, and affordable alternatives that can effectively relieve cough without side effects. Herbal formulations offer a suitable solution to this challenge.[4]

#### **Growing Popularity of Herbal Antitussive Syrups**

Herbal medicine, or phytotherapy, is one of the oldest systems of healing known to mankind. In India, systems like Ayurveda, Siddha, and Unani have been using plant-based remedies for respiratory diseases for centuries. Herbal cough syrups combine the wisdom of traditional medicine with modern pharmaceutical knowledge. These syrups contain natural ingredients that have antitussive, expectorant, bronchodilator, and soothing actions.

Herbal antitussive syrups are prepared using extracts of plants like *Adhatoda vasica* (Vasaka), *Ocimum sanctum* (Tulsi), *Glycyrrhiza glabra* (Liquorice), *Zingiber officinale* (Ginger), *Syzygium aromaticum* (Clove), and *Mentha piperita* (Peppermint). Each of these herbs contributes specific therapeutic benefits. For example, Vasaka acts as a bronchodilator and helps in clearing mucus, Tulsi boosts immunity and reduces inflammation, Liquorice soothes the throat, and Ginger acts as an expectorant. The combined action of these herbs provides overall relief from cough and throat irritation.[5]

#### **Advantages of Herbal Syrups Over Synthetic Ones**

##### **Natural and Safe Formulations**

Herbal antitussive syrups are prepared from natural plant extracts and therefore are considered safer than synthetic cough medicines. They do not contain chemical or narcotic substances, making them suitable for people of all ages including children and elderly patients. The natural ingredients work gently on the body and do not disturb normal physiological functions.[6]

##### **Non-Sedative and Non-Addictive Nature**

Unlike many synthetic cough syrups that cause drowsiness or dependency, herbal syrups are non-sedative and non-addictive. They do not interfere with the normal activity of the brain or nervous system, allowing the person to continue daily work without fatigue or sleepiness. Their non-narcotic nature also prevents the risk of misuse or addiction.

##### **Immunity-Boosting and Lung-Supporting Effects**

The herbs used in herbal cough formulations, such as Tulsi, Vasaka, and Liquorice, not only suppress cough but also help to strengthen the immune system. They improve the body's natural defense against respiratory infections and enhance the overall function of the lungs. This makes herbal

syrups beneficial not just for temporary relief but also for long-term respiratory wellness.[7]

##### **Pleasant Taste and Better Patient Acceptability**

Most herbal syrups are formulated with natural sweeteners and flavoring agents such as honey, glycerin, and menthol. These ingredients give the syrup a pleasant taste and soothing aroma, making it more acceptable for both children and adults. The smooth texture and sweetness help reduce throat irritation and make regular dosing easier.

##### **Cost-Effectiveness and Easy Availability**

Another major advantage of herbal syrups is their affordability. They can be prepared from easily available medicinal plants, many of which are grown locally in India. This makes them more economical compared to imported or chemical-based cough formulations, which can be expensive. The use of local raw materials also supports traditional herbal industries and rural healthcare.[8]

##### **Antioxidant and Anti-Inflammatory Properties**

Herbal syrups are rich in natural phytochemicals such as flavonoids, saponins, and alkaloids, which show strong antioxidant and anti-inflammatory activity. These compounds help to heal the respiratory tract, reduce throat inflammation, and protect against oxidative stress caused by infections or pollution. Thus, herbal syrups not only give symptomatic relief but also promote recovery and protect respiratory tissues from further damage.

##### **Holistic and Long-Term Benefits**

In addition to relieving cough, herbal syrups work holistically by improving overall respiratory health. They reduce the frequency of cough, clear mucus, and soothe the throat naturally. Regular use strengthens the respiratory system and prevents recurrence of cough and cold, giving long-term protection and comfort.[9]

##### **Need for Scientific Formulation and Standardization**

Even though herbal cough syrups are effective, their scientific formulation and standardization are very important to ensure quality and consistency. Variations in plant sources, extraction methods, and storage conditions can affect the concentration of active compounds in the final product. Hence, standardization according to WHO and AYUSH guidelines is necessary.

Modern analytical techniques such as Thin Layer Chromatography (TLC), High Performance Liquid Chromatography (HPLC), and Fourier Transform Infrared Spectroscopy (FTIR) are used to identify and quantify phytoconstituents. Proper formulation also requires a stable syrup base, suitable preservatives, flavoring agents, and sweeteners. Stability studies help to determine the shelf life and ensure that the herbal formulation remains effective throughout its period of use.[10]

##### **PATHOPHYSIOLOGY OF COUGH**

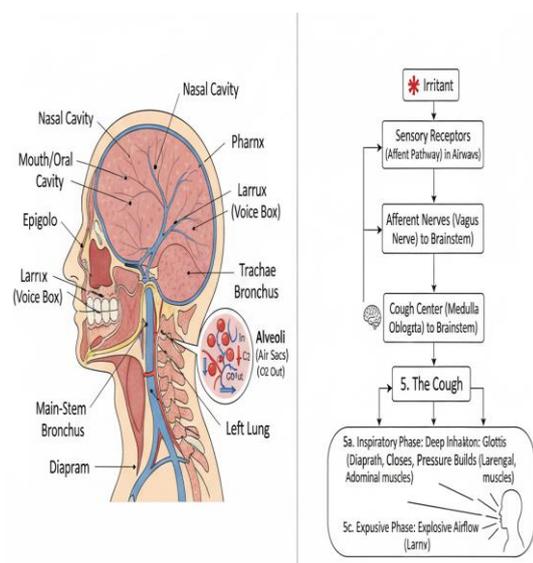
Cough is a natural protective reflex that helps to remove dust, mucus, or any foreign substance from

the respiratory passages. It is one of the body's defense mechanisms that keeps the airways clear and prevents infection. The entire process of coughing involves a series of coordinated actions between the respiratory muscles, nervous system, and the lungs. When an irritant stimulates the sensory nerves in the respiratory tract, a message is sent to the brain, which then triggers a strong expiration of air through the mouth. This is known as the cough reflex.

#### Anatomy Involved in the Cough Reflex

Several parts of the respiratory system are responsible for the initiation and control of cough. The upper respiratory tract, which includes the nose, pharynx, and larynx, is the first area exposed to irritants. The lower respiratory tract, which includes the trachea, bronchi, and lungs, also plays a key role in producing cough when these regions are inflamed or infected. The cough receptors are mainly found in the larynx, trachea, and larger bronchi. These receptors detect chemical, mechanical, or thermal irritation.

The cough center, located in the medulla oblongata of the brain, controls the entire process. Once the cough center is activated, it sends signals to the muscles of the diaphragm, chest wall, and abdomen. These muscles contract rapidly, leading to the expulsion of air from the lungs at high speed, which clears the airway.[11]



**Figure 2: Diagram Showing the Cough Reflex Arc in Humans**

#### Phases of the Cough Reflex

The cough reflex occurs in four main phases which happen very quickly, often in less than a second.

##### 1. Irritation Phase

This is the first step where foreign particles, dust, or chemical irritants stimulate the cough receptors present in the mucous lining of the respiratory tract. These irritants can be mechanical, like smoke or dust, or chemical, like strong odors or gases.

##### 2. Inspiration Phase

During this phase, the person takes a deep breath which allows air to enter the lungs. This air will later be forcefully expelled during the next phase.

##### 3. Compression Phase

In this stage, the vocal cords close and the muscles of the chest, diaphragm, and abdomen contract strongly. This increases pressure in the lungs, preparing the body for a forceful release of air.

##### 4. Expulsion Phase

Finally, the vocal cords suddenly open and the compressed air is expelled with great force through the mouth. This air carries mucus or irritants out of the respiratory tract, thereby clearing the passage.[12]

#### Types of Cough

Cough can be broadly divided into two main types depending on the presence or absence of mucus.

##### 1. Productive (Wet) Cough

In this type, there is the presence of sputum or mucus. It helps in clearing secretions, phlegm, or infection from the lungs and airways. Productive cough is usually seen in conditions like bronchitis, pneumonia, or asthma.[13]

##### 2. Non-Productive (Dry) Cough

Dry cough does not produce any mucus. It often results from irritation or inflammation of the throat and upper airways. It can be caused by viral infection, dust exposure, or allergy. Prolonged dry cough may damage the throat lining and lead to pain and hoarseness.

#### Causes of Cough

Cough can occur due to several reasons. The most common causes include viral or bacterial infection, exposure to pollutants, smoking, allergic reactions, and changes in weather. Other medical conditions like asthma, bronchitis, gastroesophageal reflux disease (GERD), and chronic obstructive pulmonary disease (COPD) can also lead to persistent coughing. Sometimes, cough may also occur as a side effect of certain medications such as ACE inhibitors used in hypertension.

#### Role of Nervous System in Cough Reflex

The nervous system plays a central role in regulating the cough reflex. Sensory nerves, mainly the branches of the vagus nerve, detect irritation in the airway lining. These signals are sent to the cough center in the brainstem. The brain processes these signals and sends motor impulses through spinal nerves to the muscles of the chest and abdomen. This coordination allows the body to generate a sudden burst of air that removes irritants. If the nervous system is damaged or overstimulated, it may cause

either a loss of cough reflex or persistent coughing.[14]

### Protective and Harmful Aspects of Cough

Cough is beneficial because it helps in maintaining a clean respiratory tract and prevents infection. It removes mucus, allergens, and bacteria, keeping the lungs healthy. However, excessive or chronic coughing can be harmful. It can lead to throat inflammation, chest pain, muscular strain, and sometimes vomiting. Continuous coughing may also disturb sleep and cause fatigue. In severe cases, it can even lead to small ruptures in blood vessels of the throat or eyes. Therefore, while mild coughing should not be suppressed, chronic cough requires proper treatment to avoid complications.

### Effect of Inflammation and Mucus Production

During infection or irritation, the mucous membranes of the respiratory tract become inflamed and produce excess mucus. The cilia present in the airways move this mucus upward toward the throat where it can be expelled by coughing. In chronic conditions like bronchitis or asthma, excessive mucus formation and inflammation make coughing more frequent and tiring. Herbal antitussive syrups help in reducing this inflammation, thinning the mucus, and making it easier to expel, which provides significant relief.[15]

### Role of Herbal Medicines in Regulating Cough Reflex

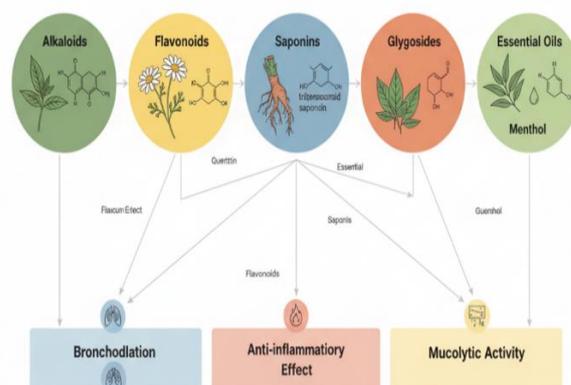
Herbal medicines work naturally by reducing irritation in the throat and respiratory lining. They contain bioactive compounds such as alkaloids, flavonoids, and glycosides that act as anti-inflammatory and soothing agents. Herbs like Vasaka, Tulsi, and Liquorice reduce inflammation of the mucous membranes, while Ginger and Peppermint help in loosening mucus and relaxing the airway muscles. Instead of suppressing the cough completely, herbal medicines regulate it, making it more effective and less distressing for the patient.[16]

### MEDICINAL PLANTS WITH ANTITUSSIVE POTENTIAL

Medicinal plants have been used since ancient times for the treatment of cough and other respiratory disorders. Traditional systems of medicine such as Ayurveda, Unani, and Siddha describe several herbs that possess natural antitussive, expectorant, and soothing properties. These plants contain various bioactive compounds like alkaloids, flavonoids, glycosides, terpenes, and essential oils which help in reducing inflammation, clearing mucus, and calming the irritated throat. The use of herbal medicines is increasing because they are safe, effective, and have minimal side effects compared to synthetic drugs. Many of these plants are easily available in India and are commonly used in household remedies and herbal cough syrup formulations.

### Phytochemical Basis of Antitussive Activity

The antitussive potential of medicinal plants mainly depends on their phytochemical constituents. Alkaloids such as vasicine from *Adhatoda vasica* show bronchodilatory and expectorant activity. Flavonoids and saponins present in herbs like Tulsi and Liquorice reduce irritation and provide anti-inflammatory action. Essential oils from Clove, Peppermint, and Eucalyptus produce a cooling and soothing effect on the throat and relieve coughing. These natural compounds act through multiple mechanisms such as relaxing bronchial muscles, reducing mucus viscosity, suppressing inflammation, and calming the cough reflex.[17]



**Figure 3: Major Phytochemical Classes Responsible for Antitussive Action in Medicinal Plants**

#### 1. *Adhatoda vasica* (Vasaka)

*Adhatoda vasica*, commonly known as Vasaka or Malabar nut, is one of the most widely used medicinal plants in the treatment of cough, bronchitis, and asthma. The main active constituents of Vasaka are vasicine and vasicinone, which show strong bronchodilator and expectorant effects. They help in loosening thick mucus and clearing the respiratory tract. The leaves of Vasaka are used in syrup formulations for their soothing action on the throat and ability to widen the bronchial passages. Vasaka also shows anti-inflammatory and antimicrobial activity which helps in reducing infection and irritation in the lungs.[18]

#### 2. *Ocimum sanctum* (Tulsi or Holy Basil)

Tulsi is regarded as a sacred plant in India and has been used in Ayurveda for centuries to cure respiratory problems. The leaves contain essential oils such as eugenol, camphene, and methyl eugenol, which help in reducing cough and cold symptoms. Tulsi acts as an antioxidant, antimicrobial, and anti-inflammatory agent. It reduces congestion, clears mucus, and improves breathing. The regular use of Tulsi strengthens immunity and prevents frequent episodes of cough and cold. Tulsi extract is a key ingredient in many commercial herbal syrups

because of its soothing aroma and strong therapeutic action.

### 3. *Glycyrrhiza glabra* (Licorice or Mulethi)

Licorice is another important herb used in herbal antitussive formulations. The root contains glycyrrhizin, which provides a soothing and demulcent effect on the throat. It helps to reduce irritation of the mucous membranes and suppresses dry cough effectively. Licorice also exhibits mild expectorant properties that help in clearing mucus from the airways. Additionally, it possesses anti-inflammatory, antioxidant, and antimicrobial properties, making it useful in treating sore throat, bronchitis, and asthma. Due to its sweet taste, Licorice improves the flavor and acceptability of herbal syrups.[19]

### 4. *Zingiber officinale* (Ginger)

Ginger is one of the most common kitchen spices and an excellent natural remedy for cough and cold. The rhizome of the plant contains gingerols and shogaols, which provide anti-inflammatory and antioxidant effects. Ginger acts as an expectorant by loosening and expelling mucus. It also improves blood circulation in the lungs and relaxes the airway muscles, which reduces coughing. Ginger juice mixed with honey is a traditional home remedy for cough relief. In syrup formulations, ginger extract provides a warm soothing sensation to the throat and helps in faster recovery from respiratory discomfort.

### 5. *Mentha piperita* (Peppermint)

Peppermint is well known for its refreshing taste and cooling effect. The essential oil of peppermint contains menthol, which has both antitussive and mild anesthetic properties. Menthol acts on the sensory nerves in the throat to reduce the cough reflex and provides a soothing, cooling sensation. It also acts as a decongestant by relaxing the muscles of the respiratory tract. Peppermint is often combined with other herbs in cough syrups to improve flavor, reduce irritation, and give a pleasant aroma.[20]

### 6. *Syzygium aromaticum* (Clove)

Clove is another aromatic herb widely used in both food and medicine. The main active compound present in clove is eugenol, which has antiseptic, anesthetic, and anti-inflammatory properties. Clove provides a warming sensation in the throat, helps in loosening mucus, and gives relief from dry cough. It also reduces throat pain and acts as a mild disinfectant against bacteria that cause respiratory

infections. In polyherbal cough syrups, clove is used not only for its medicinal value but also for its strong flavor and preservative effect.

### 7. *Piper longum* (Long Pepper)

Piper longum, also known as Pippali, is an important plant in Ayurvedic medicine used for treating cough, asthma, and bronchitis. The fruit contains piperine and essential oils that stimulate respiratory secretions and act as expectorants. It helps in clearing mucus from the airways and reducing throat irritation. Long pepper also enhances the absorption and bioavailability of other herbal ingredients in a formulation. It acts synergistically with herbs like Vasaka and Tulsi to produce better antitussive effects.

### 8. *Eucalyptus globulus* (Nilgiri Oil)

Eucalyptus oil is obtained from the leaves of the Eucalyptus tree and is well known for its strong aromatic and medicinal properties. The active component eucalyptol (1,8-cineole) acts as an expectorant and decongestant. It helps in clearing mucus and easing breathing. In addition, it shows antibacterial and antiviral properties which are useful in treating infections that cause cough and sore throat. Eucalyptus oil is commonly used in vapor rubs and also added in small quantities to herbal cough syrups for its cooling and healing effect.[21]

### Formulation aspects of herbal antitussive syrups

Formulation plays a very important role in the preparation of any herbal cough syrup. A well-designed formulation ensures uniform distribution of active ingredients, stability, safety, and patient acceptability. In herbal antitussive syrups, plant extracts are carefully selected and blended with suitable excipients such as sweeteners, preservatives, and flavoring agents. Each ingredient contributes to the overall effectiveness of the product. The formulation process must maintain the natural integrity of the herbs while ensuring proper solubility and stability of active compounds.

### Selection of Medicinal Plants

The first and most important step in formulation is the selection of suitable herbs. Plants are chosen based on their proven pharmacological actions such as antitussive, expectorant, bronchodilator, antimicrobial, and soothing properties. The herbs should be safe, easily available, and compatible with one another.[22]

**Table 1: Common Medicinal Plants Used in Herbal Antitussive Syrups**

Sr. No.	Botanical Name	Common Name	Major Phytochemical	Pharmacological Role
1.	<i>Adhatoda vasica</i>	Vasaka	Vasicine, Vasicinone	Bronchodilator, Expectorant
2.	<i>Ocimum sanctum</i>	Tulsi	Eugenol, Camphene	Anti-inflammatory, Immunostimulant
3.	<i>Glycyrrhiza glabra</i>	Liquorice	Glycyrrhizin	Soothing, Demulcent, Antitussive
4.	<i>Zingiber officinale</i>	Ginger	Gingerols, Shogaols	Expectorant, Anti-inflammatory
5.	<i>Syzygium aromaticum</i>	Clove	Eugenol	Antiseptic, Anesthetic
6.	<i>Mentha piperita</i>	Peppermint	Menthol	Cooling, Decongestant, Antitussive
7.	<i>Piper longum</i>	Long Pepper	Piperine	Mucolytic, Synergistic Enhancer

### Extraction of Active Constituents

After selecting the herbs, the next step is extraction. The purpose of extraction is to separate the active phytochemicals from the plant material using suitable solvents. Common extraction methods include maceration, percolation, or decoction. The choice of solvent depends on the nature of the compounds to be extracted. Alcohol, water, or hydroalcoholic mixtures are usually preferred because they can dissolve both polar and non-polar compounds.

The extracts are then filtered, concentrated under reduced pressure, and dried to obtain a semisolid or liquid mass which can be used directly in the formulation. Proper extraction ensures the presence of the desired amount of bioactive compounds responsible for antitussive activity.[23]

### Formulation Components and Their Roles

Herbal syrups contain both **active ingredients** (plant extracts) and **inactive ingredients** (excipients) which give the final product the desired appearance, taste, and stability.

**Table 2: Typical Ingredients Used in Herbal Cough Syrups and Their Functions**

Sr. No.	Ingredient Type	Example	Function in Syrup
1.	Active Ingredient	Herbal Extracts (Vasaka, Tulsi, Liquorice)	Provide antitussive and expectorant effect
2.	Sweetening Agent	Sucrose, Honey, Glycerin	Improves taste and patient acceptability
3.	Preservative	Methylparaben, Sodium Benzoate	Prevents microbial growth and spoilage
4.	Viscosity Enhancer	Glycerin, Sorbitol, CMC	Maintains consistency and mouthfeel
5.	Flavoring Agent	Menthol, Peppermint Oil, Lemon Oil	Provides aroma and cooling sensation
6.	Coloring Agent	Caramel, Herbal Colour	Enhances aesthetic appeal
7.	Vehicle/Base	Purified Water	Acts as solvent and carrier medium

### Mixing and Syrup Preparation

Once the extracts are ready, they are dissolved in the syrup base. The process begins by heating purified water and dissolving sugar or glycerin to form a clear syrup. The concentrated herbal extracts are then slowly added with continuous stirring to ensure uniform mixing. Preservatives, flavoring agents, and colorants are added after cooling. The final product is filtered to remove any suspended particles and then filled into clean bottles under aseptic conditions.[24]

Proper mixing is important to maintain homogeneity. The pH, viscosity, and specific gravity of the syrup should be checked to ensure consistency.

### Stability Considerations

Stability is a crucial parameter in herbal syrup formulation. Herbal extracts contain natural compounds that may degrade over time when exposed to heat, light, or microorganisms. Therefore, preservatives such as methylparaben or sodium benzoate are added to prevent microbial contamination. The syrup should be stored in airtight amber-colored bottles to protect from sunlight and moisture. Stability testing under accelerated and normal conditions helps determine the shelf life of the final formulation.[25]

### Physicochemical Parameters to be Maintained

The quality of herbal syrup depends on its physical and chemical properties. Parameters like pH, viscosity, specific gravity, and solid content are measured during and after formulation. These

ensure that the product is stable and effective during storage and use.

**Table 3: Important Physicochemical Parameters of Herbal Syrups**

Parameter	Ideal Range or Requirement	Purpose
pH	4.0 – 6.0	Maintains stability and taste
Viscosity	200 – 400 cps	Ensures proper consistency
Specific Gravity	1.2 – 1.4	Indicates syrup concentration
Total Solid Content	60 – 70%	Provides sweetness and thickness
Microbial Limit Test	Should be within pharmacopeial limits	Ensures safety and hygiene
Preservative Content	Within acceptable pharmacopeial limits	Prevents microbial contamination

### Evaluation of the Formulated Syrup

After preparation, the herbal syrup undergoes several evaluation tests to ensure its quality, efficacy, and safety. These tests include organoleptic evaluation (color, taste, and odor), pH measurement, viscosity determination, specific gravity, microbial testing, and stability studies. In addition, pharmacological testing is done to confirm its antitussive and expectorant actions using experimental models.

Organoleptic and physicochemical evaluations help in maintaining batch-to-batch uniformity. Stability studies determine whether the syrup remains safe and effective throughout its intended shelf life.[26]

### Advantages of Proper Formulation Techniques

A scientifically prepared herbal syrup ensures consistent dosage, pleasant taste, and better patient compliance. Proper formulation also enhances the bioavailability of herbal constituents and protects them from degradation. By following standardized methods, manufacturers can produce syrups that are safe, effective, and commercially acceptable.[27]

### Evaluation Parameters for Herbal Cough Syrups[28,29,30]

Sr. No.	Evaluation Parameter	Principle	Method	Acceptable Limit
1	Organoleptic Evaluation	To examine sensory characteristics like color, taste, odor, and appearance	Visual and sensory observation	Color: light–dark brown, pleasant herbal odor, sweet taste, clear and uniform appearance
2	pH Determination	To maintain product stability and taste; prevents microbial growth	Digital pH meter (at room temp)	pH between 4.0 – 6.0
3	Viscosity Measurement	To check flow property and consistency of syrup	Brookfield viscometer	200 – 400 cps for ideal consistency
4	Specific Gravity	To ensure uniform concentration of sugar and solids	Hydrometer or specific gravity bottle	1.2 – 1.4
5	Total Solid Content	To estimate total dissolved solids which affect sweetness and stability	Evaporation and residue weighing	60 – 70% (sugar-based); 40 – 60% (glycerin-based)
6	Microbial Load Testing	To ensure the syrup is free from harmful microorganisms	Nutrient agar and Sabouraud agar culture plates	Total bacterial count $\leq 10^3$ CFU/ml; fungal count $\leq 10^2$ CFU/ml; absence of <i>E. coli</i> , <i>Salmonella</i> , <i>Pseudomonas</i>
7	Preservative Efficacy Test	To confirm preservatives effectively inhibit microbial growth	Inoculation with known microorganisms and observation	No significant microbial growth within test period
8	Stability Studies	To check product stability under different conditions	Accelerated and normal stability testing	No change in color, odor, pH, or viscosity during 3–6 months

**SUMMARY AND CONCLUSION:**

Herbal antitussive syrups are gaining importance as safe and effective alternatives to synthetic cough medicines. They combine extracts of plants like Vasaka, Tulsi, Liquorice, and Ginger, which show antitussive, expectorant, and soothing actions. These herbal formulations provide relief from cough, improve immunity, and support respiratory health without causing sedation or addiction. Scientific formulation, proper standardization, and evaluation ensure stability and quality. Herbal syrups represent a successful blend of traditional healing and modern pharmacy, offering a natural approach for cough management with proven safety, affordability, and therapeutic effectiveness.

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