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Review Article

Exploring the Hypoglycaemic Effects of herbal plant: A Potential Remedy for Diabetes and Phytochemical and Pharmacological Study

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ABSTRACT

Diabetes mellitus is a chronic metabolic disorder characterized by high blood glucose levels, which can lead to severe complications if not managed properly. There is growing interest in the use of herbal plants as alternative or complementary therapies for diabetes due to their natural origin and potential for fewer side effects. This study investigates the antidiabetic properties of the herbal plant such as Ficus bengalensis, Syzygium Cumini Psidium Guajava Momordica charantia, Acacia arabica, commonly used in traditional medicine. Ficus bengalensis, Syzygium Cumini Psidium Guajava Momordica charantia, Acacia arabica In vitro and in vivo studies demonstrated that extracts from Ficus bengalensis, Syzygium Cumini Psidium Guajava Momordica charantia, Acacia arabica significantly reduced blood glucose levels and improved insulin sensitivity in diabetic models. Additionally, toxicity studies confirmed the safety of Ficus bengalensis, Syzygium Cumini Psidium Guajava Momordica charantia, Acacia arabica, with no adverse effects observed during the treatment period. The traditional use of Ficus bengalensis, Syzygium Cumini Psidium Guajava Momordica charantia, Acacia arabica in managing diabetes is supported by these findings, which highlight its potential as a natural antidiabetic agent. However, further clinical trials are needed to establish standardized dosages and to fully understand the mechanisms underlying its antidiabetic effects. This study provides a foundation for future research and development of as a therapeutic option for diabetes management. Ficus bengalensis, Syzygium Cumini Psidium Guajava Momordica charantia, Acacia arabica

INTRODUCTION

Diabetes mellitus (DM) is caused by a deficiency or ineffective production of insulin by the pancreas, leading to abnormal blood glucose levels. It is the most common endocrine disorder,

affecting over 100 million people globally (approximately 6% of the population). Diabetes is marked by elevated blood sugar levels both when fasting and after meals. It is a chronic disorder that

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affects the metabolism of carbohydrates, fats, and proteins. Diabetes is a stubborn illness, recognized by the Indian Council of Medical Research as needing new treatment options. This disorder poses significant challenges in today's world, leading to long-term damage, dysfunction, and failure of various organs. There are two main types of diabetes. Type 1 diabetes, previously known as insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes, typically develops in childhood. Type 2 diabetes, formerly called non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes, usually occurs after the age of 40 and becomes more prevalent with age.

1. Type 1 diabetes is an autoimmune disorder where the body's immune system attacks and destroys insulin-producing cells in the pancreas. Consequently, the pancreas produces little or no insulin, necessitating daily insulin injections to maintain normal metabolic functions. Individuals with Type 1 diabetes require lifelong insulin replacement through multiple daily injections, insulin pump therapy, or automated insulin delivery systems.
2. Type 2 diabetes is a chronic condition characterized by high blood sugar levels. Also known as adult-onset diabetes, it primarily affects middle-aged and older adults but has become more common among children and teenagers due to rising obesity rates. Type 2

diabetes, sometimes referred to as insulin-independent diabetes mellitus, accounts for over 90% of adult diabetes cases. This lifelong disease impairs the body's ability to use insulin effectively, necessitating ongoing management to maintain blood sugar levels.

Basic diabetes mellitus treatment

- Patient education from concerning the disease
- Physical exercise
- Diet and
- Hypoglycaemic agents

Life style for patient

Learn about planning balanced meals:

1. Turmeric and cinnamon are included in diets.
2. Oily, fried and starchy foodstuffs are avoided.
3. Coffee, sugar, refined flour and alcohol are avoided.
4. Eat smaller meals (low fat diet) five to six times a day instead of having three large meals.
5. Intake of vegetables like spinach, cucumber tomatoes, onion, sprouts, beans, garlic etc is increased.
6. Refrain from taking stress.
7. Regular exercise. Walk for at least 40 minutes a day.
8. Avoid red meat and excessive salt in your meals. Fish and soybean can be taken due to their good protein value.
9. Avoid white bread, rice, potatoes, sweet and sugary foods





Fig 1

Introduction of herbal medicine

Herbal medicine consists of natural botanical products derived from plants and animals that people use to treat and prevent diseases. The use of herbal medicine has gained significant interest in the past decade as it helps avoid the problems associated with long-term use of many synthetic drugs, particularly antidiabetic drugs. Several types of synthetic drugs, including biguanides, sulfonylureas, thiazolidinediones, α -glucosidase inhibitors, glucagon-like peptide-1 (GLP-1), dopamine-2 agonists, dipeptidyl peptidase 4 (DPP-4) inhibitors, and sodium-glucose cotransporter-2 (SGLT-2) inhibitors, are available in the market. It will cause side effects i.e. it includes cancer, hepatitis, allergy, etc. for long consumption

Herbal medicine good for?

- Herbal medicines or supplements are natural compounds derived from the leaves, bark, roots, seeds, or flowers of plants. People use them for medicinal purposes, often as a form of complementary medicine, as they may offer therapeutic benefits.
- Herbal medicine is used to treat a variety of conditions, including allergies, asthma, eczema, premenstrual syndrome, rheumatoid arthritis, fibromyalgia, migraines, menopausal symptoms, chronic fatigue,

irritable bowel syndrome, and cancer, among others.

- herbal medicine cannot be taken by under the guidance of health care professional. Consult with your doctor or ayurvedacharya before self-treating. Some common herbs.

Their mechanism of action of herbal as antidiabetic

The activity of herbal drug is based on various mechanism of action that given as follows:

- Mimicking adrenaline action and blocking pancreatic beta-cell potassium channels.
- Inhibiting glucose reabsorption in the urine.
- Stimulating insulin secretion from beta cells or inhibiting insulin degradation processes.
- Reducing insulin resistance.
- Providing essential elements like calcium, zinc, magnesium, manganese, and copper for beta cells.
- Regenerating or repairing pancreatic beta cells.
- Increasing the size and number of cells in the islets of Langerhans.
- Stimulating insulin secretion.
- Stimulating glycogenesis and hepatic glycolysis.
- Protecting beta cells from destruction.

- Improving digestion while reducing blood sugar and urea levels.
- Preventing the pathological conversion of starch to glucose.
- Inhibiting β -galactosidase and α -glycosidase.
- Lowering cortisol levels.
- Inhibiting alpha-amylase.

For most herbs, the specific ingredient responsible for the therapeutic effect is not well-known. Whole herbs consist of numerous components, and it is likely that these ingredients work in synergy to produce the desired medicinal effect. Herbal plants contain complex active compounds that drive their

mechanisms of action. Several mechanisms related to treating diabetes include improving insulin sensitivity, stimulating insulin secretion, protecting pancreatic islets, and inhibiting the absorption of intestinal carbohydrates. Generally, anti-diabetic drugs control blood glucose levels through their actions and metabolism. The liver plays a crucial role by converting glycogen to glucose, thus regulating glucose uptake and release. Meanwhile, the pancreas increases insulin production from β -cells and decreases glucagon production from α -cells to control blood glucose levels.

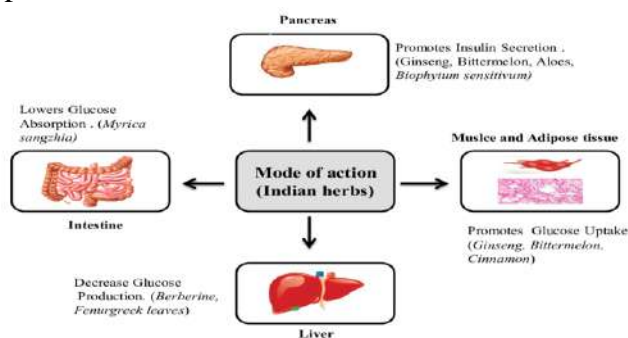


Fig 2

Anti-diabetic Effect of Medicinal Plants

While synthetic oral hypoglycaemic medications and insulin are the primary treatments for diabetes, they come with limitations and potential adverse effects. Here are some key points:

Limitations of Synthetic Oral Hypoglycaemic Medications and Insulin:

Partial Management of Complications:

These treatments help manage blood sugar levels but do not completely reverse the complications associated with diabetes, such as cardiovascular disease, neuropathy, nephropathy, and retinopathy.

Adverse Effects:

- Hypoglycaemia: Both insulin and certain oral medications, like sulfonylureas, can cause low blood sugar levels, which can be dangerous.
- Weight Gain: Insulin and some oral medications can lead to weight gain, which can worsen insulin resistance.

- Gastrointestinal Issues: Medications like metformin can cause gastrointestinal disturbances such as nausea, vomiting, and diarrhoea.
- Cardiovascular Risks: Some older diabetes medications have been associated with increased cardiovascular risks.

Patient Compliance:

Managing diabetes with medications often requires strict adherence to dosing schedules, lifestyle modifications, and regular monitoring of blood glucose levels, which can be challenging for many patients.

Progression of Disease:

Despite medication, diabetes can progress over time, leading to a need for increased doses or additional medications.

Complementary Approaches:

Diet and Exercise:

A balanced diet and regular physical activity are crucial in managing diabetes and can improve insulin sensitivity and overall health.

Lifestyle Modifications:

Stress management, smoking cessation, and reducing alcohol intake can have a significant positive impact on diabetes management.

Alternative and Complementary Therapies:

Some patients find benefit in complementary therapies such as acupuncture, yoga, and herbal supplements, though these should be used with caution and under medical supervision.

Newer Therapies:

Advances in diabetes treatment, such as continuous glucose monitors (CGMs), insulin pumps, and new classes of medications (e.g., GLP-1 receptor agonists, SGLT2 inhibitors), offer improved glucose control and potentially fewer side effects.

Education and Support:

Diabetes education programs and support groups can help patients manage their condition more effectively by providing knowledge and emotional support. While synthetic medications and insulin remain the cornerstone of diabetes management, addressing the disease's complications often requires a multifaceted approach that includes lifestyle changes and the use of newer technologies and treatments. Natural products, especially those derived from plants, are a major focus for identifying promising drug candidates and will be crucial in future drug development projects. Medicinal plants used to manage hypoglycaemic (low blood sugar) or hyperglycaemic (high blood sugar) conditions are particularly significant to the ethnobotanical community due to their valuable medicinal properties found in various parts of the plants. Many plants have shown different levels of hypoglycaemic and anti-hyperglycaemic activity.

In rural areas, plant-based preparations are essential in all current medicines because they are

readily available, cost-effective, and have minimal side effects. Medicinal plants today are known to contain phytoconstituents like flavonoids, terpenoids, saponins, carotenoids, alkaloids, and glycosides, which may have anti-diabetic properties. These plants are used to treat diseases such as diabetes. Additionally, the combined action of biologically active compounds (e.g., polyphenols, carotenoids, lignans, coumarins, glucosinolates) contributes to the beneficial properties of each plant. This synergistic effect can help understand their biological actions and therapeutic benefits.

Medicinal plant or herbs with anti-diabetic and related beneficial properties

- Ficus bengalensis
- Syzygium Cumini
- Psidium Guajava
- Momordica charantia
- Acacia arabica

FICUS BENGALENSIS

Ficus bengalensis, commonly known as the banyan tree, belongs to the Moraceae family. In Ayurveda medicine, the bark of this tree is used to treat diabetes mellitus. Research has shown that water and alcoholic extracts from the bark can lower blood sugar levels when taken orally. Some scientists have tried to isolate the active components from the bark to understand how it works to lower blood sugar levels. Until now, most studies have focused only on the bark of *Ficus bengalensis*. However, other parts of the tree, such as the fruits, leaves, and aerial roots, have not been thoroughly studied for their effects on diabetes. In a recent study, extracts from the fruits and aerial roots were tested for their ability to lower blood glucose levels. The results were compared with the effects of the bark extract.





fig 3

Ficus benghalensis, a species within this genus, is particularly noteworthy. It was the first source from which the pharmaceutical compound anthocyanin was extracted, known for its ability to inhibit the growth of new blood vessels (anti-angiogenic activity). Furanocoumarins, another group of compounds found in various *Ficus* species, have phytotoxic properties. Research has shown that the methanol extract of *Ficus benghalensis* exhibits diverse effects such as antibacterial activity, promotion of wound healing, inhibition of pollution effects, and fungicidal action. These medicinal properties highlight the potential of *Ficus* species as natural remedies for various health conditions, supported by both traditional knowledge and modern scientific research.

BOTANICAL CLASSIFICATION:

- Kingdom: Plantae
- Order: Rosales
- Family: Moraceae
- Genus: *Ficus*
- Species: *Ficus benghalensis*

This species is commonly known as the banyan tree and belongs to the Moraceae family. It is characterized by its large, spreading canopy and aerial roots that grow from its branches to the ground, giving it a distinctive appearance.

Based on the detailed botanical description provided, here is a summary of the

characteristics of *Ficus benghalensis* (banyan tree):

Tree Size and Appearance:

Ficus benghalensis is a large tree, typically reaching heights of up to 20 to 25 meters. It has a wide, leafy crown with branches that can spread over 100 meters or more. The tree is characterized by its massive trunk, which is fluted (ridged) and covered with smooth, grey bark. Younger parts of the tree may have a soft, white pubescence (fine hair).

Leaves:

The leaves of *Ficus benghalensis* have stout, hairy petioles (leaf stalks) that are compressed ventrally (flattened on one side). The leaf blades are leathery (coriaceous), and their shapes vary from ovate or obovate to elliptic, measuring between 10 to 25 cm in length and 8 to 20 cm in width. The upper surface of the leaves is smooth (glabrous), while the underside is finely pubescent (hairy). The leaf base is subcordate (nearly heart-shaped) or rounded, with obtuse (blunt) apical margins.

Hypanthodia (Fruit Structure):

The fruit of *Ficus benghalensis*, known as hypanthodia, is sessile (stalkless) and occurs in axillary pairs on young branches. They are depressed-globose (flattened and round), with diameters ranging from 15 to 25 cm. These fruits are green and hairy, subtended by small, hairy basal bracts that are reniform (kidney-shaped) and measure approximately 3-4 mm in length and 6-7 mm in width. The apical opening of the fruit is surrounded by 3 flat or slightly raised bracts, and internal bristles are absent.

Flowers:

Male Flowers:

Numerous male flowers are ostiolar (located at the opening of the fig), shortly pedicellate (with short stalks). They typically have 2-3 sepals and a solitary stamen with a shortly mucronate (pointed) anther.

Female Flowers:

These flowers are sessile (stalkless) and mixed with gall flowers. They have 3-4 small sepals, and the ovary includes an elongated style.

Gall Flowers:

- Numerous gall flowers are pedicellate (with stalks). They have small sepals like those of female flowers and a short style.

NUTRITIONAL COMPOSITION

Nutritional composition	Amount (%)
Ash content	2.55 w/w
Protein content	15.02 w/w
Carbohydrate content	12.95 w/w
Lipid content	2.56 w/w
Fiber content	19.45 w/w
Vitamin E	517.65±0.875 mg/g
Vitamin C	203.45±1.877 mg/g

Fig 4

The analysis of *Ficus benghalensis* seeds revealed several key nutritional attributes:

1. High Mineral Content:

The seeds have a high ash content (2.55%), indicating a significant presence of mineral elements.

2. Rich Protein Source:

The seed contains 15.02% protein, making it a valuable protein source.

3. Abundance of Carbohydrate:

Carbohydrates make up 12.95% of the seed composition, highlighting its energy-rich nature.

4. Moderate Fat Content:

The seed contains 2.56% crude fat, which is lower compared to its protein and carbohydrate content.

Extraction process

Drying and Grinding:

The *Ficus benghalensis* fruits were dried at room temperature until they were completely dry. Then, they were ground into a fine powder using an electric grinder. This powder was stored in a sealed container at a cool temperature (5°C) until it was needed.

Dilapidation:

- The fruits (figs) of *Ficus benghalensis* are globose to depressed-globose, with diameters of 15 to 25 cm. They are pinkish-red in colour and hairy.

The powdered root material was treated with petroleum ether (a type of solvent) at a temperature range of 60-80°C overnight. This process helps to remove fats and lipids from the plant material. After this, the mixture was filtered to separate the solid plant material from the solvent.

Ethanol Extraction:

The filtered plant material underwent a process called Soxhlet extraction using 95% ethanol. In simple terms, this involves continuously cycling the ethanol solvent through the plant material for several hours. This helps to extract the desired bioactive compounds from the plant into the ethanol.

Solvent Removal:

After extraction, the ethanol solution containing the extracted compounds was separated from the solid plant material. The ethanol was then removed from the solution using a rotary evaporator. This apparatus applies gentle heat (40-50°C) under reduced pressure to evaporate the ethanol, leaving behind a concentrated extract of the bioactive compounds.

Storage:

Finally, the concentrated extract was stored in a suitable container for further analysis or use in research or applications. This method effectively extracts bioactive compounds from *Ficus benghalensis* for potential use in various applications, including the exploration of antidiabetic properties.

Phytochemical Constituents *Ficus benghalensis*

Plants provide a rich source of natural compounds known as phytochemicals, which play a functional role in treating various health issues in humans. The diverse array of metabolites found in plants offers significant benefits for managing these conditions. Among these plants, species of the *Ficus* genus stand out as particularly rich sources of phytoconstituents belonging to different classes of compounds such as phenol's, flavonoid, sterols, alkaloids, tannin, saponins, terpenoids, and more. These compounds have been studied for their potential medicinal properties and contribute to the therapeutic potential of *Ficus* species in traditional and modern medicine. some phytochemical constituents found in *Ficus benghalensis*, as follows:

1. Triterpenoids:

These are bioactive compounds known for their potential health benefits, including anti-inflammatory and antioxidant properties.

2. Flavonoids:

These compounds have antioxidant effects and may contribute to various health benefits, such as reducing oxidative stress and inflammation.

3. Alkaloids:

Known for their pharmacological activities, alkaloids in *Ficus benghalensis* may have antimicrobial and analgesic properties.

4. Phenolic Compounds:

These compounds contribute to the antioxidant capacity of the plant and may offer protective effects against oxidative damage.

5. Tannin:

Polyphenolic compounds that can bind and precipitate proteins, often with astringent properties.

6. Saponins:

Glycosides known for their ability to produce foam in aqueous solutions and have potential health benefits such as cholesterol-lowering effects.

7. Sterols:

Lipid-like compounds that may contribute to cholesterol-lowering effects.

Pharmacological action of *Ficus benghalensis*

Ficus species have been extensively studied for their various medicinal effects (Figure 6). Researchers have investigated all parts of the plant, including leaves, stem bark, roots, latex, and fruits, to explore their potential health benefits. Some of the studied bioactivities include:

1. Antioxidant:

Ficus species contain compounds that act as antioxidants, helping to neutralize harmful free radicals in the body and reduce oxidative stress. Phenol, flavonoids, and other compounds in *Ficus benghalensis* act as antioxidants. They help neutralize free radicals, thereby reducing oxidative stress in the body.

2. Antidiabetic:

Certain species of *Ficus* have shown properties that can help manage diabetes by lowering blood sugar levels. Extracts from *Ficus benghalensis* have shown hypoglycaemic effects in studies, indicating potential benefits in managing diabetes.

3. Anti-inflammatory:

Components in *Ficus* plants have anti-inflammatory effects, which may help reduce inflammation in the body associated with various diseases. Phenols, flavonoids, and other compounds in *Ficus benghalensis* act as antioxidants. They help neutralize free radicals, thereby reducing oxidative stress in the body.

4. Anticancer and Antitumor:



Studies suggest that some Ficus species exhibit activity against cancer cells and tumours, making them potential candidates for cancer treatment.

5. Antimicrobial:

Ficus plants have compounds that can inhibit the growth of microorganisms, making them useful against infections. Alkaloids and flavonoids found in Ficus benghalensis exhibit antimicrobial properties. This makes the plant potentially effective against a range of pathogens.

6. Anthelmintic:

Some species are effective against parasitic worms.

7. Hepatoprotective:

Certain Ficus species show protective effects on the liver, potentially benefiting liver health.

8. Wound Healing:

The plants have traditionally been used to promote the healing of wounds, likely due to their antimicrobial and tissue-repair properties. Traditional uses of Ficus benghalensis include promoting wound healing. The plant's antimicrobial properties contribute to its effectiveness in supporting tissue repair.

9. Anticoagulant:

Components in Ficus species may have blood-thinning properties.

10. Immunomodulatory:

Some species can modulate the immune system, potentially enhancing immune responses.

11. Antistress:

Ficus plants may have properties that help alleviate stress and its physiological effects.

12. Toxicity Studies:

Research has also been conducted to assess the safety and toxicity levels of Ficus species.

13. Gastrointestinal Health:

The plant is used to treat various gastrointestinal disorders such as diarrheal, dysentery, and constipation. The latex is particularly effective as a laxative.

14. Respiratory Disorders:

Traditional medicine uses the bark and leaves of Ficus benghalensis to treat respiratory issues such as asthma, bronchitis, and cough.

15. Oral Health:

The roots of the banyan tree are chewed to maintain oral hygiene and treat gum diseases.

16. Skin Conditions:

The latex and leaves are used to treat skin conditions such as burns, eczema, and ulcers due to their soothing and healing properties.

17. Reproductive Health:

The plant is believed to have aphrodisiac properties and is used to enhance sexual health and treat reproductive issues.

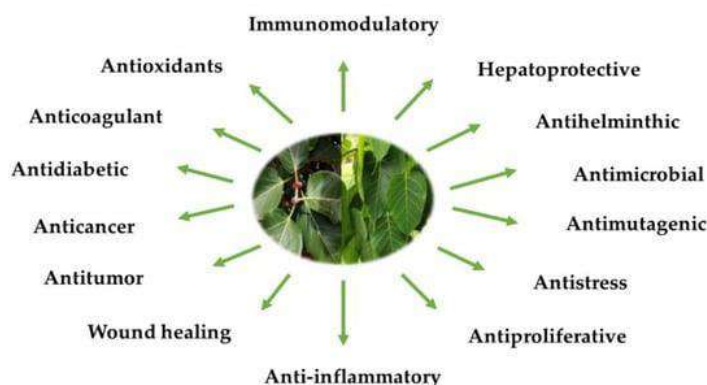


Fig 5

Syzygium Cumini

Syzygium cumini Linn. (Syn. Eugenia jambolan) is a large evergreen tropical tree belonging to the family Myrtaceae. Commonly known as Jamun,

black plum, or jambolan, S. cumini is renowned for its pharmacological properties since ancient times. The tree is native to India and the East Indies, thriving throughout India up to an altitude



of 1800 meters, and its habitat extends from Myanmar to Afghanistan. *Syzygium cumini* is also found in countries like Thailand, the Philippines, and Madagascar.

The medicinal value of *S. cumini* is attributed to the presence of malic acid, oxalic acid, gallic acid, and tannins. Research has extensively explored its pharmacological properties, focusing on compounds such as tannins, flavonoids, essential oils, and betulinic acid. These compounds are reported to have diverse pharmacological activities, including gastroprotective and antiulcerogenic effects, as well as antibacterial, anti-infective, and anti-malarial properties. In

addition to its scientific names *S. jambolanum* and *E. cumini*, other common names for the tree include Jambul, Black Plum, Java Plum, Indian Blackberry, Jamblang, and Jamun.

BOTANICAL CLASSIFICATION

Kingdom: Plantae
Subkingdom: Viridiplantae
Division: Tracheophyta
Class: Magnoliopsida
Order: Myrtales
Family: Myrtaceae
Genus: *Syzygium*
Species: *Cumini*
Scientific Name: *Syzygium cumini*



Fig 6

Nutritional Profile

These include:

1. Carbohydrates-

Carbohydrates in JS provide a primary energy source, supporting bodily functions and physical activity.

2. Protein-

Proteins are crucial for growth, repair, and maintenance of body tissues.

3. Lipids-

Lipids in JS play a role in cell structure, energy storage, and hormone production.

4. Minerals-

Minerals such as calcium, magnesium, potassium, and iron are essential for numerous bodily functions including bone health, muscle function, and oxygen transport.

5. Vitamins-

Vitamins, including vitamin C, vitamin E, and B-vitamins, are vital for metabolic processes, immune function, and antioxidant protection.

Bioactive Phytochemicals

JS is particularly notable for its array of bioactive phytochemicals, which have medicinal importance:

- **Gallic Acid:**

An antioxidant with potential anti-inflammatory and anti-cancer properties.

- **Corilagin:**

Known for its antioxidant, anti-inflammatory, and hepatoprotective effects.

- **Ellagic Acid:**

Provides antioxidant, anti-carcinogenic, and anti-inflammatory benefits.

- **3-Galloylglucose:**

A tannin with antioxidant properties.

- **3,6-Hexahydroxy Diphenoylglucose:**

Another tannin known for its antioxidant activity.

- **1-Galloylglucose:**

Contributes to the antioxidant capacity of JS.

- **β -Sitosterol:**

A phytosterol that may help reduce cholesterol levels and support prostate health.

- **Quercetin:**

An antioxidant flavonoid with anti-inflammatory and anti-carcinogenic effects.

- **4,6-Hexahydroxydiphenoyl Glucose:**

Adds to the antioxidant profile of JS.

These phytochemicals are not only essential for maintaining health but also have potential therapeutic applications in the prevention and management of various diseases\

Protein	0.7 g
Fat	0.3 g
Minerals	0.4 g
Fiber	0.9 g
Carbohydrates	14 g
Energy	62 kcal
Calcium	15 mg
Phosphorous	15 mg
Vitamin C	18 mg
Sodium	26.2 mg
Potassium	55 mg
carotene	48 mg

Fig 7

Extraction process:

Collection of Plant Materials

Fresh fruits of *Syzygium cumini* were gathered from the local area of Bhadrawati, Maharashtra, India. The collected fruits were thoroughly washed under running tap water to eliminate any dust particles. The fruit pulp was separated, and the seeds were meticulously cleaned. The cleaned seeds were then dried at room temperature for 1-2 weeks before being ground into a fine powder using an electric grinder.

Preparation of Plant Extracts

The powdered seed sample was processed using a Soxhlet apparatus and successively percolated with different organic solvents, including methanol, petroleum ether, and 70% ethanol (w/v). The resulting extracts were collected and set aside for further analysis.

CHEMICALS CONSTITUENTS

Nutritional and Medicinal Components:

Jambolan, also known as Java plum, is abundant in various bioactive compounds, which contribute to

its nutritional and medicinal properties. Key components include: The seeds are particularly noteworthy for their medicinal properties:

a. Anthocyanins

- **Types:**

Delphinidin, cyanidin, petunidin, peonidin, and malvidin.

- **Properties:**

Anthocyanins are pigments that provide the deep purple colour to the fruit and have strong antioxidant properties, which help in reducing oxidative stress and inflammation.

b. Flavonoids

- **Isoquercetin:**

A glycoside form of quercetin, known for its antioxidant and anti-inflammatory effects.

- **Kaempferol:**

Another potent antioxidant that can help in protecting cells from damage.

- **Myricetin:**

Known for its anti-cancer, anti-inflammatory, and antioxidant properties.



- **Ellagic Acid**

Properties A powerful antioxidant that also exhibits anti-carcinogenic and anti-inflammatory effects. It is found in significant amounts in the seeds and contributes to their health benefits.

- **c. Glucosides**

- **Types:**

Jambolin (antimellin)

- **Properties:**

Jambolin inhibits the diastatic conversion of starch into sugar, which can help in managing blood sugar levels.

- **d. Tannins**

- **Types:**

Gallic acid, 3-galloylglucose, 3,6-hexahydroxy diphenoylglucose, 1-galloylglucose, 4,6-hexahydroxydiphenoyl glucose.

- **Properties:**

Tannins have astringent properties and contribute to the antioxidant capacity of the plant. They also play a role in the medicinal benefits of the seeds.

- **e. Alkaloids**

- **Jambosine:**

An alkaloid reported to have hypoglycaemic effects, beneficial for managing diabetes.

- **f. Phytosterols**

- **β -Sitosterol:**

A plant sterol that helps reduce cholesterol levels and supports heart health.

- **g. Phenolic Compounds**

- **Properties:**

Phenolic compounds are known for their antioxidant properties, helping in scavenging free

radicals and protecting cells from oxidative damage.

- **h. Vitamins**

- **Vitamin c:**

An essential vitamin for immune function, skin health, and antioxidant protection.

- **Vitamin PP (Niacin):**

Supports digestive health, skin health, and helps reduce cholesterol levels.

- **i. Minerals**

- **Calcium:**

Essential for bone health and muscle function.

- **Magnesium:**

Important for many biochemical reactions in the body, including energy production and muscle function.

- **Potassium:**

Helps in maintaining proper heart function and regulating blood pressure.

- **Iron:**

Essential for the formation of haemoglobin and oxygen transport in the blood.

- **j. Lipids**

- **Properties:**

Lipids in the seeds contribute to cell structure, energy storage, and hormone production. These diverse chemical constituents contribute to the various health benefits associated with *Syzygium cumini*, including its antioxidant, anti-inflammatory, anti-carcinogenic, and hypoglycaemic effects. The combination of these compounds is an excellent source of nutrients and bioactive components with various health benefits, including antioxidant, anti-inflammatory, and potential anti-diabetic effects.

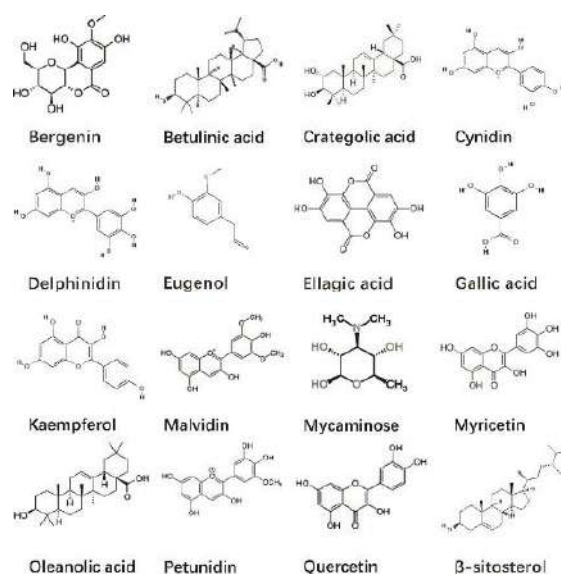


Fig 8

Medicinal and Pharmaceutical Uses (*Syzygium cumini*)

Jambolan, also known as Java plum, has garnered significant recognition in folk medicine and the pharmaceutical industry due to its diverse medicinal properties. Here's a detailed overview of its uses and benefits:

Medicinal Properties

- **Astringent:**
The fruit helps in contracting tissues and can reduce bleeding.
- **Stomachic:**
It aids in digestion and improves appetite.
- **Carminative:**
It helps in relieving flatulence.
- **Antiscorbutic:**
The fruit is used to prevent or treat scurvy.
- **Diuretic:**
It promotes the increased production of urine, helping in detoxification.

Pharmacological Activities

1. Antimicrobial:

Jambolan fruit extracts have shown potential in combating microbial infections. The fruit extract of jambolan exhibits antimicrobial activity against a range of pathogens due to its rich phytochemical content

2. Cytotoxic:

The extracts also exhibit properties that can kill or inhibit the growth of cancer cells. The cytotoxic effects of jambolan are attributed to its flavonoids and other phytochemicals, which can induce apoptosis in cancer cells and inhibit their proliferation.

3. Antioxidant:

High in anthocyanins, tannins, and flavonols, jambolan exhibits significant antioxidant activity, which can reduce oxidative stress and the risk of degenerative diseases. The high content of anthocyanins, flavonoids, and phenolic compounds in jambolan exhibits potent antioxidant properties, helping to scavenge free radicals and reduce oxidative stress

4. Anti-inflammatory Effects:-

Jambolan contains bioactive compounds like ellagic acid and flavonoids that exhibit anti-inflammatory properties by inhibiting pro-inflammatory mediators.

5. Radioprotective Effects:-

The radioprotective effects are due to the presence of antioxidants in jambolan, which can protect cells from radiation-induced damage.

6. Chemo preventive Effects-

The chemopreventive properties of jambolan are linked to its ability to inhibit mutagenesis and carcinogenesis due to its rich antioxidant content.

7. Gastroprotective Effects-

Jambolan exhibits gastroprotective properties by reducing gastric acid secretion and protecting the gastric mucosa.

Traditional and Topical Uses

- **Enlargement of the Spleen, Chronic Diarrhea, and Urine Retention:**

The juice of ripe fruit, a decoction of the fruit, or jambolan vinegar are traditionally used in India.

- **Sore Throat and Ringworm:**

Water-diluted juice is used as a gargle for sore throat and as a lotion for treating ringworm of the scalp.

- **Diabetes Management:**

Jambolan juice mixed with mango juice can help quench thirst in diabetics. Seed and bark extracts are widely used in tropical medicine for managing diabetes mellitus or glycosuria. Fresh seeds are considered more effective than dried ones. Jambolan seeds and bark contain compounds like jamboline and ellagic acid that inhibit the conversion of starch into sugar, helping in the management of blood glucose levels.

- **Cancer Prevention and Treatment:**

Recent studies have shown that jambolan possesses antineoplastic, radioprotective, and chemopreventive effects due to its diverse phytochemical composition, including flavonoids, anthocyanins, and terpenes.

Uses in Food and Pharmaceutical Industries

- **Natural Food Colorants:**

The high anthocyanin content in jambolan fruits makes them an excellent source of natural food colorants for the food processing industry.

- **Pharmaceutical Supply:**

The seeds and bark of jambolan are exported to pharmaceutical supply houses in Europe and England, primarily from India, Malaya, Polynesia, and the West Indies.

Psidium Guajava

The guava tree, scientifically known as *Psidium guajava* L., belongs to the Myrtaceae family and is valued for its diverse medicinal and nutritional properties. It is extensively cultivated in tropical regions such as India, Indonesia, Pakistan, Bangladesh, and South America.

Guava has a low glycaemic index (GI) of 12–24 and only 8.92 grams of sugar per 100 grams, so it's easy to digest and absorb, which can help minimize blood glucose level spikes.

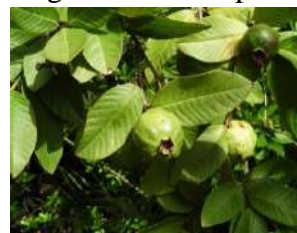


Fig no 9

Guava has a low glycaemic index (GI) of 12–24 and only 8.92 grams of sugar per 100 grams, so it's easy to digest and absorb, which can help minimize blood glucose level spikes. Polysaccharides are a major component of guava fruit, and some studies have reported that they may have anti-diabetic effects. For example, one study found that polysaccharides from guava leaves could lower fasting blood sugar, total cholesterol, and other markers in diabetic mice.

Botanical Description

- **Leaves:**

Dark green, elliptical, oval with an obtuse-type apex.

- **Roots, Bark, Stem, and Fruits:**

All parts of the tree have medicinal uses

BOTANICAL CLASSIFICATION:

Botanical Classification	
Kingdom	Plantae – Plants
Subkingdom	Tracheobionta Vascular plants
Division	Magnoliophyta Flower plants
Class	Magnoliopsida Dicotyledonous
Subclass	Rosidae
Order	Myrtales
Family	Myrtaceae
Subfamily	Myrtoideae
Gender	Psidium
Species	<i>Psidium guajava</i>

Fig 10

NUTRITION FACTS:

1. Low Glycemic Index

- **GI Value:**

Guava has a low glycemic index (GI) of 12–24.

- **Sugar Content:**

Contains only 8.92 grams of sugar per 100 grams, making it suitable for people with diabetes as it minimizes blood glucose spikes.

2. Polysaccharides

- **Composition:**

Polysaccharides are a significant component of guava fruit.

- **Anti-diabetic Effects:**

Studies indicate that guava leaf polysaccharides can lower fasting blood sugar, total cholesterol, and other markers in diabetic mice.

3. Weight Management

Benefit:

Helps with weight management, reducing the risk of obesity in insulin-resistant diabetic individuals.

Guavas Nutrition Facts		
Serving size 100 g		DV
Calories	61 kcal	3%
Total Carbohydrate	14.7 g	5%
Dietary Fiber	2.99 g	12%
Sugars	8.98 g	
Total Fat	0.58 g	1%
Protein	1.12 g	2%
Vitamin C	92.65 mg	155%
Vitamin K	4.28 µg	50%
Folate	24.97 µg	6%
Magnesium	17.56 mg	4%
Potassium	311.86 mg	9%
Copper	0.11 mg	6%
Manganese	0.11 mg	5%

Fig 11

EXTRACTION PROCESS

QUERCETIN

MATERIALS AND METHODS:

1. Sample Preparation:

- Collect fresh guava leaves and wash them thoroughly with distilled water.



- Dry the leaves at room temperature or in an oven at a low temperature (below 40°C) to avoid degradation of active compounds.
- Grind the dried leaves into a fine powder using a grinder or mill.

2. Solvent Extraction:

- Weigh a specific amount of guava leaf powder (e.g., 10 g).
- Add the powder to a suitable solvent such as ethanol, methanol, or a mixture of water and ethanol/methanol.
- Use a solvent-to-powder ratio of 10:1 (v/w) for effective extraction.
- Stir the mixture continuously using a magnetic stirrer for a specific period (e.g., 24 hours) at room temperature or under controlled conditions.

3. Filtration and Concentration:

- Filter the mixture through Whatman filter paper to remove solid residues.
- Concentrate the filtrate using a rotary evaporator under reduced pressure at a temperature not exceeding 40°C to obtain a concentrated extract.

4. Purification (if needed):

- Use techniques such as column chromatography or HPLC to further purify the quercetin.

Ascorbic Acid

MATERIALS AND METHODS:

1. Sample Preparation:

- Follow the same initial steps as for quercetin extraction to prepare the guava leaf powder.

2. Extraction:

- Weigh a specific amount of guava leaf powder (e.g., 10 g).
- Add the powder to an acidified solvent (e.g., 5% metaphosphoric acid or 3% oxalic acid) to prevent oxidation of ascorbic acid.
- Use a solvent-to-powder ratio of 10:1 (v/w).

- Stir the mixture continuously for a specific period (e.g., 1-2 hours) at room temperature.

3 Filtration. and Analysis:

- Filter the mixture through Whatman filter paper to remove solid residues.
- Analyze the filtrate for ascorbic acid content using methods such as HPLC or spectrophotometric assays.

Chemical composition

Chemical Composition of Guava (*Psidium guajava* L.)

Fruits

• Vitamins and Minerals:

The guava fruit is rich in vitamin A, vitamin C, iron, phosphorus, and calcium. It has a higher vitamin C content than oranges.

• Phytochemicals:

The fruit contains several bioactive compounds including:

- Saponin
- Oleanolic Acid
- Lyxopyranoside
- Arabopyranoside
- Guaijavarin
- Quercetin:

A flavonoid with antioxidant properties (Fig. a).

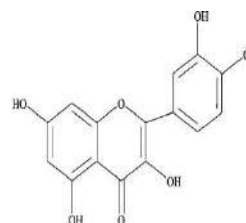
- Flavonoids
- Ascorbic Acid:

Also known as vitamin C, it plays a key role in anti-mutagenic activity (Fig. b).

• Citric Acid:

Contributes to the fruit's anti-mutagenic properties.

Leaves



(a)

- Essential Oils:

Guava leaves contain essential oils with the following components:

- α -Pinene
- **Limonene:**

Present in high content (about 42.1%).

- β -Pinene
- Isopropyl Alcohol
- Menthol
- Terpenyl Acetate

- **Caryophyllene:**

Makes up about 21.3% of the essential oils.

- Longicyclene
- β -Bisabolene
- Oleanolic Acid
- Volatile Compound: Guava leaves are rich in volatile compounds.

Bark

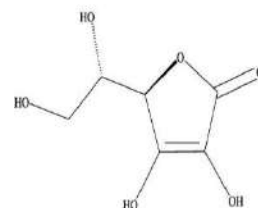
Tannins:

The bark contains 12–30% tannin, with some sources reporting up to 27.4%. Tannins are a type of polyphenol.

- Other Components
- Polyphenols
- Resin
- Calcium Oxalate Crystals

Roots

- Tannins: Similar to the bark, tannins are present in the roots.
- Other Phytochemicals
- Leucocyanidins
- Gallic Acid
- Sterols



(b)

Physico chemical constituents

Traits	Fresh fruit	Fruit Pulp
TSS (%)	10.0	9.0
pH	4.10	4.1
Titration acidity (%)	0.54	0.64
Ascorbic acid(mg/100g)	200.5	198.7
Reducing sugars (%)	6.23	4.21
Non-reducing sugars (%)	4.37	1.37
Total sugars (%)	10.60	5.58

Fig 12

NUTRITIONAL BENEFITS:

Benefits and Uses of Guava (*Psidium guajava* L.)

1. Boosts Immunity

Vitamin C:

Guavas are one of the richest sources of vitamin C, containing four times more than oranges. Vitamin C enhances immunity, protects against infections, and helps reduce the duration of the common cold.

Main Benefit:

Regular consumption of guava boosts immunity and protects against illnesses and infections.

2. Improves Thyroid Health

Copper Content:

Guava contains copper, essential for hormone production and absorption, improving endocrine system functions, especially thyroid glands. This helps maintain a healthy metabolic rate and overall thyroid health.

Main Benefit:

Guavas help maintain a healthy metabolic rate and positively affect overall thyroid health.

3. Anti-cancer Properties

Antioxidants:

Rich in vitamin C and antioxidants like lycopene, guava helps eliminate harmful free radicals, potentially reducing cancer risk. Studies indicate regular guava consumption can inhibit the growth of cancerous cells and tumors.

Main Benefit:

Guava juice can help decrease cancer cell development.

4. Anti-diabetic Effects

Fiber Content:

High in fibre and with a low glycaemic index, guavas help lower blood sugar levels and prevent rapid glucose absorption. Studies show that guava leaf tea can significantly reduce postprandial blood sugar levels.

Main Benefit:

Regular consumption of guava helps manage blood sugar levels in diabetics.

5. Skin Care

Antioxidants and Vitamins:

Guavas are rich in vitamins A, B, C, carotene, and lycopene, which protect the skin from aging, UV damage, and pollution. They help maintain skin hydration, reduce wrinkles, and improve skin texture.

Main Benefit:

Guava is a comprehensive solution for skin care, enhancing skin health and appearance.

6. Improves Digestion

Fiber and Antimicrobial Properties:

The high fibre content in guava aids in constipation relief and promotes healthy bowel movements. Guava leaf extract has antimicrobial properties that help heal diarrhoea and maintain intestinal health.

Main Benefit:

Guava juice treats constipation and diarrhoea, promoting healthy digestion.

7. Supports Eye Health

Vitamin A:

While not as rich in vitamin A as carrots, guava still provides a good amount of this nutrient,

essential for maintaining good vision and preventing eye disorders like cataracts and macular degeneration.

Main Benefit:

Eating guava helps maintain good eye health and vision.

8. Enhances Brain Function

Vitamins B3 and B6:

Guavas contain niacin (B3) and pyridoxine (B6), which improve blood circulation to the brain and relax the nerves. Magnesium in guavas also helps relax muscles and nerves.

Main Benefit:

Eating guava helps relax the nerves and enhance brain function.

9. Promotes Hair Health

Nutrients for Hair Growth:

Guava is rich in vitamins A, C, folic acid, potassium, and other nutrients that promote healthy hair growth and help combat hair loss.

Main Benefit:

Guava is beneficial for healthy hair growth and maintenance.

10. Aids in Weight Loss

Caloric Content:

Guavas are filling and satisfy hunger without high caloric intake, making them an ideal snack for weight loss. They are rich in vitamins, minerals, and dietary fiber.

Main Benefit:

Guavas are a weight loss-friendly snack that keeps the stomach full for a long time.

11. Treats Scurvy

High Vitamin C Content:

Guavas contain four times more vitamin C than oranges, making them highly effective in treating scurvy, a condition caused by vitamin C deficiency.

a. Main Benefit:

Scurvy can be cured by drinking guava juice, thanks to its high vitamin C content.

THERAPEUTIC EFFECT:



Benefits and Uses of Guava (*Psidium guajava* L.)

Laxative Properties

- **Dietary Fiber:**

Guava, particularly its fruits and leaves, is rich in dietary fibre, essential for constipation therapy. A 100-gram serving of guava fruit provides approximately 36 grams of dietary fibres.

- **Guava Seeds:**

Known to be effective laxatives, aiding in the relief of chronic constipation and colon cleaning.

- **Digestive Health:**

One guava provides about 12% of the daily required fibre intake, promoting digestive health.

Oral Health Benefits

- **Periodontitis Prevention:**

Guava is rich in quercetin, which has strong antibacterial properties effective against pathogens causing periodontitis, such as *Aggregatibacter actinomycetemcomitans* and *Prohormones gingivalis*.

- **Gum Health:**

High vitamin C content in guava helps treat scurvy and gum bleeding. Its astringent properties are useful for treating toothaches and ulcers.

- **Oral Hygiene:**

Chewing guava leaves can alleviate bad breath, making it beneficial for overall oral health.

Anti-diabetic Properties

- **Blood Sugar Regulation:**

Guava leaves and fruits can lower blood sugar levels. Studies have shown that guava leaf extract reduces postprandial hyperglycemia by inhibiting intestinal glycosidases.

- **Guava Tea:**

Drinking guava tea after meals helps manage blood glucose levels. Consuming guava leaf decoction regularly can reduce fasting blood glucose levels.

Respiratory Health

- **Cold and Cough Relief:**

Guava leaves are effective in treating colds and coughs by reducing lung congestion and mucus production. The high vitamin C content boosts immunity.

Traditional Remedies:

In many cultures, roasted guava is used to treat severe coughs, colds, and congestion.

Antibacterial Properties

- **Broad Spectrum Antibacterial Activity:**

Guava extracts are effective against Gram-positive and Gram-negative bacteria, including multidrug-resistant *Vibrio cholerae*, *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella* spp.

- **Traditional Use:**

In some villages, guava leaves are chewed to treat infections, particularly in children.

Anticancer Activity

- **Lycopene:**

An antioxidant found in guava, particularly in the red flesh, is effective in cancer prevention and treatment, especially breast and prostate cancer.

- **Flavonoids and Carotenoids:**

Guava contains carotenoids, vitamin C, and quercetin, which help in preventing lung and oral cancers.

Cardiovascular Health

- **Antihypertensive:**

Guava contains potassium, which aids in blood pressure regulation.

- **Hypolipidemic Effects:**

High in pectin and other compounds, guava reduces blood lipids, decreasing the risk of cardiovascular diseases.

Gastrointestinal Health

- **Protective Effect:**

The flavonoids and quercetin in guava protect against gastrointestinal illnesses. The alkalinity of the fruit and leaves prevents harmful bacterial growth.

- **Antidiarrheal:**

Guava leaves have significant antibacterial action against pathogens causing diarrhea. Drinking



guava leaf tea can help in maintaining stool consistency and treating gastrointestinal issues.

General Health Benefits

- **Stomach-ache Relief:**

Various parts of the guava tree are used to alleviate stomach-aches.

- **Diabetes Management:**

Guava components are employed in managing diabetes.

- **Respiratory Disorders:**

Leaves, pulp, and seeds are used for respiratory issues.

- **Dengue Fever:**

Guava leaves help increase platelet counts in dengue patients. Guava (*Psidium guajava* L.) is a multifaceted plant with extensive medicinal and nutritional properties, making it valuable for various health benefits and treatments.

Momordica charantia

M. charantia, otherwise known as bitter melon or bitter gourd. It is a member of the Cucurbitaceae family distinctly known for its intensely bitter taste. This flowering vine is widely cultivated in tropical and subtropical regions around the world, including Asia, India, East Africa, and South America. Bitter melon (*Momordica charantia*) is a complex plant with a rich history of use as both food and medicine.



Fig 13

IDENTIFICATION

Kingdom Plantae

Division Magnoliophyta

Family Cucurbitaceae

Genus *Momordica*

Species *charantia*

Duration Annua

Bitter melon (*Momordica charantia*) is a complex plant with a rich history of use as both food and medicine.

SCIENTIFIC IDENTIFICATION

Kingdom Plantae

Division Magnoliophyta

Family Cucurbitaceae

Genus *Momordica*

Species *charantia*

Duration Annua

BOTANICAL CLASSIFICATION

Kingdom- Plantae

Division -Magnoliophyte

Family -Cucurbitaceae

Genus -*Momordica*

species -*charantia*

Duration -Annua

Nutritional composition

Momordica charantia, commonly known as bitter melon, is primarily composed of water (91.8%), with 0.20% fat, 4.2% carbohydrates, and 1.4% fibre. The protein fractions present in bitter melon are albumin (49.3%), globulin (29.3%), and glutelin (3.1%). The seeds contain a significant amount of oil, ranging from 35% to 40%, with a fatty acid profile dominated by polyunsaturated fatty acids (59.96%), followed by saturated fatty acids (36.71%), and monounsaturated fatty acids (3.33%). Notably, the seeds contain α -eleostearic acid, a polyunsaturated fatty acid, at 54.26% (Grossmann et al., 2009).

Bitter Melon Nutrition Facts			Compounds	Content
Serving size	100 g	DV		
Calories	17 kcal	1%		
Total Carbohydrate	3.7 g	1%	Water (%, wb)	93.4 + 1.4
Dietary Fiber	2.8 g	11%	Total carotene (%, wb)	0.10+ 0.02
Total Fat	0.2 g	0%	β carotene (ppm, wb)	0.11+ 0.01
Protein	1 g	2%	Pectin (%, wb)	1.41+0.05
Vitamin A	471 IU	9%	Soluble dietary fiber (%, wb)	2.99 +0.07
Vitamin C	84 mg	140%	Insoluble dietary fiber (%)	0.55+ 0.01
Thiamin	0 mg	3%	Diosgenin (ppm, wb)	16.42+0.06
Niacin	0.4 mg	2%	β -sitosterol (ppm, wb)	348.16+ 1.66
Vitamin B6	0 mg	2%	Stigmasterol (ppm, wb)	183.08+0.8
Folate	72 μ g	18%	Campesterol (ppm, wb)	130.79+ 0.4
Pantothenic Acid	0.2 mg	2%		
Calcium	19 mg	2%		
Iron	0.4 mg	2%		
Magnesium	17 mg	4%		
Phosphorus	31 mg	3%		
Potassium	296 mg	8%		
Zinc	0.8 gm	5%		
Copper	0 mg	2%		
Manganese	0.1 mg	4%		
Selenium	0.2 μ g	0%		

Fig 14

Extraction process:**Preparation of Bitter Melon Powder:**

- Bitter melons (*Momordica charantia*) are harvested and thoroughly cleaned to remove dirt and debris. They are then dried until they reach a suitable moisture content for grinding into a fine powder.
- Bitter melon powder (1,150.1 g) was extracted with methanol (MeOH) under reflux (65-75°C) for 3 hours (total volume 6 liters \times 5).
- After extraction, the solvent was evaporated under reduced pressure (in vacuo), yielding a brown residue (351.4 g).
- The concentrated extract is then stored in suitable containers (e.g., amber glass bottles) protected from light and moisture to maintain its stability and bioactivity.

PHYTOCHEMICAL CONSTITUENTS OF MOMORDICA CHARANTIA

Momordica charantia, commonly known as bitter melon, primarily contains cucurbitacin's, sterols, triterpenoids, and vicine. These phyto-constituents contribute to the plant's medicinal properties. Here is an overview of the main chemical structures of these isolated compounds:

1. Cucurbitacin's:

These are highly oxygenated tetracyclic triterpenoids known for their bitter taste and biological activities, such as anti-inflammatory and anti-cancer properties.

Structure:

Cucurbitacin's have a characteristic triterpenoid skeleton with various functional groups, including hydroxyl, acetyl, and ketone groups.

2. Sterols:

These are steroid alcohols, a subgroup of steroids, and are important components of cell membranes in plants.

Structure:

Sterols have a tetracyclic structure with a hydroxyl group at the C-3 position and a side chain at the C-17 position. Common examples include β -sitosterol and stigmasterol.

3. Triterpenoids:

These are a diverse class of organic compounds composed of six isoprene units and are known for their therapeutic potential.

Structure:

Triterpenoids typically have a 30-carbon skeleton that can be arranged in various structures, such as oleanane, ursane, and lupane.

4. Vicine:

This is a glycoside found in various plants and known for its potential toxic effects in some individuals.

Structure:

Vicine is composed of a pyrimidine base attached to a sugar moiety (glucose).

These compounds are responsible for the diverse pharmacological activities of *Momordica*

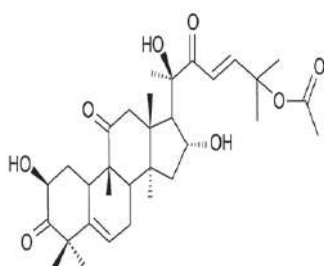
charantia, making it a valuable plant in traditional and modern medicine.

Cucurbitacin's

Cucurbitacins are highly oxygenated tetracyclic triterpenoids. They are known for their bitter taste and are found in various parts of the plant, including the fruit, seeds, and leaves.

General Structure:

Cucurbitacins have a tetracyclic structure with various functional groups, including hydroxyl, acetyl, and ketone groups. The core structure typically resembles a steroid framework with modifications



Sterols

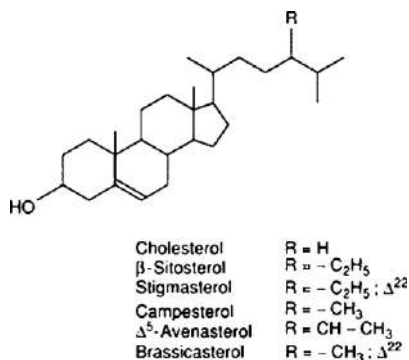
Sterols are steroid alcohols and are important components of cell membranes. In plants, they help maintain cell membrane integrity and fluidity.

β-Sitosterol:

One of the most common plant sterols, it has a structure similar to cholesterol but with an ethyl group at C-24.

Stigmasterol:

Another common plant sterol, with a structure similar to β-sitosterol but with a double bond at C-22.



Triterpenoids

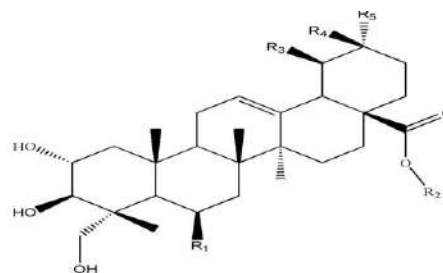
Triterpenoids are a diverse class of organic compounds composed of six isoprene units. They are known for their therapeutic potential, including anti-inflammatory and anti-cancer properties.

Oleanolic Acid:

A common triterpenoid with a structure based on the oleanane skeleton.

Ursolic Acid:

Similar to oleanolic acid but based on the ursane skeleton.



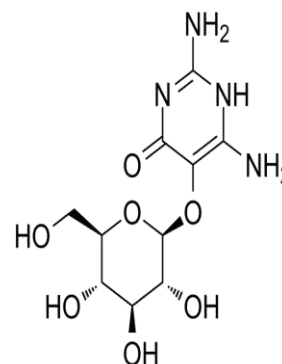
Asiaticoside B	R ₁ =OH	R ₂ =Glu-Glu-Rha	R ₃ =H	R ₄ =CH ₃	R ₅ =CH ₃
Madecassoside	R ₁ =OH	R ₂ =Glu-Glu-Rha	R ₃ =CH ₃	R ₄ =H	R ₅ =CH ₃
Asiaticoside	R ₁ =H	R ₂ =Glu-Glu-Rha	R ₃ =CH ₃	R ₄ =H	R ₅ =CH ₃
Madecassic acid	R ₁ =OH	R ₂ =H	R ₃ =CH ₃	R ₄ =H	R ₅ =CH ₃
Asiatic acid	R ₁ =H	R ₂ =H	R ₃ =CH ₃	R ₄ =H	R ₅ =CH ₃

Vicine

Vicine is a glycoside found in various plants and can have toxic effects in certain individuals (e.g., those with favism).

Structure:

Vicine consists of a pyrimidine base (specifically, a 2,6-diaminopyrimidine) linked to a glucose moiety. These phyto-constituents contribute to the medicinal properties of *Momordica charantia*, making it valuable in both traditional and modern medicinal applications.



Therapeutic Uses

The pharmacological profile of *Momordica charantia* (bitter melon) as per the Ayurvedic

Pharmacopoeia includes its various properties, therapeutic uses, and actions according to traditional Ayurvedic medicine. Here is a summary based on the principles of Ayurveda:

Ayurvedic Properties

- Rasa (Taste): Tikta (Bitter), Katu (Pungent)
- Guna (Quality): Laghu (Light), Ruksha (Dry)
- Virya (Potency): Ushna (Hot)
- Vipaka (Post-Digestive Effect): Katu (Pungent)

Dosha Effects

- Balancing Effect: Kapha and Pitta doshas
- Aggravating Effect: Vata dosha in excess

Therapeutic Uses

1. Antidiabetic:

Momordica charantia is widely used to manage diabetes and lower blood sugar levels.

2. Digestive Aid:

It helps in stimulating digestive processes and alleviating indigestion.

3. Liver Health:

Acts as a hepatoprotective agent, supporting liver function and detoxification.

4. Anti-inflammatory:

Reduces inflammation and can be used in the treatment of conditions like arthritis.

5. Antimicrobial:

Possesses antibacterial and antiviral properties, making it useful in treating infections.

6. Antioxidant:

Contains compounds that help neutralize free radicals, thus protecting cells from damage.

7. Anthelmintic:

Used to expel parasitic worms and other internal parasites from the body.

8. Skin Conditions:

Applied topically for skin disorders such as acne, eczema, and psoriasis.

9. Pharmacological Actions

Hypoglycaemic Activity:

Momordica charantia is known for its blood sugar-lowering effects, useful in the management of

diabetes. It increases insulin sensitivity and glucose uptake in cells.

Antioxidant Activity:

Rich in antioxidants, it helps protect the body from oxidative stress and free radical damage.

Anti-inflammatory Activity:

Reduces inflammation by inhibiting the production of pro-inflammatory cytokines.

Antimicrobial Activity:

Effective against a wide range of bacteria, viruses, and fungi.

Hepatoprotective Activity:

Protects liver cells from damage and supports liver function.

Anthelmintic Activity:

Effective in eliminating intestinal worms and parasites.

Anti-cancer Activity:

Contains compounds that may help in inhibiting the growth of cancer cells.

Usage and Dosage

1. Juice (Swarasa): 10-20 ml, typically taken twice a day.
2. Powder (Churna): 1-3 grams, typically taken twice a day with water or honey.
3. Decoction (Kwath): 30-50 ml, typically taken twice a day.

- Momordica charantia is a versatile plant used extensively in Ayurvedic medicine for its numerous health benefits. Its pharmacological profile highlights its significance in managing a variety of health conditions, particularly diabetes and digestive disorders.

Medicinal Uses

Momordica charantia, commonly known as bitter gourd or bitter melon, is a plant with a wide range of medicinal properties. It has been studied extensively and found to be effective in treating several health conditions. Here's a summary in simpler terms:

1. Antidiabetic: Helps in managing diabetes.



2. **Antibacterial:** Fights against bacterial infections.
3. **Antiviral:** Effective against viruses like HIV and herpes.
4. **Anticancer:** Shows potential in combating cancer cells.
5. **Anti-inflammatory:** Reduces inflammation and pain.
6. **Immunomodulatory:** Modifies immune responses.
7. **Hypotensive:** Lowers blood pressure.
8. **Antioxidant:** Protects against cell damage.
9. **Antifertility:** Affects fertility, sometimes used as a contraceptive.
10. **Cardioprotective:** Benefits heart health.
11. **Other uses:** Treats conditions like eczema, gout, jaundice, and rheumatism. Also used for its laxative and anthelmintic (against worms) properties.

Acacia arabica

Acacia arabica, commonly known as babul or gum arabic tree, belongs to the family Mimosaceae and is found extensively across India, Arabia, Sudan, Sri Lanka, Morocco, and Senegal. Sudan is the largest producer of acacia gum, supplying about 85% of the world's demand. Here are some of its notable medicinal properties: The study mentioned focuses on evaluating the antidiabetic activity of a hydroalcoholic extract of Acacia arabica leaves collected from Amravati District, Maharashtra, India. The leaves were identified and authenticated by Namrata Kakpure from the Department of Botany at Vidyabharati Mahavidyalaya, Amravati. After collection, the leaves were cleaned, dried in shade, and stored in air-tight containers for further research.

Nutritional requirement

Finding specific nutritional requirements for Acacia arabica can be challenging as it's primarily valued for its medicinal and industrial uses rather

than as a food source with well-documented nutritional data. However, here are some general insights: Acacia arabica is known to produce edible gum Arabic, which is used in various food applications as a stabilizer and thickening agent. It also contains phytochemicals and bioactive compounds that contribute to its medicinal properties. The study mentioned focuses on evaluating the antidiabetic activity of a hydroalcoholic extract of Acacia arabica leaves collected from Amravati District, Maharashtra, India. The leaves were identified and authenticated by Namrata Kakpure from the Department of Botany at Vidyabharati Mahavidyalaya, Amravati. After collection, the leaves were cleaned, dried in shade, and stored in air-tight containers for further research.



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Contents

Water (g/100 g)	15.9
Carbohydrate (g/100 g)	83.9
Lipid (g/100 g)	< 0.1
Protein (g/100 g)	0.1
Ash (g/100 g)	0.0
Energy (kcal/100 g)	337.0

BOTANICAL CLASSIFICATION

Genus - shrubs and trees

Subfamily -Mimosoideae

Family -Fabaceae or Leguminosae

Species- *Acacia nilotica*

Extraction process

Here's a detailed description of the extraction process for *Acacia arabica* for antidiabetic use, explained in following:

1. Collection and Preparation of Plant Material:

Acacia arabica leaves, bark, or other parts are gathered from a known and verified source. They undergo a thorough cleaning process to remove any dirt or unwanted materials. After cleaning, the plant material is dried under controlled conditions to preserve its natural chemical properties.

2. Extraction Using Methanol-Water Solvent:

Dried leaves of *Acacia arabica* (100 grams) are used for extraction. They are placed in a Soxhlet extractor, where they are repeatedly soaked and rinsed with a mixture of methanol and water (1:1 ratio). This extraction process helps dissolve and extract the beneficial compounds from the plant material. The solvent is then evaporated and the resulting extract is concentrated using a water bath at controlled temperatures. The yield of the extract obtained from this process is typically around 10.58%.

3. Further Purification Techniques:

Depending on the complexity of the extract and its intended use (in this case, for antidiabetic properties), additional purification methods may be employed. Techniques such as

chromatography (like column chromatography or HPLC) are used to isolate specific bioactive compounds known to have antidiabetic effects. This step ensures that the extract is enriched with compounds that target diabetes-related symptoms.

4. Storage of Concentrated Extract:

The concentrated extract, now enriched with targeted bioactive compounds, is stored in appropriate containers such as amber glass bottles. These containers are chosen to protect the extract from light and maintain its stability. Storage is done in cool, dark places to prevent degradation and preserve the extract's bioactivity over time.

CHEMICALS CONSTITUENTS

Over the past seventy years, approximately 152 chemical compounds have been isolated from the *Acacia* genus. These include flavonoids (1-44), terpenoids and phytosterols (45-78), phenolic acids (79-99), fatty acids (100-110), hydrocarbons (111-123), and other compounds. Among these, flavonoids, terpenoids, and phenolic acids are the most commonly found substances in this genus.

Acacia arabica, also known as babul or gum arabic tree, contains a variety of phytochemicals that contribute to its medicinal properties. These constituents can vary significantly based on factors such as geographical location, climate, and the specific part of the plant used. Here are some key phytochemicals identified in *Acacia arabica*:

1. Tannins:

Known for their antioxidant and antibacterial properties.



2. Flavonoids:

Examples include quercetin, kaempferol, and catechins, which possess antioxidant and anti-inflammatory effects.

3. Alkaloids:

Bioactive compounds with potential pharmacological activities.

4. Saponins:

Compounds known to lower cholesterol and exhibit antifungal properties.

5. Glycosides:

Including cyanogenic glycosides, which have diverse biological activities.

6. Phenolic acids:

Such as gallic acid and ellagic acid, known for their antioxidant properties.

7. Terpenoids:

Including triterpenes and sterols, which have various biological activities. These phytochemicals collectively contribute to the medicinal properties associated with *Acacia arabica*, including antioxidant, antimicrobial, anti-inflammatory, and other therapeutic effects. The diversity of compounds underscores its potential in traditional and modern medicine applications.

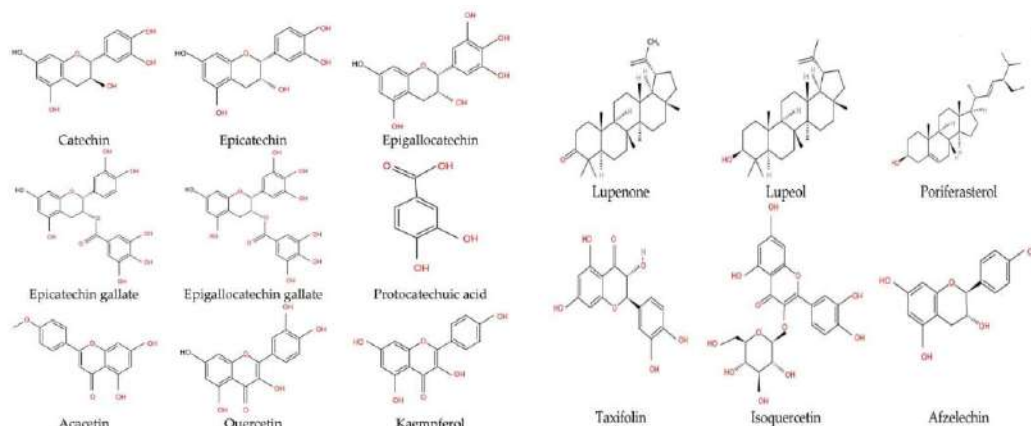


Fig 17

a. Flavonoid:

Flavonoids are abundant in *Acacia arabica* and include compounds such as quercetin, kaempferol, catechins, and flavones. These compounds exhibit antioxidant, anti-inflammatory, and antimicrobial properties.

b. Terpenoids and Phytosterols:

Terpenoids and phytosterols found in *Acacia arabica* include triterpenes and sterols. These compounds have shown diverse biological activities, including anti-inflammatory and antimicrobial effects.

c. Phenolic Acids:

Phenolic acids such as gallic acid and ellagic acid are present in *Acacia arabica*. These compounds are known for their antioxidant and anti-inflammatory properties.

d. Tannin:

Tannins contribute to the astringent properties of *Acacia arabica* and possess antioxidant and antibacterial activities.

e. Alkaloids:

Bioactive alkaloids found in *Acacia arabica* have shown potential pharmacological activities, although specific compounds and their effects vary.

f. Saponins:

These compounds are known for their cholesterol-lowering and antimicrobial properties in *Acacia arabica*.

MEDICINAL USES AND PHARMACOLOGICAL EFFECTS

Acacia arabica, also known as the gum arabica tree or Babul, is renowned for its diverse medicinal uses across different cultures. Here are some of the

medicinal traits and pharmacological activities associated with various parts of *Acacia arabica*:

Antimicrobial Activity:

Acacia arabica is known for its antimicrobial properties, which make it effective in treating infections of the skin, respiratory tract, and gastrointestinal system. It has been traditionally used for its ability to combat various pathogens

Anti-inflammatory Effects:

Compounds like flavonoids and phenolic acids found in *Acacia arabica* contribute to its anti-inflammatory properties. These compounds help reduce inflammation and alleviate symptoms of inflammatory conditions

Antioxidant Properties:

Acacia arabica contains flavonoids, phenolic acids, and tannins that exhibit antioxidant activity. These compounds scavenge free radicals, protect cells from oxidative stress, and support overall cellular health.

Wound Healing:

Traditional uses of *Acacia arabica* include wound healing due to its antimicrobial and tissue-repairing properties. It aids in faster healing and prevents infections in wounds

Antidiabetic Potential:

Research suggests that *Acacia arabica* may have antidiabetic effects by lowering blood sugar levels and improving insulin sensitivity. This makes it potentially beneficial in managing diabetes

Gastrointestinal Disorders:

It is used traditionally to treat diarrhea and dysentery, owing to its astringent properties that help reduce intestinal inflammation and combat microbial infections

Pharmacological Effects of *Acacia arabica*:

Hepatoprotective Activity:

Compounds in *Acacia arabica* have demonstrated hepatoprotective effects, protecting the liver from toxins and chemicals. This property supports liver health and function

Cardioprotective Effects:

Some studies indicate that *Acacia arabica* may have beneficial effects on heart health. Its antioxidant and anti-inflammatory actions potentially contribute to protecting the heart from oxidative damage and inflammation

Anti-ulcer Properties:

Acacia arabica is known for its traditional use in treating ulcers. It protects the stomach lining and reduces gastric acidity, thereby alleviating ulcer symptoms

Immunomodulatory Effects:

Compounds such as flavonoids and polysaccharides found in *Acacia arabica* may modulate immune responses, enhancing the immune system's ability to defend against infections and diseases

Analgesic and Antipyretic Activities:

Traditional uses of *Acacia arabica* include pain relief and fever reduction. Its anti-inflammatory and analgesic properties contribute to these therapeutic effects

CONCLUSION:

The present study confirms that the herbal plant [*Ficus bengalensis*, *Syzygium Cumini*, *Psidium Guajava*, *Momordica charantia*, *Acacia arabica*] possesses significant antidiabetic properties. Through a series of phytochemical analyses and pharmacological evaluations, it has been demonstrated that *Ficus bengalensis*, *Syzygium Cumini*, *Psidium Guajava*, *Momordica charantia*, *Acacia arabica*] effectively lowers blood glucose levels and improves insulin sensitivity. The bioactive compounds identified, such as [alkaloid, glycoside, tannins, terpenoids, etc], contribute to its hypoglycemic activity. Furthermore, the safety profile of [*Ficus bengalensis*, *Syzygium Cumini*, *Psidium Guajava*, *Momordica charantia*, *Acacia arabica*] has been established through toxicity studies, indicating its potential for long-term use without adverse effects. The traditional use of this plant in managing diabetes is supported by



scientific evidence, making it a promising alternative or complementary therapy for diabetes management. In conclusion, [Ficus bengalensis, Syzygium Cumini Psidium Guajava Momordica charantia, Acacia arabica] holds considerable promise as an antidiabetic agent. However, further clinical studies are necessary to fully understand its mechanisms of action and to establish standardized dosages for therapeutic use. Integrating this herbal remedy into modern medical practice could provide a natural and effective option for individuals with diabetes, enhancing overall treatment outcomes.

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