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Research Article

Formulate and Evaluate the Herbal Syrup by Using Garlic and Ajwain Extract

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A B S T R A C T

In this study, two plants that are well-known for their therapeutic qualities in conventional medical systems—Allium sativum, or garlic, and Trachyspermum ammi, or ajwain—are used to formulate and assess a herbal syrup. The goal was to create an herbal remedy that was safe, natural, and helpful for common conditions like colds, coughs, dyspepsia, and minor infections. Allicin, which is abundant in garlic, has potent antibacterial, antioxidant, and anti-inflammatory qualities. Thymol, an ingredient in ajwain, has antifungal, antibacterial, and carminative properties.Aqueous and ethanolic extraction techniques were used to extract the active ingredients from ajwain and garlic. To increase taste and acceptability, these extracts were added to a syrup base that also contained natural sweeteners, preservatives, and flavorings. To guarantee stability and safety, the prepared syrup was further tested using a number of evaluation criteria, such as viscosity, pH, microbiological load, and organoleptic qualities (color, taste, odor, and consistency).The existence of advantageous substances such flavonoids, tannins, saponins, and phenolics was verified by phytochemical screening. When tested against common infections, the syrup's antibacterial action was effective, especially against S. aureus and E. coli. Over the course of storage, the syrup also exhibited good microbiological and physical stability.According to the study's findings, the herbal syrup made with ajwain, and garlic is a potential natural cure with few negative effects and a number of health advantages. It presents a viable substitute for synthetic formulations, particularly when it comes to treating respiratory and intestinal disorders. It is advised that more clinical research be done to validate its therapeutic claims and create uniform dose recommendations.

Keywords: Herbal syrup, garlic, ajwain, formulation, evaluation, antimicrobial, phytochemicals, natural remedy.

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INTRODUCATION

The term "tussis" is another name for "cough," referring to the voluntary or involuntary act of expelling foreign particles, bacteria, irritants, fluids, and mucus from the throat and respiratory tract. It is the swift ejection of air from the lungs. When there is obstruction or discomfort in the throat or upper airway, the brain detects a foreign object and promptly signals the body to cough to remove it. The cough response comprises three phases: intake, forced exhalation against a closed glottis, and a forceful expulsion of air from the lungs upon glottal opening, accompanied by a characteristic sound. The majority of respiratory conditions, including TB, lung cancer, viral infections, asthma, and pulmonary emboli, are associated with this symptom Coughing repeatedly causes discomfort and inflammation, which makes a person cough more. Children typically get respiratory tract infections, some of which resolve on their own with little chance of complications.[1]

COUGH TYPES:

Cough is categorized based on its type, character, and duration.

A. Based on the type

Cough is divided into two categories based on its type: dry cough and wet cough. Signs and symptoms are used to identify these.

1. **Dry cough**: Effective and productive cough

- Sensitive throat non-expelled mucus, and a brief, dry, and frequent cough are the first three symptoms.

- A continuous or persistent tickling
- Medication: antitussive and cough suppressant.

2. Wet cough: Ineffective and contagious cough

- Phlegm-filled cough
- Wheezing
- Tightness in the chest
- Breathing difficulties
- Expectorant is the medication.

B. Depending on how long

Depending on how long it lasts, it can be categorized as acute, subacute, or chronic cough.

1. Severe cough

- Coughs that last fewer than three weeks fall into this category.
- The common cold, URTI, COPD, environmental pollution, and infective bronchitis are the causes of acute cough.

2. Subacute cough:

This form of cough is defined as one that lasts for at least three to eight weeks. Pneumonia and B. pertussis infections are the respiratory causes, while GERD and, in rare cases, Tourette's disease are the non-respiratory causes.

3. Chronic cough:

Pneumoconiosis, lung cancer, COPD, asthma, and tuberculosis are the respiratory causes of coughs that linger for eight weeks or more.

Coughing in children

Coughing by a child indicates that their body is trying to get rid of irritants, poisons, and other foreign substances. Coughing is one of the most common reasons parents take their kids to the doctor. The following are common causes of coughing:

1. Allergies or sinusitis: These illnesses may induce a persistent cough with accompanying symptoms such as a rash, runny nose, watery eyes, itchy throat, or other symptoms. Allergy tests are conducted to identify the allergens causing the problem and to offer advice on how to prevent them.
2. Asthma: Since each child's symptoms are unique, diagnosing asthma in youngsters can be somewhat challenging. Coughing and wheezing, which worsens at night is among the numerous indicators. Playing, exercising, and other physical activities raise the likelihood of the other cough. The real cause of asthma will determine how it is treated.
3. Infection: Children who have the flu, croup, or cold experience a protracted cough. While the flu can occasionally cause a severe, dry cough and croup, colds cause a mild to moderate hacking cough.[1]

Herbal cough remedies

Herbal remedies are the most popular way to treat coughs. Herbal remedies are significantly contributing to the advancement of the medical field. Asthma, TB, cough, pneumonia, renal disease, cancer, diabetes, allergies, lung cancer, and viral infections are among the mild to severe medical conditions that can be treated with herbal remedies. According to WHO estimates, 80% of people even use herbal remedies for their basic medical needs. Traditionally, medicinal herbs have been employed as primary healthcare agents, particularly in Asian countries. Herbal remedies are primarily used to treat chronic illnesses and promote health rather than life-threatening ones. Many adverse effects, including nausea, vomiting, sedation, allergies, respiratory tract infections, changes in appetite, irritability, drowsiness, addiction, and organ or organ-related damage, are caused by the majority of synthetic medication treatments. Herbal medications and therapies that have fewer or no side effects during and after treatment have been the primary focus of study in recent years.[1]

HERBAL SYRUP:

Herbal syrup It is described as a prepared mixture and concentrated decoction made with honey, sugar, or occasionally alcohol. The foundation of this type of syrup is a potent herbal infusion, which is thickened and preserved by combining it with sugar honey. Cough syrup and other ailments are treated with herbal plants and formulations. The cough syrup medication is a liquid dose form that is used in oral liquid pharmaceuticals. Its basic simplicity of administration has been confirmed for individuals who have trouble swallowing solid prescription dosages. A concentrated mixture of sugar and purified water is called syrup. from the other kind of syrup solutions in syrup. Medication or a combination of flavoring agents may or may not be present in the syrup. Flavored or non-medicated syrup is defined as syrup that contains a flavoring agent but no medication.Sincesyrup is easier to swallow (ingest) than tablets and capsules, it is a common delivery method for anti-tissue medications. This drug is closely monitored. The same synthetic cough medicines are available, but they have a number of negative effects. Thus, the current investigation demonstrated that violet herbal cough syrup has a natural ingredient with no negative effects.[2]

Herbal syrup varieties include:

1. Sweetened syrup
2. Syrup with medication
3. Artificial sweetener

Benefits of herbal syrup include:

- No negative effects
- No harm
- The patient can take it without assistance; it is readily available; the dosage can be easily adjusted for the child's weight; and nursing is not necessary.
- For items such as cough medications, the liquid dose form used.
- Herbs are grown in public areas.
- Good patient compliance, particularly in young patients, because syrup is tasty in test.
- Antioxidant by delaying oxidation when sugar is hydrolyzed into cellulose and dextrose
- It functions as a preservative by delaying the growth of mold, fungus, and bacteria through osmotic pressure.

Drawback of herbal syrup:

- Solid sedimentation might occasionally result in product foot.
- Suspension suspensions must be packed in unit dosage forms in order to achieve dose precision.
- The same microbiological contamination occurs when preservation is not added in the proper amount.
- Another drawback of herbal medication is the extremely uncommon possibility of herb self-dosing.
- Crystallization of sucrose from saturated syrup may result from variations in storage temperature.[2]

PLANT PROFILE:

GARLIC *(Allium sativum)*[3]

Figure 1: Image of Garlic

SYNONYMS: - Lahsun, Rasona
BIOLOGICAL SOURCE: - Garlic is the edible bulb derived from the plant *Allium sativum,* which is cultivated worldwide.
FAMILY: - Amaryllidaceae (formerly Liliaceae)
CHEMICAL CONSTITUENTS: - Allicin, Diallyl disulfide, Allin, Vitamin C
USES: -

i. Used in traditional medicine for cold, flu, and digestive issues
ii. Antimicrobial
iii. Cardioprotective
iv. Antioxidants
v. Anti -inflammatory
vi. Anti-diabetic

One of the earliest plants that humans have used for thousands of years is common garlic (Allium sativum L.). It is currently grown in the majority of temperate-zone nations.The bulb is the part that is consumed the most. Nonetheless, the leaves are also utilized for this purpose throughout the Balkans, Asia, and Poland's Podkarpacie region. The stems and immature flower shoots are also consumed in North American and Asian nations.

NUTRITIONAL COMPOSITION AND PHYTOCHEMICALS OF GARLIC:

The nutritional value of garlic comprises dietary fiber, which helps digestion, and macronutrients including protein, fat, and carbohydrates, which are important for delivering energy. Additionally, it contains minerals like calcium, phosphorous, magnesium, and manganese that help to maintain and strengthen bones; iron that helps produce hemoglobin in the blood; potassium that maintains the fluid balance of the body; sodium that speeds up metabolism; and zinc that supports healthy senses. It also includes several vitamins, including the antioxidant vitamin C, the niacin (B3) that promotes healthy skin, the folate (B9) that promotes normal blood formation, the thiamine (B1), riboflavin (B2), pantothenic acid (B5), and pyridoxine (B6) that aid in the production of cellular energy. About 60% of the fresh garlic bulb is made up of water, 32% of carbs, and 6.45% of protein. Garlic has a rather high caloric content (146 kcal/100 g fresh mass (FM) of the product). Numerous minerals can be discovered in the bulbs: potassium (400 g), phosphorus (153 g), magnesium (25 mg), sodium (17 g), and calcium (41 mg/100 g FM). Garlic also contains selenium and germanium, the amounts of which are determined by the minerals in the soil. [3]

AJWAIN (*Trachyspermum ammi)*[4]

Figure 2: Image of Ajwain

SYNONYMS: - Ajwain, Bishops weed, Carum copticum

BIOLOGICAL SOURCE: - Carom seeds are the dried, ripe fruits of the herb *Trachyspermum ammi*, an aromatic plant.

FAMILY: - Apiaceae (also known as Umbelliferae)

CHEMICAL CONSTITUENTS: - Oleic acid (10.4%), Linoleic acid (9.6%), Thymol (72.03%)

USES: -

i. Improve digestive health
ii. Provide relief from cough and congestion
iii. Fight bacteria and infection
iv. Helps improve cholesterol level

PHYTOCHEMICAL:

Ajwain, also known as Trachyspermum ammi (L.), is a traditional herb used as a spice to treat a number of illnesses in both humans and animals. The most popular usage of ajwain is for its fruit, which resembles caraway and is used as a spice and in savory snacks, pastries, and cooking. The fragrance chemicals in ajwain stop further negative changes to food that might affect its nutritional value, flavor, and texture. Cough, stomach problems, diarrhea, and abdominal pain can all be treated with ajwain seed decoction. Ajwain fruit has been shown to have antiseptic, antifungal/antibacterial, and antithelminitic qualities. Ajwain's primary phenolic compound, thymol, has been demonstrated to possess germicidal, antifungal, and antispasmodic qualities. The primary active ingredients in T. ammi's essential oil are phenols, primarily thymol (35–60%) and a small amount of carvacrol.The antibacterial, antitussive, and expectorant qualities are attributed to the

phenols thymol and carvacrol. Additionally, carvacrol has antifungal qualities and thymol has antibacterial activity.[4]

MATERIAL AND METHODS:

Collection and Authentication of *Allium sativum bulb* and *Trachyspermum ammi seeds*

The *Allium sativum* and *Trachyspermum ammi*were collected from Local market Butibori, Nagpur, Maharashtra, India and authenticated by Dr. j. R. Baheti (Pharmacognosist) Kamla Nehru College of Pharmacy, Nagpur. The collected materials were cleaned and air dried in shade, reduced to coarse powder with the help of grinder and stored in airtight container for further process of extraction.

FORMULATION OF HERBAL SYRUP

Step 1: Decoction Preparation Method
150 ml of filtered water was combined with 20 g of garlic powder and 20 g of ajwain powder in separate beakers, and the mixture was heated until the total volume was one-third of the original amount. After cooling, the decoction was filtered.
Step 2: Simple Syrup Preparation Method
To make a concentrated solution of simple syrup, mix 33.3% w/w honey with the necessary amount of distilled water.

Step 3: Herbal Syrup Preparation Method
To get the final syrup, the filtrate was removed and mixed with the simple syrup. One part of the decoction was combined with five parts simple syrup (1:5) to create the finished herbal syrup. After adding the excipient, 50 ml of cleaned water was added to complete the volume.[5]

Table 1: Formulation Table

Sr. No.	Ingredients	Role	Quantity F1	Quantity F2	Quantity F3
1.	Garlic Powder	Antimicrobial, Expectorant, Anti inflammatory	10ml	15ml	20ml
2.	Carom Seeds	Antispasmodic, Digestive Aid	20ml	15ml	10ml
3.	Honey	Soothing, Sweetener	33.3ml	33.3ml	33.3ml
4.	Sodium Benzoate	Preservative	0.1	0.1	0.1
5.	Water	----	Q. S	Q. S	Q. S

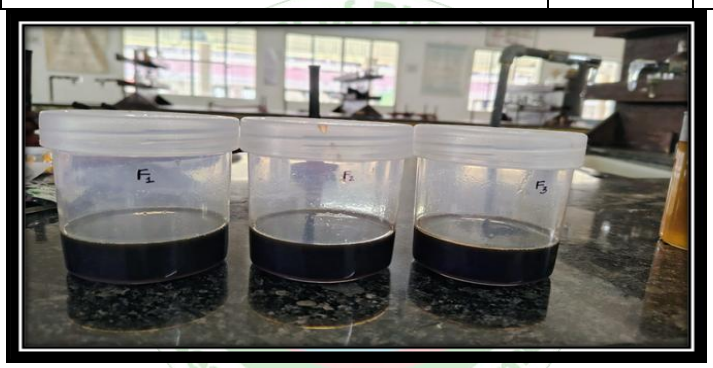

Figure 3: Formulated Herbal Syrup Sample [F1, F2, F3]

EVALUATION OF SYRUP

pH [MFRS Toshiniwal Inst.Mfg.Pvt.Ltd.Ajmer]

Deionized water was used to rinse the electrode tip. A click was heard after pressing the dispenser button on top of the electrode. After dipping the electrode into the gel, the readings were tracked until they stabilized. The outcomes were noted when the readings had stabilized. After use, the electrode was finally rinsed once more.[5]

Taste: A drop of syrup was applied to the tongue's taste buds, and the resultant syrup's flavor was assessed. [5]

Color: By using our unassisted eyes to gaze at the syrup directly, we may determine its color. **Odor:** After five milliliters of the completed syrup were smelled independently, the scent was determined. [5]

Density Determination

The specific gravity of the bottle was used to calculate the density of the syrup. A clean specific gravity bottle was taken and rinsed with distilled water for two to three times. Using the capillary tube stopper (w1), weigh the empty, dry bottle. Now, fill the container with an unknown liquid, put the cork on, and use the analytical balance (w2) to wipe away any extra liquid. Finally, figure out the unknown liquid's weight in grams. [6]

Density formula:

Density of test liquid (syrup) = weight of test liquid divided by volume of test liquid = w3/v

Specific Gravity

Used a capillary tube stopper (W1) to support the weight of the empty, dry bottle.

poured distilled water into the bottle, put the stopper on, and used tissue paper (w2) to remove any extra liquid from the side tube. used the analytical balance (W2) to weigh the bottle with the cork and water. used the analytical balance (w3) to weigh the container containing the liquid being tested and the cork. The specific gravity formula is: The specific gravity of the test liquid (syrup) is equal to the weight of the liquid divided by the weight of water, or w5/w4. [7]

Viscosity [Brookfield Viscometer]

The pre-assembled gel's consistency was assessed using a Brookfield viscometer. Spindle number 7 was used to rotate the gel at rpm 10, and the matching dial reading was noted[8]

Formula for viscosity

$$\text{Viscosity} = \frac{\text{Density of test liquid} \times \text{Time required to flow test liquid}}{\text{Viscosity of water}}$$

$$\text{Density of water} \times \text{Time required to flow water}$$

Anti-microbial

Prepared the agar medium (Mueller-Hinton agar) and poured it into sterile petri dishes, allowing it to solidify then inoculated the agar surface with a uniform suspension of the test microorganism using a sterile swab, ensuring even coverage. Afterward, created 3-4 wells in the agar using a sterile cork borer, added specific volumes of antimicrobial agents to each well, and included a control well with a solvent. The plates were incubated at 37°C for 24–48 hours, after which examined the zones of inhibition around the wells, measuring their diameter. Based on the size of the zones, then categorized the antimicrobial agents as [9]

Sensitive (large zone)
Intermediate (moderate zone)
Resistant (no or small zone)

RESULTS AND DISCUSSION

Table 3: Comparative evaluation of the formulation

Sr.no.	Evaluation	F1	F2	F3
1	**Organoleptic evaluation**	**Colour –**Brown **Taste:** sweet, slightly bitter Odor: Sweet, Aromatic	**Colour –** Brown **Taste:** sweet, Mild bitter Odor: -Sweet, Aromatic	**Colour –** Brown Taste: Spicy Odor: Sweet, Aromatic
2	**PH**	4.12	4.13	4.11
3	**Viscosity**	300 cP	480 cP	400cP
4	**Specific Gravity**	47.59	47.37	47.42
5	**Density**	47.44	47.22	47.27
6	**Anti-microbial (e. coli)**	15mm	20mm	18mm
7	**Anti-microbial (s. aureus)**	17mm	19mm	23mm
8	**Anti-fungal**	10mm	13mm	16mm

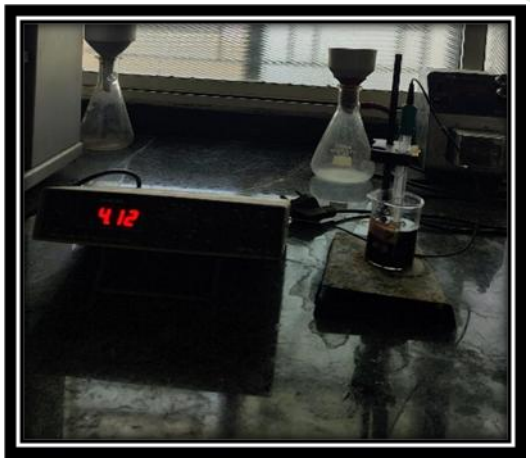

Figure 4: pH Meter

Figure 5: Organoleptic characteristics

Figure 6: Specific Gravity

Figure 7: Brookfieldviscometer

Figure 8: *E. coli* Agar Plate

Figure 9: *S. aureus* Agar plate

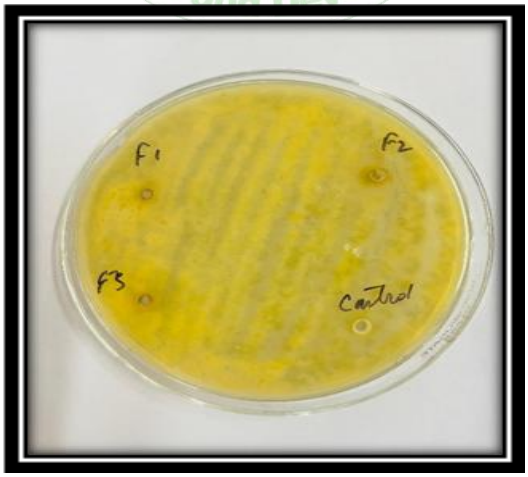

Figure 10: *Aspergillus Niger*

The result of post-evaluation parameters such as pH determination (4- 5), taste (sweet, bitter, spicy), colour (brown), odour (aromatic), viscosity (300- 500 cp), density (45- 50), anti-microbial test (zone of inhibition 15mm-25mm), anti- fungal test and specific gravity (45-50) were analysed. The daily consumption of both herbs (garlic and ajwain) may help to reduce the risk of various health conditions, including digestive issues, respiratory problems, and high cholesterol. Garlic is known for its antimicrobial and cardiovascular benefits, while ajwain aids in digestion and has carminative properties.All the formulations are effective, but F3 is significantly better. The antimicrobial activity of the formulations was found to be significant against *E. coli*. However, the activity was more pronounced

against *S. aureus*, where the formulations exhibited superior effectiveness. This statement clearly communicates that all formulations were effective against both bacteria, with a stronger effect on *S. aureus* but F3 is significantly better. Hence it will be very helpful for research as well as industries to make the similar formulation on large scale and this formulation can be consumed by human having cough. All formulations showed antifungal activity, with F3 exhibiting the largest zone of inhibition, indicating the highest efficacy. The control showed no activity, confirming the effect was due to the herbal ingredients.

CONCLUSION

Based on post-evaluation characteristics such as pH, taste, color, odor, viscosity, density, anti-microbial and anti-fungal tests, and specific gravity, the prepared garlic and ajwain herbal syrup showed encouraging therapeutic potential. Along with possible hypolipidemic effects, garlic and ajwain may also have synergistic healthbenefits, including better digestion. Even after four weeks, the syrups remained stable at room temperature.Formulation F3 showed the strongest antifungal effect, suggesting its potential as an effective herbal antifungal preparation.

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