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FORMULATION AND EVALUATION HERBAL SYRUP FOR URINARY TRACT INFECTION

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Abstract:

The creation and assessment of a herbal syrup utilizing extracts from medicinal plants recognized for their therapeutic potential in the treatment of urinary tract infections (UTIs) is the main goal of this study. Microbial infections are frequently the source of UTIs, which are characterized by symptoms like burning, frequent urine, and inflammation. There is a need for safer and more potent herbal alternatives because traditional antibiotic treatments may cause adverse effects and antimicrobial resistance Due to their established antibacterial, anti-inflammatory, antioxidant, and immunomodulatory qualities, garlic (Allium sativum) and turmeric (Curcuma longa) were chosen for this investigation. To improve palatability and stability, the herbal syrup was made with appropriate excipients such sucrose, glycerine, and preservatives. Several physicochemical measures, including as appearance, pH, viscosity, clarity, and taste, were used to assess the generated formulations. The formulation's pH was determined to be within an acceptable range, suggesting that it is suitable for oral administration. Garlic and turmeric work together to reduce inflammation, prevent microbial growth, and improve urinary tract health in general. When compared to other batches, the improved formulation demonstrated superior stability and organoleptic qualities.

Keywords: *UTI, herbal syrup, turmeric, garlic, antibacterial, polyherbal*

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1. INTRODUCTION:

Urinary tract infections (UTIs) are among the most common bacterial disorders, affecting 150 million individuals globally each year. Although both men and women can get UTIs, they are generally thought of as a disease that affects women, of whom 50% will experience them at some point in their life. About 25% of women (see Glossary) suffer recurrent UTIs within six months of their first episode of bacterial cystitis, and some of them get six or more infections in the following year. Current treatments are insufficient since multidrug-resistant uropathogens are becoming more prevalent and antibiotic treatment for acute infections does not prevent recurrences. [1,2]

A tract infection (UTI) is any contamination when bacteria are present and grow inside any part of the urogenital device, such as the kidneys, ureters, bladder, or urethra. The irritation of the urinary transition epithelium brought on by the presence of microorganisms in the tract was another explanation for tract infections. UTIs are also known as bladder infections. Both the lower and upper urinary tracts, as well as the declining tractor, may be impacted by these pollutants. Dysuria (difficulty urinating), suprapubic discomfort (less stomachache), and urgency and frequency of urination are symptoms of cystitis, which are indicative of lower urinary tract infections.[3]

Symptoms

The following are typical signs of a urinary tract infection:

- A burning sensation when urinating.
- A persistent urge to urinate.
- Frequent and infrequent urination.
- Red, bright pink, or cola-colored pee. This may indicate that there is blood in the pee.
- A pelvic ache. The majority of this discomfort is felt in the pelvic center and in the vicinity of the pubic bone. [4]

Causes

- **Bladder infection**
  This kind of UTI is frequently caused by the bacteria E. coli. The gastrointestinal (GI) tract is a popular home for this kind of bacteria.
  However, other microorganisms can occasionally be the reason. [5]

- **Urethral infection**
  GI bacteria that go from the intestine to the urine system can cause this kind of UTI. Sexually transmitted infections like herpes, gonorrhea, chlamydia, and mycoplasma can also result in urethral infections. [6]

Risk element

- **Menopause and perimenopause**
  During the perimenopause and menopause, there is a decrease in the amount of estrogen in the blood. The bacteria that are normally present in the vagina change as a result. These modifications may increase the likelihood of UTIs.
- **Anatomy of women**
  Compared to men, women's urethras are shorter. Consequently, bacteria have a shorter path to the bladder. [7]
- **Low consumption of fluids**
  Drinking lots of water helps clear the bladder of germs and the nutrients they require to develop.
- **Urinary tract obstruction**
  Urine may be trapped in the bladder above kidney stones or an enlarged prostate. UTI risk increases as a result. [8]

2. PLANT PROFILE

1. Turmeric

One of the most popular therapeutic plants in traditional medicine is turmeric. The rhizome's anti-inflammatory, antioxidant, and antibacterial properties are attributed to curcuminoids, particularly curcumin.

Fig 2. Turmeric

Botanical Profile of Turmeric

Botanical Name: Curcuma longa
Synonym: Curcuma longa, Haldi
Biological source: Dried rhizome of Curcuma longa Linn
Family: Zingiberaceae
Part used: Rhizome
Key Active Constituents: Curcumin demethoxycurcumin, bisdemethoxycurcumin
Role in UTI Suspension: Anti-inflammatory, antibacterial, antioxidant
Taxonomic classification:
Kingdom: Plantae
Family: Zingiberaceae
Genus: Curcuma
Species: Curcuma longa
Common name: Turmeric

Part used: Rhizome (underground stem) [9]

2. Garlic

One of the most popular therapeutic plants in traditional medicine is garlic. The antibacterial, anti-inflammatory, and antioxidant properties of the bulb are attributed to sulfur-containing substances, particularly allicin. Garlic has a potent antibacterial effect on a variety of microorganisms, including those that cause urinary tract infections. It also lowers inflammation and strengthens immunity.

Fig 3. Garlic

Botanical profile of Garlic
Botanical name: Allium sativum Linn
Synonym: garlic, Allium longicupspis Regel
Biological source: Garlic Consists of the fresh or dried bulbs of Allium sativum Linn.
Family: Liliaceae
Part used: Bulb (cloves)
Key active Constituents: Allicin, alliin, ajoene, S-allyl cysteine
Role in UTI suspension: Antibacterial, biofilm inhibition, immune modulation

Taxonomic Classification:
Kingdom: Plantae
Subkingdom: Tracheobionta (Vascular plants)
Division / Phylum: Magnoliophyta (Angiosperms)
Class: Liliopsida (Monocotyledons)
Subclass: Liliidae
Order: Asparagales
Family: Amaryllidaceae (formerly Liliaceae)
Genus: Allium
Species: Allium sativum Linn. [10]

3. MATERIAL AND EQUIPMENT

- **Material**

Sr No	Ingredient	Uses
1	Garlic (Allium sativum)	Antibacterial, antimicrobial
2	Turmeric (Curcuma longa)	Anti-inflammatory, antioxidant
3	Sucrose	Sweetening agent, vehicle
4	Glycerine	Co-solvent, improves viscosity
5	Sodium benzoate	Preservative
6	Flavouring agent	Improves taste and palatability
7	Purified water	Solvent

Table no. 1 Use of material

- **Equipment**

Sr No	Equipment	Uses
1	Analytical balance	Accurate weighing of ingredient
2	Hot plate	Heating during preparation
3	pH meter	Measuring pH of syrup

Table No 2. Equipment

4. METHOD AND EVALUALTION

1. Preparation of turmeric extract

In a sterile 250 ml volumetric flask or conical flask, combine 10 g of turmeric powder with 100 ml of distilled water or hydroalcoholic solvent (1:10 ratio). To guarantee adequate extraction, the mixture is sealed firmly and left to remain at room temperature for 48 to 72 hours with sporadic stirring. Following the maceration phase, the mixture is filtered via filter paper or muslin cloth. The turmeric extract is the filtrate that is produced.[11]

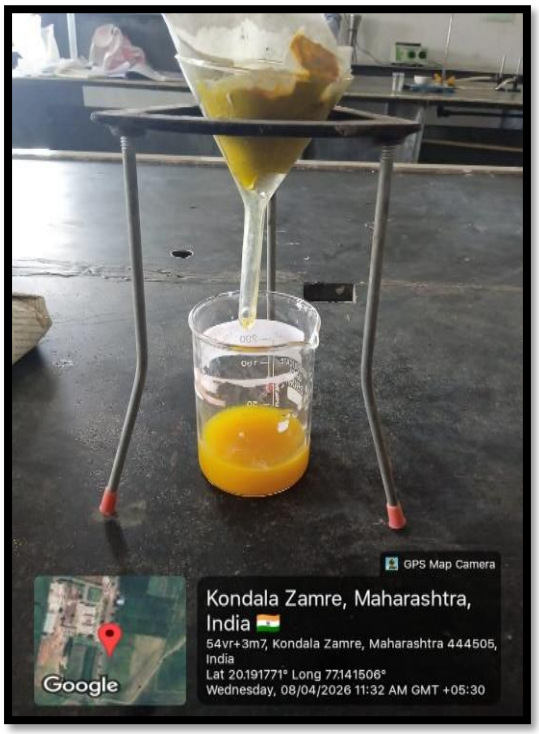

Fig 1. Extraction Process of Turmeric

2. Preparation of Garlic extract

Using a mortar and pestle, peel and crush ten grams of fresh garlic cloves. Add 100 ml of distilled water or hydroalcoholic solvent (1:10 ratio) to a clean 250 ml volumetric flask or conical flask containing the crushed garlic. To guarantee correct extraction, the mixture is sealed tightly and left to remain at room temperature for 48 to 72 hours with sporadic stirring. Following the maceration phase, the mixture is filtered via filter paper or muslin cloth. Garlic extract is the filtrate that is produced. [12]

Fig 2. Extraction Process of Garlic

3. Preparation of syrup formulation

The syrup formulation is prepared by heating purified water to 80–85°C in a borosilicate glass beaker. Using a glass rod, continuously whisk the boiling water to dissolve the sugar until a clear, simple syrup base forms. Next, use a water bath to chill the syrup base to 40°C. Stirring constantly until all solid particles are dissolved, dissolve sodium benzoate in a little amount of purified water. As you continue to stir, immediately add the turmeric and garlic extracts to the syrup base. Blending glass rods should be done repeatedly until a uniform mixture is produced. Once the syrup is created, flavor it with either orange or peppermint oil.[13]

Fig 3. Preparation Of Syrup

Formulation table

Sr No	Ingredient	F1	F2	F3
1	Garlic extract	2ml	3ml	4ml
2	Turmeric extract	2ml	3ml	4ml
3	Sucrose	20g	20g	20g
4	Glycerine	2ml	2ml	2ml
5	Sodium benzoate	0.1g	0.1g	0.1g
6	Flavouring agent	q. s	q. s	q. s
7	Purified water	40ml	40ml	40ml

Table No 3. Formulation Table

Evaluation test

The formulated herbal syrup for urinary tract infection are evaluated for the following parameter.

- Organoleptic properties
- PH determination
- Clarity test
- Solubility test
- Viscosity

1. Organoleptic test

Evaluating the syrup using sensory attributes such appearance, color, taste, texture, and odor is known as organoleptic evaluation. It aids in assessing the formulation's acceptance and quality.

- Appearance: Clear and free from suspended particles
- Colour: Yellow to golden yellow
- Odour: Characteristic aromatic with slight pungent smell of garlic
- Taste: Sweet with slightly pungent and bitter aftertaste
- Texture: Smooth, viscous, and free from grittiness [14]

2. Measurement of pH

A calibrated pH meter was used to measure the prepared herbal syrup's pH. A beaker was filled with the necessary amount of distilled water and about 10 milliliters of the syrup. Standard buffer solutions were used to calibrate the pH meter. After submerging the electrode in the syrup sample, the pH was noted.

Fig 4. PH Determination

3. Clarity test

To verify clarity, the prepared herbal syrup is visually inspected against a light source.

The syrup should be clear and devoid of any turbidity or suspended particles

Fig 5. Clarity test

4. Solubility test

A tiny amount of the produced herbal syrup is combined with a predetermined volume of distilled water to test the syrup's solubility. In order to create a transparent solution free of precipitation, the syrup must totally dissolve.

Fig 6. Solubility Test

5. Viscosity test

A viscometer is used to measure the prepared herbal syrup's viscosity. The viscosity of the syrup is measured at room temperature after it is placed in the sample container. For the syrup to flow properly and be pourable, the viscosity should be enough. [15]

Fig 7. Viscosity test

5. RESULT AND DISCUSSION:

The herbal syrup made with garlic and turmeric was successfully created and assessed using a number of criteria. The syrup had a distinct smell and a slightly strong flavor. It was clear and yellowish-brown in color. The pH was found to be between 4.5 and 6.5, which is an acceptable range. The formulation exhibited suitable viscosity, acceptable clarity, and solubility. There was no instability or precipitation. The syrup was stable and appropriate for treating UTIs.

1. Organoleptic properties

Organoleptic properties	F1	F2	F3
Physical state	Liquid	Liquid	Liquid
Colour	Light yellow	Yellowish brown	Yellowish brown
Odour	Slight pungent	Aromatic pungent	Aromatic pungent
Taste	Sweet	Sweet, moderate pungent	Sweet, moderate pungent
Clarity	Clear	Clear	Clear

Table No 4. Organoleptic Properties of Syrup

Discussion

According to the organoleptic evaluation, every batch was liquid and had a suitable look. Comparable concentrations of active substances were indicated by the identical color, taste, and odor of F2 and F3. While F1 showed relatively lower intensity, both batches demonstrated superior palatability and overall acceptability.

2. Measurement of pH

Formulation	F1	F2	F3
PH	5.6	6.3	6.3

Discussion

Every developed formulation had a pH between 5.6 and 6.3. It was discovered that the pH was within the permissible range for oral herbal syrup, suggesting good stability and administration appropriateness. The pH values of F2 and F3 were comparable, suggesting formulation homogeneity

3. Solubility

Formulation	F1	F2	F3
Solubility	Soluble	Completely soluble	Completely soluble

Discussion
Every formulation demonstrated good water solubility. Compared to F1, F2 and F3 were fully soluble and displayed superior clarity, suggesting improved consistency and formulation stability.

4. Viscosity

Formulation	F1	F2	F3
Viscosity	Low	Moderate	Moderate

Discussion
All formulations were confirmed to have acceptable viscosities. While F1 shown lesser viscosity, F2 and F3 demonstrated comparable mild viscosity, which guarantees improved pourability and consistent uniformity.

5. Clarity

Formulation	F1	F2	F3
Clarity	Slightly clear	Clear	Clear

Discussion
Better quality and stability were shown by the clarity test, which revealed that the F2 and F3 formulations were clear and devoid of suspended particles. Compared to F2 and F3, F1 was marginally less obvious.

6. CONCLUSION:

The study comes to the conclusion that the herbal syrup made with turmeric (Curcuma longa) and garlic (Allium sativum) is a viable, secure, and efficient treatment for urinary tract infections.
The formulation showed: Strong antibiotic action against UTI-causing organisms, good physicochemical stability, acceptable organoleptic properties, and increased patient compliance because of the syrup dose form.
Allicin and curcumin worked in concert to improve therapeutic efficacy.
Using natural herbal compounds reduces the possibility of adverse effects and aids in addressing the issue of antibiotic resistance.

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