

THE BRIEF REVIEW ON ANTI DIABETES ACTIVITY OF TINOSPORA CARDIFOLIA

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India.**ABSTRACT**

An important medicinal plant is *Tinospora Cordifolia*. *Tinospora cordifolia* belongs to the "Menispermaceae" family. Every portion of the plant has medicinal uses. Traditionally, the many Folk, Ayurvedic, Unani, and Siddha medical systems have employed the same component. The root, stem, and leaf of this plant are principally responsible for its ceremonial medicinal significance. This is because the stems contain more alkaloids than the leaves do. Numerous chemical constituents with a broad range of traditional and therapeutic purposes, including anti-inflammatory, hypoglycemic, immunomodulatory, antioxidant, anti-allergy, antipyretic, and anti-arthritis properties, as well as use in the treatment of diabetes mellitus, fever, arthritis, and skin problems. Information about the pharmacology, phytochemistry, and pharmacognosy of *Tinospora cordifolia* is provided in this review study. Examining *T. cardifolia* Hyperglycemia is a hallmark of a set of metabolic illnesses known as diabetes mellitus (DM). It's acknowledged that there have been issues. To control blood sugar levels in the body, this disease requires lifelong treatment; nevertheless, oral antidiabetic medications sometimes cause undesirable side effects such bloating, diarrhea, and stomach cramps. Finding natural remedies with reasonably safe substances, such as plants like *Tinospora cardifolia*, is one method of treating diabetes. The World Health Organization (WHO) estimates that 80 percent of people on the planet are dependent on primary healthcare. Utilizing herbal remedies has been shown to have significant pharmacological effects. An extensive and up-to-date review of plants and phytoconstituents with antimicrobial and anti-diabetic properties is given in this article. These herbal compounds interfere with primary and secondary hemostasis, which acts against components that are involved in thrombosis. The need for more research is suggested by the potential of herbal substances to combat a variety of ailments. With an emphasis on papers published in English-language publications, referenced articles were obtained from Google Scholar, PubMed, ScienceDirect, and Elsevier. The findings of this study collectively emphasize the significance of novel phytoconstituents in reducing the side effects of existing anti-diabetic medications. Every portion of the plant has medicinal uses. Traditionally, the many Folk, Ayurvedic, Unani, and Siddha medical systems have employed the same component. The root, stem, and leaf of this plant are principally responsible for its ceremonial medicinal significance. This is because the stems contain more alkaloids than the leaves do. a variety of chemical elements present, traditional and pharmacological use in the management of diabetes mellitus,

KEYWORDS: *Tinospora cardifolia*, Medicinal plants; Phytoconstituents, antidiabetic, Phytochemicals.

INTRODUCTION

Hyperglycemia is a hallmark of a group of metabolic diseases known as diabetes mellitus (DM). To control blood sugar levels in the body, this disease requires lifelong treatment; nevertheless, oral antidiabetic medications sometimes cause undesirable side effects such bloating, diarrhea, and stomach cramps. The plant has various medicinal qualities, including the ability to

treat jaundice, rheumatism, urinary disorders, skin conditions, diabetes, anemia, inflammation, allergic conditions, anti-periodic, and radioprotective qualities. It is widely employed in traditional ayurveda medicine.^{[6,7][8,9]} Giloya (*T. cordifolia*) root is used as a strong emetic and for intestinal obstruction.

This plant's starch promotes energy and hunger, reduces burning sensations, and acts as a useful home cure for chronic fever. Finding natural remedies with reasonably safe ingredients, such as employing plants as medicines, is one method of treating diabetes. A metabolic condition affecting individuals of all ages and backgrounds is diabetes mellitus (DM). An estimated 150 million people worldwide^[1] have diabetes, nearly five times as many as were thought to have the disease ten years ago.

Hypothesis/Purpose: *Tinospora cordifolia* is a well-known antidiabetic herb, but nothing is known about how it affects DKD. Thus, we evaluated the effectiveness and mode of action of *Tinospora cordifolia* extract (TC) against DKD in the current investigation. A prospective randomized controlled trial examined the immunomodulatory function of *Tinospora cordifolia* as an adjuvant in the surgical treatment of diabetic foot ulcers.^[18] Wild *Tinospora cordifolia* Hook, known locally as Guduchi or Amrita; in English, Indian *Tinospora*, also known as Giloya or Gulancha in Hindi, is a member of the Menispermaceae family and is found in China, Bangladesh, Myanmar, and Sri Lanka.^[2] is a shrub that spreads and climbs and has many twisted branches.

With many medicinal uses in the Ayurvedic medical system, *T. cordifolia* is used to treat inflammation, rheumatism, anemia, urinary disorders, skin diseases, jaundice, diabetes, allergic conditions, and more.^{[3][4]} The allopathic medical method was used more often over time. The use of phytomedicines began to wane as a result of the allopathic drugs' speedier therapeutic effects. When synthetic acetyl salicylic acid (aspirin) was first made available to the public in 1897 by Friedrich Bayer & Co., the importance of plants for human health became apparent. Salicylic acid, the active component of willow bark, has a safer synthetic analogue in aspirin, which was first used as a fever and aching cure on its own. Aspirin, digoxin (found in foxglove), quinine (found in cinchona bark), and morphine (found in opium poppy) are among the other common medications that are derived from plants. According to the WHO, more than 70% of people worldwide use herbal remedies rather than synthetic ones.

Humanity uses herbal medicines to treat a wide range of illnesses, including diabetes, asthma, psoriasis, diarrhea, heart disease, lung disease, malaria, chicken pox, cholesterol, and skin disorders. Since herbal remedies tend to be safer, more effective, and have less side effects, they are more popular as primary healthcare options. Currently a major global health issue, diabetes mellitus (DM) is a chronic metabolic disorder/syndrome caused by a variable interaction of genetic and environmental factors. It is characterized by abnormal insulin secretion, insulin receptor dysfunction, or post receptor events that affect metabolism of carbohydrates, proteins, and fats, as well as causing damage to the kidneys, liver, and pancreatic cells (Baynes, 1991).

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Fig. *Tinospora cordifolia* (a) Plant habit.

Anti-diabetic activity

The stem of this plant is generally used to cure diabetes by S. No. Tissue Activity

1. Aerial parts: Neuroprotective,^[25] and anti cancer effect.^[26]
2. Whole plant Anti ulcer,^[27] anti diarrhoea,^[28] antioxidant,^[29] Cardioprotective,^[30] and analgesic activity.^[31]
3. Stem Anti-dyslipidemic,^[32] anti inflammatory,^[33] anti bacterial,^[34] anti-diabetic,^[35] and anti malarial activity.^[36]
4. |Root Ameliorative effect.^[30]

Tinospora cordifolia: Biological roles

Numerous physiologically significant substances, derived from various plant components, have been identified, such as alkaloids, glycosides, steroids, sesquiterpenoid, phenolics, aliphatic compounds, and polysaccharides. These substances may be used in clinical research because of reports that they play various biological roles in various disease states.

Tinospora cordifolia extracts have a wide range of applications in herbal remedies due to their anti-inflammatory, anti-arthritic, anti-allergic, anti-microbial, anti-periodic, anti-spasmodic, and anti-microbial qualities.

Table: Active Components and Structure biological roles in Humans and Animals.

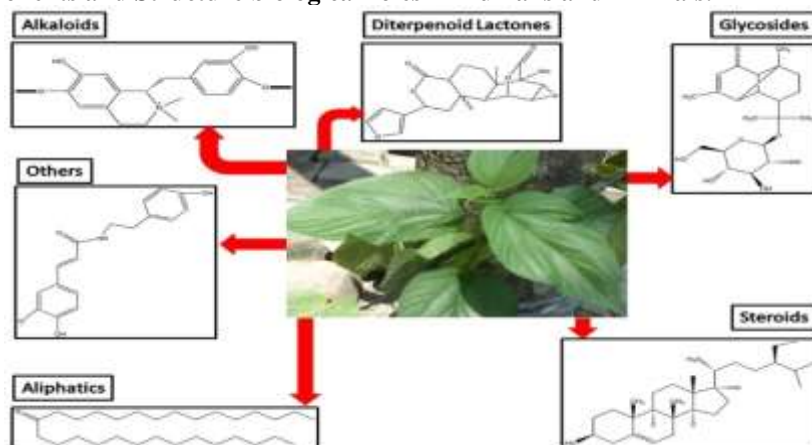


Table: Active Components and Biological roles in Humans and Animals.

Active component types	Compounds	Source	Reported biological effects in animals	In humans, cell lines	References
Alkaloids	Berberine Choline Palmatine Tambetarine Magnoflorine Tetrahydropalmatine Tinosporin Isocolumbin Tetrahydropalmatine Jatrorrhizine Aporphine alkaloids, N-formylasimilobine 2-O-β-D-glucopyranosyl-(1→2)-β-D-glucopyranoside (tinocorside A, 1) Aporphine alkaloids, N-acetyl asimilobine 2-O-β-D-glucopyranosyl-(1→2)-β-D-glucopyranoside (tinocorside B, 2)	Stem root	Isoquinoline alkaloids have anti-cataract potential in rats. Anti-oxidant activity in mice, anti-cancer in Ehrlich ascites carcinoma (EAC) mice, hypoglycemic activity in RINm5F rat insulinoma cell line	Anti-cancer, anti-viral infections, inflammation and immuno-modulatory roles. Neurological, psychiatric conditions, anti-diabetes	[8,11-18]
Glycosides	18-norclerodane glucoside Furanoid diterpene glucoside Tinocorsoside Tinocordifolioside Cordioside Palmatosides	Stem	Cytotoxic action, protection against iron-mediated lipid peroxidation of rat brain homogenate, anti-oxidant and hydroxyl radical scavenging activities in Swiss albino mice	Treats neurological disorders like ALS, Parkinson's, dementia, motor and cognitive deficits, and neuron loss in spine and hypothalamus. Immunomodulation; IgG increase and macrophage activation. Inhibits NF-κB and act as nitric oxide scavengers to show anti-cancer activities	[17-19]
Diterpenoid lactones	Furanolactone Clerodane derivatives [(5R,10R)-4R,8R-dihydroxy-2S,3R:15,16 diepoxy-cleroda-13 (16), 14-dieno-17,12S:18,1S-dilactone] Tinosporides	Whole plant	Chemopreventive potential in diethylnitrosamine (DEN) induced hepatocellular carcinoma (HCC) in rats	Vasorelaxant; relaxes Norepinephrine induced contractions. Inhibits Ca ²⁺ influx. Anti-inflammatory, anti-microbial, anti-hypertensive, anti-viral. Induce apoptosis in leukemia by activating caspase-3 and bax, inhibits bcl-2	[17-19]
Steroids	β-sitosterol hydroxy ecdysone Ecdysterone Gilonsterol	Stems aerial parts	Beta-Ecdysone shows anabolic and anti-osteoporotic effects in mammals	IgA neuropathy, glucocorticoid induced osteoporosis in early inflammatory arthritis, induce cell cycle arrest in G2/M phase and apoptosis through c-Myc suppression. Inhibits TNF-α, IL-1 β, IL-6 and COX-2. Activates NF-κB	[17-19]
Aliphatic compounds	Octacosanol Heptacosanol Nonacosan-15-one dichloromethane	Whole plant	Radiosensitizing activity in Ehrlich ascites carcinoma mice. Modulating the pro-inflammatory cytokines. Inhibits proliferation of endothelial cells and Ehrlich ascites tumor cells	Anti-nociceptive and anti-inflammatory. Protection against 5-hydroxydopamine induced parkinsonism in rats. Down regulate VEGF and inhibits TNF-α from binding to the DNA	[20-24]
Others	3, (4-di-hydroxy-3-methoxy-benzyl)-4-(4-hydroxy-3-methoxy-benzyl)-tetrahydrofuran Jatrorrhizine N-trans-feruloyl tyramine Gilon Tinosporic acid	Root whole plant	Insulin-mimicking and insulin-releasing effect. Enhanced phagocytic activity of milk polymorphonuclear cells in bovine subclinical mastitis	Protease inhibitors for HIV and drug resistant HIV. Tyramine is a neuro-modulator. Used to treat anxiety and depression by inactivating neurotransmitters	[19,25-26]

NF-κB = Nuclear factor-kappa B. VEGF = Vascular endothelial cell growth factor. TNF = Tumor necrosis factor. IL = Interleukin. COX = Cyclooxygenase. ALS = Amyotrophic Lateral Sclerosis, IgG = Immunoglobulin G, IgA = Immunoglobulin A

Cordifolia (Guduchi) Ayurvedic Pharmacology (Dravya Guna-Karma)

The biophysical, experiential, inferential, and intuitive mechanisms underlie Ayurvedic pharmacology. A substance's five modes of action, or characteristics,

determine its effect. These include rasa, which is the tongue's chemical receptors' recognition of a substance's taste. There are six distinct tastes that are described: guna (10 pairs of opposite or mirror image qualities; attribute or property of any material), sweet (madhura), sour

(amla), salty (lavana), bitter (tikta), pungent (katu), and astringent (kasāya); vipaka (intestinal digestion and tissue metabolism; ushna (hot), sheeta (cool), madhura (neutral), amla (acidic), and katu (alkaline); virya (potency) (specific action through specialized receptors). These drug-action mechanisms are all of a biophysical nature. Karma is the action pertaining to the performance or activity. It is the medication's ultimate result. T. cordifolia's characteristics, mode of action

(pharmacodynamics), and applications (indications). T. cordifolia is said to be helpful in treating leprosy, fever, asthma, anorexia, jaundice, gout, skin infections, diabetes, chronic diarrhea, and dysentery in the classical Ayurvedic texts, such as Charak, Sushruta, and Ashtang Sangraha, as well as other treatises like Bhava Prakash and Dhanvantari Nighantu, etc.

Ayurvedic properties (*dravya-guna*) of *T. cordifolia* (*Guduchi*)[5-8]

<i>Rasa</i>	<i>Guna</i>	<i>Virya</i>	<i>Vipaka</i>	<i>Prabhava</i>
<i>Tikta, Kasaya</i>	<i>Laghu, Guru, Snigdha</i>	<i>Ushna</i>	<i>Madhura</i>	<i>Vishaghna</i>
Bitter, Astringent	Light, Heavy, Unctuous	Hot potency	Neutral	Anti-toxic

Rasa: Taste appreciation of the substances by chemical receptors on tongue; sweet, sour, salt, bitter, pungent and astringent, Guna: Ten pairs of opposite or mirror image attributes; attribute or property of any substance, Virya: potency; ushna- hot, sheeta- cold, Vipaka: Intestinal digestion and tissue metabolism; madhura- neutral, amlaacidic, katu- alkaline, Prabhava: Specific action through specialized receptors

Active constituent

- 1) Terpenoids: Tinosporide, Furanolactone diterpene, Furanolactone clerodane diterpene, furanoid diterpene, Tinosporaside, ecdysterone makisterone and several glucosides isolated as poly acetate, phenylpropene disaccharides cordifolioside A, B and C, cordifolioside D and E, Tinocordioside, cordioside, palmatosides C and F, Sesquiterpene glucoside tinocordifolioside, Sesquiterpene tinocordifolin.
- 2) Alkaloid: Tinosporine, (S), Magnoflorine, (S), Berberine, (S), Choline, (S), Jatrorrhizine, (S), 1,2-Substituted pyrrolidine(S), Alkaloids, viz. jatrorrhizine, palmatine, beberine, tembeterine, choline.
- 3) Lignans:
- 4) Steroids:
- 5) Others: 4-dihydroxy-3-methoxybenzyl)-4-(4-hydroxy-3-methoxybenzyl), (S), (S), 20a-Giloinsterol, (S), B-Sitosterol Hydroxy ecdysone, (S). Giloin, Tinosporan acetate, Tinosporal acetate, Tinosporidine, Heptacosanol, Octacosanol, sinapic acid, Tinosponone, two phytoecdysones an immunologically active arabinogalactan.

Classification

Taxonomical Classification.

1. Kingdom----->Plantae
2. Division----->Magnoliophyt
3. Class----->Magnoliopsida
4. Order----->Ranunculales
5. Family----->Menispermaceae

6. Genus----->Tinospora
7. Species----->T. cardifolia.

Vernacular names

Languages. Vernacular names

English. Tinospora

Punjab. Gilo

Oriya. Guluchi

Marathi. Gulvel

Kashmiri. Amrita, Gilo

Bengali. Gulancha

Sanskrit. Chakralakshanika

Hindi. Gurcha

Gujarati. Garo, Galac

Uses & Effectiveness Possibly Effective for Allergies (hay fever). A particular extract of *Tinospora cordifolia* (Tinofend, Verdure Sciences) seems to significantly decrease sneezing and nasal itching, discharge, and stuffy nose after about 2 months of treatment.

Insufficient Evidence to Rate Effectiveness for.

Diabetes.

High cholesterol.

Upset stomach.

Gout.

Cancer, including lymphoma.

Rheumatoid arthritis.

Liver disease.

Stomach ulcer.

Fever.

Gonorrhea.

Reverse Pharmacological and Clinical correlates

Reverse pharmacology will eventually need to incorporate modern high-throughput screening, combinatorial chemistry, and the effects of novel or ancient compounds/plants on human gene expression and proteomics in India's contributions to the therapeutic revolution.

To validate the effects of *T. cordifolia*, a great deal of research has been conducted; some of these studies are described in this section.

For millennia, Ayurvedic formulations containing *T. cordifolia* have been used to treat a wide range of illnesses. As a rasayana, it strengthens the body's defenses against illnesses and the immune system. The Ayurvedic Pharmacopoeia of India lists the stem as acceptable for use in medicine, however the entire plant is used medicinally. This is because the stems contain more alkaloids than the leaves do. There is a traditional notion that the Guduchi plant is the source of Guduchi satva.

Dose and Administration mode

The recommended oral dosage for Guduchi is 3–6 gm of powder.⁴⁴ Security and Harm When Guduchi aerial parts were given orally to Swiss mice at doses of 2, 4, 6, and 8 gm/kg body weight whole-plant powder and 3, 5, 7, and 9 mL/kg decoction, there was no change in body weight, food or water consumption, or mortality seen.⁴⁵ Rats given an aqueous extract of Guduchi up to 800 mg/kg did not exhibit any toxicity. ²¹ There were no signs of toxicity following a single oral dosage of 150 mg/kg body weight of Guduchi's aqueous extract.⁴⁶ Rats given aqueous and alcoholic extracts of the complete Guduchi plant showed no negative effects and no death.

Methods

A prospective, double-blind, randomized controlled study involving 50 patients that lasted more than 18 months. Using the Pecoraro-Reiber approach, the ulcer was categorized based on its form and severity using the Wound Severity Score. In addition to taking swabs for culture, the mean ulcer area, depth, and perimeter were measured. To measure polymorphonuclear% phagocytosis (PMN function by Lehrer-Cline C. albicans technique), blood was drawn. Debridement, medical therapy, glucose management, and wound care were all optimized. The parameters were reviewed after four weeks. At three months, the PMN function was examined. Some of the important components of *Tinospora cordifolia* are found in *T. cardifolia*.

CONCLUSION

Possible advantages for issues, highlighting their superiority over synthetics because of less adverse effects. It draws attention to the significance of herbal remedies, their mode of action, and their anticoagulant properties. The review discusses a variety of bioactive substances that are present in different plants and demonstrates their potential for prevention. The overall objective is to present a thorough overview of the topic and document the impacts of natural. This review could be helpful from the standpoint of future research.^[14,2]

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