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A review on *Tinospora cordifolia* potential uses and its nutritional composition

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Abstract
This review focussed on potential uses of *Tinospora cordifolia* and its nutritional composition. Natural products with therapeutic value are increasingly being studied in clinical trials due to their superior pharmacological response and lack of adverse effects as compared to allopathic medications. *Tinospora cordifolia*, often known as "Guduchi" or "Giloy," is well-known in old Ayurveda literature for its use in the treatment of numerous ailments. The active components collected from the plant, as well as their biological function in illness prevention, have led to people's curiosity. This overview includes the plant's venicular nomenclature, its components, and their use in illness treatment. Giloy is a vital herb for the treatment of a variety of ailments.

Keywords: Therapeutic, pharmacological, *Tinospora cordifolia*, ayurveda, active components, biological, nutritional, potential

1. Introduction
Tinospora cordifolia, often known as Guduchi or Giloy, is a huge climbing shrub with greenish-yellowish flowers that grows at higher altitudes and is genetically varied. It is a Menispermaceae family herbaceous vine native to the tropical parts of the Indian Subcontinent. For generations, it has been used in traditional and ayurvedic medicine to treat a variety of ailments (Modi *et al*., 2021) [2]. According to (Tiwari *et al*., 2018) [3, 11], this herbaceous deciduous plant reaches a height of 3–4 feet and a width of 1 foot. The stems are succulent, and long, filiform, fleshy aerial roots form the branches. The bark is wet and grey-brown. The leaves are cordate and membranous. The flowers are tiny and yellowish green in colour. This herb can be seen growing to a height of 300 metres in tropical Asia. It grows in a variety of soils, from acidic to alkaline, and only needs a tiny quantity of moisture to thrive. The giloy plant is found throughout tropical India and can be found at elevations of 1000 feet in South Asia, Indonesia, the Philippines, Thailand, Myanmar, China, and Sri Lanka (Modi *et al*.,2021) [2].
Male flowers are crowded in racemes panicles, whereas female flowers are solitary. Summers and winters extend the blossoming season. Alkaloids, steroids, diterpenoid lactones, aliphatics, and glycosides, among other active components obtained from the plant, have been isolated from various portions of the plant, including the root, stem, leaves, and whole plant. Nowadays, the plant is more important for research and the preparation of various dosage forms. due to its anti-diabetic, anti-periodic, anti-spasmodic, anti-inflammatory, anti-arthritic, antioxidant, anti-allergic, anti-stress, anti-leprotic, anti-malarial, hepatoprotective, immune-modulatory, and anti-neoplastic effects. *Tinospora cordifolia* has several chemical components that may have an impact on the body. Some of these chemical compounds have antioxidant properties, while others may boost the immune system's activity. Certain compounds appeared to have anti-cancer activity in test animals. The majority of the research has been conducted in test tubes or on animals. The medical properties and nutritional composition of the giloy plant in various parts like stems and leaves will be focussed in this review.

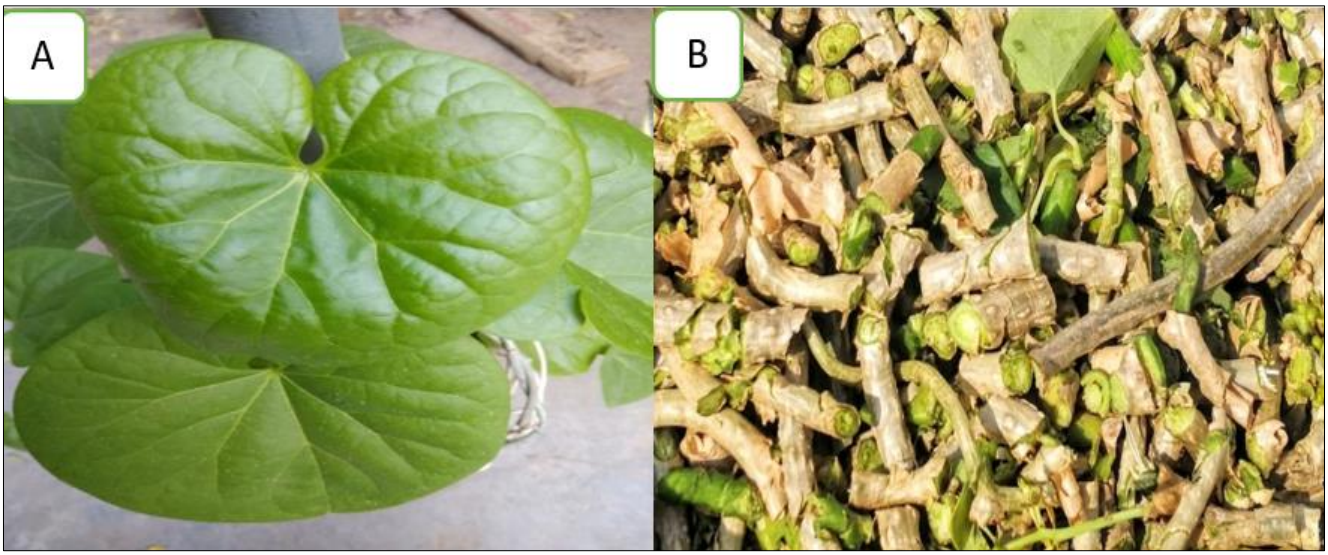

Fig 1: (A) Giloy leaves; (B) Giloy stems

2. Active constituents of the giloy

The active constituents of the giloy plant can be extracted from many portions of the plant, such as the leaves, stems, and roots (Table 1)

Table 1: Active constituents of *Tinospora cordifolia*

S. No.	Type of active component	Source	Compounds	Biological response	References
1.	Alkaloids	Root, stem	Berberine, Choline, Palmatine, Tembetarine, Magnoflorine, Tinosporin, and Isocolumbin	Anticancer, Antiviral infections, Neurological Disorders, and Diabetes	Saxena and Rawat *et al*., 2019 [1, 9]
2.	Steroids	Stem aerial parts	Beta-Sitosterol	Induce osteoporosis in patients with early inflammatory arthritis	Arshad *et al*., 2018 [23]
3.	Glycosides	Stem	Tinocordiside, Cordioside	Treats Parkinson's Disease and Other Neurological Disorders	Arshad *et al*., 2018 [23]
4.	Aliphatic compound	Whole plant	Octacosanol	Anti-inflammatory and anti-nociceptive	Khan *et al*., 2016 [24]
5.	Diterpenoid	Whole plant	Furanolactone	Anti-inflammatory, Antimicrobial, Antihypertensive, Antiviral, Vasorelaxants	Saxena and Rawat *et al*., 2019 [1, 9]
6.	Others	Root	Giloin, Tinosporic acid	Used to treat anxiety. HIV protease inhibitors	Promila *et al*., 2017 [25]

Table 2: Different names in Indian languages

S. No	Name	Language
1.	Telugu	Teepa-teega
2.	Hindi	Giloy
3.	English	Tinospora
4.	Sanskrit	Amrita
5.	Punjabi	Gllow
6.	Bengali	Golancha
7.	Gujarati	Gulvel
8.	Odia	Guluchi
9.	Malayalam	Amruthu
10.	Urdu	Gilo

3. Nutritional composition of *Tinospora cordifolia*

Tinospora cordifolia is a useful herb since it contains a significant number of various minerals. Along with all of the other macronutrients, several minerals and vitamins are present. According to them (Modi *et al*., 2021) [2]. *Tinospora cordifolia* stems normally contain a lot of protein (4.5–11.2%), a lot of carbs (20.78%), a little fat (6.68%), and a lot of fibre (39.26 percent). It has a 156.44 kcal per 100 gramme nutritional value. The list consists of some of them.

Table 3: Nutritional composition of *Tinospora cordifolia*

Nutrients	Amount	References
Proximate analysis		
Moisture content (%)	23.11	Modi *et al.* (2021) [2]
Ash content (%)	6.86	
Carbohydrates (%)	20.78	
Protein (%)	4.5-11.2	
Fat (%)	6.68	
Fiber (%)	39.26	
Energy (kcal/100gms)		
Minerals		
Potassium (%)	0.845	Khan *et al.* (2011) [4]; Nile & Khobragade (2009).
Calcium (%)	0.131	
Iron (%)	0.28	
Chromium (%)	0.006	
Copper (mg/100gms)	0.81	
Zinc (mg/100gms)	3.3	
Iodine (mg/100gms)	72.4	
Sodium (mg/100gms)	39.32	
Magnesium (mg/100gms)	67.57	
Vitamins		
Ascorbic acid (µg/gm)	0.24	Khan *et al.* (2011) [4]
Niacin (mg/100gms)	0.7	
Tocopherol (mg/100gms)	0.7	
β-carotene	0.11	

4. Pharmacological properties of *Tinospora cordifolia*

Tinospora cordifolia has been the most extensively used plant in traditional medicine for its spasmolytic, allergen-free, and anti-diabetic characteristics since ancient times. The plant has a significant effect on the immune system and a number of useful properties. The stem is utilised as a bitter stomachic and diuretic, while the root is used for stress relief and antimalarial properties. It helps with biliary secretion, blood enrichment, and jaundice treatment (Tiwari *et al*., 2018) [3, 11]. Guduchi is a drug that has undergone significant research to determine its therapeutic potential. It has been shown to have beneficial effects on a range of systems throughout the body. According to Ayurveda, it's a rasayana with an all-encompassing impact (Kavya *et al*., 2015) [5, 21].

4.1 Anti-oxidant activity

In methanol, ethanol, and water extracts, *Tinospora cordifolia* extracts were found to have excellent antioxidant activity. The extracts' high antioxidant activity suggest that the stem could be a source of natural antioxidants or nutraceuticals that can aid to reduce oxidative stress and provide health benefits (Srivastava and Singh, 2021) [6, 14]. There has been evidence of antioxidant activity as well as a reduction in the toxicity caused by cyclophosphamide. In ducks, it has an antiaflatoxicosis action (Sinha *et al*., 2004) [7]. We calculated the total flavanol and total phenolic content. Superoxide anion scavenging assay, hydroxyl radical scavenging assay, DPPH radical scavenging, and the ABTS radical scavenging method are all examples of mechanisms that alter antioxidant activity (Bharath *et al*., 2021) [19].

4.2 Anti-diabetic activity

Anti-diabetic activities are attributed to tannins, cardiac glycosides, flavonoids, saponins, alkaloids such as magnoflorine, palmetine, and jatrorrhizine, and other substances. When rats were given an aqueous extract lacking *Tinospora cordifolia* extract, glucose levels rose 21.3 percent, insulin levels rose 51.5 percent, triglycerides rose 54.12%, and the glucose insulin index rose 59.8%. (Sharma *et al*., 2019). Giloy is a hypoglycaemic medication that helps in diabetes treatment, particularly Type 2 diabetes. It also aids in the reduction of blood sugar levels. It is thought to have anti-diabetic characteristics via lowering oxidative stress (OS), boosting insulin secretion, and suppressing gluconeogenesis and glycogenolysis, all of which aid in blood glucose regulation. Alkaloids, tannins, cardiac glycosides, flavonoids, saponins, and steroids found in *Tinospora cordifolia* have been proven to have anti-diabetic activities (Saxena *et al*., 2019) [1, 9]. As a result of gestational diabetes, GSH levels and other reactive species can rise, providing a risk to both the mother and the foetus. *Tinospora cordifolia* was introduced to the daily diet of a diabetic pregnant rat (streptozotocin-induced diabetes) and showed a protective effect by lowering the oxidative load, preventing illnesses and birth abnormalities (Patel *et al*., 2011) [17].

4.3 Hepatoprotective activity

In numerous parts, *Tinospora cordifolia* has been proven to have hepatoprotective qualities. *Tinospora cordifolia's* hepatoprotective properties could be due to a multitude of factors, such as its ability to accelerate liver regeneration and antioxidant or free radical scavenging properties (Tiwari *et al*., 2018) [3, 11]. In numerous parts, *Tinospora cordifolia* has been proven to have hepatoprotective qualities. *Tinospora cordifolia's* hepatoprotective properties could be due to a multitude of factors, such as its ability to accelerate liver regeneration and antioxidant or free radical scavenging properties (Baghel *et al*., 2017) [12].

4.4 Immunomodulatory activity

Tinospora cordifolia has long been known for its immunomodulatory properties, which have been well established by scientists. Only a few of the substances with immunomodulatory and cytotoxic effects are 11-hydroxy muskatone, Magnoflorine, Cordifolioside A, Tinocordioside, and syringin (Mittal *et al*., 2014) [13]. A deadly disease struck

human life a few months ago and spread like wildfire. The only way to be safe and healthy was to build high immunity and avoid getting the virus, people were informed. In order to avoid coronavirus infection and sickness, a robust immune system is required. Giloy is a fully natural drug with no side effects because it is known as the "ultimate immune booster" and contains antioxidants that help to detoxify the body and stimulate immunity. Giloy is a completely natural medicine that has no negative side effects in healthy persons (Srivastava and Singh, 2021) [6, 14]. *Tinospora cordifolia's* stem alters the levels of enzymes like catalase and activates lymphocyte cells to preserve immunological vigour, demonstrating the shrub's immuno-protective value. When macrophage cells are exposed to *Tinospora cordifolia* extract, more enzymes are produced, including myeloperoxidase, which improves antimicrobial activity and protects immunity. It does, however, increase macrophage phagocytic activity. Preclinical testing of alkaloids, steroids, aliphatic compounds, and other Guduchi chemicals in a rat model revealed significant immunoprotective activity (Tiwari *et al*., 2018) [3, 11].

5. Potential health benefits of *Tinospora cordifolia*

According to evidence from Ayurveda and ethnobotanical studies, *Tinospora cordifolia* offers a wide range of medicinal applications. *Tinospora cordifolia* extracts such as aqueous, alcohol, methanol, chloroform, ethanol, acetone, and others are extensively used in pharmacological, preclinical, and clinical studies (Choudhary *et al*., 2013) [15]. *Tinospora cordifolia* stem has been shown to be useful in the treatment of cancer, high blood pressure, cardiovascular disease, and other health problems. Some of the qualities of this miraculous herb, such as anti-cancer, hepatoprotective, cardioprotective, and analgesic, are described below, along with beneficial plant parts and extracts for the specific health benefit.

Table 4: Show the plan extract health benefits

Plant extract/part	Health benefits	References
Whole plant/ Aqueous extract	Improves immunity	Sharma *et al*. (2012) Srivastava and Singh (2021) [6, 14]
Stem/ Aqueous alcohol extract	Prevents cancer	Modi *et al*. (2021) [2]
Stem/ Aqueous extract	Anti-inflammatory effect	Bharath *et al*. (2020) [19]
Whole plant/ Aqueous extract	Treats liver infection	Akhtar *et al*. (2010)
Stem/ Aqueous extract	Prevents diabetes	Patel *et al*. (2011) [17] Modi *et al*. (2021) [2]
Whole plant/ Aqueous extract	Strengthens heart and improves heart health	Cicero *et al*. (2016) [18] Gupta *et al*. (2012)
Whole plant/ ethanol extract	Protects against oxidative damage	Bharath Raj *et al*. (2020) [19] Cicero *et al*. (2016) [18]

6. Conventional usage of *Tinospora cordifolia*

Tinospora cordifolia is a common herb in Ayurvedic medicine, and it has long been used as a therapeutic herb by people and tribes for a range of diseases. In Ayurveda, it offers a variety of medicinal properties, including energizing, immune-boosting, antirheumatic, and cleaning properties. The medicinal properties of *Tinospora cordifolia* are now utilized in modern medicine to treat cold and flu prevention, skin problems, liver disorders, immunological support, gout, arthritis, and, more recently, to fight chemotherapy side effects (Sharma *et al*., 2020) [20]. *Tinospora cordifolia* is used to treat a variety of ailments. Its whole plant, powdered root and stem bark, decoction of roots and stems, juice of the root, juice or paste of the leaves and stems are all used to treat various ailments. Chronic fever, jaundice, diarrhea, cough, asthma, leucorrhea, skin illnesses, fractures, eye difficulties, deadly insect bites, and venomous snake bites are just a few examples (Devprakash *et al*., 2011) [22]. Jaundice, intestinal worms, and vermifuge are all treated with *Tinospora cordifolia* stem extract. Rheumatism and jaundice are treated with dried fruit and ghee or honey (Bharath *et al*., 2020) [19]. The National Ayurveda Dietetics Research Institute (Bangalore), which conducts local health traditional survey excursions in several districts of Karnataka, India, collected many usage of Guduchi. Some traditional healers in Karnataka's Davanagere area claim to use Guduchi decoction orally to treat hyperacidity, indigestion, and leucorrhoea (Kavya *et al*., 2015) [5, 21].

7. Conclusion

A plant that performs various functions is a valuable resource for all life forms. Alkaloids, glycosides, lactones, and steroids are among the active chemicals found in plant extracts. All of these active chemicals have distinct types of immune-modulatory and physiological functions, illustrating the plant's diversity. Studies must be carried out to see how active substances interact with living systems and impact structure-function relationships. *Tinospora cordifolia* is a South Asian traditional medicinal herb with a wide range of biological activities and is mostly used as a therapeutic drug. The whole plant, stem, powdered root and stem bark, decoction of aerial root and stem, juice of the root, and juice or paste of the leaves of this crucial drug have traditionally been used to cure fever, jaundice, diarrhoea, dysentery, general debility, and other ailments. Ayurvedic manuscripts on its pharmacological properties include evidence that this drug has significant potential in current pharmacology. Overall, this review reveals antidiabetic, anticancer, immunomodulator and antioxidant properties of *Tinospora cordifolia*, which can be used to further medication research and development.

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