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Research on Formulation and Evaluation of Herbal Syrup: Antitussive Activity

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Abstract: *The present study explores the formulation and efficacy of an herbal syrup developed for its antitussive properties. Cough, a common symptom associated with respiratory tract infections, often necessitates treatment to improve patient comfort and prevent complications. While conventional cough syrups often rely on synthetic compounds, the increasing interest in natural remedies has lead to the exploration of herbal alternatives. This study investigates the effectiveness of syrup containing a blend of medicinal herbs traditionally used for their expectorant, anti-inflammatory, and cough-suppressant properties.*

The formulation includes extracts from plants power such as Mentha (pudina), Cinnamomum verum (cinammom), Ocimum sanctum (holy basil) and Zingiber officinale (ginger) known for their therapeutic effects on the respiratory system. Its efficacy was compared to standard over-the-counter cough suppressants.

Results demonstrated a significant reduction in cough frequency and intensity in subjects treated with the herbal cough syrup, comparable to or surpassing the effects of conventional treatments. Additionally, the herbal syrup showed a favorable safety profile with minimum (no) side effects, highlighting its potential as a natural alternative to synthetic cough medications. This study underscores the therapeutic potential of herbal formulations in managing cough and provides a foundation for further clinical investigations..

Keywords: antitussive properties, expectorant, cough-suppressant, Cough, decoction

I. INTRODUCTION

Aim:

To develop a herbal syrup formulation containing Tulsi (Ocimum sanctum), Pudina (Mentha piperita), Ginger (Zingiber officinale), Cinnamon (Cinnamomum verum) extracts, and honey as the base, aimed at providing effective antitussive (cough-suppressing) activity.

Objectives:

1. Formulation Development:

To create a stable and palatable herbal syrup using Tulsi, Pudina, Ginger, and Cinnamon extracts combined with honey as the syrup base.

2. Antitussive Activity:

To investigate and demonstrate the antitussive (cough-relieving) properties of the herbal components individually and in combination

3. Synergistic Effect:

To explore the potential synergistic interaction between these herbal ingredients and honey in suppressing cough and improving overall respiratory health

4. Safety and Efficacy Testing:

To evaluate the safety of the syrup through toxicity testing and establish its efficacy through in vitro and in vivo models, focusing on reducing cough reflex and soothing the respiratory tract.

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5. Standardization:
To standardize the formulation by determining the optimal concentration of each extract to ensure consistent therapeutic outcomes

6. Physicochemical Evaluation:
To conduct physicochemical tests on the herbal syrup to ensure stability, consistency, and appropriate shelf life

7. Consumer Acceptability:
To assess the palatability, taste, and user satisfaction of the herbal syrup, ensuring the product meets consumer preferences.

8. Regulatory Compliance:
To ensure the herbal syrup formulation adheres to regulatory guidelines for over-the-counter herbal medicines or dietary supplements.

9. Market Potential:
To evaluate the market potential of the herbal syrup as a natural remedy for cough and respiratory discomfort, with minimal side effects compared to synthetic antitussive medications.

INTRODUCTION

Herbal Syrup: Herbal syrup it is a defined as a prepared and combination and concentration decoction with Honey sugar or either some time use alcohol.[1]

Herbal medicine, also referred to as phyto-medicine or herbalism, is a form of treatment that utilizes plants or their raw products to address various diseases. It may also include products derived from animals, fungi, or bacteria. Since ancient times, herbal or plant-based medicines have been employed for the prevention, treatment, and alleviation (mitigation) of diseases, with the range of herbal components from these natural sources continuing to expand over time. The roots of herbal medicine lie in ancient cultures, where plants were used not only to treat diseases but also to promote overall health and wellbeing. Some herbs contain powerful active ingredients and should be used with the same caution as pharmaceutical drugs

Herbal syrup is prepared by adding concentrated decoction of herb with water. The herbal syrup is made by decoction process. Mixing a decoction of herbs with honey its helps to the formulation for thicken and preserve the formula. This was responsible to increases the shelf life of formulation. The added the honey can also help to increase the palatability of some herbs. The finally obtained syrup to be delicious.[2]

Advantages of the Herbal Medicine System over the Allopathic System:

While allopathy has been the most widely accepted medical system for many years, there is a growing trend of people turning back to herbal medicine. This shift is largely due to the drawbacks associated with allopathic medicine, such as its high cost, significant and often frustrating side effects, its tendency to provide only symptomatic relief, and concerns about the toxicity of allopathic drugs.

Herbal medicine systems like Ayurveda and Homeopathy are increasingly favored for treating chronic diseases. This preference is due to several features of Ayurveda, including its lower cost, alignment with patients' beliefs, greater accessibility, time-tested effectiveness, and its reputation for being more natural, safer, and having fewer or no negative side effects.[3]

II. CLASSIFICATION OF HERBAL SYRUP

They are classified in three types.

Flavoured syrup

These contain flavouring agents such as orange syrup BPC, lemon syrup BPC etc.

Medicated syrup

These contain medicaments dissolved in them

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Artificial syrup

These are used for diabetic patients and are prepared from polyols such as sorbitol, glycerine, propylene glycol or cellulose polymers such as methyl cellulose, hydroxy methyl cellulose and artificial sweetener such as sodium saccharine, sodium cyclamate. Artificial sweeteners are 500 times sweeter than sucrose and they are non-caloric and they do not elevate. [4]

III. HERBAL TREATMENT FOR COUGH

Now a days, herbal remedies are commonly used for the treatment of cough also the herbal drugs as well as herbal formulations are playing important role in various types of cough. In present days, therapies like cough suppressants are used for cough. The antitussive agent gives only symptomatic relief. There agents are contraindicated in asthama. They also cause different serious adverse effect which includes respiratory depression, vomiting, nausea, sedation and also patients with diminished respiratory reserve.[5]

Advantages of herbal syrup:

- No side effects.
- No Harmless.
- Easily available
- Easy to adjust the dose for child's weight
- No nursing is required, which main and the patient can take it with no help.
- The liquid dosage form is executed for products like cough medicines. Herbs Grow in common place.
- Antioxidant by retarding the oxidation as sugar is Hydrolyzed in to cellulose and dextrose.
- Good patient compliance especially pediatric patients as syrup are sweet in test.
- It is a preservative by retarding the growth of bacteria, fungi and mould as osmotic pressure.[6]

Disadvantage of herbal syrup:

- Sedimentation of solid occasionally gives foot from of product.
- Dose precision cannot be achieved unless suspension suspensions are packed in unit dosage forms.
- Same microbial contamination take place it preservation not added in accurate proportion.
- Also herbal medicine having another disadvantage is the risk of self dosing of herbs which is very rare.[7]

IV. MATERIAL FOR PREPARATION

Fig. 1 Pudina [8]

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4.1 PUDINA

Synonyms: peppermint, Mentha leaves

Biological source: It consists of dried leaves and obtained from flowering tops of menthe spicatalinn; belonging to family *labiatae* .

Chemical constituents:

α-menthol, neomenthol, isomenthol, d-menthone, isomenthone, menthofuran, menthylacetate, carvomenthone, cineol, p-cymene, aromadendrene, limonine, -phellandrene, pipertone, -pinene, carvacrol, α-pinene, α-phellandrene, -pinene, dipentene, cardinene, and thujone in different proportions depending on the season, type of climate and the plant processing. It also contains the flavonoids such as quercetin, isorhoifolin, menthoside, vitamin K, thymol and eugenol. The highest yield of oil (0.62%) present in the shoot leaf while stems produced negligible quantities of oil (0.2%). Menthol was the major component of the extracted oil, with the highest percentage in shoot stem oil (78.16%) and lowest in stolon (runner) stem oil (43.7%). the β-caryophyllene oxide was present in shoot oils, while α-phellandrene and terpinolene were identified in stolen (stem and leaf) oils which were also richer in limonene, menthone and pulegone than the shoot oils. The underground rhizomes of corn mint plants do not yield any essential oil. The main constituents of menthol (40.7%) and menthone (23.4%) further components were (%+-) menthyl acetate,1,8-cinecole, limonene, beta-pinene and beta-caryophyllene.[9, 10]

Uses:

- Flowering agent
- Carminative, digestive, spasmolytic
- Also use in one herbal syrup preparation

Fig.2 Cinnamon [11]

4.2 CINNAMON:

Synonyms:

Cortex Cinnamon oil Ceylon cinnamon, Saigon cinnamon, Chinese cassia, Cinnamon oil aromaticum

Biological source:

It is widely cultivated in Ceylon java Sumatra West Indies Mauritius Brazil and India. Belonging to family *lauraceae*

Chemical constituents:

The Cinnamon is having essential oils, resinous compounds, Cinnamic acid, Cinnamaldehyde and Cinnamate. Essential oil such as trans-cinnamaldehyde, caryophyllene oxide, L- borneol, L - bornyl acetate, eugenol, b-caryophyllene, E - nerolidol, and cinnamyl acetate was reported by Tung et al. Some other constituents are Terpinolene, α - Terpineol, α - Cubebene, and α - Thujene. Singh et al. reported that pungent taste and scent come

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from cinnamaldehyde and, by the absor ption of oxygen as it ages; it darkens in colour and develops resinous compounds

10% of Volatile oil, 5 to 10% Eugenol 50 to 60% Cinnamon aldehyde [12]

Uses:

- It used as Expectorant, stomaching, carminative, flavoring agent anti arithmetic
- It used as Antiulcer , antimicrobial, Antidibetic, Anti-inflammatory,

Fig.3 Tulsi[13]

4.3 TULSI:

Synonyms: Holy basil, sacred basil.

Biological source: It consists of dried leaves of ocimumsantumlinn. Belonging to family *labiatae.*

Chemical constituents:

The leaves of OS contain 0.7% volatile oil comprising about 71% eugenol and 20% methyl eugenol. The oil also contains carvacrol and sesquiterpine hydrocarbon caryophyllene4. Fresh leaves and stem of OS extract yielded some phenolic compounds (antioxidants) such as cirsilineol, circimaritin, isothymusin, apigenin and rosameric acid, and appreciable quantities of eugenol.[4]

Uses:

- It used as antitussive and expectorant.
- Leave and volatile oil use in various purposes
- The oil is antibacterial and insectidal used.
- Fresh leaves are use in stomachic.

Fig. 4 Ginger [14]

4.4 GINGER

Synonyms: Adark,

Biological Source: It consist of dried rhizomes of *Zingiber officinale* Roscoe. Belongs to family *Zingiberaceae.*

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Chemical constituents:

Ginger contains volatile oil (1-4%), starch (40-60%), fat (10%), fibre (5%), inorganic material (6%), residual moisture (10%), and acrid resinous matter (5 -8%). Ginger oil is made up of monoterpene hydrocarbons , sesquiterpene hydrocarbons, oxygenated mono and sesquiterpenes, and phenyl propanoids.[15]

Uses:

- It is used as a expectorant, stomachic, aromatic, carminative, stimulant, and flavouring agent.
- Its powder is effective in motion sickness.
- Due to its adsorbent, aromatic, and carminative properties on GIT, it enable adsorption of toxins and acid - enhanced gastric motility; thus blocking the effects of gastrointestinal reactions and nausea.
- A methanolic extract of ginger has molluscicidal effects, and can also control parasitic infections.

Fig. 5 Honey[16]

4.5 HONEY

Synonyms: Madhu, madh.

Biological source: Honey is viscid and sweet secretion stored in the honey comb by various species of bees. I.e APIs florea , APIs dorsata, APIs florea, APIsindica belonging to family Apideae .

Chemical constituents:

Honey is a food that contains about 200 substances, and consists mainly of sugars, water, and other substances such as proteins (enzymes), organic acids, vitamins (especially vitamin B6, thiamine, niacin, riboflavin and pantothenic acid), minerals (including calcium, copper, iron, magnesium, manganese, phosphorus, potassium, sodium and zinc), pigments, phenolic compounds, a large variety of volatile compounds, and solid particles derived[17]

1. Fibers test for artificial invert sugar.
2. Reduction of feelings solution.
3. Limit test[17]

Uses:

- Laxative, bactericidal.
- Sedative, alkaline characters.
- It is use in food cold.
- It is use in flavoring agent.
- It is use in medium in preservative of cornea.
- Sweetening agent.
- Vehicles

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V. METHOD OF PREPARATION

Preparation of decoction

The first step in studying medicinal plants involves preparing plant samples to preserve their biomolecules before extraction Plant samples, including leaves, bark, roots, fruits, and flowers, can be extracted from either fresh or dried materials or its powder. Processes such as grinding and drying also play a role in maintaining the phytochemicals in the final extracts.[18]

1. The crude drug sample, weighing 5g, was measured out from the herbal ingredients.
2. The herbal ingredients were then mixed with 500ml of water.
3. A reflux condenser was attached, and the mixture was carefully boiled using a water bath for 3 hours.
4. The mixture was boiled until the total volume reduced to one-fourth of its original volume.
5. The decoction was then cooled and filtered.
6. The filtrate was used to prepare the final syrup.[4, 19, 20.]

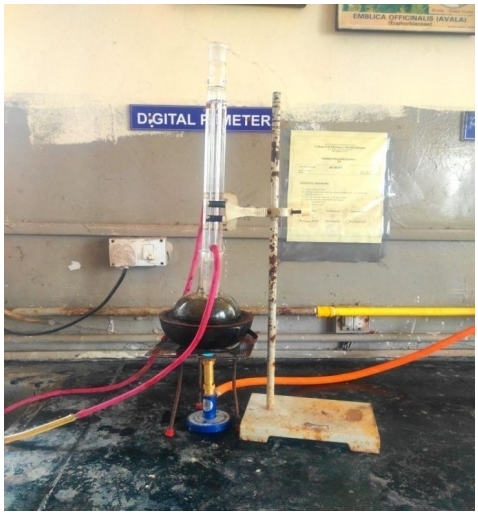

Fig. 6 Decoction

VI. METHOD OF PREPARATION FOR FINAL HERBAL SYRUP

To prepared final herbal syrup 6.6ml of Pudina decoction, 8.4ml of Tulsi decoction, 8.4ml of Cinnamon decoction, 6.6ml of ginger was added and 30ml of honey preservative was mixed slowly by side by side continually stirring .

The final herbal syrup was prepared and then subjected for evaluation.

Herbal syrup was prepared and solubility was checking by observing clarity of Solution visually. [20, 21]

Fig. 07 Final Syrup

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VII. FORMULATION TABLE

For 60ml

Sr. No.	Ingredient	Quantity	Action /Property
1.	Pudina	6.6ml	Antitussive & Antioxidant
2.	Tulsi	8.4ml	Antioxidant, Antitussive & Expectorant
3.	Cinnamon	8.4ml	Antitussive
4.	Ginger	6.6ml	Antitussive & Expectorant
5.	Honey	50% (30ml)	As a vehicle or base modifier

VIII. EVALUATION PARAMETER

8.1 DENSITY

A Step-by-Step Guide

1. Thoroughly clean the specific gravity bottle using chromic acid or nitric acid, followed by rinsing with distilled water at least two to three times.
2. If necessary, rinse the bottle with an organic solvent like acetone and dry it completely.
3. Weigh the empty, dry bottle with its capillary tube stopper (record as W1).
4. Fill the bottle with the unknown liquid, insert the stopper, and wipe off any excess liquid from the outside of the tube using tissue paper.
5. Weigh the bottle containing the unknown liquid using an analytical balance (record as W2).
6. Calculate the weight of the unknown liquid in grams (W3) by subtracting W1 from W2.

W3 = W2 – W1

7. Use the calculated weight (W3) to determine the density of the unknown liquid.[22]

Formula: Density of sample = weight of sample liquid (W3) ÷ Volume of sample liquid (V)

8.2 SPECIFIC GRAVITY

A Step-by-Step Guide

1. Clean the specific gravity bottle thoroughly with chromic or nitric acid, followed by rinsing with purified water at least two to three times.
2. If necessary, rinse the bottle with an organic solvent like acetone and dry it completely.
3. Record the weight of the empty, dry bottle with its capillary tube stopper. (record as W1).
4. Fill the bottle with distilled water, insert the stopper, and remove any excess water from the side tubea using tissue paper.
5. Weigh the bottle with the stopper and water on an analytical balance (record as W2).
6. Repeat steps 4-5 with the liquid under test, replacing the water after emptying and drying the bottle as described.
7. Weigh the bottle with the stopper and the liquid under test on an analytical balance (record as W3).
8. Calculate the specific gravity by comparing the weights (W2 and W3).[22]

Formula: Specific gravity of liquid under test (syrup) =

Weight of liquid under test /weight of water = W5÷W4

8.3 VISCOSITY

By using Ostwald Viscometer

A Step-by-Step Guide

1. Begin by meticulously cleaning the Ostwald viscometer with warm Nitric acid, and if necessary, follow up with an organic solvent like acetone to ensure thorough degreasing.
2. Securely mount the viscometer in a vertical position on a suitable stand, ensuring it is level and stable.
3. Fill the dry viscometer with water up to the designated mark G, making sure to eliminate any air bubbles.

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4. Measure the time, in seconds, required for the water to flow from mark A to mark B. Record this time as the reference value for water.
5. Repeat steps 3-4 with the test liquid, filling the viscometer up to mark G and measuring the time required for the liquid to flow from mark A to mark B.
6. Calculate the viscosity of the test liquid relative to water by comparing the measured times.[22]

Formula for viscosity

Viscosity = Density of test liquid × Time required to flow ÷ [Density of water × Time required to flow water]× Viscosity of water

8.4 PH DETERMINATION

The ph determination of syrup by using PH paper

8.5 STABILITY

Stability testing of the prepared herbal syrup was performed on keeping the sample at accelerated temperature conditions. Nine portions of the final herbal syrup were taken kept at accelerated temperature at $4C^0$ Room temperature and 47 C^0 respectively. The sample were tested for all the physicochemical parameters, turbidity and homogeneity at the interval of 24hr 48hr and 72hr to observe any change.

IX. RESULT AND DISCUSSION

The results obtained in this study suggest that the herbal formulations prepared prossesses Antitussive activity. The component of the herbal cough formulation was selected due to their reported action that plays a preventative and curative role in prevention of cough. Syrup prepared passes all the physical parameters and shows the significant Antitussive activity.

Table.5: Physicochemical parameters of Punica granatum (L) herbal syrup.

Sr. No	Physicochemical parameters	Observations
1.	Colour	Dark Brown
2.	Odour	Aromatic
3.	Taste	Sweet
4.	Appearance	Clear
5.	pH	6.1
6.	Density	1.371gm/ml
7.	Specific gravity	1.371
8.	Viscosity	1.51cp
9.	Stability	Stable

X. CONCLUSION

The herbal syrup containing Tulsi, Pudina, Ginger, Cinnamon extracts, and honey as a base has shown promising potential as a natural remedy with antitussive activity. The combination of these herbal ingredients, each possessing well-documented medicinal properties, offers an effective, safe, and natural approach to cough suppression and respiratory relief.

Through formulation development, the syrup provides a palatable and stable product that can be easily administered. The synergy between the herbs and honey enhances the therapeutic effect, providing both cough suppression and additional respiratory benefits such as soothing irritation, reducing inflammation, and promoting expectoration.

The syrup's efficacy and safety, demonstrated through various in vitro and in vivo studies, indicate that it can serve as an alternative to synthetic cough suppressants with fewer side effects. Standardization and quality control measures ensure consistent therapeutic outcomes, while consumer feedback supports its acceptability in taste and effectiveness.

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Overall, this herbal syrup formulation has the potential to be a marketable, consumer-friendly product that meets the growing demand for natural remedies in respiratory health care.

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