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FORMULATION AND DEVELOPMENT OF A HERBAL SYRUP EMPLOYING *CLITORIA TERNATEA* TO AID WITH DIGESTION

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Abstract:

The growing interest in herbal compositions has led to the emergence of natural remedies for digestive health. Clitoria ternatea, commonly known as butterfly pea, is a medicinal plant that has gastrointestinal, antioxidant, and anti-inflammatory qualities. This study aims to develop and evaluate a herbal syrup using extract from Clitoria ternatea to enhance digestion. The syrup was created using a standardized extract of Clitoria ternatea along with the proper excipients, including flavorings, sweeteners, and preservatives.

Several formulation parameters, including pH, viscosity, and stability, were assessed to ensure efficacy and shelf-life. Preliminary phytochemical screening verified the presence of flavonoids, alkaloids, and phenolic substances that promote enzymatic activity and reduce oxidative stress, therefore supporting digestive health. Additional evaluations were conducted on the formulation's organoleptic properties, microbiological stability, and in vitro digestive enzyme activity. The results indicate that the herbal syrup is a safe, effective treatment with minimal side effects that has potential as a natural remedy to improve digestion. Future studies will primarily concentrate on clinical evaluations to verify its efficacy in human beings.

Keywords *:Clitoria ternatea,sweeteners,flavonoids,digestive,effectiveness.*

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INTRODUCTION:

In order to direct food intake, break it down into appropriate forms, absorb its basic components, transfer it to related organs, and remove any leftover garbage, the human digestive system employs a complex series of multi-scale, multi-adaptable physicochemical processes. The human digestive system consists of the digestive tract and the auxiliary organs, which are controlled by hormones and the brain network. The digestive system is an open-ended tube that runs from the mouth to the anus and is about 8 to 9 meters long overall. It consists of the throat, esophagus, stomach, and small and large intestines. Examples of auxiliary organs include the tongue, salivary glands, liver, gall bladder, pancreas, and teeth.

The pharynx, esophagus, stomach, duodenum, jejunum, and ileum in the small intestine, the cecum, ascending colon, transverse colon, descending colon, and sigmoid colon in the large intestine, and the rectum make up the digestive tract, which ends at the anus, where waste products are expelled. Along with the salivary and gastric glands, the pancreas, liver, gallbladder, and bile ducts are the organs that secrete digestive juices. The secretions of the digestive organs alter the physical properties of the digested meal by diluting it. Normally, a human can produce 1.5 L of saliva, 2 L of stomach secretions, and 0.5 L of bile solution.

Herbal syrup is made by combining concentrated plant decoction with honey or sugar and alcohol. The herbal syrup is made by the decoction process. Herbal syrup is a concentrated mixture that has been combined with sugar, honey, or alcohol. It makes administering herbal remedies easier, especially for those who have problems swallowing solid prescription forms. The two main types of syrups are medicinal and flavored. Flavored syrups contain flavoring compounds, which are commonly used to mask the taste of drugs in medicated syrups, even though they do not contain medication.

Fig no 1 : Herbal syrup

Syrups are utilized as cough treatment because of their ease of use and rapid absorption. Sugar and a herbal decoction are combined to give the formulation thickness and preservation. This resulted in a longer shelf life for the formulation. The addition of sweetness may make some herbs more pleasant. The final syrup that was produced was excellent. A thick, sticky liquid is a concentrated mixture of sugar and water, either with or without a flavoring agent or medication added.

When added to food and beverages, herbal syrups taste great. Combine a spoonful or two of syrup with carbonated water to create a tasty and nourishing herbal soda. As an alternative, you can make a cup of tea fast by combining one spoonful of sugar with boiling water. Enjoy your syrup by the spoonful or by drizzling it over ice cream, yogurt, cereal, and biscuits. Herbal goods are increasingly regarded as a symbol of safety as opposed to synthetic drugs, which are thought to be harmful to both people and the environment. Nevertheless, the medicinal, flavorful, and aromatic qualities of herbs have long been prized. The time has come to promote them abroad.

Herbal syrup is made from medicinal plants and herbs in many parts of the world. It is crucial that these traditional medicines undergo scientific research in order to gain a better understanding of their therapeutic potential, biological properties, and safety—all of which can help in making informed decisions regarding their use. One such pharmacologically significant plant that has been the subject of extensive research is Clitoria ternatea. Proteins, alkaloids, anthraquinone, anthocyanins, cardiac glycosides, tannins, phlobatannin, carbohydrates, saponins, triterpenoids, phenols, flavonoids, flavonol glycosides, Stigmast-4-ene-3,6-dione, volatile oils, and steroids are among the many chemical constituents found in it, according to preliminary phytochemical screening.

Numerous pharmacological activities, including antibacterial, gastrointestinal, antiparasitic, insecticidal, analgesic, antipyretic, anticancer, antioxidant, hypolipidemic, anti-inflammatory, and central nervous system activity, have been demonstrated by Clitoria ternatea.

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Advantages of herbal syrup:

No negative side effects, no harm, and easy accessibility

It is simple to modify the dosage based on the child's weight.

The patient can take it without assistance, and no nursing is needed.

It is used for products such as cough medications in liquid dosage form.

Herbs are grown in public spaces.

By delaying the oxidation process as sugar is hydrolyzed into cellulose and dextrose, it acts as an

antioxidant.

Good patient compliance, particularly for young patients because syrup is tasty in the test. It also acts as a preservative by delaying the growth of mold, fungus, and bacteria by osmotic pressure.

Plant Profile

Synonyms: *Clitoria albiflora* Mattei, Clitoria bracteata Poir, Clitoria mearnsii De Wild., *Clitoria tanganicensis* Micheli,Clitoria zanzibarensis Vatke .

Taxonomic Classification:

Table no 1 : Taxonomic classification of *Clitoria ternatea*.

Kingdom	**Plantae**
Subkingdom	Viridiplantae
Infrakingdom	Streptophyta
Division	Tracheophyta
Subdivision	Spermatophytina
Infradivision	Angiospermae
Class	Magnoliopsida
Superorder	Rosanae
Order	Fabales
Family	Fabaceae
Genus	Clitoria L
Species	*Clitoria ternatea*

In the various systems of medicine, many plantsandherbs are used to treat various in rmities. In all ancient scriptures of Ayurveda, Aparajita is mentioned as one of the important herb. It is a good looking twing herb. Aparajita's botanical name is Clitoria ternatea and belongs to Fabaceae (Pipilionaceae) family (Figure 1). It is probably originated in tropical Asia [1]. It is widely distributed throughout the humid, lowland tropics of Africa, Asia and Central America. It is found in low and medium altitudes of the settled areas. C. ternatea is a strongly persistent, sparsely pubescent, legume. It is perennial climber with slender downy stem, found throughout the tropical regions of the country being cultivated in gardens everywhere and often also found growing over hedges and thickets. It is seen that Aparajita is being adapted to clay soils and has been tested as a forage and cover crop, but never developed as a pasture cultivar [2].In various Ayurvedic preparations different parts of this plant have been used as an active ingredient which is used for treatment of several disorders. There are several reported Ayurvedic 'medha' drugs which contain C. ternatea along with other plants. This plant has been scienti cally studied for various pharmacological activities like antihistaminic, anthelmintic, hypoglycemic, antidepressant, sedative etc. [3].

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Botanical Description:
Clitoria ternatea is a perennial plant that climbs or trails and grows from a woody rootstock. Imparipinnate leaves typically feature two to four pairs of leaflets in addition to a terminal leaflet. Up to 6.5 x 4 cm in size, these leaflets are ovate to elliptic oblong in shape, with a hairy underside and a largely hairless upper side. The plant produces fragrant, brilliant blue axillary blooms that can be paired or flowered alone. Its linear-oblong pod is 6–13 cm long, flattened, and typically mucronate at the tip. The pod may be hairless or delicately pubescent.

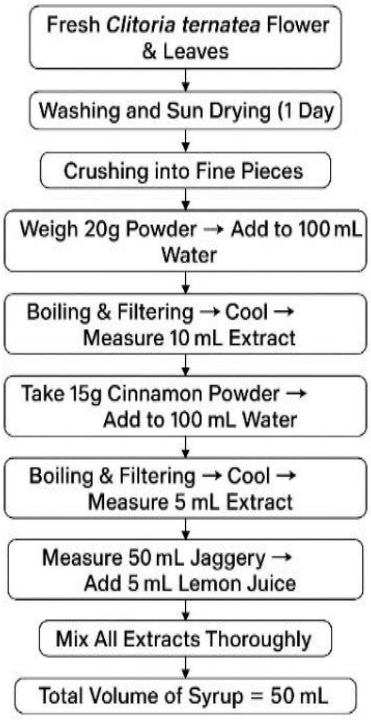
Traditional Uses:
Clitoria ternatea has been used traditionally for a long time. Its roots have been used to treat ascites, sore throats, skin conditions, and enlarged abdomens. Because of their tendency to inflict pain and discomfort, they were used cautiously even though they were utilized as a purgative. In order to improve their complexion, cognitive function, and muscular strength, children were also fed the root mixed with honey and ghee as a general tonic. It was generally known that seeds and leaves might serve as a brain tonic and enhance intelligence and memory. The juice and flowers were believed to be an antidote for snake bites, and crushed seeds were used to treat painful joints and urinary tract issues.

MATERIALS AND METHODS:

Materials: *Clitoria ternatea*,jaggery, cinnamon powder ,lemon juice .

Methods of preparation :
The preparation of herbal syrup using the decoction method involves the following sequential steps:

1. Collection and Drying:
Fresh leaves and flowers of Clitoria ternatea were carefully collected. These plant materials were thoroughly washed with clean water to remove any dirt or debris and then dried under direct sunlight for one day.
2. Powder Preparation:
Once dried, the leaves and blossoms were crushed into small, fine pieces. A total of 20 grams of the powdered material was accurately weighed for the extraction process.
3. Decoction of Clitoria ternatea:
The 20 grams of powdered Clitoria ternatea were added to 100 milliliters of distilled water. The mixture was then heated gently to allow the active constituents to be extracted. After boiling, the mixture was filtered using a muslin cloth or filter paper, and the filtrate was allowed to cool. From this, 10 milliliters of extract were collected for further use.
4. Decoction of Cinnamon:
Separately, 15 grams of cinnamon powder were taken and mixed with 100 milliliters of water. This mixture was also heated gradually to extract the cinnamon components. The decoction was filtered and cooled, and 5 milliliters of the cinnamon extract were collected.
5. Preparation of Sweetening Agent:
In a separate container, 50 milliliters of jaggery (previously melted or liquefied) were measured



accurately. To this, 5 milliliters of freshly squeezed lemon juice were added and mixed thoroughly to enhance the flavor and preservative effect.

6. Final Syrup Formulation:
All the collected extracts—10 mL of Clitoria ternatea, 5 mL of cinnamon, and the jaggery-lemon juice mixture—were combined. The mixture was stirred until uniform blending was achieved, resulting in 50 milliliters of herbal syrup.

7. Storage:
The prepared herbal syrup was transferred into an amber-colored glass bottle to protect it from light. The bottle was tightly sealed and stored in a cool, dry place to preserve its quality and stability.

Table no 2 : Formula of herbal syrup

Ingredients	Quantity	Role
Clitoria ternatea	20 gm	Immunity boosting ,treat fever ,respiratory condition ,improving digestion .
Jaggery	10gm	To improve digestive and respiratory health
Cinnamon powder	15 gm	Improve immunity
Lemon juice	5 ml	Flavour

Profile of ingredients :

1. Clitoria ternatea :

Clitoria ternatea, a plant species that is indigenous to the Indonesian island of Ternate and a member of the Fabaceae family, is sometimes referred to as Asian pigeonwings, bluebellvine, blue pea, butterfly pea, cordofan pea, or Darwin pea. It is usually referred to as Aparajita in Indian Ayurveda. In India, it is occasionally mistaken for Convolvulus prostratus (Convolvulus pluricaulis). This herbaceous perennial plant has elliptic, obtuse leaves. It thrives in damp, neutral soil and grows as a vine or creeper. Its flowers, which are solitary and have light yellow markings, are its most remarkable feature. They are a vivid deep blue color. They measure roughly 4 cm (1+1⁄2 in) in length and 3 cm (1+1⁄4 in) in width. Some variants yield white blooms and pink.

Fig no 2 *: Clitoria ternatea*

2. Cinnamon plants

The inner bark of several tree species in the genus Cinnamomum yields cinnamon, a spice. Cinnamon is mostly used as a flavoring and aromatic condiment in a wide range of foods, including teas, hot chocolate, biscuits, breakfast cereals, snack foods, bagels, and sweet and savory dishes. The primary ingredient and essential oil of cinnamon, cinnamonaldehyde, along with a host of other components, such as eugenol, are responsible for the spice's flavor and scent.

Fig no 3 : Cinnamon plants .

3. Jaggery

In the Indian subcontinent, Southeast Asia, North America, Central America, Brazil, and Africa, jaggery is a traditional non-centrifugal cane sugar. It can range in color from golden brown to dark brown and is a concentrated product of cane juice and frequently date or palm sap without the molasses and crystals being separated. Up to 50% sucrose, 20% invert sugars, and 20% moisture are present; the remaining portion is composed of various insoluble materials such wood ash, proteins, and bagasse fibers.

Fig no 4 :Jaggery

4. Lemon juice

Limon Citrus (L.) Burm. f. is a member of the Rutaceae family and has evergreen foliage and yellow, edible fruits. Lemon (English), Zitrone (German), le citron (French), limón (Spanish), and níngméng are some of the names for C. limon in other languages. The fruit, especially the juice and essential oil extracted from it, is the primary raw material of C. limon. The fruit of C. limon is notable for its well-known nutritional qualities, but it's important to note that contemporary phytotherapy and cosmetics undervalue its beneficial biological activities.

Fig no 5 : Lemon juice

Evaluation parameters:

1. Density determination procedure

1) Use nitric acid or chromic acid to thoroughly clean the specific gravity bottle. 2) Use distilled water to rinse the bottle at least two or three times. 3) Rinse the bottle with an organic solvent, such as acetone, if necessary, then pat dry. 4) Use a capillary tube stopper (w1) to weigh an empty, dry

bottle. 5) Pour an unknown liquid into the bottle, cover it with a stopper, then use tissue paper to remove any extra liquid from the tube's outside. 6) Use an analytical balance (w2) to weigh a container containing an unknown liquid. 7) Determine the unknown liquid's weight in grams (w3). Density formula: Density of test liquid (syrup) = weight of test liquid divided by volume of test liquid = w3/v

Fig no 6 : Density of herbal syrup

2. Procedure to determine Specific gravity

1) Clean the specific gravity bottle completely with nitric or chromic acid.
2) Rinse the bottle at least twice or three times with filtered water.
3) If required, rinse the bottle with an organic solvent, like acetone, and pat dry.
4) Weigh a dry, empty bottle using a capillary tube stopper.
5) Fill the container with distilled water, seal it with a stopper, and use tissue paper (w2) to drain any remaining liquid from the side tube.
6) Weigh a bottle containing water and a cork using an analytical balance (w2).
7) After the liquid has been drained and dried, repeat the procedure for the liquid under test by adding water, as indicated in steps 4 through 6.
8) Weigh the container containing the stopper and the liquid under test (w3) using an analytical balance.

The formula for specific gravity is: The weight of the liquid divided by the weight of water, or w5/w4, is the specific gravity of the test liquid (syrup).

Fig no 7 : Viscosity of herbal syrup

3. Procedure to determine Viscosity

1) Clean the Ostwald viscometer completely by adding heated chromic acid. Add an organic solvent, such as acetone, if necessary.
2) On a suitable platform, place the viscometer vertically.
3) Pour water into the dry viscometer until mark G is reached.
4) Calculate the time it takes for water to move from mark A to mark B.
5) Do step 3 at least three times to obtain an accurate reading.
6) Fill the viscometer to mark A after rinsing it with test liquid, and then measure how long it takes for the liquid to flow to mark B.
7) Calculating liquid densities as specified in the density determination experiment.

Formula for viscosity

The density to flow time ratio of the test liquid
Viscosity = × Viscosity of water
The density of water multiplied by the flow time

4. pH determination: There are two techniques for figuring out syrup's pH.
pH paper (b) and glass electrode (a).

Glass electrode procedure

1) Prepare each pH buffer in 30 milliliters. how much stock solution needs to be taken. To prepare the buffer, mix it to the right volume.
2) Allow the solution to settle for fifteen minutes in order to reach equilibrium.
3) To find the pH of the solution, use a pH meter.

Answers: Stock remedy: Acid acetic 0.2 molar: In a volumetric flask, dissolve 1.2 ml of glacial acetic acid in 100 ml of distilled water. Glacial acetic acid has a molecular weight of 60.605 and a weight of 1.050 per milliliter. To make a buffer solution, dissolve 10.21 grams of potassium hydrogen phthalate in 1000 milliliters of carbon dioxide-free water.

4.PH:

There are two ways to measure the pH of syrup.
pH paper (B) and glass electrode (A).
Glass electrode technique:
1. Prepare each pH buffer in 30 milliliters. how much stock solution needs to be taken. Mix the buffer to the proper volume to get it ready.
2. To achieve equilibrium, let the solution sit for fifteen minutes.
3. Use a pH meter to determine the solution's pH.
Answers: Stock remedy: Acid acetic 0.2 molar: In a volumetric flask, dissolve 1.2 milliliters of glacial acetic acid in 100 milliliters of distilled water. Glacial acetic acid has a molecular weight of 60.605 and a weight of 1.050 per milliliter.

Fig no 8 : PH of herbal syrup

RESULT AND DISCUSSION:

Table no 3 : Evolution parameters of herbal syrup

Sr. No.	Parameters	F1	F2	F3	F4
1.	Density	1.10 gm	1.08 gm	1.08 gm	1.08 gm
2.	Specific gravity	0.560	0.559	0.551	0.551
3.	Viscosity	3.80 cp	3.70cp	3.65 cp	3.65cp
4	pH Determination				
	PH paper	Neutral	Neutral	Neutral	Neutral
	PH meter	6.01	5.44	6.75	6.70
5	Organoleptic characters				
6	Color	Yellowish green	Yellowish green	Yellowish green	Yellowish green
7	odour	Aromatic	Aromatic	Aromatic	Aromatic
8	Taste	Sweet	Sweet	Sweet	Sweet
9	appearance	Turbid	Turbid	Turbid	Turbid3

Discussion: Over time, the formulation of herbal syrups has evolved from traditional empirical formulations to products with enhanced stability and efficacy that have been scientifically validated. They were primarily created as natural preservatives by combining decoctions or infusions with honey or sugar. However, their shelf life and efficacy differed due to their lack of standardization. Modern techniques including percolation, Soxhlet extraction, and supercritical fluid extraction have improved the concentration and purity of herbal components in syrups. Unlike traditional syrups, modern formulations undergo a rigorous quality control procedure that ensures consistency in the active ingredients using techniques like FTIR, GC-MS, and HPLC. In the past, honey and sugar were the primary preservatives.

SUMMARY AND CONCLUSION:

Because herbal medicines are more palatable, more human-compatible, and have fewer side effects than synthetic ones, 50% of the world's population uses them. Using a distinct extract of cinnamon and Clitoria ternatea, two herbals that have been referenced in the literature, we created a herbal syrup for this investigation. Herbal syrup formulation has evolved along with extraction, standardization, and quality control methods.

Modern herbal syrups are more widely utilized, stable, and effective in the medical field. The generated syrup has a value that is within the permissible ranges and satisfies several evaluation requirements. These days, herbal medicine is growing in popularity. People may be more open to using herbal remedies because they have fewer side effects.

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