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Review Article

A Review on Anti-Diabetic Activity of Herbal Drugs with Special Reference to Eucalyptus

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ABSTRACT

Diabetes mellitus is a long-lasting metabolic condition marked by elevated blood sugar levels, caused either by insufficient insulin production or the body's inability to effectively use insulin. Although various synthetic drugs are available, many have adverse side effects or limited efficacy. Herbal medicines are increasingly used as complementary approaches due to their effectiveness, safety, and affordability. This review highlights the anti-diabetic potential of various herbal drugs with a specific focus on Eucalyptus species. Eucalyptus globulus, among others, is widely studied for its bioactive compounds, such as flavonoids, tannins, and essential oils, which exhibit hypoglycemic and antioxidant properties. Mechanisms of action include stimulation of insulin secretion, enhancement of glucose uptake, and inhibition of α -glucosidase. This review aims to provide a comprehensive understanding of Eucalyptus as a promising natural remedy for diabetes management.

INTRODUCTION

Diabetes makes many sick all around the world. It kills many too. It can negatively affect the health of the heart, kidneys, eyes, as well as the hands and feet. There are many drugs that help fix the sugar in the blood. But many of them can cause bad side effects or stop working. This has made many people want to use natural things made from

plants. They may be safer, cheaper, and work for many things to help treat the illness.

Herbal medicines such as *Gymnema sylvestre*, *Momordica charantia*, and *Eucalyptus globulus*, have shown very good results in treating diabetes. These medicines work by helping the body make more insulin, use insulin better, not take in so much sugar from food, and by fighting the damage that diabetes can cause.[2]

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Eucalyptus globulus, known as blue gum, has been used in traditional medicine for its effects on the lungs and its anti-inflammatory effects. It is rich in essential oil especially 1,8-cineole. In recent years, this plant has attracted interest due to its potential anti-diabetic properties. The plant's bioactive compounds such as flavonoids, tannins, saponins and phenolic acids could change how carbohydrates are processed, block the enzymes α -amylase and α -glucosidase (which cuts down the spike in blood sugar after a meal), and enhance lipid profiles.[3] Experimental studies have shown that extracts from the leaves can reduce fasting blood glucose, raise the activity of antioxidant enzymes and shield pancreatic β -cells from damage in diabetic animals.

So, the use of Eucalyptus globulus as part of other ways to treat diabetes is a hopeful new use for herbal medicine. It calls for more careful studies to find out how best to use it and how safe it is over the long term.[4]

History:

Humanity has been aware of diabetes mellitus for more than three millennia. Ancient Indian, Egyptian, and Chinese civilizations recognized the symptoms of excessive urination and weight loss. The term "diabetes" was first used by the Greek physician Aretaeus of Cappadocia, while Thomas Willis added "mellitus" (meaning "honey-sweet") in the 17th century after discovering sugar in urine.[5] Historically, herbal medicine has played a vital role in the treatment of diabetes. In Ayurveda, herbs like Gudmar (*Gymnema sylvestre*), Neem, and Karela (*Momordica charantia*) have been used for centuries to manage high blood sugar levels. Similarly, in Traditional Chinese Medicine (TCM), plant-based therapies were commonly prescribed for regulating metabolism. The genus *Eucalyptus*, native to Australia, has been traditionally used by

Aboriginal communities for wound healing, fever, and respiratory conditions. Over the years, modern research has identified its potential anti-diabetic properties, leading to scientific investigations of its flavonoids, essential oils, and tannins for glucose-lowering activity. Today, with the rise in global diabetes cases and limitations of synthetic drugs, there is a renewed focus on the historical and modern uses of herbal drugs like *Eucalyptus* in diabetes management.[6-7]

Aim:

To study and review the anti-diabetic activity of various herbal drugs with special reference to *Eucalyptus* species, focusing on their phytochemical constituents, mechanisms of action, and therapeutic potential in the management of diabetes mellitus.

Objectives :

To understand the pathophysiology of diabetes mellitus: Gain a clear understanding of the types, causes, and biochemical mechanisms of diabetes, including insulin deficiency and resistance.

1. **To identify and review herbal drugs with anti-diabetic potential:** Study commonly used medicinal plants such as *Gymnema sylvestre*, *Momordica charantia*, *Trigonella foenum-graecum*, and others that have shown hypoglycemic effects.
2. **To focus on Eucalyptus species as a herbal anti-diabetic agent:** Explore the traditional uses, pharmacological studies, and therapeutic relevance of *Eucalyptus globulus* and related species in diabetes treatment.
3. **To evaluate the phytochemical constituents of Eucalyptus:** Study active components such as flavonoids, tannins, and essential oils (like 1,8- cineole) responsible for its medicinal activity.



4. **To discuss the mechanism of anti-diabetic action of Eucalyptus:** Explain how Eucalyptus may help regulate blood sugar through antioxidant activity, insulin mimetic effects, enzyme inhibition (α -glucosidase, α -amylase), and glucose uptake stimulation.
5. **To summarize the scientific and clinical evidence available:** Review findings from in-vitro, in-vivo, and (if available) clinical studies that support the anti-diabetic role of Eucalyptus.
6. **To promote awareness about the use of herbal drugs in diabetes management:** Highlight the importance of integrating plant-based medicine with modern therapies for safer and affordable treatment options.[8]

BIOLOGICAL DESCRIPTIONS:



Fig 1:Eukalyptus Globulus

Eucalyptus globulus (Blue Gum Tree)

Leaves of Eucalyptus globulus:

The leaves of Eucalyptus globulus are the most pharmacologically important part of the plant and are primarily used for medicinal purposes. The leaves have a distinctive aroma, are shaped like a spear, and have a tough, leathery feel. They exhibit a bluish-green color and are arranged alternately on mature trees. Young leaves are opposite,

sessile, and glaucous (bluish-white), while mature leaves are stalked, elongated, and more leathery.

The distinctive strong, camphor-like aroma of the leaves is due to the presence of essential oils, mainly 1,8-cineole (eucalyptol), which constitutes about 70–85% of the oil content. These oils are stored in oil glands embedded in the leaf surface. The leaves also contain other important phytochemicals such as flavonoids, tannins, terpenes, and phenolic acids like gallic acid and chlorogenic acid.[9]

Traditionally, the leaves are used in the form of infusions, decoctions, and essential oils to treat respiratory conditions like cold, cough, asthma, and bronchitis. Recent scientific research has demonstrated that eucalyptus leaves possess properties that may help in managing diabetes. The leaf extracts help lower blood glucose levels by inhibiting digestive enzymes and improving insulin sensitivity. They also possess strong antioxidant activity, which helps protect pancreatic beta cells from oxidative damage—a common issue in diabetic patients. Due to their therapeutic properties, eucalyptus leaves are now widely used in the preparation of herbal teas, syrups, capsules, and topical ointments. However, internal use of essential oil derived from the leaves should be done with caution, as high doses can be toxic. When used appropriately, the leaves of Eucalyptus globulus serve as a potent herbal remedy with broad pharmacological applications, especially in the management of diabetes.[10]



Fig 2: Leaves Of Eukalyptus

Leaves of Eucalyptus globulus:

The Blue Gum Tree, scientifically named *Eucalyptus globulus*, is a tall, evergreen species that is part of the Myrtaceae family. It is native to Australia but is now widely cultivated in several countries, including India, due to its medicinal and commercial value. The tree typically grows up to 30–55 meters in height and is characterized by its smooth bark, which peels off in strips, and its aromatic lance-shaped leaves. These leaves are rich in essential oils and are the primary part used in traditional and modern herbal medicine.

The chemical composition of *Eucalyptus globulus* is dominated by 1,8-cineole (eucalyptol), a major compound responsible for its distinctive aroma and pharmacological properties. The plant also contains flavonoids like quercetin and kaempferol, phenolic acids such as gallic acid and caffeic acid, along with tannins and terpenes including limonene and linalool. These bioactive constituents contribute to its anti-diabetic, antioxidant, anti-inflammatory, antibacterial, and expectorant properties.

As an anti-diabetic agent, *Eucalyptus globulus* works by inhibiting carbohydrate-digesting enzymes such as α -amylase and α -glucosidase, which slows down the absorption of glucose in the intestines. This leads to a reduced postprandial blood sugar level. Furthermore, its antioxidant

activity helps protect pancreatic β -cells from oxidative stress, thereby supporting insulin production and improving glucose utilization in peripheral tissues. Several animal studies have demonstrated the hypoglycemic effect of eucalyptus leaf extracts, confirming their traditional use in managing diabetes. In vitro experiments also support its ability to inhibit digestive enzymes and neutralize harmful free radicals. [11]

Despite its benefits, *Eucalyptus globulus* should be used with caution. The essential oil, in particular, should not be consumed internally without professional supervision, as it can be toxic in large doses. It is not recommended for use in young children, pregnant or lactating women, or individuals with severe liver conditions unless advised by a qualified healthcare provider.

In conclusion, *Eucalyptus globulus* serves as a promising herbal option in the management of diabetes due to its multiple mechanisms of action, natural origin, and supportive research evidence. Its traditional usage and modern scientific validation make it a key candidate for further study and formulation in anti-diabetic herbal preparations.

Leaf of Eucalyptus globulus:

The leaves of *Eucalyptus globulus* are long, narrow, and bluish-green with a strong aromatic smell. They contain oil glands rich in 1,8-cineole (eucalyptol), which gives the plant its medicinal properties. These leaves are mainly used in herbal medicine for their anti-diabetic, antioxidant, and antibacterial effects. The extract from the leaves helps lower blood sugar by slowing down carbohydrate digestion and protecting insulin-producing cells. They are commonly used in teas, oils, and herbal preparations to help manage diabetes and respiratory problems.

Size and Shape of Leaves

Eucalyptus globulus leaves are typically long, narrow, and shaped like a spear. When fully grown, they usually range from 15 to 30 cm in length and 2 to 5 cm in width. They are leathery in texture, bluish-green in color, and have a smooth margin. Young leaves are more rounded and arranged oppositely, while mature leaves are alternate and elongated with a pointed tip.

Flowers of Eucalyptus globulus.

The flowers of Eucalyptus globulus are creamy white and appear singly or in clusters in the leaf axils. They are small, fluffy, and lack petals, consisting mainly of numerous prominent stamens, which give the flower its fuzzy appearance. Flowering usually occurs during summer and autumn. The flowers are rich in nectar and attract bees, making the plant useful for honey production. Though not directly used for diabetes, they play a role in the plant's overall medicinal and ecological value. [12]



Fig. Flower of Eucalyptus

Seeds of Eucalyptus globulus

The seeds of Eucalyptus globulus are small, brown to black, and somewhat angular or irregular in shape. They are enclosed in a woody capsule

(fruit) that opens when mature to release the seeds. Although each capsule holds many small seeds, only a limited number are capable of germination. The seeds are lightweight and adapted for wind dispersal. They are mainly used for propagation and cultivation of the plant. Although the seeds themselves are not commonly used medicinally, they play a vital role in growing the plant for its therapeutic leaves and oils.



Fig. Seeds of Eucalyptus

SCIENTIFIC CLASSIFICATION:

A. Eucalyptus globulus (Blue Gum Tree)

Taxonomic Rank	Classification	Details
kingdom	plantae	Include all multicellular green plant
phylum	magnoliophyta	Also known as angiosperms-flowering, seed producing plants.
class	Magnoliopsida	Dicotyledons with net-veined leaves and flower parts in 4s or 5s0
order	Myrtales	Contains aromatic plants with oil glands; mostly trees or shrubs.

family	Myrtaceae	The myrtle family; rich in essential oils; includes eucalyptus, guava, etc.
genus	Eucalyptus	Over 700 species; mostly native to Australia; known for medicinal leaves.
species	Eucalyptus globulus	Also called the Blue Gum Tree; widely used for oil extraction and medicine.

BOTANICAL SPECIFICATION

Eucalyptus globulus (Blue Gum Tree)

- **Botanical Name:** Eucalyptus globulus
- **Common Name:** Blue Gum, Southern Blue Gum
- **Family:** Myrtaceae
- **Part Used:** Leaves, oil
- **Plant Type:** Tall, evergreen tree
- **Height:** Can grow up to 30–55 meter
- **Leaf Type:** Lance-shaped, aromatic, bluish-green in color
- **Flower:** Creamy-white, solitary flowers
- **Fruit:** Woody capsule
- **seed:** small, dark brown to black in color, and have an irregular shape
- **Native To:** Australia
- **Habitat:** Temperate regions, grown in India for medicinal use
- **Odour:** Strong camphor-like aroma (from leaves)
- **Taste:** Aromatic and slight bitter

Vernacular Names: Eucalyptus globulus

Language	Name
English	Blue Gum, Eucalyptus
Latin	Eucalyptus globulus
Hindi	Safeda (सफेदा)

marathi	Nilgiri (निलिरी)
Gujarati	Nilgiri (નીલગિરી)
Tamil	Thailamaram (தையிலமரம்)
Telugu	Neelagiri Chettu (నీలగిరి చెట్టు)
Malyalam	Neelamari (നീലമര)
Kannada	Neelamari (ನೀಲಮರ)

PHYTOCHEMISTRY OF EUCALYPTUS GLOBULUS :

Major Phytoconstituents:

Eucalyptus contains several bioactive compounds, especially in its essential oil, with significant therapeutic importance. The main chemical compounds include:

Compound name	Type	Main activity
1,8-Cineole	Monoterpenoid	Antiseptic, anti-inflammatory
α -Pinene	Monoterpene	Bronchodilator, antimicrobial
Limonene	Monoterpene	Antioxidant, anti-cancer
Camphene	Monoterpene	Antioxidant, antibacterial
p-Cymene	Aromatic terpene	Anti-inflammatory
Tannins	Polyphenols	Astringent, anti-diabetic
Flavonoids	Polyphenols	Antioxidant, glucose regulation

Chemical Structures of Major Constituents:

❖ 1,8-Cineole (Eucalyptol)

- **Structure:** Cyclic ether (epoxide ring)
- **Formula:** $C_{10}H_{18}O$
- **Description:** Gives eucalyptus its strong aroma and medicinal properties.

❖ α -Pinene

- **Structure:** Bicyclic monoterpene
- **Formula:** $C_{10}H_{16}$
- **Description:** It contributes to the characteristic pine-like aroma and functions as a bronchodilator.



❖ Limonene

- **Structure:** Monocyclic monoterpene
- **Formula:** C₁₀H₁₆
- **Description:** Found in citrus oils; used in perfumes and as antioxidant.

❖ Tannins (general structure)

- **Structure:** Polyphenolic compound with multiple phenol rings
- **Function:** Astringent, helps in glucose metabolism.

OIL OF EUCALYPTUS:

Introduction: Eucalyptus oil is a volatile essential oil extracted mainly from the leaves of the Eucalyptus globulus tree. It is known for its strong aromatic scent and multiple medicinal uses, especially in respiratory and diabetic conditions. [13]

Extraction Method: Eucalyptus Oil

Source The essential oil of Eucalyptus is mainly obtained from the fresh or partially dried leaves and young shoots of Eucalyptus globulus. The oil content and quality depend on the age of the leaves, harvesting season, and environmental conditions. Leaves are selected when they contain the highest concentration of volatile oils, typically before flowering or during early stages of growth. selected when they contain the highest concentration of volatile oils, typically before flowering or during early stages of growth. [14]

Method Used – Steam Distillation:

Steam distillation is the preferred and most efficient technique for extracting eucalyptus oil. Detailed Procedure

1. **Harvesting:** Mature but tender eucalyptus leaves and twigs are harvested manually or mechanically.

2. **Preparation:** The plant material is cut or crushed to increase surface area and enhance oil release during distillation.
3. **Loading the Still:** The prepared plant material is placed into a steam distillation chamber or still.
4. **Steam Application:** Steam generated in a separate boiler is passed through the still. The heat and moisture from the steam cause the oil glands in the leaves to rupture, releasing the volatile essential oils.
5. **Condensation:** The mixture of steam and essential oil vapors passes into a condenser, where it is cooled down using water. This results in condensation into a liquid form.
6. **Oil Separation:** The oil-water mixture then flows into a separator (Florentine flask), where the oil floats on top due to its lower density and is separated manually or automatically.
7. **Filtration and Bottling:** The separated oil is filtered to remove impurities and then stored in airtight, ambercolored bottles to protect it from light and oxidation. [15]

Yield and Quality of Eucalyptus Oil

1. Yield of Eucalyptus Oil:

The oil yield from Eucalyptus globulus leaves typically ranges between 1.0% to 2.0% by weight of fresh leaves.

Factors influencing yield:

- Species of Eucalyptus (e.g., E. globulus, E. citriodora)
- Age of leaves (younger leaves may have higher oil content)
- Climatic conditions o Harvesting season o Soil type and nutrient availability
- Moisture content of the leaves o Distillation time and pressure



Example: From 100 kg of fresh eucalyptus leaves, approximately 1 to 2 liters of oil can be extracted.

- 2. Quality of Eucalyptus Oil:** The quality of eucalyptus oil is primarily determined by its chemical composition, especially the percentage of 1,8-cineole, which defines its medicinal and aromatic value.[16]

Parameter	Ideal Range / Requirement
1,8-Cineole	Content 70%–85% (main active compound)
Color	Clear, colorless to pale yellow
Odor	Strong, camphor-like, fresh aroma
Specific Gravity	0.905–0.925
Refractive Index	1.458–1.470
Solubility	Soluble in alcohol; insoluble in water
Acid Value	< 1.0
Optical Rotation	+1° to +4°

Impurities & Adulteration:

Adulterant	Why It's Used	Effects
Turpentine oil	Cheaper and has a similar aroma	Irritating, reduces efficacy
Synthetic cineole	Used to increase cineole percentage	Non-natural, unstable
Other essential oils (e.g. pine, camphor)	Dilute the eucalyptus oil	Alters smell and medicinal quality

Detection of Adulteration:

- Gas Chromatography (GC): Used to detect purity and exact composition
- Refractive index, specific gravity, and optical rotation tests
- Organoleptic testing: (smell, color, clarity)[17-18]

Traditional Uses of Eucalyptus

Eucalyptus, especially *Eucalyptus globulus*, has been widely used in traditional medicine systems

across various cultures for centuries. Its therapeutic benefits have been utilized in Ayurveda, Traditional Chinese Medicine, and folk remedies.

1. Respiratory Ailments

- Steam inhalation of eucalyptus oil was traditionally used to relieve:
 - Cough
 - Cold
 - Bronchitis
 - Asthma
- The volatile oils help in clearing nasal congestion and improving breathing

2. Antiseptic and Wound Healing

- Crushed eucalyptus leaves were applied directly to:
 - Cuts
 - Wounds
 - Insect bites
- The leaves have antimicrobial properties that prevent infection and aid healing.

3. Fever Reduction ("Fever Tree")

- Historically known as the 'Fever Tree,' eucalyptus leaves were:
 - Used in herbal teas to reduce fever
 - Applied as cold compresses on the forehead

4. Muscle and Joint Pain

- Eucalyptus oil was traditionally applied topically to:
 - Relieve muscle aches, arthritis, and joint stiffness
 - Promote circulation and reduce inflammation

5. Oral Health



- In traditional remedies, eucalyptus was incorporated into mouthwashes and gargles to:

- Fight bad breath
- Soothe sore throats
- Heal mouth ulcer

6. Insect Repellent

- Burned eucalyptus leaves or oil acted as a natural mosquito repellent.
- It was applied on skin or clothes to repel insects.

7. Diabetes Management (Traditional Belief)

- In folk medicine, eucalyptus leaf decoctions were consumed:
- To lower blood sugar levels
- Improve digestion and pancreatic function

Uses of Eucalyptus

• Antiseptic and Medicinal:

Eucalyptus has a wide range of therapeutic and healing properties, especially due to its essential oil rich in 1,8-cineole (eucalyptol). These properties make it valuable in both traditional and modern medicine.

1. Antiseptic Uses:

- **Wound Care:** Eucalyptus oil is applied to minor cuts, burns, and insect bites to prevent infection. It acts as a natural antiseptic due to its strong antibacterial and antimicrobial activity.
- **Mouthwash & Gargle:** Used in oral hygiene to treat mouth ulcers, gingivitis, and sore throats. Kills bacteria and promotes healing.
- **Skin Infections:** Effective against fungal infections, boils, and acne.

2. Medicinal Uses:

- **Respiratory Relief:** Used in steam inhalation, balms, and rubs for treating:

- Cough
- Cold
- Asthma
- Bronchitis: It clears nasal passages and acts as a decongestant.
- **Pain Relief:** Applied topically to relieve muscle pain, arthritis, and joint stiffness due to its antiinflammatory effect.
- **Fever Reduction:** In traditional medicine, known as the "fever tree" and used to reduce body temperature.
- **Insect Repellent:** Eucalyptus oil is used in sprays and creams to repel mosquitoes and insects.
- **Anti-Diabetic Potential:** Decoctions of eucalyptus leaves have traditionally been used to help lower blood sugar levels, though more scientific studies are ongoing.
- **Scent:** Eucalyptus leaves and oil have a strong, sharp, and refreshing aroma. It is often described as:
 - Camphor-like
 - Mentholated
 - Cooling and clean

This distinctive scent is due to the high content of eucalyptol (1,8-cineole) in the essential oil, which also contributes to its medicinal and decongestant properties. Because of this scent, eucalyptus is commonly used in:

- Cough drops and inhalers
- Room fresheners
- Aromatherapy oils
- Balms and vaporizer

Industrial Uses of Eucalyptus

Eucalyptus is not only valuable medicinally, but also holds significant industrial importance. Various parts of the plant, especially the wood, leaves, and essential oil, are used across multiple industries.



1. Paper and Pulp Industry

- Eucalyptus wood is widely used in the manufacture of paper due to its high cellulose content and fast growth rate.
- It produces high-quality pulp, making it a preferred species in the paper industry.

2. Timber and Furniture

- Eucalyptus wood is hard, durable, and resistant to pests.
- Used for construction, flooring, furniture, fencing, and railway sleepers.

3. Essential Oil Industry

- Eucalyptus oil is extracted on a large scale for use in:
 - Pharmaceuticals
 - Cosmetics
 - Soaps
 - Disinfectants
 - Aromatherapy products

4. Biofuel

- Eucalyptus trees are a potential source of bioenergy.
- Their fast growth makes them suitable for biomass and charcoal production.

5. Perfumery and Fragrance

- The fresh, sharp aroma of eucalyptus oil is used in perfumes, air fresheners, and cosmetic formulations.

6. Textile Industry

- Eucalyptus-based solvents and chemicals are used in cleaning and processing fabrics.
- Eucalyptus-derived fibers are being researched for use in eco-friendly textiles.

While eucalyptus offers numerous health and industrial benefits, its use should be done with caution, especially when using the essential oil.

Safe Usage:

- **Dilution Required:** Eucalyptus oil should always be diluted with a carrier oil (like coconut or olive oil) before applying to the skin.
- **Inhalation:** Safe when used in steam inhalation for relief from colds and congestion. Avoid prolonged or excessive exposure.
- **Oral Use:** Only use under medical supervision. Consuming large quantities of pure eucalyptus oil can be toxic.
- **Dosage Control:** Always follow recommended dosages in herbal preparations, especially in diabetic treatments, to avoid hypoglycemia.

Potential Side Effects:

- **Toxicity:**
 - Ingesting even a small amount (3.5 mL or more) of undiluted oil can cause:
 - Nausea
 - Vomiting
 - Diarrhea
 - Dizziness
 - Muscle weakness of Respiratory issues
- **Allergic Reactions:**
 - Some people may experience:
 - Skin irritation
 - Rashes
 - Breathing difficulties (especially in asthma patients)
 - Drug Interactions: May interact with diabetes medications, anti-seizure drugs, and anesthetics.

Safety of Eucalyptus Use

Not Recommended For:



- Children under 6 years
- Pregnant or breastfeeding women
- People with epilepsy or asthma (unless prescribed)

PHYTOCHEMISTRY OF EUCALYPTUS OIL

Eucalyptus oil is a volatile essential oil primarily obtained from the leaves and twigs of *Eucalyptus globulus*. Consuming large quantities of pure eucalyptus oil can be toxic. The therapeutic activity of eucalyptus oil is largely due to its unique blend of phytochemical constituents.[19]

Major Chemical Components of Eucalyptus Oil:

Compound Name	Percentage Range	Function / Property
1,8-Cineole (Eucalyptol)	70–85	Antiseptic, anti-inflammatory, mucolytic
α -Pinene	10–20%	Bronchodilator, antibacterial
Limonene	1–2%	Antioxidant, flavoring agent
Camphene	<1%	Decongestant, antimicrobial
globulol	<1%	Antifungal, aromatic
α -Terpineol	<1%	Mild sedative, fragrance

ANTI-DIABETIC ACTIVITIES OF EUCALYPTUS

Herbal plants like *Eucalyptus globulus* shown significant antidiabetic potential due to the presence of various bioactive phytochemicals. Their natural compounds help in lowering blood glucose levels and improving insulin sensitivity with fewer side effects compared to synthetic drugs.

The essential oil extracted from the ripe fruits, buds, and bare branches of *Eucalyptus globulus*

contains numerous highly important chemical compounds. One key component, 1,8-cineole, varies in concentration depending on the maturity and collection location of the leaves, ranging from 4.10% to 50.3%.[20]

Eucalyptus Extracts

1. Key Active Compound:

- Eucalyptol (1,8-cineole) – Found in the essential oil of eucalyptus leaves.

2. Mechanism of Action:

- Enhances glucose uptake by muscle cells.
- Possesses anti-inflammatory and antioxidant properties that protect pancreatic β -cells.
- Reduces oxidative stress, a key contributor to insulin resistance.

3. Scientific Evidence:

- Studies have shown that aqueous and methanolic leaf extracts of *Eucalyptus globulus* reduce fasting blood sugar levels in diabetic rats.
- The polyphenols and flavonoids in the extract contribute to antihyperglycemic effects.

CONCLUSION:

The review of *Eucalyptus globulus* highlights the significant potential of this herbal drug in managing diabetes. These plants contain a rich variety of phytochemicals such as flavonoids, tannins, phenolic compounds, and essential oils, which have demonstrated anti-diabetic activity in various experimental models.

Eucalyptus is particularly valued for its essential oil, especially eucalyptol (1,8-cineole), which has anti-inflammatory, antimicrobial, and possible glucose-lowering effects.



These herbal alternatives may offer cost-effective, natural, and safer options for diabetes management. However, further clinical research and standardization of extracts are essential to validate their efficacy and safety in long-term use.

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