

Development and Assessment of *Tinospora cordifolia* for Anti-diabetic Activity

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Abstract: *This study aimed to evaluate the pre-test blood glucose levels in Type-II Diabetic adults within both experimental and control groups, to determine the effectiveness of Giloy juice on these levels in the experimental group, to assess the post-test blood glucose levels in both groups, and to identify any associations between post-test blood glucose levels and selected sociodemographic variables. A true experimental, one-group pre-test post-test design was utilized. Sixty Type-II Diabetic adults meeting the inclusion criteria were selected via probability-simple random sampling. Informed consent was obtained, and Giloy juice was administered to participants in ward-9, Purani Basti, Kohka Nagar Nigam Bhilai, (C.G.). The findings indicated a highly significant difference between pre-test and post-test blood glucose levels in the experimental group, with a calculated 't' value of 14.05 (df=19) exceeding the table value of 2.09 at the 0.05 level of significance*

Keywords: Effectiveness, Diabetes Mellitus Type II, Giloy Juice.

I. INTRODUCTION

Herbal formulations are medicinal preparations consisting of one or more herbs in specified quantities, intended for cosmetic purposes, diagnosis, or to mitigate diseases in humans or animals. Also known as botanical medicine or phytomedicine, herbal medicine was the primary system of medication in the early twentieth century, prior to the availability of antibiotics and analgesics. With the advent of allopathic medicine, known for its fast therapeutic action, the popularity of herbal medicine declined. For instance, Curcuma has been used in Traditional Chinese Medicine for over two thousand years due to its anti-inflammatory properties and robust antioxidant effects. Despite the rise of synthetic drugs, approximately 70–80% of people continue to use herbal medicine as their primary healthcare due to its fewer side effects and better compatibility with the human body. Herbal medicine has gained renewed interest and is considered more effective in certain aspects compared to synthetic drugs.



Fig 1.1 *Tinospora Cordifolia*

T. cordifolia (synonym: *Tinospora sinensis* (Lour.) Merr.), commonly known as Guduchior Amrita, has several names: in Latin, it is *Tinospora cordifolia* (Wild) Hook. F. & Thomson; in English, it is referred to as *Tinospora Gulanchaor* Indian *Tinospora* and in Hindi, it is called Giloya. This plant belongs to the family Menispermaceae and is found in Myanmar, Sri Lanka, and China .

1.1 Health benefits of Giloy (*Tinospora cordifolia*):

- Controls blood sugar levels
- Boosts immunity
- Improves digestion
- Reduces stress
- Improves eyesight
- Improves respiratory health
- Reduces anxiety
- Treats arthritis and gout
- Relieves hay fever
- Detoxifies the body
- Anti-aging properties
- Enhances skin health
- Fights respiratory infections
- Supports weight management
- Reduces fever

1.2 Medicinal Properties

Tinospora cordifolia, commonly known as Giloy, is widely used in traditional Ayurvedic medicine in India and has shown great potential for the development of biopharmaceutical products for the treatment of various diseases. It possesses several medicinal properties, including:

1. Immunomodulatory: Enhances the immune system's response.
2. Hepatoprotective: Protects the liver from damage.
3. Anti-allergic: Reduces allergic reactions.
4. Antipyretic: Reduces fever.
5. Anti-HIV: Exhibits activity against the HIV virus.
6. Antidiabeti: Helps manage diabetes.
7. Anticancer: Shows potential in cancer treatment.
8. Antitoxic: Protects against toxins.
9. Antiasthmatic: Aids in the treatment of asthma.
10. Antimalarial: Effective against malaria.

The leaves extract of Giloy has demonstrated anti-HIV activities, suggesting that biological extracts from this plant could be beneficial in protecting and treating various viral diseases in humans. Additionally, Guduchi is used to soothe inflamed and injured mucous membranes in the digestive tract, protecting the stomach and duodenum by increasing mucin production. The starch obtained from Giloy stem or roots can be used to treat chronic diarrhea and dysentery.

Furthermore, Giloy is beneficial for treating chronic fever, cancer, jaundice, dysentery, bone fractures, pain, asthma, skin diseases, snake bites, poisonous insect bites, and eye disorders.

Anti-diabetes property

In Indian traditional folk medicine, the stem of *Tinospora cordifolia* is frequently used to treat diabetes by controlling blood sugar levels. It mediates its anti-diabetic potential through several mechanisms:

1. Mitigating Oxidative Stress (OS): Reduces oxidative stress, which is often associated with diabetes.
2. Promoting Insulin Secretion: Enhances the secretion of insulin from the pancreas.

3. Inhibiting Gluconeogenesis: Prevents the formation of glucose from non-carbohydrate sources.
4. Inhibiting Glycogenolysis: Reduces the breakdown of glycogen to glucose.

These actions collectively help in regulating blood glucose levels. The major phytoconstituents of *Tinospora cordifolia*, including alkaloids, tannins, cardiac glycosides, flavonoids, saponins, and steroids, play a significant role in its anti-diabetic effects .

Tinospora cordifolia

In numerous investigations, *Tinospora cordifolia* (also known as *T. crispa*) has been identified as a rich source of secondary metabolites, which are divided into several groups including alkaloids, flavonoids, terpenoids, lignans, and sterols. The key phytochemical constituents isolated from *Tinospora cordifolia* include:

1. Alkaloids:

1. N-formylasimilobine 2-O-β-D-glucopyranoside
2. N-formylasimilobine 2-O-β-D-glucopyranosyl-(1→2)-β-D-glucopyranoside (tinoscorside A)
3. N-formylanonaine
4. N-formyldehydroanonaine
5. N-formylnomuciferine
6. N-demethyl-N-formyldehydronomuciferine
7. Magnoflorine

2. Flavones and Flavone Glycosides:

1. Apeginin
2. Diosmetin
3. Genkwanin
4. Luteolin 4'-methyl ether 7-glucoside
5. -Genkwanin 7-glucoside
6. Luteolin 4'-methyl ether 3'-glucoside

These phytochemical bioactive constituents contribute to the therapeutic potential of *Tinospora cordifolia*, making it valuable in traditional medicine and for the development of modern biopharmaceutical products

Antidiabetic Activity

The Investigation by Noor and Ashcroft [106] indicated that the orally administered extract of *Tinospora crispa* (*T. crispa*) exhibited a potential antidiabetic effect. The mechanisms behind these activities were predicted to include the stimulation of insulin secretion through the modulation of β-cell Ca²⁺ concentration. Additionally, in Noipha's experiment, *T. crispa* extracts improved the glucose transport activity of L6 myotubes by increasing the GLUT1 transporter. These findings suggest that *T. crispa* can be further used as an antidiabetic agent for the treatment of type II diabetes

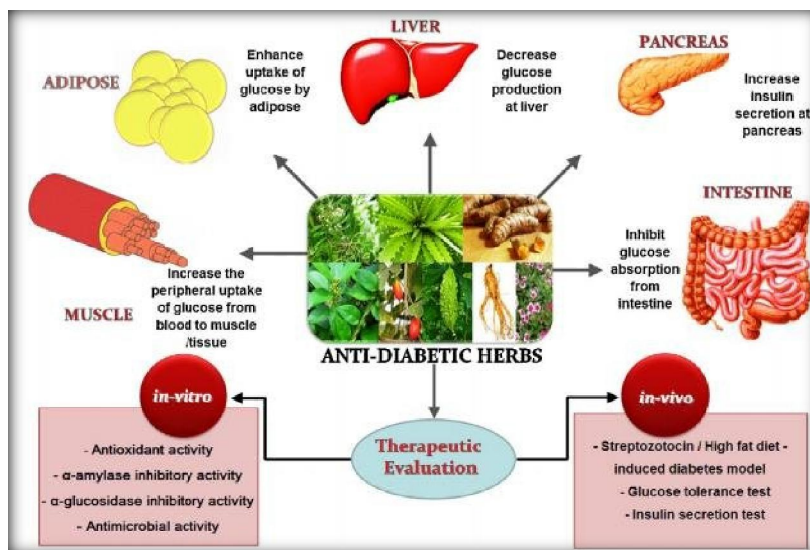


Fig 1.2 Therapeutic Evaluation effect of Antidiabetic herbs

Neem

Neem, scientifically known as *Azadirachta indica*, is widely recognized for its extensive medicinal properties. The diverse array of bioactive compounds found in neem includes nimbin, nimbolide, azadirachtin, and quercetin, which contribute to its wide range of therapeutic effects.

Properties of Neem:

1. **Antioxidant:** Neem contains potent antioxidants that help neutralize harmful free radicals, protecting cells from oxidative stress and damage.
2. **Antimicrobial:** It exhibits strong antibacterial, antiviral, and antifungal activities, making it effective against a variety of pathogens.
3. **Anti-parasitic:** Neem is effective in treating parasitic infections, such as those caused by intestinal worms.
4. **Anti-inflammatory:** It helps reduce inflammation and alleviate conditions such as arthritis and other inflammatory diseases.
5. **Anti-diabetic:** Neem has been shown to improve insulin sensitivity, promote insulin secretion, and lower blood glucose levels, making it beneficial for managing diabetes.
6. **Wound Healing:** Its ability to promote wound healing and tissue regeneration makes it valuable in treating cuts, ulcers, and other skin conditions.

Aloe vera L. Burm. :-

Aloe vera, a plant from the family Asphodelaceae, is renowned for its medicinal properties and extensive applications, particularly in the cosmetic industry and as an antidiabetic treatment (Figure 8). Traditionally, it was classified under the family Liliaceae. It is original to Africa and Mediterranean countries. There are reports that it is widely distributed throughout the islands of India, Sicily, Malta, Cape Verde, and Cyprus.

Aloe vera (*Aloe vera* L. Burm.) is one of the most renowned medicinal plants, especially prevalent in the cosmetic and pharmaceutical industries. This plant belongs to the Asphodelaceae family, though it was previously classified under Liliaceae. Originating from Africa and Mediterranean regions, Aloe vera has been extensively distributed and cultivated in various parts of the world, including Cyprus, Malta, Sicily, Cape Verde, and India.

Properties and Applications of Aloe vera:

Antidiabetic Effects: Aloe vera has shown potential in managing diabetes. It can help lower blood glucose levels, improve insulin sensitivity, and reduce fasting blood sugar levels.

II. SCOPE OF WORK

Plants have long been a vital source for the development of many therapeutic drugs, including those used to manage diabetes. Ethnobotanical research indicates that around 800 plants may possess anti-diabetic properties. Among these, notable examples include:

Anti-diabetic Plants:

Momordica charantia (Bitter Melon): Contains compounds like charantin, vicine, and polypeptide-p, which have been shown to have hypoglycemic effects

Bitter melon is known to improve glucose uptake and insulin sensitivity.

2.1 Bioactive Compounds in Anti-diabetic Plants:

The wide array of bioactive compounds found in these and other plants includes:

1. Alkaloids
2. Glycosides
3. Galactomannan gum
4. Polysaccharides
5. Peptidoglycans
6. Hypoglycans
7. Guanidine
8. Steroids
9. Carbohydrates
10. Glycopeptides
11. Terpenoids
12. Amino acids
13. Inorganic ions

These compounds have demonstrated various biological activities beneficial in the treatment of diabetes.

2.2 Benefits of Giloy

- Improves Metabolism: Enhances digestion (pachan) and absorption (deepan), leading to better regulation of blood sugar levels.
- Antioxidant Properties: Helps combat oxidative stress, which is beneficial for managing diabetes-related complications.
- Anti-inflammatory: Supports wound healing and kidney function, which are often compromised in diabetic patients.

2.3 Consumption:

- Morning Routine: Ideally consumed on an empty stomach for enhanced digestion.
- Forms: Available as juice, capsules, or powder mixed with warm water.
- Incorporating these plants into a daily routine can offer natural support for managing blood sugar levels and improving overall health in individuals with type 2 diabetes.

III. PREPARATION OF GILOY JUICE

Ingredients:

- Fresh stem of Giloy (Tinospora cordifolia) – 1 foot or more

- Water – 1 liter
- Neem leaves, Alovera, Momordica charantia, jamun leaves.

Instructions:

1. Preparation of Giloy Stem:
 - Take the fresh stem of Giloy and cut it into small pieces (3 to 4 equal parts).
2. Crushing and Boiling:
 - Crush the Giloy pieces to help release the active compounds.
 - Place the crushed pieces in a pot and add approximately 1 liter of water.
 - Optionally, you can add Neem leaves, Alovera, Momordica charantia, jamun leaves for added benefits.
3. Boiling: - Boil the mixture on a low flame until the water reduces to approximately 250 ml.
4. Cooling: - Allow the mixture to cool until it is lukewarm (not too hot, not too cool).
5. Filtering: - Filter the mixture to remove the solid pieces and obtain the juice.
6. Consumption:- Drink the juice on an empty stomach in the morning for optimal benefits.
 - The juice can be consumed up to 3 times a day if desired.

3.3 Benefits of juices :

- Enhances Digestion: Drinking Giloy juice on an empty stomach can improve digestion and absorption, helping to regulate blood sugar levels.
- Antioxidant and Anti-inflammatory: Provides support against oxidative stress and inflammation, which can aid in managing diabetes-related complications. By incorporating this preparation method, you can enjoy the therapeutic benefits of Giloy for better health and blood sugar management.



Fig 1.3 Herbal Juices

IV. EVALUATION TEST

1. Test for tannins

2–3 drops of FeCl₃ were added to 1 milliliter of juices. A few minutes were given to the solution to stand. The greenish-black color that results will indicate that tannins are present. The acetonicejuices of *T. cordifolia* were found to contain tannins, as evidenced by the blackish-green precipitation.

As evidence of the tannins' existence. Two to three FeCl₃ drops were added to a milliliter of juices. After a few minutes, the solution was left to stand.

The greenish-black color that results will indicate that tannins are present.

It was discovered that the acetonicjuices of *T. cordifolia* contained tannins, as evidenced by the precipitation that was blackish-green. As evidence of the tannins' existence.

2. Test for alkaloids

The presence of alkaloids in the acetonic juices of *T. cordifolia* was indicated by the formation of a yellow precipitate.

a. Mayer's test:-Five ml juices was combined with Mayer's reagent. The sample's presence of a creamy white precipitate suggested the presence of alkaloids.

b. Dragendr off's test: Excerpt five milliliters was combined withtwo milliliters of the reagent Dragendorff. The color reddish brown indicates the presence of alkaloids.

c. Wagner's test:-Two drops of the 5 mL juices were added to the The agent Wagner wore was augmented. A precipitate with a reddish brown color indicates the presence of alkaloids.

3. Test for flavonoids

When HCL was added, the color did not change from yellow to colorless, indicating that there were no flavonoids present. *T.cordifolia*juicesin aceonic form.

4. Test for saponins

After diluting the 1 milliliter extract with 20 milliliters of distilled water, it was shaken for 15 minutes using a graduated cylinder.

Saponins can be detected by a 1 cm layer of foam. When the test was shaken vigorously, foam formed on top, indicating the presence of saponins in the *T. cordifolia* juices in acetonic form

5. Test for phenols

The presence of phenols in the juices of *T. cordifolia* was indicated by the appearance of a bluish-black color.

6. Test for terpenoids

Salkowaski Test:5.2 ml of juices, 2 ml of chloroform, and 3 ml of were added along the sides of the testtube. Combined H₂SO₄. There will be a reddish-brown interphase formation when terpenoids are present.

The presence of terpenoids in the *T. cordifolia* acetonicjuices was indicated by the violet color.

V. CONCLUSION

Diabetes mellitus significantly impacts patients, their families, and society economically. Uncontrolled diabetes can lead to severe chronic complications such as blindness, kidney failure, and heart failure. To mitigate these issues, research into new antidiabetic agents is crucial. Due to the adverse effects of modern therapies, traditional medicines have gained attention. Nowadays, herbal extracts are often used alongside standard drugs in combinatorial therapies. Each herb contains active ingredients that can lower blood sugar levels and control diabetes complications. This review aims to provide essential information for diabetes management. We have introduced a comprehensive list of antidiabetic plants from the Vietherb database. The advancement of anti-diabetic functional foods and medication development depends on the extraction and identification of bioactive phytochemicals from these plants.

Sr.no.	Chemical Constituents	Test	Observation
1	Tannins	Ferric Chloride test	+
2	Alkaloids	1.Mayers test 2.Dragendroff's test 3.Wagners test	+ + +
3	Flavanoids	Shinoda test	

	Saponins	1.Foam test + 2.Froth test	+ +
4	Phenols Ferric	Chloride test	+
5	Phenols Ferric	Chloride test	+

Table 1.1 Evaluation Test & Result:

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