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Formulation and Evaluation of Herbal Candy for Cough Treatment

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A B S T R A C T

Cough is a common respiratory symptom often associated with viral infections, allergies, or other respiratory conditions. The use of herbal remedies for managing cough has gained widespread popularity due to their perceived safety, affordability, and accessibility. This review explores the effectiveness, safety, and mechanisms of action of commonly used herbal remedies for cough. Many herbal preparations, including honey, ginger, thyme, licorice root, ivy leaf, and marshmallow root, have been traditionally used for cough relief. These remedies often work through mechanisms such as anti-inflammatory, expectorant, demulcent, or antitussive effects. For instance, honey has been shown to soothe the throat and reduce cough frequency, while ivy leaf extracts promote mucus clearance. Scientific studies support the use of several herbal remedies, such as Pelargonium sidoides and Echinacea, in reducing cough severity and duration, particularly in cases of acute bronchitis or mild upper respiratory infections.

Keywords: Accessibility, Respiratory, Bronchitis, Anti-inflammatory.

1. Introduction

Coughing is brought on by the activation of vagal afferent neurons, which have terminals in the trachea, bronchi, and larynx. The cough reflex involves two different types of fibres: C-fibres and A-delta fibers. In contrast to C-fibres, which are non-myelinated, a delta fibre is a sensory nerve fiber that is myelinated and hence carries sensory information quickly.Piperine is responsible for the punent flavor of long pepper .it has also been shown to have expectorant properties, helping to loosen mucus and promote its expulsion. Another significant alkaloid, piperlongumine, has been identified as having potential expectorant effects.it may also have other beneficial properties, including anti-inflammatory and antioxidant effects. Long pepper contains a variety of other alkaloids, such as methyl piperine, iperonaline,andasarinine, which may also contribute to its expectorant and other pharmacological properties. The essential oil of long pepper, which contains sesquiterpenes like caryophyllene and hydrocarbons, may also contribute to its expectorant and other medicinal properties. The reflux may also be regulated by additional vagal afferent neurons. Mechanical forces are effectively absorbed by receptors that are able to rapidly adapt to novel stimuli. When cough is lessened by medicine, it has a significant impact on the action potentialof vagal afferent nerves, or the efficiency of synaptic transmission at their primary terminal position. (1)

The purpose of the proposed study was to create and evaluate a herbal dosage form that included the popular spice *Piper longum* L. The plant known as "long pepper," *P. longum* L. (Piperaceae), is widespread in tropical and subtropical areas of the world, including the Indian subcontinent, Sri Lanka, and other Middle Eastern and American countries. Black pepper was especially valued by Roman emperors due to its significant commercial and economic significance. Antimicrobial, immunomodulatory, anti-inflammatory, anti-asthmatic, and antioxidant properties are all present in long pepper. (2)

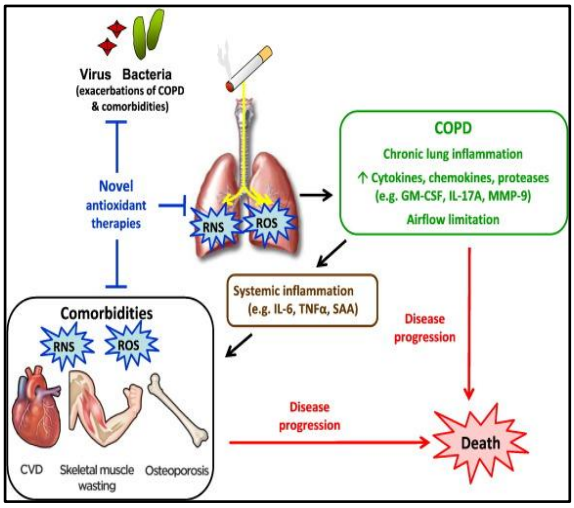
A cough is an abrupt, forceful release of air that helps to clear the airways of debris. Sputum, commonly known as phlegm, is a mixture of mucus, debris, and cells that are evacuated from the lungs and can occasionally be brought up by coughing. Via the vagus nerve, the internal laryngeal nerve transports the sensory data from the region above the glottis in the trachea to the cough center situated in the medulla oblongata. When dust or other foreign particles stimulate this location, a cough is produced to clear the respiratory system of the foreign object before it enters the lungs. (3)

Candy is simple to use and doesn't interfere with your day because it doesn't need to be diluted in water. If necessary, treatment can be discontinued at any moment. Additionally, because the drugs will dissolve or be suspended in the saliva, the ones released from the jelly will be easily accessible. It is therefore intriguing to think of creating possible anti-tussive formulations based on confectionery formulations made from natural ingredients. (4)

CLASSIFICATION OF COUGH

- **Dry cough (non-productive):** Cough without mucus, often seen in viral infections or irritants.
- **Productive cough (wet cough):** Cough with mucus, commonly due to bacterial infections, chronic respiratory conditions. (5)
- **Advantages of Herbal Remedies for Cough**

- Herbal remedies for cough are often favoured for their natural ingredients and minimal side effects compared to conventional medications. Here are some key advantages:
- **Soothing and Anti-inflammatory Properties**
- Many herbs, like liquorice root, ginger, and marshmallow root, contain natural compounds that soothe irritated throat tissues and reduce inflammation, providing relief from cough. (6)
- **Minimal Side Effects**
- Herbal remedies are generally considered safer, with fewer side effects compared to pharmaceutical drugs. This makes them suitable for children, pregnant women, and individuals with certain medical conditions, provided they are used correctly.
- **Benefits**
- **Holistic** Herbal treatments often provide additional health benefits, such as boosting immunity or improving respiratory function. For example, honey, commonly used in herbal cough remedies, has antimicrobial properties and enhances healing. (7)
- **Affordable and Accessible**
- Herbs are often more cost-effective and widely available compared to synthetic drugs, making them a convenient choice for many.
- **Sustainability** Using herbal remedies can be environmentally sustainable, as they rely on renewable natural resources when harvested responsibly. (8)



MATERIALS AND METHOD:

Sr. No.	Name of the Ingredient	Lollipop Candy (Quantity in gm)
1	**Ethanolic extract of *P. longum L.***	2.43
2	**Granular sugar**	87.5
3	**Corn syrup**	18.75
4	**Chocolate**	3 drops
5	**Ginger**	5
6	**Turmeric**	5
7	**Glycerin**	2
8	**Water**	**qs**

Ingredients Used in Formulation of Cough Remedy

1. ***P. longum* L**

- **Scientific Name:** *Piper longum*
- **Common Name:** Long pepper, Indian long pepper
- **Synonyms**: None mentioned
- **Family:** Piperaceae
- **Chemical constituents :** alkaloids, piperine, piper longumine

Mechanism :

Pippali (Piper longum), through its anti-inflammatory and cough-relieving properties, may help soothe coughs by reducing inflammation in the respiratory passages and potentially suppressing cough reflexes.

- Granular Sugar;
- Biological Name: Saccharum officinarum
- Family: Poaceae (Grass family)

Synonyms: White sugar

Mechanism:

Granulated sugar's mechanism of action to cough is primarily related to its sweet taste, which can induce analgesia and potentially elevate the cough reflex threshold. It's also used in cough syrups and other remedies to improve taste, and its sweetness can have a soothing effect, potentially reducing the urge to cough.

Corn Syrup
Biological Name: Glucose syrup
Synonyms Molasses
Family: Poaceae (Grass family)
Chemicalconstituents: Maltose, Saccharides.
Machanism: While not a direct cough suppressant, corn syrup can soothe a cough by coating the throat and acting as a lubricant, making it easier to clear mucus and reduce throat irritation.

Rock Salt
Biological Name: sodium chloride
Family: chloride
Chemical constituents: Sodium chloride
Mechanism:Rock salt, or Saindhava in Ayurvedic medicine, is believed to help with coughs through its decongestant, anti-inflammatory, and antibacterial properties, potentially aiding in clearing airways and reducing inflammation.

Butter
Scientific Name: dairy butter" or "milk fat
Biological Name: Vitellariaparadoxa
Family: Perthshire
Chemical constituents: Butterfat
Mechanism:Butter, especially when consumed in excess or as part of deep-fried foods, can potentially worsen cough symptoms by stimulating the body to produce more mucus, a common response to irritation in the airways.

Glycerine
Biological Name: Glycerol
Synonyms: Propanetriol, 1,2,3-Trihydroxypropane, Glycerine, Glycerine
Family: Alcohol
Mechanism:Glycerine, a common ingredient in cough syrups, soothes coughs by acting as a demulcent, coating the throat and reducing irritation, and possibly blocking sensory cough receptors.

Water
Chemical Name: Dihydrogen oxide
Synonyms: Aqua (18)

Chocolate
Synonyms: Candy, Dessert, Confection, Sweet, Pastry, Sweetmeat, Confectionery, Goodie
Scientific Name: Theobroma cacao

Family: Mallow
Chemical constituents: Flavonoids, phenylethylamine

Ginger

- **Family**: Zingiberaceae
- **Key Chemical Constituents**: Gingerols, shogaols, zingerone, volatile oils
- **Health Benefits**: Antiemetic, anti-inflammatory, aids digestion, alleviates nausea

MOA:
Anti-inflammatory Effects: Ginger's compounds inhibit enzymes like cyclooxygenase (COX) and lipoxygenase (LOX), which are involved in producing pro-inflammatory chemicals (prostaglandins and leukotrienes). This helps reduce inflammation and can alleviate pain in conditions like arthritisDigestive Aid: Ginger stimulates bile production and gastric secretions, aiding in the breakdown and absorption of food. It also increases gastrointestinal motility, which can help reduce bloating, indigestion, and nausea.

Turmeric (Curcuma longa)

- **Family**: Theaceae
- **Key Chemical Constituents**: Polyphenols (epigallocatechingallate or EGCG), caffeine, theanine
- **Health Benefits**: Antioxidant, promotes weight loss, cardiovascular health, anticancer

MOA: Curcumininfluences cellsignalling pathways, including COX-2, LOX, and MAPK, which are involved in inflammation and immune responses. This modulation may help reduce chronic disease risk.Anti-inflammatory effects: Curcumin inhibits molecules in the inflammatory pathway, particularly NF-kB (nuclear factorkappa-light-chain-enhancer of activated B cells). NF-kB plays a key role in controlling the body’s inflammatory response.Byinhibiting NF-kB, curcumin reduces inflammation, which may help in conditions like arthritis, digestive disorders, and cardiovascular disease

Methods of preparation

Material and methods

Materials

- Dried fruit Powder of P. longum L. was purchased from a local market
- pasteurized butter, sucrose, and baby corn seeds procured by local market
- Corn syrup USP was prepared by standard laboratory method using baby corn seeds.
- Rock salt and honey was obtained from local market
- other chemicals and materials are available in college.

Methods

- Preparation of ethanolic extract of P. longum L.

Procedure:

Preparation of Plant Material:

Dry the Piper longum fruits if they aren't already.

Coarsely powder or crush them for better surface area exposure.Solvent Selection: Use 70% ethanol (aqueous ethanol) for a balance between polarity and efficiency in extracting both polar and non-polar compounds like piperine.

- Maceration: Place the powdered plant material in a glass jar.Add solvent in a 1:5 to 1:10 ratio (w/v), depending on how concentrated you wanttheextract.Seal the container and keep it in a cool, dark place.
  Agitate occasionally (e.g., shake once or twice daily).
- Duration: Typically, 7–10 days.
- Filtration: After maceration, filter the mixture through muslin cloth or filter paper to remove solids.
- Concentration (Optional):Concentrate the filtrate using a rotary evaporator
  or by evaporating the solvent under reduced heat (not above 40–45°C to
  preserve compounds).
- Storage:Store the extract in a dark glass bottle in a refrigerator or cool place.

•Flavoured lollipop candy of P. longum L. Formulation

Maceration

1. **Preparation of Plant Material**
   - Dried the plant material (P.Longum,Ginger.Tuemeric)
   - Crushed to increase surface area for better extraction.
2. **Soaking in Solvent**
   - Place the powdered material in a clean container.
   - Add a suitable **solvent** (e.g., ethanol).
   - Ratio is typically **1:5 to 1:10** (solid: liquid).
3. **Maceration Period**

- Let it stand for a **specified time** (usually 3–7 days).
- Keep the container **sealed and protected from light**.
- Stir or shake occasionally to improve solvent penetration.

4. **Filtration**
   - After maceration, filter the mixture to separate the **extract (liquid)**
5. **Storage or Concentration**
   - The liquid extract can be used directly or further concentrated via evaporation.
   - Store in an amber bottle to protect from light and degradation.

- Cleaned candy molds were lubricated with molten, unflavored butter of a well-known Indian brand.
- The candy base was prepared using granulated sugar and corn syrup USP followed by the addition of water in a stainless steel (SS) vessel. This solution is heated on a cooking gas burner's medium flame until vigorous boiling (144–148°C).
- The required quantity of P. longum L Ginger, Turmeric,). ethanolic extract was added into the syrupy mass with Continuousstirring.add drops of chocolate, GeletinandGlycerin. This hot candy mass was poured into lubricated mold cavitie and colored plastic straw wasimmersed (vertically) into each filled mold. Candies are allowed to settle by congealing at ambient temperature**.**
- **EVALUATION OF FLAVORED CANDIES OF P. LONGUM L**

Appearance: Texture**:**The texture is smooth, glossy, rough.

Organoleptic Characteristics:

Aroma: The smell and scent of the candy, which can significantly influence consumer preference.

Taste: The profile, including sweetness, sourness, saltiness, and other taste sensations.

Hardness: .**Using a Texture Analyzer (Universal Testing Machine - UTM)**

A texture analyser is often used for more precise, scientific measurements of hardness. The process involves:

- **Prepare the sample**: Select a piece of candy that is representative of the batch you want to test. Ensure the piece is of a consistent size and shape.
- **Calibrate the machine**: Make sure the texture analyser is calibrated correctly for the type of test you're going to perform (e.g., compression, puncture, or shear tests).
- **Test procedure**: Place the candy on the test platform. Using the probe or plunger, the machine applies a
- force to the candy.
  - **For hard candies**: A compressive force is usually applied to break the candy, and the force
  - required to do so ismeasured.

pH: Prepare the Candy Sample

You need to extract the candy's soluble components (which affect pH) into a liquid.

For **hard candy**:

- Crush the candy into small pieces using a clean, dry tool (like a mortar & pestle or rolling pin).
- Mix it with **distilled water** in a cup or beaker (about 1 part candy to 5 parts water).
- Stir until the candy dissolves fully
- . **Disintegration Time**:

1. Prepare the Medium

- Use**distilled water** at around **37°C (98.6°F)** to simulate body temperature.
- Filled a beaker or cup with a consistent volume (e.g. 200 mL).

2. Weigh and Record the Candy

- Optional: weighed the candy before testing to track disintegration in terms of mass loss.

3. Start the Test

- Drop the candy into the medium and **start your timer immediately**.
- Stir gently every 30–60 seconds (if desired) to simulate movement in the mouth.
  - If using a magnetic stirrer, keep the speed low and consistent.
- Observe and note:
  - Time to **first visible signs of breakdown**.
  - Time to **partial disintegration** (pieces falling apart, center exposed).

- Time to **complete disintegration** (no solid chunks remaining).

4. Record the Final Time

- Stop the timer when the candy has fully disintegrated (or set a time limit, like 30 minutes, for harder candies).
- You can also filter the solution to ensure no solid material remains if you want a more precise end point
- **Conditions of Temperature**: Room temperature (22–27°C) and between 2 and 8°C. The sample was tested every 0, 15, and 30 days. The examinations conducted were:

5.Drug Release

Jelly candy was shown to have very slow drug release; therefore, the inclusion of gelatin may provide sustained release. According to normal protocols, stability studies were conducted (Table 3). As a result, the butterscotch, jelly, and flavored lollipops had a smooth surface and were palatable. There was no indication of microbial development on the candies' surface, and they still had their distinct smell. The sample's pH values, disintegration time, hardness, and drug content barely changed when it was placed in stable conditions.

Conclusion

When made into sweets, the ethanolic extract of P. longum L., a member of the Piperaceae family, has shown outstanding anti-tussive action. Additionally, the prepared jelly, butterscotch, and lollipops are palatable. As a result, candy formulations could be regarded as lead formulations. Using various flavored candies for oral delivery systems, more thorough research may be done to validate the claim regarding its clinical safety and effectiveness.

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