

**REVIEW ON GULVEL AS AN ANTIOXIDANT****Yash K. Chajed<sup>1\*</sup>, Shravan J. Somani<sup>2</sup> and Dr. Mahesh R. Sherkar<sup>3</sup>**<sup>1</sup>Student of Pratibhatai Pawar College of Pharmacy, Shrirampur.<sup>2</sup>Asst. Professor, Dept of Pharmaceutics, Pratibhatai Pawar College of Pharmacy, Shrirampur.<sup>3</sup>Professor, Dept. of Pharmaceutics, Pratibhatai Pawar College of Pharmacy, Shrirampur.

Article Received on: 03/02/2025

Article Revised on: 23/02/2025

Article Accepted on: 13/03/2025

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**ABSTRACT**

Gulvel (*Tephrosia purpurea*), a traditional medicinal plant, has garnered significant attention for its potential therapeutic applications. This review paper delves into the antioxidant properties of Gulvel and its various constituents. Gulvel (commonly known as *Tinospora cordifolia*), a medicinal plant widely recognized in traditional Ayurvedic practices, has garnered increasing attention for its potential therapeutic properties, including its antioxidant activity. This review synthesizes existing research on the antioxidant properties of Gulvel, highlighting its bioactive compounds, mechanisms of action, and potential health benefits. Various studies have demonstrated that Gulvel's chemical constituents, such as alkaloids, flavonoids, and terpenoids, possess significant free radical-scavenging activity, contributing to cellular protection against oxidative stress. These antioxidants are believed to mitigate the damage caused by reactive oxygen species (ROS), which is implicated in the pathogenesis of numerous chronic diseases, including cancer, cardiovascular diseases, and neurodegenerative disorders. Furthermore, the plant's ability to modulate antioxidant enzymes and enhance cellular defense mechanisms suggests a multifaceted approach to combat oxidative damage. This review also explores the pharmacological potential of Gulvel as a complementary therapeutic agent for oxidative stress-related conditions, discussing both in vitro and in vivo studies, along with the challenges in translating these findings to clinical applications. Overall, Gulvel's antioxidant properties position it as a promising candidate for future research and therapeutic development in the realm of oxidative stress management.

**INTRODUCTION**

In recent years, there has been a growing interest in the potential health benefits of natural antioxidants, particularly from medicinal plants. One such plant that has garnered attention for its antioxidant properties is *Tinospora cordifolia*, commonly known as *Gulvel* in Ayurvedic medicine. Traditionally, *Gulvel* has been used for a variety of therapeutic purposes, including boosting immunity, enhancing vitality, and managing metabolic disorders. Recent scientific studies have further elucidated its role as a potent antioxidant, helping to neutralize harmful free radicals in the body, which are implicated in the development of numerous chronic diseases, including cancer, cardiovascular diseases, and neurodegenerative disorders.

The antioxidant activity of *Gulvel* is attributed to its rich phytochemical composition, which includes alkaloids, flavonoids, phenolic compounds, and polysaccharides. These bioactive compounds have demonstrated significant free radical scavenging ability, contributing to cellular protection and overall health improvement. Given the rising incidence of oxidative stress-related diseases, exploring natural antioxidant sources like *Gulvel* is becoming increasingly relevant in the context of

both preventive and therapeutic medicine.

This review aims to consolidate the current research on *Gulvel* as an antioxidant, evaluating its mechanisms of action, bioactive compounds responsible for its activity, and potential therapeutic applications. Furthermore, it seeks to highlight the gaps in research and suggest future directions for investigating *Gulvel's* role in combating oxidative stress and promoting human health.

Oxidative stress, caused by an imbalance between the production of reactive oxygen species (ROS) and the body's ability to neutralize them, is a key factor in the pathogenesis of various chronic diseases, including cancer, cardiovascular diseases, diabetes, and neurodegenerative conditions. As the world grapples with the increasing prevalence of these health challenges, the exploration of natural antioxidants has gained significant attention. Among the numerous plant-based antioxidants, *Tinospora cordifolia*, commonly known as *Gulvel* or *Giloy*, stands out for its traditional use in Ayurvedic medicine and its promising potential as a therapeutic agent against oxidative stress-related diseases.

*Gulvel* is a climbing shrub native to India and other parts of Southeast Asia. In Ayurvedic practice, it has long been revered for its ability to enhance immunity, alleviate fever, improve digestion, and promote overall health. More recently, scientific investigations have begun to uncover the molecular mechanisms behind its antioxidant properties, which are largely attributed to its diverse array of bioactive compounds, such as alkaloids, flavonoids, glycosides, and phenolic acids. These compounds are known to possess potent free radical scavenging activities, making *Gulvel* a valuable candidate for combating oxidative stress.

The growing body of research suggests that *Gulvel*'s antioxidant effects extend beyond simple free radical scavenging. It has been shown to modulate important cellular pathways, enhance endogenous antioxidant enzyme activities, and reduce oxidative damage to lipids, proteins, and DNA. Additionally, its ability to regulate inflammation and promote cellular repair further enhances its therapeutic potential in mitigating the adverse effects of oxidative stress.

Despite its promising properties, much of the research on *Gulvel* remains preliminary, and there is a need for more rigorous clinical studies to establish its efficacy and safety for human use. This review aims to critically examine the available scientific literature on the antioxidant activity of *Gulvel*, focusing on its chemical composition, mechanisms of action, and the evidence supporting its use in both traditional and modern medicinal contexts. Moreover, it highlights the gaps in current knowledge and suggests future directions for research that could pave the way for the development of *Gulvel*-based natural therapies for oxidative stress-related diseases. By synthesizing the existing findings, this review seeks to provide a comprehensive understanding of *Gulvel* as a potent natural antioxidant and its potential applications in promoting human health.

In recent decades, the increasing prevalence of oxidative stress-related disorders has prompted a surge in research aimed at identifying natural antioxidants capable of mitigating the harmful effects of reactive oxygen species (ROS) and free radicals. Oxidative stress is closely linked to a variety of chronic diseases, including cardiovascular diseases, cancer, diabetes, and neurodegenerative disorders like Alzheimer's and Parkinson's disease. In this context, medicinal plants have emerged as promising sources of bioactive compounds with antioxidant properties, offering a natural and effective means of combating oxidative damage and promoting overall health.

Among the plants gaining significant attention for their antioxidant potential is *Tinospora cordifolia*, known as *Gulvel*, a herbaceous vine traditionally used in Ayurvedic medicine for its wide range of therapeutic benefits. *Gulvel* is valued for its immune-boosting, anti-inflammatory, and antipyretic effects, and it is also

regarded as a rejuvenative tonic that promotes vitality and longevity. In recent years, scientific studies have begun to validate these traditional uses, particularly its antioxidant activity, which is increasingly recognized as a key mechanism behind its health benefits. The rich phytochemical composition of *Gulvel*, which includes alkaloids, glycosides, flavonoids, and phenolic compounds, is believed to be responsible for its strong free radical-scavenging properties, making it a promising candidate for the prevention and management of oxidative stress-related diseases.

Research indicates that *Gulvel* not only neutralizes free radicals but also plays a significant role in modulating key cellular pathways involved in oxidative damage. It enhances the activity of endogenous antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx), which act as the body's first line of defense against oxidative damage. Furthermore, *Gulvel* has shown potential in reducing lipid peroxidation, preventing DNA damage, and protecting proteins from oxidative degradation. Beyond its direct antioxidant action, studies suggest that *Gulvel* also possesses anti-inflammatory, immunomodulatory, and neuroprotective effects, further reinforcing its therapeutic value.

Despite the growing body of evidence supporting its antioxidant properties, there remains a need for further clinical and preclinical studies to fully elucidate the mechanisms through which *Gulvel* exerts its effects, as well as to confirm its safety and efficacy in human populations. The current literature is promising, but many questions regarding optimal dosage, bioavailability, and long-term therapeutic use remain unanswered. This review seeks to compile and critically assess the latest findings on the antioxidant activity of *Gulvel*, exploring the specific bioactive compounds responsible for its effects, the molecular mechanisms involved, and its potential applications in the treatment of oxidative stress-related diseases. Additionally, we will examine the challenges and limitations of current research and suggest potential areas for future investigation to fully realize the medicinal potential of *Gulvel* as an antioxidant.

By providing a comprehensive overview of the scientific evidence, this review aims to contribute to the growing interest in *Gulvel* as a natural antioxidant, paving the way for its potential incorporation into modern therapeutic strategies for the prevention and management of oxidative stress-induced diseases.

**Rich in Phytochemicals:** *Gulvel* is a treasure trove of phytochemicals, including flavonoids, terpenoids, and alkaloids, which are renowned for their potent antioxidant activities.

**Free Radical Scavenging:** Studies have demonstrated the ability of *Gulvel* extracts and isolated compounds to

effectively scavenge reactive oxygen species (ROS) such as superoxide radicals, hydroxyl radicals, and hydrogen peroxide.

**Antioxidant Enzyme Modulation:** Gulvel has been shown to modulate the activity of crucial antioxidant enzymes, including superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx), thereby enhancing the body's intrinsic antioxidant defense mechanisms.

**Cellular Protection:** The antioxidant properties of Gulvel contribute to its cytoprotective effects. Studies have shown that Gulvel extracts can protect cells from oxidative damage induced by various stressors, including heavy metals, radiation, and inflammatory mediators.

Gulvel (*Tephrosia purpurea*), a widely distributed medicinal plant, has been traditionally employed in various ethnomedicinal systems for the treatment of diverse ailments. This review comprehensively examines the accumulating evidence supporting the potent antioxidant properties of Gulvel.

#### What is mean by antioxidant?

An antioxidant is a substance that protects cells from damage caused by free radicals, which are unstable molecules produced by the body's metabolism. Free radicals can damage cells and DNA, which can lead to chronic illnesses like cancer, heart disease, and stroke.

An antioxidant is a molecule that checks the oxidation of other molecules. Oxidation is the chemical reaction involving the loss of electrons or a growth in oxidation condition. Oxidation reactions can produce free radicals. In turn, these radicals will start chain reactions. Once the chain reaction occurs inside a cell, it could cause damage or death towards cell. Antioxidants discourage these chain tendencies by removing free radical intermediates, and also inhibit other oxidation tendencies.

**Antioxidants** are compounds that inhibit oxidation (usually occurring as autooxidation), a chemical reaction that can produce free radicals. Autooxidation leads to degradation of organic compounds, including living matter. Antioxidants are frequently added to industrial products, such as polymers, fuels, and lubricants, to extend their usable lifetimes.<sup>[1]</sup> Foods are also treated with antioxidants to forestall spoilage, in particular the rancidification of oils and fats. In cells, antioxidants such as glutathione, mycothiol, or bacillithiol, and enzyme systems like superoxide dismutase, can prevent damage from oxidative stress.

Known dietary antioxidants are vitamins A, C, and E, but the term *antioxidant* has also been applied to numerous other dietary compounds that only have antioxidant properties in vitro, with little evidence for antioxidant properties in vivo. Dietary supplements marketed as antioxidants have not been shown to maintain health or

prevent disease in humans.

#### Literature Review

**1 Rao et al. (2011):** In their studies author demonstrate that investigated the antioxidant properties of *Gulvel* and its potential to counteract oxidative stress. The authors emphasized the plant's rich phytochemical composition, including alkaloids, flavonoids, terpenoids, glycosides, and phenolic compounds, all of which contribute to its antioxidant effects. These bioactive compounds are known for their ability to scavenge free radicals and prevent oxidative damage at the cellular level. The study noted that *Gulvel's* extract exhibited a significant free radical scavenging ability, which was attributed to the presence of polyphenolic compounds, particularly flavonoids.

In vitro experiments conducted by **Rao et al. (2011)** demonstrated that *Gulvel* extracts possess considerable antioxidant activity. The study used various models to measure antioxidant potential, including the DPPH (2,2-diphenyl-1-picrylhydrazyl) assay, hydroxyl radical scavenging assay, and superoxide anion radical scavenging assay. Results indicated that *Gulvel* significantly scavenged free radicals, including DPPH, superoxide anion, and hydroxyl radicals, which are key contributors to oxidative stress.

**2 Nadkarni et al. (2013):** In their studies author demonstrate that Oxidative stress, caused by the accumulation of reactive oxygen species (ROS), is a significant factor in the pathogenesis of several chronic diseases, including cardiovascular diseases, diabetes, cancer, and neurodegenerative disorders. Antioxidants help to neutralize ROS, preventing cellular damage. *Tinospora cordifolia*, commonly known as *Gulvel*, is a plant widely recognized for its therapeutic potential in traditional medicine. Known for its immunomodulatory, anti-inflammatory, and antipyretic effects, *Gulvel* has increasingly attracted scientific attention for its antioxidant properties. The study by **Nadkarni et al. (2013)** is an important contribution to understanding the antioxidant potential of *Gulvel* and its bioactive components. This literature review focuses on the findings of Nadkarni et al. (2013) and their investigation into *Gulvel's* antioxidant activity.

Oxidative stress, caused by the accumulation of reactive oxygen species (ROS), is a significant factor in the pathogenesis of several chronic diseases, including cardiovascular diseases, diabetes, cancer, and neurodegenerative disorders. Antioxidants help to neutralize ROS, preventing cellular damage. *Tinospora cordifolia*, commonly known as *Gulvel*, is a plant widely recognized for its therapeutic potential in traditional medicine. Known for its immunomodulatory, anti-inflammatory, and antipyretic effects, *Gulvel* has increasingly attracted scientific attention for its antioxidant properties. The study by **Nadkarni et al. (2013)** is an important contribution to understanding the

antioxidant potential of *Gulvel* and its bioactive components. This literature review focuses on the findings of Nadkarni et al. (2013) and their investigation into *Gulvel*'s antioxidant activity.

In their study, Nadkarni et al. (2013) highlighted that the presence of these phytochemicals in *Gulvel* allowed it to effectively scavenge free radicals and neutralize oxidative stress. The research indicated that *Gulvel* possesses significant free radical scavenging potential, which was comparable to well-known synthetic antioxidants, such as butylated hydroxyanisole (BHA). This suggests that *Gulvel* can be considered a natural alternative to synthetic antioxidants, providing a safer and more sustainable option for mitigating oxidative damage.

**3 Sharma et al. (2014):** In their studies author demonstrate that Oxidative stress, resulting from an imbalance between the production of reactive oxygen species (ROS) and the body's ability to neutralize them, is implicated in the pathogenesis of various diseases, including cancer, diabetes, cardiovascular diseases, and neurodegenerative disorders. Antioxidants play a crucial role in protecting cells from ROS-induced damage. *Tinospora cordifolia* (*Gulvel*), a well-known medicinal plant in traditional Ayurvedic medicine, has been studied for its therapeutic potential, including its antioxidant properties. In their 2014 study, Sharma et al. investigated the antioxidant activity of *Gulvel*, evaluating its ability to mitigate oxidative stress and protect against cellular damage. This review focuses on the findings of Sharma et al. (2014) and highlights the antioxidant properties of *Gulvel*.

The antioxidant potential of *Gulvel* is attributed to its rich phytochemical profile. Sharma et al. (2014) identified several bioactive compounds in *Gulvel*, including alkaloids, flavonoids, terpenoids, glycosides, and phenolic acids. Among these, flavonoids and polyphenolic compounds such as tinosporin, tinosporide, and berberine are particularly significant for their antioxidant activity. These compounds possess the ability to scavenge free radicals and reduce oxidative damage in cells.

The study by Sharma et al. (2014) demonstrated that *Gulvel* extracts exhibit strong antioxidant properties, which were comparable to those of synthetic antioxidants. By testing various concentrations of *Gulvel* extracts, the researchers found that the plant had a dose-dependent effect, with higher concentrations showing more pronounced antioxidant activity. This finding suggests that *Gulvel* could be a potential natural alternative to synthetic antioxidants in preventing oxidative stress-related diseases.

**4 Singh et al. (2017):** In their studies author demonstrate that Oxidative stress, caused by the overproduction of reactive oxygen species (ROS), is linked to a variety of

chronic diseases, including neurodegenerative disorders, cancer, cardiovascular diseases, and diabetes.

Antioxidants, which neutralize ROS, are essential in maintaining cellular health and preventing oxidative damage. *Tinospora cordifolia* (*Gulvel*), a plant widely used in traditional medicine, has garnered attention for its potential antioxidant properties. The study by Singh et al. (2017) investigates the antioxidant activity of *Gulvel* and its possible therapeutic implications. This review highlights the key findings of Singh et al. (2017) and evaluates *Gulvel*'s antioxidant potential.

**Phytochemical Composition of *Gulvel*:** *Tinospora cordifolia* contains a variety of bioactive compounds, which contribute to its antioxidant properties. According to Singh et al. (2017), the plant is rich in alkaloids, flavonoids, terpenoids, glycosides, and phenolic compounds. These compounds have been shown to possess strong antioxidant activity, primarily due to their ability to scavenge free radicals and inhibit oxidative damage. Notably, flavonoids and polyphenolic compounds like tinosporin and berberine were highlighted as key contributors to the antioxidant effects of *Gulvel*. These compounds have been identified in various studies as potent free radical scavengers and inhibitors of lipid peroxidation, making *Gulvel* a promising natural source of antioxidants.

#### In Vitro Antioxidant Activity

Singh et al. (2017) assessed the antioxidant potential of *Gulvel* through several in vitro assays, including the DPPH (2, 2-diphenyl-1-picrylhydrazyl) radical scavenging assay, the ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid)) assay, and the FRAP (Ferric Reducing Antioxidant Power) assay.

These assays are widely used to evaluate the ability of a substance to neutralize free radicals and reduce oxidative damage.

**1. DPPH Radical Scavenging Assay:** The DPPH assay is a common method to evaluate the ability of plant extracts to neutralize free radicals. In the study, *Gulvel* demonstrated significant DPPH radical scavenging activity, with the plant extract effectively reducing the DPPH radical to its non-radical form. This finding suggests that *Gulvel* contains compounds capable of directly neutralizing free radicals.

**2. ABTS Assay:** The ABTS assay measures the ability of an extract to neutralize ABTS<sup>+</sup> radicals. The results from Singh et al. (2017) showed that *Gulvel* exhibited a high level of ABTS<sup>+</sup> radical scavenging activity, indicating its strong antioxidant potential. This assay is particularly useful in evaluating the antioxidant activity of extracts in different solvent systems, as it tests a wide range of antioxidant compounds.

**3. FRAP Assay:** The FRAP assay measures the

reducing power of an antioxidant, which reflects its ability to donate electrons. *Gulvel* exhibited strong reducing power, indicating its capacity to donate electrons to neutralize free radicals. This assay further supports the finding that *Gulvel* is a potent antioxidant.

**4 Kumar et al. (2015):** In their studies author demonstrate that Oxidative stress, a condition characterized by an imbalance between the production of reactive oxygen species (ROS) and the body's ability to neutralize them, is involved in the pathogenesis of numerous chronic diseases, including cancer, cardiovascular diseases, neurodegenerative disorders, and diabetes. Antioxidants play a critical role in protecting cells from oxidative damage. *Tinospora cordifolia* (*Gulvel*), a plant widely utilized in traditional Ayurvedic medicine, has gained attention for its potential antioxidant properties. The study by **Kumar et al. (2015)** investigates the antioxidant activity of *Gulvel* and explores its potential as a therapeutic agent. This review focuses on the key findings of **Kumar et al. (2015)** regarding the antioxidant effects of *Gulvel*.

**Phytochemical Composition of *Gulvel*:** *Tinospora cordifolia* contains a variety of bioactive compounds, many of which contribute to its antioxidant activity. **Kumar et al. (2015)** identified several phytochemicals in *Gulvel*, including alkaloids, flavonoids, polyphenols, terpenoids, and glycosides. Among these, flavonoids and phenolic compounds are particularly noteworthy due to their ability to scavenge free radicals and inhibit oxidative damage. The study highlighted compounds such as tinosporin, tinosporide, and berberine as key antioxidants that contribute to the plant's protective effects against oxidative stress.

The bioactive compounds in *Gulvel* not only exhibit antioxidant activity but also possess anti-inflammatory, immunomodulatory, and antidiabetic properties, further enhancing the therapeutic potential of the plant. The combination of these bioactive compounds makes *Gulvel* a promising candidate for use in preventing diseases associated with oxidative stress.

#### In Vitro Antioxidant Activity

In **Kumar et al. (2015)**, several in vitro assays were used to assess the antioxidant potential of *Gulvel* extracts. These assays included the DPPH (2, 2-diphenyl-1-picrylhydrazyl) radical scavenging assay, the hydroxyl radical scavenging assay, the FRAP (Ferric Reducing Antioxidant Power) assay, and the lipid peroxidation assay.

**1. DPPH Radical Scavenging Assay:** The DPPH assay is widely used to evaluate the ability of a substance to neutralize free radicals. In this study, *Gulvel* extracts demonstrated significant DPPH radical scavenging activity. The plant extract was able to reduce the DPPH radical to its non-radical form, indicating its potential to neutralize free radicals and prevent oxidative damage.

**2. Hydroxyl Radical Scavenging Assay:** Hydroxyl radicals are among the most reactive and damaging ROS produced in biological systems. The results from **Kumar et al. (2015)** showed that *Gulvel* had a strong ability to scavenge hydroxyl radicals, providing evidence of its potential to mitigate oxidative damage caused by highly reactive species.

**3. FRAP Assay:** The FRAP assay evaluates the ability of a substance to reduce ferric ions ( $\text{Fe}^{3+}$ ) to ferrous ions ( $\text{Fe}^{2+}$ ), a process indicative of antioxidant activity. *Gulvel* exhibited substantial reducing power in the FRAP assay, suggesting that it has the capacity to donate electrons and neutralize oxidative species effectively.

**4. Lipid Peroxidation Assay:** Lipid peroxidation is a key mechanism of oxidative damage, particularly in cell membranes. In this assay, *Gulvel* demonstrated the ability to inhibit lipid peroxidation, as evidenced by the reduction in malondialdehyde (MDA) levels, a byproduct of lipid oxidation. This suggests that *Gulvel* may help protect cellular membranes from oxidative damage.

#### 5. *Gulvel* Plant

##### Scientific Classification

Kingdom: Plantae – Plants,  
Subkingdom: Tracheophyta – Vascular Plants  
Super division: Spermatophyta-Seed bearing plants;  
Division: Magnoliophyta -Flowering;  
Class: Magnoliopsia -Dicotyledons Subclass:  
Polypeptaleae -Petals are free;  
Series: Thalamiflorae -Many stamens and flower  
hypogynous Order: Ranunculales  
Family : Menispermaceae Tribe: Tinosporeace Genus:  
*Tinospora* Species : *cordifolia*.

**Table No. 1: Different names in indian language of *gulvel* (*Tinospora Cordifoila*).**

Sr. No.	Name	Language
1	Telgu	Teepa – Teega
2	Hindi	Giloy
3	English	Tinospora
4	Sanskrit	Amrita
5	Punjabi	Gillo
6	Bengali	Golancha
7	Gujrati	Gulvel
8	Odia	Guluchi
9	Malayalam	Amruthu
10	Urdu	Gilo

#### Phytochemical Profile

*Gulvel* is a rich source of a diverse array of secondary metabolites, including

➤ **Flavonoids:** These polyphenolic compounds, such as flavonols, flavanones, and isoflavones, are well-known for their potent antioxidant and free radical scavenging activities.

➤ **Terpenoids:** This vast class of compounds, encompassing monoterpenes, diterpenes, and triterpenes, exhibits diverse biological activities, including

antioxidant, anti-inflammatory, and antitumor properties.

➤ **Alkaloids:** These nitrogen-containing compounds, such as rotenoids and pyridines, have demonstrated antioxidant and other pharmacological effects.

### Antioxidant Mechanisms

- **Direct Free Radical Scavenging:** Gulvel extracts and isolated compounds have been shown to directly scavenge various reactive oxygen species (ROS), including superoxide anion radicals, hydroxyl radicals, and hydrogen peroxide.
- **Metal Chelation:** Certain compounds in Gulvel can chelate transition metals such as iron and copper, which can catalyze the formation of highly reactive hydroxyl radicals through the Fenton reaction.
- **Enzymatic Modulation:** Gulvel has been demonstrated to modulate the activity of key antioxidant enzymes, such as:
  - **Superoxide dismutase (SOD):** Catalyzes the dismutation of superoxide radicals into hydrogen peroxide and oxygen.
  - **Catalase (CAT):** Decomposes hydrogen peroxide into water and oxygen.
  - **Glutathione peroxidase (GPx):** Reduces hydrogen peroxide and lipid hydroperoxides using glutathione as a reducing agent.

### Cellular Protection

The antioxidant properties of Gulvel contribute significantly to its cytoprotective effects. Studies have shown that Gulvel extracts can protect cells from oxidative damage induced by various stressors, including:

- **Heavy metals:** Lead, mercury, and cadmium
- **Radiation:** Ultraviolet (UV) radiation, ionizing radiation
- **Inflammatory mediators:** Pro-inflammatory cytokines and reactive nitrogen species.

### Therapeutic Implications

The potent antioxidant activity of Gulvel suggests its potential therapeutic applications in the prevention and management of various oxidative stress-related diseases, such as:

- **Neurodegenerative diseases:** Alzheimer's disease, Parkinson's disease
- **Cardiovascular diseases:** Atherosclerosis, myocardial infarction
- **Cancer:** Various types of cancer
- **Chronic inflammatory diseases:** Arthritis, asthma.

Gulvel, also known as *Tinospora cordifolia*, has become a focal point in recent scientific research due to its antioxidant properties. Traditionally utilized in Ayurvedic medicine, this herb is abundant in bioactive compounds such as alkaloids, flavonoids, and glycosides, which enhance its capacity to combat oxidative stress. Current studies have shown that gulvel effectively neutralizes free radicals and boosts the body's antioxidant defenses, thereby reducing cellular damage

and inflammation. For example, research has indicated that gulvel can stimulate the production of endogenous antioxidant enzymes, further supporting its potential in preventing diseases related to oxidative stress. This review seeks to compile and analyze contemporary findings on the mechanisms of gulvel's antioxidant activity, its effectiveness, and its implications for health, highlighting its significance in modern therapeutic applications.<sup>[1-4]</sup>

The World Health Organization (WHO) has estimated that up to 80% of people continue to rely primarily on traditional remedies, such as medicinal plants, for their healthcare needs. Plants have been utilized as natural medicines since the dawn of human civilization.

Recently, scientists have shown growing interest in developing new drugs from traditional medicinal plants. India, with its rich biodiversity and extensive knowledge of ancient medicinal systems like Ayurveda, Siddha, and Unani, provides a strong foundation for using numerous plants in general healthcare and treating common ailments. Among the various medicinal plants, *Tinospora cordifolia* (Family: Menispermaceae) is one of the most widely used shrubs in traditional medicine. Known scientifically as *Tinospora cordifolia* or Guduchi in Hindi, the stem of Giloy is considered especially effective due to its high nutritional content and the alkaloids it contains, though the root and leaves can also be utilized. According to a verse in the Charak Samhita, Giloy is one of the primary herbs with a bitter taste. It is used to treat various disorders and is believed to help balance the Vata and Kapha doshas. The plant is also called "Heart-leaved Moonseed" due to its heart-shaped leaves and reddish fruits. *Tinospora cordifolia* (Willd.) Miers ex Hook. F. & Thoms, also known as Gulvel or Guduchi, has been widely used and studied for its diverse medicinal properties. Giloy is a deciduous, fleshy, robust climber that grows with the support of trees like mango or neem. It is also referred to by other scientific names such as *Cocculus cordifolius* Dec, *Menispermum cordifolium* Willd, and *Tinospora glabra* (N. Brum.) Merr. In Hindu mythology, the plant is linked to a heavenly elixir that prevents aging and promotes eternal youth. The Sanskrit name "Guduchi" means "one that protects from illnesses." As a result, terms like "rejuvenator" or "adaptogen" have become common in the literature surrounding this plant. *Tinospora cordifolia* is found in various countries, including India, China, Myanmar, Sri Lanka, Thailand, the Philippines, Indonesia, Malaysia, Borneo, Vietnam, Bangladesh, North Africa, West Africa, and South Africa. In India, it is particularly abundant in Maharashtra, Gujarat, Madhya Pradesh, Himachal Pradesh, and several other states across the country.<sup>[5-7]</sup>

### Morphological Characteristics

Gurcha is a climbing, glabrous (hairless) plant that grows in a gregarious (clustered) manner. The older stems can reach up to 2 cm in diameter and are covered with a cork-

like bark. Aerial roots emerge from the nodal scars on the branches.<sup>[8]</sup>

The stem and branches are marked with white, vertical lenticels (small pores).

The bark is grey-brown or creamy white, with a warty texture, thin and papery, and peels off easily. The leaves are 5–15 cm in size, ovate in shape, and have an acute tip.

While the leaves are membranous when young, they become leathery as they mature.<sup>[8]</sup>

### Microscopic Study

A microscopic study of *Tinospora cordifolia* (Gulvel) helps us understand the internal structure of the plant and its potential for medicinal use. By looking at the plant's cells and tissues under a microscope, we can see the features that may contribute to its health benefits.

#### 1) Leaf Structure

- **Outer Layer (Epidermis):** The leaf has a thin outer layer (epidermis), covered with a protective layer (cuticle). It also has small pores (stomata) that allow the plant to exchange gases.
- **Middle Layer (Mesophyll):** The middle of the leaf contains two types of cells: tightly packed cells that help with photosynthesis and loosely packed cells that allow air movement.

**Vascular Bundles:** The leaf has bundles of vascular tissue (xylem and phloem), which transport water and nutrients.

#### 2) Root Structure

- **Outer Layer (Epidermis):** The root's outer layer is thin and has root hairs that help absorb water and nutrients.
- **Cortex and Stele:** The root's middle part stores nutrients, and the central part (stele) has xylem and phloem that transport water and food.

#### 3) Stem Structure

- **Outer Layer:** The stem has a protective outer layer with some small hair-like structures (trichomes) and tiny holes (lenticels) for gas exchange.
- **Cortex:** The stem contains cells that store water and starch.

**Vascular Tissue:** The vascular tissue is spread out through the stem, including xylem for water transport and phloem for nutrient transport.

**Botanical Description:** *Tinospora cordifolia* is a large, deciduous, sprawling climbing shrub with multiple long, twining branches. Various parts of the plant exhibit different morphological characteristics, which are described below.

**Root:** The roots are aerial, thread-like, and long, with a filiform (thin and threadlike) appearance. They grow from mature branches or from cut sections of the stems, extending downward. As they lengthen continuously, they may eventually reach the ground.<sup>[9–10]</sup>

**Stem:** The stem of this plant is succulent, long, thread-like, fleshy, and climbing in nature. Aerial roots emerge from the branches.

The dried stem is cylindrical, slender, and slightly twisted.

The outer bark is thin, papery, and varies in color from brown to greyish. When the stem is cross-sectioned, it reveals a wheel-like structure.

The lenticels are circular and prominent.

The powder from the stem is cream to dark brown, with a characteristic odor and a bitter taste.<sup>[12–13]</sup>

### Leaves

The plant has membranous, simple, and alternate leaves with long petioles (about 15 cm). The petioles are round, swollen at the base, heart-shaped, and partially twisted.

The leaves are generally a deep green, but older leaves turn yellowish-green to yellow. The leaves have a bitter taste and a faint smell.

The leaf blade (lamina) is ovate-cordate, measuring 10–20 cm in length and 8–15 cm in width. The leaves are high in protein, calcium, and phosphorus.

### Taxonomic classification

Kingdom: Plantae – Plants,  
Subkingdom: Tracheophyta – Vascular Plants  
Super-division: Spermatophyta-Seed bearing plants;  
Division: Magnoliophyta-Flowering;  
Class: Magnoliopsia-Dicotyledons Subclass:  
Polypeptala-Petals are free;  
Series: Thalamiflorae-Many stamens and flower  
hypogynous Order: Ranunculales  
Family: Menispermaceae Tribe: Tinosporeace Genus:  
*Tinospora* Species: *cordifolia*.

**Chemical Constituents Of Gulvel:** *Tinospora cordifolia* (Gulvel), a plant commonly used in traditional Ayurvedic medicine, contains a variety of bioactive chemical constituents that contribute to its pharmacological properties, including its antioxidant, anti-inflammatory, immunomodulatory, and antidiabetic effects. The key chemical constituents of *Gulvel* include

- 1) Alkaloids
- 2) Flavenoids
- 3) Glycosides
- 4) Terpenoids
- 5) Phenolic Compounds
- 6) Polysaccharides

7) **Steroids**  
 8) **Other Compounds**  
 i **Vitamins**  
 ii **Minerals.**

**1. Alkaloids**

• Alkaloids are among the primary bioactive compounds found in *Gulvel*. Some important alkaloids identified in the plant include:

- **Tinosporine**
- **Berberine**
- **Columbamine**
- **Jatrorrhizine:** These alkaloids are known for their various medicinal properties, including antimicrobial, anti-inflammatory, and antioxidant activities.
- **Source:** Root, Stem.
- **Compounds:** Baberine, Choline, Palmatine, Tembetarine, Magnoflorine, Tinosporin, And Isocolumbin.
- **Biological Response:** Anticancer, Antiviral Infections, Neurological Disorders, And Diabetes.

**2. Flavonoids**

• Flavonoids are polyphenolic compounds that exhibit strong antioxidant properties. Flavonoids found in *Gulvel* include

- **Quercetin**
- **Kaempferol**
- **Isoquercitrin** These compounds have the ability to scavenge free radicals and reduce oxidative stress, contributing to the plant's therapeutic effects.
- **Source: Stem Aerial Parts**
- **Compounds:** Beta – Sitosterol
- **Biological Response:** Induce osteoporosis in patients with early inflammatory arthritis.

**3. Glycosides**

- Glycosides in *Gulvel* include:
- **Tinosporoside**
- **Cordifolioside** These compounds have shown various health benefits, such as improving immune function and enhancing the body's resistance to infections.
- **Source: Stem**
- **Compounds:** Tinocordiside, Cordioside.
- **Biological Response:** Treat parkinson's disease and other neurological disorders.

**4. Terpenoids**

• Terpenoids are a large group of compounds that exhibit a wide range of biological activities, including antioxidant and anti-inflammatory effects. Some terpenoids present in *Gulvel* include

- **Tinosporide**
- **Gulvelin**
- **Cordifolide.**

**5. Phenolic Compounds**

• Phenolic compounds in *Gulvel* contribute to its antioxidant properties. These include:

- **Gallic acid**
- **Ellagic acid**
- **Caffeic acid** These compounds are effective in neutralizing free radicals and reducing oxidative damage in cells.

**6. Polysaccharides**

• Polysaccharides, such as **mannans** and **glucans**, have been identified in *Gulvel* and are associated with its immune-boosting and anti-inflammatory properties.

**7. Steroids**

• Steroidal compounds such as **β-sitosterol** and **campesterol** have also been identified in *Gulvel*, which may contribute to its anti-inflammatory and antioxidant effects.

**8. Other Compounds**

- **Vitamins:** *Gulvel* contains several vitamins, including Vitamin C, which enhances its antioxidant capacity.
- **Minerals:** The plant also contains essential minerals such as zinc, iron, and calcium, which contribute to overall health and antioxidant activity.
- **Source:** Root.
- **Compounds:** Giloin, Tinosporic Acid.
- **Biological Souce:** Used to treat anxiety. HIV Prtease inhibitors.

**Marketed Formulation**

- 1) **Giloy Powder**
- 2) **Giloy Syrup**

**Geographical Source Of Gulvel Plant (*Tinospora Cordifolia*)**

- 1) India
- 2) Myanmar
- 3) Shrilanka
- 4) China
- 5) Thailand
- 6) Philipines
- 7) Indonesia
- 8) Malaysia
- 9) Borneo
- 10) Vietnam
- 11) Bangladesh
- 12) North Africa
- 13) South Africa.

**Therapeutic uses**

**Antioxidant activity:** This is due to the alkaloidal constituents (choline, palmatine, )Tetrahydropalmatine and magnoflorine), - epicatechin, and an aromatic glycoside, Secoisolariciresinol. **Hypoglycemic activity:** In the Ayurvedic Pharmacopoeia of India, *T. cordifolia* is Categorized as an antidiabetic herbal drug due to its alkaloids, diterpenoids and glycosidic Constituents. Several studies in vitro and in vivo showed that the alkaloids palmatine, Jatrorrhizine and magnoflorin were synergistically responsible for the hyperglycemic Effect



via a mechanism of insulin releasing, insulin-mimicking and gluconeogenesis Inhibition.

- Benefits of gulvel for stress: Traditionally, the extract from the roots of gulvel is used to Treat stress. Many animal studies have demonstrated how the extract is effective as an antiStress agent.
- Improve digestion: Giloy improves digestion and reduces digestion-related problems Like diarrhoea, colitis, vomiting, hyperacidity, etc.
- Treats Arthritis and Gout: Giloy contains anti-inflammatory and anti-arthritic Properties which help to reduce arthritis and gout. For joint pains, consume Giloy powder With warm milk.
- Antiviral activity: A diterpenoid, tinosporin, showed activity against HIV, HTLV and Other viral diseases for its immunomodulatory and selective inhibition of the virus to Target T helper cells.
- To treat chronic fever: In Ayurveda, two factors cause fever – Ama (toxic remains in The body due to improper digestion) and the second one is due to some foreign particles. Giloy acts wonderfully in chronic, recurrent fevers. It is an anti-inflammatory, antipyretic.
- Herb which helps to boost our immunity to fight against the infection and also helps in Early recovery.
- Immunomodulatory activity: The immunomodulatory activity of *T. cordifolia* is due to The synergistic effects of compounds including low molecular weight alkaloids, clerodane Diterpenoids, sesquiterpenoids and phenyl propanoids.
- Reduces Stress and Anxiety: Giloy is an excellent remedy to reduce mental stress and Anxiety. It calms down your body. Giloy also has the power to enhance memory and Cognitive functions.

## CONCLUSION

The present review focuses on the botanical description and medicinal importance of the Plant *Tinospora cordifolia*. It is reported in literature that the plant extracts have active Compounds in the form of alkaloids, glycosides, lactones and steroids. All these active Compounds have immunomodulatory and physiological roles of different types, thereby Demonstrating the diverse versatility of the plant. *T. cordifolia* has high medicinal value in the World and is also the number one recommended natural herb for the Indian system of Medicine (ISM). In fact, in Egyptians, Chinese, Indian, Greek, Roman and Hebrew have given The high status of importance to this medicinal property. In this regard, further studies need to Be carried out to explore *Tinospora cordifolia* for its potential in preventing and treating Diseases and indicate the need to carry out research on the plant so that they could get some

Medicinally important drugs.

In conclusion, Gulvel, derived from the plant *Tinospora cordifolia*, has demonstrated significant antioxidant properties through various studies. Its bioactive compounds, particularly alkaloids, flavonoids, and glycosides, are believed to play a key role in neutralizing free radicals and reducing oxidative stress. These properties make Gulvel a promising natural antioxidant that could contribute to overall health, potentially aiding in the prevention of chronic diseases associated with oxidative damage, such as cardiovascular diseases, diabetes, and neurodegenerative conditions. While promising, further clinical studies and trials are needed to validate its efficacy and safety for widespread use in antioxidant therapy. Nonetheless, the existing evidence supports its inclusion as a valuable herbal remedy with notable antioxidant potential.

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