

FORMULATION AND EVALUATION OF ANTIDIABETIC HERBAL SYRUP USING MORINGA OLEIFERA AND WITHANIA COAGULANS

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ABSTRACT

Since herbal remedies are utilized in systems like Unani, Ayurveda, and Siddha, they are considered traditional. Medical disorders such as hyperglycemia are prevalent in today's population. In order to reduce adverse and long-term consequences, herbal therapies and treatments are preferable to allopathic treatments. Developing and evaluating herbal syrup's antidiabetic properties is the aim of this research. According to the Ayurvedic system, the plants Moringa oleifera and Withania coagulans have antidiabetic properties. Flavonoids, saponins, alkaloids, and steroids are among the phytochemical components that exhibit potent antidiabetic effects. In doing so, we have guaranteed stability, insulin production, sensitivity, and glucose reduction. The assessment tests are carried out on the herbal syrup formulation to guarantee stability, safety, and appropriate extraction of bioactive compounds. A number of

evaluation criteria, including pH, density, viscosity, stability, and specific gravity, were applied to the manufactured herbal syrup. Moringa oleifera and Withania coagulans are plants that have demonstrated notable health advantages, and all the examined assessment factors are found to be within acceptable bounds.

KEYWORDS: Diabetics, Antidiabetic herbal syrup, Moringa Oleifera, Withania Coagulans, Evaluation, Result.

INTRODUCTION

Diabetes mellitus is a long-lasting metabolic condition marked by increased blood sugar levels, caused by either inadequate insulin production or the body's failure to efficiently use insulin. This condition has emerged as a worldwide health issue, with its prevalence rising globally.^[1] The pancreas secretes the hormone insulin, which serves as the main messenger for glucose from food to go from the bloodstream into the body's cells where it is utilized as fuel. Diabetes affects every part of the body and can lead to problems with particular organs including the kidneys, eyes, and nerves. The World Health Organization estimates that 9.0% of adults worldwide are affected. The rapid increase in fat and inactivity may be the cause of this emerging epidemic.^[2]

Classification of Diabetes Mellitus

Type 1 diabetes, also known as insulin-dependent diabetes.^[3]

Type 2 diabetes, known as non-insulin-dependent or adult-onset diabetes.^[3]

Type 1 Diabetes Mellitus

The loss of beta cells causes the pancreas to be unable to produce enough insulin, which leads to type 1 diabetes. Previously, "juvenile diabetes" or "insulindependent diabetes mellitus" were used to describe this kind. An autoimmune reaction results in the death of beta cells. This autoimmune reaction has no known etiology. Type 1 diabetes can occur in adults, however it typically manifests in childhood or adolescence.^[4]

Type 2 Diabetes Mellitus

Insulin resistance, a disorder in which cells do not react appropriately to insulin, is the first stage of type 2 diabetes. A shortage of insulin may also arise as the illness worsens. The terms "non insulin-dependent diabetes mellitus" and "adult-onset diabetes" were previously used to describe this kind. Although type 2 diabetes is more common in older folks, it is now increasingly common in younger people due to a notable rise in childhood obesity. Excess body weight combined with inadequate exercise is the most typical cause.^[4]

Syrup

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Medicated Syrup

Medicated syrups are a nearly saturated sugar-water solution that dissolves medications and medicines. It is intended for oral use.^[5]

HerbalSyrup

A prepared mixture and concentration decoction made with honey, sugar, or occasionally alcohol is known as herbal syrup.¹¹ Strong herbal decoctions serve as the foundation for these syrups, and combining them with sugar and honey thickens and preserves the decoction. In both developed and developing nations, herbal formulations are most frequently utilized for medical purposes. A concentrated mixture of sugar and purified water is called syrup. in syrup from several kinds of syrup solutions. Medication or a combination of flavoring agents may or may not be present in the syrup. Flavored or non-medicated syrup is defined as having a flavoring additive but no medication. Herbal medicines are crucial to the creation of powerful medicinal agents. Additionally, it has demonstrated their ability to overcome a number of illnesses. In order to maximize the benefits of their combined ability to lessen each other's adverse effects, plant medicines are easily utilized in combination rather than alone.^[3]

Benefits of Herbal Syrup

1. Natural and Safer Alternative

a) Natural origin

Herbal syrups are prepared from extracts of medicinal plants, making them natural therapeutic preparations.

b) Safer than synthetic drugs

When used in appropriate doses, they are generally considered safer compared to many synthetic medications.

c) Fewer side effects

Herbal syrups usually produce fewer side effects, which makes them widely used in traditional and complementary medicine.^[3]

2. Pleasant Taste and Easy Administration

a) Improved palatability

Syrup formulations contain sweetening agents that help mask the bitter taste of herbal ingredients.

b) Easy to administer

Due to their liquid form and pleasant taste, herbal syrups are easy to consume.

c) Suitable for all age groups

They are especially suitable for children and elderly patients who may have difficulty swallowing tablets or capsules.^[3]

3. Enhanced Bioavailability

a) Liquid dosage form

Herbal syrups are in liquid form, which allows the active phytoconstituents to dissolve easily.

b) Faster absorption

The liquid form helps in quicker absorption of active compounds in the body compared to tablets or capsules.

c) Improved therapeutic effect

Due to better absorption, herbal syrups may provide faster and more effective therapeutic action.^[3]

Objectives

- 1) To design a patient-centric liquid dosage form suitable for long- term use in diabetic patients with swallowing difficulty or poor compliance.
- 2) To eliminate the use of sucrose based syrup vehicles and replace them with non- glycemic sweeteners without compromising palatability.
- 3) To select antidiabetic herbs based on reported pharmacological evidence and traditional use.
- 4) To promote the concept of herbal formulation as supportive therapy, minimizing dependency on high- dose synthetic antidiabetic drugs.

DRUG PROFILE

❖ MORINGA OLEIFERA



Synonyms: - Drumstick tree, Saguna^[6]

Taxonomical classification

BIOTICAL CLASS	CATEGORY
Kingdom	Plantae
Sub kingdom	Tracheobionta
Super division	Spermatophyta
Division	magnoliophyte
Class	Magnoliopsida
Family	Moringceae
Genus	Moringa
Species	Oleifera ^[6]

Morphology

The tree grows rapidly in loamy and well-drained sandy soils, preferring a height of 500 m above sea level. Normally, the tree is small to medium in size, the leaves are naturally trifoliate, the flowers are born on an inflorescence 10–25 cm long, and the fruits are usually trifoliate and commonly referred to as “pods”. The trunk usually grows straight but is occasionally poorly formed, the branches are usually disorganized, the canopy is umbrella-shaped; the brown seeds have a semi-permeable hull, and each tree has a capacity of about 15,000–25,000 seeds per year.^[6]

Phytochemistry

Leaves of Moringa act as a decent source of natural antioxidant due to the occurrence of different types of antioxidant compounds such as flavonoids, phenolics, ascorbic acid and carotenoids. The high concentrations of calcium, iron, phosphorus, copper, vitamins A, B and C, α -tocopherol, folic acid, riboflavin, nicotinic acid, pyridoxine, β -carotene, protein, ascorbic acid, oestrogenic substances, β -sitosterol and in some specific vital amino acids such as tryptophan methionine, cysteine and lysine present in leaves of Moringa and pods make it essentially perfect dietary supplement. compound like Quercetin, Myricetin show antidiabetic activity.^{[7],[8]}

Antidiabetic activity

Numerous plant-based compounds, including those in *Moringa oleifera*, have demonstrated promise for diabetes management, particularly type 2 diabetes. Strong anti-diabetic properties have been found in the dried leaf powder and various *M. oleifera* extracts (made with water, methanol, or ethanol from leaves, pods, seeds, stems, and root bark). Additionally, research indicates that streptozotocin-induced and type 1 diabetes can be managed with the assistance of the residue from the aqueous extract of *M. oleifera*. *M. oleifera* leaf extract has been shown in experiments with diabetic mice to not only have antibacterial properties but also to assist in repairing the structure of pancreatic cells in diabetic rats, supporting its potential as a natural treatment option.^[9]

❖ WITHANIA COAGULANS



Synonyms: - Paneer doda, Paneer phool, Indain Rennet^[10]

Taxonomical classification

BIOTICAL CLASS	CATEGORY
Kingdom	Plantae
Sub kingdom	Tracheobionta
Order	Solanales
Class	Magnolipsida
Family	Solanaceae
Genus	Withania
Species	Withania Coagulans ^[10]

Morphology

Shrub with ridges and furrows, 2-3m in length, slightly hairy stem cylindrical, 0.5-0.16cm length, hair curving. Sepals cover the fruit and end in a crown-like structure. Fruit berries and globose are 1.5-1 cm long and 0.7-1 cm wide. Seeds are yellowish-brown, oblong to rounded, 41-59 in number, 0.1-0.3cm long, 0.2- 0.3cm broad, and dotted.^[11]

Phytochemistry

A phytochemical examination revealed that the alkaloids, steroids, tannins, saponins, phenolic substances, proteins, amino acids, and organic acid compounds were among the extracts. Coagulin, coagulin L, withanolide F ect compound show antidiabetic activity.^{[10],[12]}

Antidiabetic activity

Research on male albino wistar rats shows that this plant will be more beneficial for diabetes at the right concentration. The rats' plasma glucose level, kidney weight, and catabolic reactions all dramatically increased as a result of STZ, but their body weight and serum insulin levels decreased. The aforementioned experiment has demonstrated that treating diabetes requires a daily dose of roughly 10 gm per person. If taken consistently for 14 days,

the aqueous extract of W. coagulans aids in lowering blood plasma glucose levels. For around a month, diabetics who drink fruit aqueous extract in addition to allopathic medication find it to be highly helpful. Controlling blood sugar levels requires ongoing medication for at least two months. Folk medicine frequently uses the fruits and blossoms of paneer dodi to treat diabetes. Paneer dodi was found to alleviate signs and symptoms of type 2 diabetes in an animal model while maintaining normal blood glucose levels.

METHOD OF PREPARATION OF HERBAL SYRUP

Preparation of herbal syrup

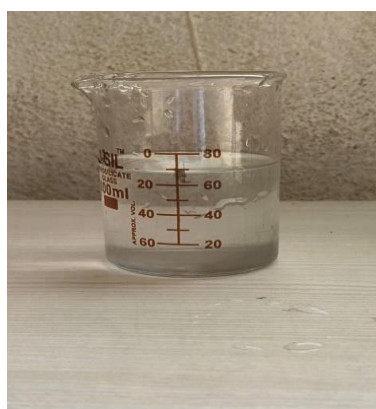
Preparation of decoction

Take required quantity of herb in the form of fine powder mix into the required quantity of water. Boil the mixture until the volume reaches a quarter of the original volume and cool the boiled mixture and strain it through a filter paper .the filtrate from the boiling mixture is use to prepare the final syrup.^[13]



Preparation of Simple Syrup

Mix sodium saccharin with distilled water to make thick solution and add to the mixing bowl.^[13]



Preparation of Herbal Syrup

Mix the one part of decoction with five parts of simple syrup. Add preservatives, thickening agent and other excipients. Make up the volume upto required quantity with simple syrup. Pack the syrup it in dry place.^[13]



EVALUATION

1) Colour

Five milliliters of the finished syrup were put into watch glasses and exposed to a white tube light against a white background. Its color was noted.^[14]

2) Odour

Each of the final two milliliters of syrup was smelled. To counteract the impact of the first smell, a two-minute gap was maintained between the two scents.^[14]

3) Taste

Take a pinch of final syrup and examine for its taste on taste buds of the tongue.^[14]

4) Appearance^[14]

5) Determination of pH

10 ml of the finished syrup, precisely measured, was added to a 100 ml volumetric flask, and the volume was increased to 100 ml using distilled water. For roughly ten minutes, the solution was sonicated. A digital pH meter was used to measure the pH.^[14]

6) Stability testing

Stability testing of the prepared herbal syrup performs on keeping the samples at accelerated temperature conditions. Take the final syrup in culture tubes and keep at Room temperature. Test the sample for all the physicochemical parameters, turbidity and homogeneity at the

interval of 7 days to observe any change.^[14]

7) Determine density

- 1) Clean thoroughly the specific gravity bottle with chromic acid or nitric acid.
- 2) Rinse the bottle at least two to three times with distilled water.
- 3) If required, rinse the bottle with an organic solvent like acetone and dry.
- 4) Take the weight of empty dry bottle with capillary tube stopper (w1).
- 5) Fill the bottle with unknown liquid and place the stopper, wipe out excess liquid from outside the tube using tissue paper.
- 6) Weight bottle with unknown liquid on analytical balance (w2).
- 7) Calculate weight in grams of unknown liquid (w3).^[15]

8) Specific gravity

- 1) Clean thoroughly the specific gravity bottle with chromic or nitric acid.
- 2) Rinse the bottle at least two to three times with purified water.
- 3) If required, rinse the bottle with an organic solvent like acetone and dry.
- 4) Take weight of empty dry bottle with capillary tube stopper.
- 5) Fill the bottle with distilled water and place stopper; wipe out excess liquid from side tube using tissue paper (w2).
- 6) Weight bottle with stopper and water on analytical balance (w2).
- 7) Repeat the procedure for liquid under test by replacing the water after emptying and drying as mentioned in step 4 to 6.
- 8) Weight bottle with stopper and liquid under test on analytical balance (w3).^[15]

9) Viscosity

- 1) Thoroughly clean the Ostwald viscometer with warm chromic acid and if necessary used an organic solvent such as acetone.
- 2) Mount viscometer in vertical position on a suitable stand.
- 3) Fill water in dry viscometer up to mark G.
- 4) Count time required, in second for water to flow from mark A to mark B.
- 5) Repeat step 3 at least 3 times to obtained accurate reading.^[15]

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