

Review on the Effect of the Medicinal Plant on Diabetic Mellitus

Channe Pranjal Santosh and Mr. Milind B. Kshirsagar

Dr. N. J. Paulbudhe College of Pharmacy, Ahmednagar, India

Abstract: *Diabetes mellitus is a chronic metabolic disorder, resulting from insulin deficiency, characterized by abnormal increase in the blood sugar level, altered metabolism of carbohydrates, proteins and lipids, and an increased risk of vascular complications. According to the World Health Organization, diabetes mellitus is a chronic metabolic disorder marked by persistent hyperglycemia and disturbances in the metabolism of carbohydrates, fats, and proteins. This involves the autoimmune destruction of pancreatic beta cells, leading to insulin deficiency, along with abnormalities that cause resistance to insulin action. Diabetes affects individuals of all ages. All types of diabetes can be managed with medication and lifestyle modifications, with most cases requiring long-term (lifelong) care.*

Keywords: Diabetes mellitus.

I. INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder, resulting from insulin deficiency, characterized by abnormal increase in the blood sugar level, altered metabolism of carbohydrates, proteins and lipids, and an increased risk of vascular complications. According to the World Health Organization, diabetes mellitus is a chronic metabolic disorder marked by persistent hyperglycemia and disturbances in the metabolism of carbohydrates, fats, and proteins. This involves the autoimmune destruction of pancreatic beta cells, leading to insulin deficiency, along with abnormalities that cause resistance to insulin action. Diabetes affects individuals of all ages. All types of diabetes can be managed with medication and lifestyle modifications, with most cases requiring long-term (lifelong) care.

Primary source of glucose, sugar is found in carbs in food and beverages change the sentence. It is the main energy source for your body, supplying glucose to all of your cells through the bloodstream to be used as fuel.

II. HISTORY

Diabetes is among the earliest documented diseases, with an Egyptian manuscript from around 1500 BCE referring to it as "excessive urination." The earliest recorded cases are thought to have been type 1 diabetes. Around the same time, Indian physicians recognized the disease and named it madhumeha, meaning "honey urine," as they observed that the urine

would attract ants. The term "diabetes," meaning "to pass through," was first introduced in 230 BCE by the Greek physician Apollonius of Memphis. The disease was considered rare during the Roman Empire, with Galen noting that he had encountered only two cases

throughout his career. This may have been due to the diet and lifestyle of ancient populations, or because the clinical symptoms were typically recognized only in the advanced

stages of the disease. Type 1 and type 2 diabetes were first recognized as distinct conditions by the Indian physicians Sushruta and Charaka between 400 and 500 CE, with type 1 linked to youth and type 2 associated with being overweight. The term "mellitus," meaning "from honey," was added by the British physician John Rollo in the late 1700s.

III. CLASSIFICATION

Type 1 diabetes commonly develops in children and is referred to as juvenile-onset diabetes mellitus or insulin-dependent diabetes mellitus. In this type, the pancreas produces insufficient insulin, requiring individuals to take insulin injections for life.

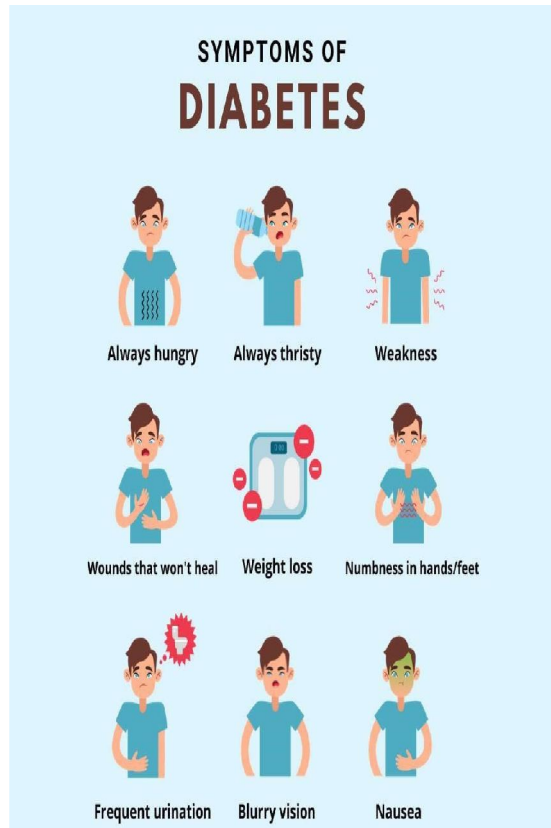
Type 2 Diabetes

Type 2 diabetes, which is more prevalent, typically occurs in individuals over 40 and is known as adult-onset diabetes mellitus. It is also referred to as non-insulin-dependent diabetes mellitus. In type 2 diabetes, the pancreas produces insulin, but the body does not utilize it effectively. High blood sugar levels can often be managed through diet and/or medication, although some patients may require insulin.

Type 2 diabetes mellitus is characterized by insulin resistance, which may be accompanied by relatively decreased insulin secretion. The impaired responsiveness of body tissues to insulin is thought to involve the insulin receptor, although the exact defects remain unidentified. Cases of diabetes mellitus resulting from known defects are classified separately.

IV. SIGNS AND SYMPTOMS

The symptoms of diabetes vary based on the level of elevated blood sugar. Some individuals, particularly those with prediabetes or type 2 diabetes, may not show symptoms initially. In contrast, symptoms of type 1 diabetes usually develop rapidly and are often more severe.



- Fatigue
- Blurred Vision
- Slow-healing sores
- Frequent infection
- Increased hunger
- Weight loss
- Red, swollen, tender gums
- Skin itchy
- Irritability
- Increase hunger

V. CAUSES

- Hormonal imbalances can cause disruptions in hormone levels, contributing to the development of diabetes.
- Autoimmune disorders can play a role in the development of diabetes.
- High blood pressure is an additional risk factor for the development of diabetes.
- Chronic inflammation caused by HIV and the use of HAART medications can increase the risk of developing diabetes.
- Lack of physical activity can raise the risk of developing type 2 diabetes.
- Obesity, particularly excess weight and abdominal fat, can lead to insulin resistance, a primary factor in the onset of type 2 diabetes.
- Genetics contribute to the increased likelihood of developing diabetes, and the condition often runs in families.

VI. PATHOPHYSIOLOGY

The pathophysiology of Type 2 DM involves insulin resistance, reduced insulin sensitivity, declining insulin production, and eventual beta-cell dysfunction. This impairs glucose transport into the liver, muscle, and fat cells, leading to increased fat breakdown and hyperglycemia. Recent evidence also highlights the role of impaired alpha-cell function in the development of Type 2 DM.

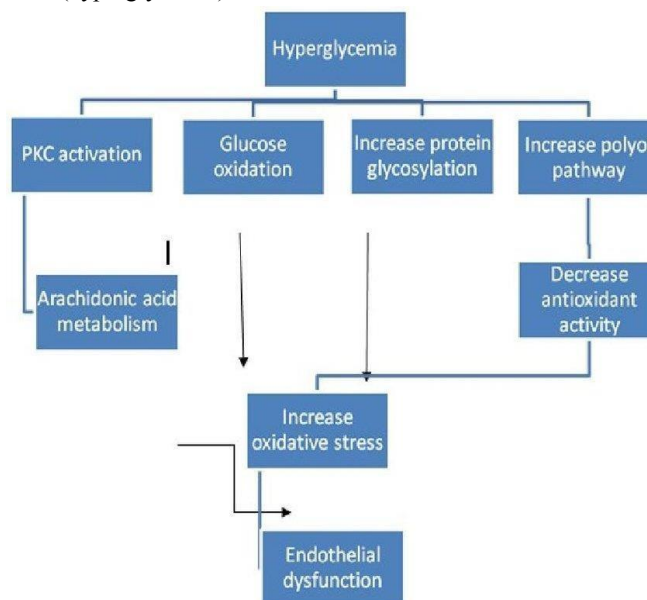
Due to this dysfunction, elevated glucagon and hepatic glucose levels during fasting are not adequately suppressed after a meal. With insufficient insulin levels and increased insulin resistance, hyperglycemia occurs. Incretins, particularly GLP-1, play a key role in stimulating insulin release and suppressing glucagon. While GIP activity is impaired in individuals with Type 2 DM, GLP-1’s insulinotropic effects remain intact, making it a promising therapeutic target. However, like GIP, GLP-1 is quickly inactivated by DPP-IV in vivo.

Type 1 Diabetes Mellitus (T1DM)

1. Autoimmune-mediated destruction of pancreatic beta cells
2. Reduced or absent insulin production
3. Decreased glucose uptake by cells
4. Hyperglycemia

Type 2 Diabetes Mellitus (T2DM)

1. Decreased sensitivity to insulin (insulin resistance)
2. Dysfunctional insulin secretion
3. Enhanced glucose production by the liver
4. Elevated blood glucose levels (hyperglycemia)



Here are the top 10 countries with the highest percentage of adults with diabetes mellitus (both Type 1 and Type 2):

1. India – 65.1%
2. Pakistan – 30.8%
3. Egypt– 20.9%
4. Saudi Arabia – 20.4%
5. Qatar – 20.0%
6. Mexico– 16.9%
7. Oman – 16.7%
8. Bahrain– 16.6%
9. Malaysia – 16.1%
10. United Arab Emirates (UAE)* – 16.0%

These percentages represent the share of adults (ages 20-79) in each country who are living with diabetes.

7. List Of Antidiabetic Medicinal Plants:

- Aloe Vera
- Cinnamon
- Green tea
- Momordica Charantia
- Garlic
- Fenugreek
- Ginger
- Annona squamosa
- Medicago sativa
- Azadiracta indica
- Coriandrum sativum
- Caffeine
- Capsicum frutescens
- Syzygium cumini
- Hibiscus rosa sinensis
- Tinospora crispa

1. SYZYGIUM CUMINI (Jamun)

Syzygium cumini (L.) Druce, also known as “*Eugenia jambolana*” Lam. and *Syzygium jambolanum* DC.,. It is a large evergreen tree that can grow up to 30 meters in height, with a girth of 3.6 meters and a bole reaching up to 15 meters. It is commonly found throughout India, thriving at altitudes up to 1,800 meters.



Fig1: syzygium cumini fruits and seed

- Synonym – Malabar plum, java plum, black plum.
- Family – Myrtaceae.
- Biological source - It is native to the Indian subcontinent and other regions of South and Southeast Asia. The biological source refers to the tree itself, *Syzygium cumini*, which produces the jamun fruit, known for its deep purple or black skin and sweet-tart flavor.
- Geography – India, Thailand, Philippines, Madagascar.
- Chemical Constituent- *Syzygium cumini* (Java plum or jamun) contains a variety of chemical constituents that contribute to its medicinal properties. Some of the key compounds found in different parts of the plant include:

1. Alkaloids

- Jambosine
- Glycosides

2. Flavonoids

- Quercetin
- Kaempferol
- Myricetin

3. Tannins

- Ellagic acid
- Gallic acid
- Corilagin

4. Anthocyanins

- Delphinidin
- Petunidin
- Malvidin (responsible for the purple color of the fruit)

5. Terpenoids

- Oleanolic acid
- Betulinic acid

6. Phenolic compounds

- Catechin
- Epicatechin

7. Vitamins and Minerals

- Vitamin C
- Calcium
- Potassium
- Iron

8. Fatty acids (in seeds)

- Linoleic acid
- Palmitic acid
- Oleic acid

The plant contains anthocyanins, glucosides, ellagic acid, isoquercetin, and myricetin. The high flavonoid content in *Syzygium cumini* seeds is responsible for their antidiabetic properties.

Syzygium cumini seed extract significantly reduces blood glucose, blood urea, and serum cholesterol levels.

• Sample Preparation:

The Jamun fruit was first washed, and then the fruits and seeds were separated. Both were dried in a tunnel dryer at 40 °C for 24 hours. The dried fruits and seeds were then finely ground using a PHILIPS 600W grinder (Type HR 2068). The resulting powders were packed in airtight glass jars and stored in a laboratory cabinet at room temperature (25-30 °C) for further analysis.

• Preparation of Syzygium Cumini Extracts:

Jamun extracts are prepared using a binary solvent system consisting of 50% aqueous ethanol (v/v). Approximately 50 g of the sample is added to volumetric flasks, followed by the addition of the solvent. The flasks are then placed in an orbital shaker set to 280 rpm at 50 °C for 45 minutes. After extraction, the mixtures are filtered, and the filtrate is evaporated using a Rotary Evaporator (Eyela, Japan) at 40 °C under reduced pressure to remove the solvent. The extracts are stored in sealed bottles for future use.

• Formulation of syzygium cumini :

Syzygium cumini, also known as Jamun, black plum, or Java plum, has various formulations that leverage its antidiabetic, antioxidant, and anti-inflammatory properties. Here are some common formulations used for medicinal purposes:

1. Jamun Seed Powder: The seeds of Syzygium cumini are dried and ground into a fine powder. Jamun seed powder is commonly used in capsules or tablets and is known for its potential in managing blood sugar levels due to compounds like jamboline and ellagic acid.
 2. Jamun Fruit Juice or Pulp: Fresh juice made from the Jamun fruit is rich in vitamins and antioxidants. It is often used for digestive health, skin benefits, and general wellness. Some people use it as a supportive therapy for diabetes, although the seeds are more potent for this purpose.
 3. Jamun Extracts: Extracts made from Syzygium cumini seeds, bark, or fruit are concentrated forms often used in liquid or capsule form. They are typically standardized to ensure certain active components, enhancing their efficacy in controlling blood glucose levels and providing antioxidant benefits.
 4. Jamun Leaf Extract: Leaves of Syzygium cumini are also believed to possess medicinal properties. Leaf extracts are used in some traditional formulations for managing blood sugar and reducing inflammation.
 5. Jamun Seed Oil: The oil extracted from Jamun seeds contains fatty acids and bioactive compounds that may support skin health and glucose metabolism. It's generally used in topical formulations but can be taken orally when properly processed.
 6. Jamun Syrup: Made from the pulp of the Jamun fruit, this syrup is commonly used as a natural remedy for digestive health, acidity, and general immunity. It is sometimes combined with other herbal extracts to enhance its benefits.
- Each formulation of Syzygium cumini can target specific health benefits, with seed-based products commonly used for antidiabetic effects and fruit-based preparations valued for their high antioxidant content.

•Uses:

Syzygium cumini, commonly known as Java plum or black plum, has long been used in Ayurvedic medicine for managing diabetes mellitus. Below are its uses and benefits:

- Traditional Uses:

1. Seed powder: Taken orally to lower blood sugar.
2. Leaf decoction: Used to reduce glucose levels and enhance insulin sensitivity.
3. Fruit juice: Consumed to alleviate diabetic symptoms.

2. ALEO VERA

- Synonym: Aleo barbadensis, Aloe humilis Blanco, Aloe indica Royle.
- Family: Liliaceae
- Biological source: aloe is the bried juice of the leaves of the aloe barbadensis miller, known as Curacao Aloes.
- Chemical constituent:

Aloe vera is known for its rich composition of various beneficial chemical constituents, including:

- Vitamins: Contains vitamins A, C, E, and several B vitamins.
- Enzymes: Contains enzymes like amylase and lipase that help in digestion.
- Minerals: Rich in minerals such as calcium, magnesium, zinc, and selenium.
- Lignin: A compound that may enhance the absorption of other nutrients.
- Saponins: Have antiseptic properties and can help cleanse the skin.
- Salicylic Acid: Known for its anti-inflammatory and antibacterial properties.
- Amino Acids: Provides building blocks for proteins and contributes to skin health.

These constituents contribute to aloe vera's reputation as a natural remedy for various skin conditions, digestive issues, and overall health.

- Anthraquinones: These compounds have strong laxative effects and can also possess antimicrobial properties.
- Glycosides: Plant compounds that can have various health benefits, including anti-inflammatory effects.
- Aloin: A compound found in the latex of aloe vera, known for its laxative properties.
- Barbaloin: A type of anthraquinone with potential anti-inflammatory and antimicrobial effects.
- Aloinodin: Another anthraquinone that may have laxative effects.
- Resins: Provide anti-inflammatory properties and can help in wound healing.

The identified compounds include lophenol, 24-methyl-lophenol, and 24-ethyl-lophenol, all of which exhibit anti-hyperglycemic effects.



Fig2: Aloe Vera Leaf and Plant.

• Preparation of Aloe Vera Leaf Pulp Extract:

The leaves of aloe vera, over three years old, were washed, weighed, peeled, and the pulp was scraped out with a spoon. The pulp was homogenized using a homogenizer, then mixed with an equal volume of phosphate-buffered saline (0.1M, pH 7), homogenized again, and stored at 4°C overnight. It was then filtered through cloth, and the clear filtrate was stored at -20°C in small portions until it reached approximately 35% v/w of the initial fresh leaf weight.

• Formulation of aloe vera:

Aloe vera is widely used in various formulations for its soothing, moisturizing, and healing properties. Here are some common formulations of Aloe vera used for medicinal, cosmetic, and health purposes:

1. Aloe Vera Gel: This is the most common form and is derived from the inner leaf pulp of the Aloe vera plant. It's used topically for skin hydration, soothing sunburns, healing wounds, and reducing inflammation. Aloe vera gel is also sometimes taken internally, but only if it's processed to remove aloin (a potentially harmful compound in the latex).
2. Aloe Vera Juice: Aloe vera juice is made from the inner leaf gel and is typically used as a dietary supplement for digestive health, immune support, and general wellness. It should be free from latex, which can have laxative effects if consumed in large amounts.
3. Aloe Vera Powder: Dehydrated Aloe vera gel can be turned into powder and used in capsules, tablets, or dissolved in liquids. Aloe vera powder is commonly used in supplements for internal health benefits, such as digestive and immune support.
4. Aloe Vera Extract: Concentrated extracts of Aloe vera can come in liquid or powdered form. These are typically standardized to contain specific bioactive compounds and are used in both topical and oral formulations for targeted therapeutic benefits.
5. Aloe Vera Oil: Aloe vera oil is made by infusing Aloe vera gel with a carrier oil (like coconut or olive oil). This oil is used for skin and hair care due to its moisturizing and anti-inflammatory properties, making it ideal for dry or irritated skin and scalp.

6. Aloe Vera Capsules or Tablets: Aloe vera in capsule or tablet form often contains Aloe vera powder or concentrated extracts. These are commonly used as dietary supplements for digestive health, immune support, and to provide antioxidants.

7. Aloe Vera Creams and Lotions: Aloe vera is a popular ingredient in creams, lotions, and other skin-care products. Its hydrating and healing properties make it a key ingredient for moisturizing and treating sensitive or damaged skin.

8. Aloe Vera Shampoo and Conditioner: Used in hair care products, Aloe vera helps to hydrate, strengthen, and soothe the scalp. Its nourishing properties make it suitable for various hair types, particularly for dry or itchy scalps.

9. Aloe Vera Soap: Soaps infused with Aloe vera provide gentle cleansing along with hydration and skin-soothing benefits, making them suitable for sensitive or irritated skin.

10. Aloe Vera Mouthwash: Aloe vera's natural antibacterial and anti-inflammatory properties make it a valuable addition to mouthwash formulations, providing a natural option for oral hygiene.

Each formulation is designed to make the most of Aloe vera's bioactive compounds like vitamins, enzymes, and polysaccharides. The choice of formulation depends on whether the intended use is topical (for skin and hair) or internal (for digestive and immune health).

3. AZADIRACTA INDICA

- Synonym: Neem, Indica lilac, Margosa
- Family: Meliaceae

• Biological source: Azadirachta indica, a medium to large-sized tree, grows in India and other tropical countries.

• Geographical Cultivation: Nepal, Pakistan, Bangladesh, and Sri Lanka.

• Chemical Constituents:

1. Terpenoids:

- Azadirachtin: The most well-known compound in neem, responsible for its insecticidal properties.
- Nimbin: Exhibits anti-inflammatory, antipyretic, and antifungal activities.
- Nimbidin: Has antibacterial, anti-inflammatory, and antifungal properties.
- Nimbinene: Associated with anti-inflammatory and anti-fungal effects.
- Salanin: Known for its insecticidal properties.

2. Flavonoids:

- Quercetin: A flavonoid with potent antioxidant and anti-inflammatory activities.
- Myricetin: Another powerful antioxidant that helps in modulating enzymatic activities and reducing oxidative stress.

3. Fatty Acids:

- Oleic acid: A monounsaturated fatty acid found in neem oil, which is known for moisturizing and nourishing skin.
- Stearic acid: A saturated fatty acid that contributes to the texture and spreadability of neem oil.
- Palmitic acid: A common fatty acid that has emollient properties.

4. Limonoids:

- Gedunin: Possesses anti-malarial, anticancer, and anti-inflammatory properties.
- Epoxyazadiradione: Another limonoid with pesticidal activity.

5. Tannins:

- Present in various parts of the plant and known for their astringent and antioxidant effects.

6. Steroids:

- Beta-sitosterol: A phytosterol that helps in lowering cholesterol and also has anti-inflammatory effects.
- Known for their foaming characteristics and exhibit antimicrobial and immune-boosting properties.



Fig. No. 3. Azadiracta Indica Leaves and Seeds

• Preparation of Extract:

Boil approximately 20 neem leaves in half a litre of water for about 5 minutes until the leaves soften and the water turns a deep green. Strain the liquid, store it in a container, and drink this decoction twice a day.

The leaf extract paste, prepared with water, is consumed in a dose of 2-3 teaspoons daily on an empty stomach.

• Formulation of Azadiracta Indica:

Neem (*Azadirachta indica*) is highly valued in traditional medicine for its antimicrobial, antiinflammatory, and skin-healing properties. Here are some common formulations of neem used for medicinal, skincare, and health applications:

1. **Neem Oil:** Extracted from neem seeds, neem oil is rich in bioactive compounds like azadirachtin, nimbin, and nimbolide. It is often used topically to treat skin conditions like acne, eczema, and fungal infections, as well as to promote hair health and repel insects.
2. **Neem Leaf Powder:** Made from dried neem leaves, this powder can be used directly on the skin as a paste for treating acne and inflammation. Neem leaf powder is also taken internally, often in capsule or tablet form, for its benefits in promoting immunity, managing blood sugar, and supporting liver health.
3. **Neem Extracts:** Concentrated extracts from neem leaves, seeds, or bark are used in various products. They are often standardized to contain specific bioactive compounds and are commonly found in capsules, tablets, and skincare formulations. Neem extract is valued for its anti-inflammatory and antimicrobial properties.
4. **Neem Juice:** Fresh neem juice, made from crushed neem leaves, is traditionally used as a detoxifying tonic. Due to its bitter taste, neem juice is sometimes mixed with other herbs or juices and is believed to support immune health and skin clarity.
5. **Neem Capsules and Tablets:** Neem leaf powder or extract is encapsulated in capsules or tablets for easy ingestion. These are widely used as dietary supplements for immunity, blood sugar management, and skin health.
6. **Neem Bark Powder:** This powder is made from dried neem bark and is used in Ayurvedic medicine for its antibacterial and anti-inflammatory properties. It can be taken internally or used in herbal formulations for dental care.
7. **Neem Soap:** Neem soap combines neem oil or neem leaf extract with soap bases, offering gentle cleansing with natural antibacterial benefits. It is popular for treating skin problems like acne, rashes, and infections.
8. **Neem Creams and Lotions:** Neem-infused creams and lotions are used to treat dry, irritated, or inflamed skin. These formulations take advantage of neem's soothing and antimicrobial properties for topical relief.
9. **Neem Toothpaste and Mouthwash:** Due to its antibacterial and antifungal properties, neem is often included in oral hygiene products like toothpaste and mouthwash, which help in reducing plaque, preventing cavities, and promoting gum health.
10. **Neem Shampoo and Conditioner:** Neem is used in hair care products for its antifungal and antibacterial effects on the scalp, making it helpful in treating dandruff and promoting scalp health.
11. **Neem Fertilizers and Pesticides:** Neem's natural insect-repellent properties make it a popular ingredient in organic fertilizers and pesticides, safe for plants and the environment.

Each of these formulations utilizes neem's bioactive compounds, such as azadirachtin, nimbin, and quercetin, to target various health and skincare needs. The formulation choice depends on whether it's intended for skin, hair, immune health, or dental care.

•Uses of Azadirachta indica:

Neem (*Azadirachta indica*) has a wide range of applications due to its bioactive compounds, including azadirachtin, nimbin, and nimbolide. These compounds give neem powerful medicinal, cosmetic, and agricultural properties. Here are the primary applications of neem:

1. Medicinal Applications

Antimicrobial Treatment: Neem is widely used for its antibacterial, antifungal, and antiviral properties. It can help treat skin infections, wounds, acne, and fungal infections.

Diabetes Management: Neem leaves, powder, and extracts are used in traditional medicine to help manage blood sugar levels and improve insulin sensitivity in individuals with diabetes.

Digestive Health: Neem is known to have detoxifying properties and is used in Ayurvedic medicine to treat digestive issues, including constipation, bloating, and parasitic infections.

Liver Health: Neem supports liver detoxification and is used to treat liver disorders, promote better liver function, and improve digestion.

Immune Boosting: Neem is often used as a natural remedy to strengthen the immune system and fight infections due to its powerful antiviral and antibacterial effects.

2. Cosmetic and Skin Care Applications

Acne Treatment: Neem oil and neem-based creams are used to treat acne due to neem's antibacterial and anti-inflammatory properties, which help reduce pimples, blemishes, and skin inflammation.

Wound Healing: Neem's antimicrobial properties help speed up wound healing and prevent infections, making it beneficial for cuts, burns, and minor injuries.

Anti-Aging: Neem's antioxidant properties help protect the skin from free radical damage, reducing the appearance of wrinkles and fine lines.

Soothing Skin Conditions: Neem is applied topically to soothe conditions like eczema, psoriasis, and rashes due to its anti-inflammatory and healing properties.

Moisturizing and Hydrating: Neem oil is widely used in creams and lotions for its hydrating effects, helping to treat dry, flaky, or irritated skin.

3. Hair Care Applications

Dandruff Control: Neem's antifungal properties help control dandruff and soothe itchy, dry scalps, often found in neem shampoos or oils.

Hair Growth: Neem oil promotes hair health, reduces hair loss, and strengthens hair roots by improving scalp circulation and preventing fungal infections.

Scalp Health: Neem oil is used to maintain a healthy scalp, reduce scalp infections, and promote overall hair health.

4. Garlic (*ALLIUM SATIVUM*)

• Synonym: garlic, lasun

• Family: Liliaceae

• Biological source: the drug consist of the fresh ripe bulbs of allium sativumlinn

• Geography: Asia

• Chemical constituent:

The intact cloves of garlic contain odourless sulphur containing amino acid derivative (+)-Sallyl-L-cysteine sulfoxide.

This component is called alliin and occurs in garlic upto about 1.2 per cent fresh weight. When garlic cloves are crushed, alliin comes in contact with enzyme allinilase which is present in vacuoles and is converted to allicin or diallyl thiosulphinate as illustrated. Allicin is highly unstable and in the presence of water and oxygen it get decomposed into polysulphide which is responsible for the unpleasant odour.



Fig. No. 4. Garlic

•Formulation of allium sativum:

Garlic formulations used for medicinal purposes come in various forms, each designed to preserve or enhance garlic's bioactive compounds. Here are some common formulations:

1. Garlic Powder: Dried and powdered garlic retains many of its compounds. It is often used in capsules or tablets for its convenience.
2. Aged Garlic Extract: This involves aging garlic for up to 20 months to enhance stability, increase antioxidant levels, and reduce the strong odor. Aged garlic extract is considered a potent source of S-allyl cysteine, a bioactive compound with antidiabetic effects.
3. Garlic Oil: This is typically prepared by steam distillation or by soaking garlic in vegetable oil. It contains various sulfur compounds, though it has a lower allicin content.
4. Allicin Standardized Tablets or Capsules: Allicin is one of the most beneficial compounds in garlic but is unstable and degrades quickly. Standardized formulations attempt to provide a guaranteed allicin content for more targeted health benefits.
5. Garlic Tincture or Liquid Extract: Prepared by soaking garlic in alcohol or water, this formulation provides a liquid extract that can be easily absorbed, often used in herbal medicine.
6. Enteric-Coated Tablets or Capsules: These capsules are designed to release garlic compounds in the intestines rather than the stomach, preserving bioactive compounds and reducing garlic breath.

Each of these formulations aims to maximize specific therapeutic compounds in garlic, like allicin, ajoene, and S-allyl cysteine, to enhance health benefits, including potential antidiabetic effects.

•Uses:

Garlic is used as carminative, aphrodisiac, expectorant, stimulant, and disinfectant in the met of pulmonary conditions. It is largely used as condiment. Oil of garlic is used as temintc and rubefacient. Allicin is antibacterial. Garlic oil is useful in high blood pressure and reterostosis.

Fresh garlic is prophylactic against amoebic dysentery. It has strong anti-oxidant..

6. Ginger:

- Synonym- Adrak, Zingiber.
- Family- Zingiberaceae
- Biological Source- Ginger consist of dried rhizomes of Zingiber officinale.
- Geography- India, Africa, Australia.
- Chemical Constituent-

Ginger contains a rich array of chemical compounds that contribute to its unique flavor, aroma, and medicinal properties. Here are some of the main chemical constituents:

1. Gingerols

The primary bioactive compounds in fresh ginger, gingerols are responsible for its spicy taste and many of its medicinal benefits.

- [6]-Gingerol is the most abundant gingerol, with anti-inflammatory, antioxidant, and anti-nausea properties.

2. Shogaols

- Shogaols are formed when gingerols are dried or cooked, as they undergo a dehydration reaction.

- Shogaol is more potent than gingerol and has strong anti-inflammatory and antioxidant effects. Shogaols contribute to the intense flavor of dried ginger.

3. Zingerone

- Zingerone is produced when ginger is cooked, giving it a sweeter, less spicy flavor. - It has anti-inflammatory, antioxidant, and anti-cancer properties and is also known for its role in treating diarrhea.

4. Paradol

- Paradol is another compound found in ginger with a pungent flavor.

- It has antioxidant and anti-cancer properties and may also contribute to ginger's analgesic effects.

5. Volatile Oils

- Ginger contains volatile oils that give it a distinct aroma and flavor, including zingiberene, camphene, phellandrene, and citral.

- These oils have antimicrobial and anti-inflammatory properties, contributing to the health benefits of ginger.

6. Vitamins and Minerals

Ginger contains small amounts of essential nutrients, including vitamins (like vitamin C, B6) and minerals (like magnesium, potassium, and manganese), which support overall health.

7. Other Phenolic Compounds

- Other bioactive phenolics, such as gingerdiols, gingerones, and gingerols derivatives, add to the antioxidant and anti-inflammatory properties of ginger.



Fig. No. 6 Ginger

•Formulation Of Cinnamon:

Cinnamon is commonly used in various formulations, both for culinary and medicinal purposes. Here are some common forms of cinnamon:

1. Ground Cinnamon

- Description: Cinnamon powder made by grinding the inner bark of cinnamon trees. - Uses: Commonly used in baking, beverages (like cinnamon tea or lattes), and as a spice for various dishes.

- Formulations: Can be added to smoothies, desserts, and savory dishes.

2. Cinnamon Sticks (Quills)

- Description: Whole cinnamon bark rolled into sticks.

Uses: Often used in whole form to infuse flavor into liquids (soups, stews, or teas), or as a garnish.

- Formulations: Boiled to extract flavor or used as an aromatic in hot beverages.

3. Cinnamon Extract

- Description: A concentrated form of cinnamon, usually made by steeping cinnamon in alcohol or glycerin.
- Uses: Added to recipes or used for medicinal purposes, such as improving digestion, regulating blood sugar, or in skin care formulations.
- Formulations: Found in tinctures, supplements, and beauty products.

4. Cinnamon Oil (Essential Oil)

- Description: Cinnamon essential oil is extracted from the bark or leaves of the cinnamon tree.
- Uses: Often used in aromatherapy, for its antimicrobial properties, or in cosmetics.
- Formulations: Used in diffuser blends, skincare products, and cleaning products. Also used for medicinal purposes (e.g., massage oils for relief from aches).

5. Cinnamon Tablets or Capsules

- Description: Concentrated cinnamon in pill or capsule form, often used for health benefits.
- Uses: Taken as a supplement for its antioxidant, anti-inflammatory, or blood sugar-regulating properties.
- Formulations: Available in standard doses for specific therapeutic uses.

6. Cinnamon Tea

- Description: A beverage made by infusing cinnamon sticks or powder in hot water.
- Uses: Consumed for its flavor and potential health benefits, such as improving digestion and controlling blood sugar.
- Formulations: Can be found in pre-packaged tea bags or homemade by steeping cinnamon sticks or powder in hot water.

7. Cinnamon- Infused Honey or Syrup

- Description: Honey or syrup infused with cinnamon.
- Uses: Used as a sweetener in tea, coffee, or desserts.
- Formulations: Often found as an ingredient in specialty health products or gourmet food items.

•Uses:

Ginger is a versatile root with a wide range of uses in culinary, medicinal, and even cosmetic contexts. Here are some common uses:

1. Culinary Uses

- Flavoring Agent: Adds a warm, spicy flavor to dishes, soups, marinades, and sauces.
- Baking: Used in sweets like gingerbread, cookies, cakes, and ginger snaps.
- Beverages: Commonly used in teas, smoothies, ginger ale, and infused water.
- Pickling: Pickled ginger, especially popular in Japanese cuisine, is often served with sushi.

2. Medicinal Uses

- Digestive Aid: Helps relieve nausea, indigestion, and bloating. Often recommended for motion sickness and morning sickness.
- Anti-inflammatory: Used to alleviate symptoms of arthritis and joint pain.
- Cold & Flu Remedy: Known for its warming effect, it can help relieve sore throat, congestion, and cough.
- Pain Relief: Ginger's anti-inflammatory properties can reduce muscle pain and soreness.

3. Skincare & Cosmetic Uses

- Anti-aging: Its antioxidants may help reduce skin damage and improve elasticity.
- Anti-acne: Known to have antibacterial properties that help reduce acne.
- Hair Health: Ginger oil is used to stimulate hair growth and improve scalp health.

4. Household & Aromatherapy Uses

- Essential Oil: Often used in aromatherapy to relieve stress, reduce nausea, and energize.
- Household Cleaner: Its antimicrobial properties make it suitable for natural cleaning solutions.
- Insect Repellent: Ginger essential oil is sometimes used to deter insects.

5. Cultural & Ritual Uses

- In some cultures, ginger is used for traditional remedies, ceremonies, and offerings, often associated with its purifying properties.

6. Momordica Charantia (Bitterground)

- Synonym- Karela, Bitterground
- Family- Cucurbitaceae
- Biological Source - Karela consist of fresh green fruit of the plant known as Momordica Charantia
- Geography- Asia, Africa, India.
- Chemical Constituent-

Momordica charantia, commonly known as bitter melon, contains a variety of chemical constituents that contribute to its medicinal and nutritional properties. These include:

1. Alkaloids:

Momordicine: Bitter compounds contributing to the characteristic taste.

Charantin: Known for its hypoglycemic effect, it is considered a key bioactive compound.

2. Flavonoids:

Quercetin, Kaempferol, Rutin: These possess antioxidant, anti-inflammatory, and potential anticancer properties.

3. Glycosides:

Momordicoside, Charantin, and other saponins are known to possess medicinal qualities, particularly for their potential hypoglycemic and antidiabetic effects.

4. Sterols:

Beta-sitosterol: A compound that may aid in lowering cholesterol and boosting immune function.

5. Triterpenoids:

These include compounds like momordic acid which have shown anti-inflammatory and anticancer effects.

6. Polypeptides:

MAP30 (Momordica Anti-HIV Protein) is a compound that has shown antiviral activity, particularly against HIV.

7. Vitamins and Minerals:

Vitamin C, Vitamin A, B vitamins (such as B1, B2, B3), and minerals like iron and calcium are present, contributing to its nutritional value.

8. Fatty Acids:

Linoleic acid, Oleic acid: Found in the seeds, beneficial for health.

8. Phenolic Compounds:

Phenolic acids like gallic acid contribute to antioxidant properties.



Fig. No. 7 Momordica Charantia

• Formulation of Momordica Charantia:

The formulation of Momordica charantia (bitter melon) for medicinal or therapeutic use can vary based on its intended application. Below are some common formulations and preparations:

Copyright to IJAR SCT

DOI: 10.48175/568

www.ijarsct.co.in



1. Powdered Form (Capsules/Tablets):

Preparation: Dried and ground leaves, fruits, or seeds of *Momordica charantia* are processed into fine powder.

Uses: Can be used as a supplement to manage diabetes, support immune health, or improve digestive function.

Dosage: Usually 500–1000 mg per capsule or tablet, 1–3 times daily depending on the condition.

2. Juice:

Preparation: Fresh bitter melon fruit is juiced.

Uses: Fresh juice is commonly used for managing blood sugar levels, detoxifying the body, or improving skin health.

Dosage: Typically 30–50 ml of fresh juice, taken once or twice a day.

3. Extract (Alcoholic or Water-based):

Preparation: The plant material (leaves, fruit, or seeds) is soaked in a solvent like ethanol or water to extract its bioactive compounds.

Uses: Concentrated extracts are often used in herbal medicines, tinctures, or liquid supplements.

Dosage: Extracts may be standardized for specific active compounds, like charantin or momordicine, with dosages ranging from 5–30 drops, 1–3 times daily.

4. Tea

Preparation: Dried leaves, fruit, or seeds of *Momordica charantia* are steeped in hot water.

Uses: Commonly consumed for blood sugar management, digestive issues, and detoxification.

Dosage: 1–2 cups of tea per day.

5. Topical Cream/Ointment

Preparation: Extracts from *Momordica charantia* are incorporated into creams or ointments, often mixed with other herbal ingredients.

Uses: Applied to the skin for treating wounds, ulcers, or skin infections.

Dosage: Apply a thin layer of the cream or ointment to the affected area, usually 1–2 times a day.

6. Seed Oil

Preparation: Oil extracted from bitter melon seeds.

Uses: Often used for its anti-inflammatory and skin-healing properties, and sometimes for hair care.

Dosage: Apply a few drops of oil directly to the skin or scalp.

7. Combination Formulations

Preparation: In some cases, *Momordica charantia* is combined with other herbal ingredients (like ginger, turmeric, or garlic) to enhance its therapeutic effects.

•Uses:

These combinations may target conditions like diabetes, high cholesterol, or inflammation.

Momordica charantia (bitter melon) has a wide range of applications, particularly in traditional medicine, modern pharmaceuticals, and health supplements. Below are some key applications of *Momordica charantia*:

1. Diabetes Management:

Application: *Momordica charantia* is most commonly used in the management of type 2 Diabetes: Its bioactive compounds, such as charantin, momordicine, and polypeptides, help in lowering blood glucose levels by improving insulin sensitivity and promoting better glucose metabolism.

2. Antioxidant and Anti-inflammatory Therapy:

Application: The antioxidants present in bitter melon (like vitamin C, flavonoids, and phenolic compounds) help neutralize free radicals and reduce oxidative stress, which is linked to various chronic diseases such as cardiovascular diseases, arthritis, and cancer. It also has antiinflammatory effects that can help alleviate conditions like arthritis.

3. Weight Management and Obesity:

Application: Bitter melon has been used in weight loss programs due to its ability to regulate blood sugar, improve metabolism, and reduce fat accumulation. It is believed to help reduce appetite and promote fat oxidation.

4. Liver Health and Detoxification:

Application: *Momordica charantia* has hepatoprotective properties, which help in improving liver function and detoxifying the body. It is commonly used for managing conditions like fatty liver and improving overall liver health.

5. Skin Care and Acne Treatment:

Application: Bitter melon is used to treat skin conditions like acne, eczema, and psoriasis due to its antibacterial, antifungal, and anti-inflammatory properties. It helps in healing wounds and promoting clear skin.

6. Cancer Treatment (Adjunctive Use):

Application: There is emerging evidence suggesting that bitter melon may have anticancer properties due to compounds like charantin and momordicine, which may inhibit the growth of certain cancer cells (e.g., breast cancer, colon cancer). MAP30, a protein found in bitter melon, has shown potential as an anti-HIV agent, which also suggests anticancer activity.

7. Cholesterol and Heart Health:

Application: Bitter melon has been used to manage high cholesterol by helping reduce LDL (bad cholesterol) and triglyceride levels while promoting HDL (good cholesterol). It supports overall heart health by improving lipid profiles and promoting healthy circulation.

8. Antimicrobial and Antiviral Use:

Application: Bitter melon has shown antimicrobial properties against bacteria, fungi, and viruses. It has been studied for its potential in inhibiting the growth of pathogens and for antiviral activity, especially HIV (through MAP30 protein).

9. Digestive Health:

Application: The fruit and leaves of bitter melon are traditionally used to promote digestion, alleviate bloating, and treat digestive disorders like constipation and indigestion. It has mild laxative effects that help in regulating bowel movements.

10. Hair Care and Scalp Health:

Application: Bitter melon is believed to promote hair growth and treat dandruff due to its anti-inflammatory and antimicrobial properties. It is sometimes used to nourish the scalp and prevent hair loss.

Formulation: Available in hair oils, shampoos, or as a topical solution applied directly to the scalp.

11. Immune System Support:

Application: The vitamin C and other bioactive compounds in bitter melon help strengthen the immune system and support the body's defense against infections and diseases.

12. Treatment of Asthma and Respiratory Conditions:

Application: Bitter melon has been used to relieve symptoms of asthma and other respiratory conditions, thanks to its anti-inflammatory and bronchodilator effects.

13. Hormonal Balance and Menstrual Health:

Application: In traditional medicine, bitter melon is used to regulate menstrual cycles, relieve menstrual cramps, and promote hormonal balance in women.

14. Anti-aging and Skin Rejuvenation:

Application: The antioxidants in bitter melon help to reduce the signs of aging, such as wrinkles and fine lines, by neutralizing free radicals that cause cellular damage.

15. Anti-viral and Immune Modulation in HIV/AIDS:

Application: Research suggests that bitter melon may help in the treatment of HIV/AIDS due to MAP30, a protein found in the plant that has antiviral properties.

II. CONCLUSION:

In this review, we discussed five medicinal plants used in the treatment of diabetes mellitus, focusing on their active chemical constituents and the chemical tests used to detect these compounds, which demonstrate antidiabetic activity. This review aims to provide valuable insights for health professionals, scientists, and researchers in pharmacology and therapeutics, supporting the development of antidiabetic drugs.

REFERENCES

- [1]. Singh N, Roohi kesherwani, Arun kumar Tiwari and Dilip Kumar Patel. A review on diabetic mellitus. The Pharma Innovation journal 2016;5(7):36-40
- [2]. Chinmay D. Deshmukh and Anurekha Jain; A review: Diabetic mellitus, International journal of pure and Applied Bioscience, 2015;3(3)224-230(2015)

- [3]. D.K.Patel ,S.K.Prasad and S.Hemalatha,An overview on antidiabetic medicinal plant having insulin mimetics property.
- [4]. Surendran Surya,and christudas Sunil, Diabetic mellitus and medicinal plant - A review.
- [5]. Abdulfatai B.olakoba,Olusegun A.Obateru,Lateefat B.olakoba; type 2 diabetic mellitus: A review of current trends;Oman Med.J,July-27(4):269-273.
- [6]. Amit sapra; Priyanka Bhandari; A review of diabetic mellitus; National library of medicine;June 21,2023.
- [7]. V.M.Jadhav,S.S.Kamble,V.J .Kadam; Herbal medicine; syzygium cumini:A review; Journal of pharmacy research 2009,2(8),1212-1219.
- [8]. Book of pharmacognosy 50th edition,page no.9.9-9.10,By C.K.kokate, A.P.Purohit,S.B.Ghokhale.
- [9]. Amira Mourad Hussein Abo-Youssef,Basin Anwar shehata Messiha;Beneficial effect of aloevera.
- [10]. Book of pharmacognosy and phytochemistry, Volume II,By Vinod.D.Rangari. page no 216-217.(Azadiracta indica)
- [11]. Book of pharmacognosy 50th edition, page no 19.3,By C.K.Kokate, A.P.Purohit, S.B.Ghokhale(Azadiracta indica)
- [12]. Book of pharmacognosy and phytochemistry Volume 2, By Vinod.D.Rangari, page no 211(Allium Sativum)
- [13]. Hsien-Yi wang, Wei- chih kan, Tain- Junn Cheng, Sung- Hsun Yu, Liang- Hao chang, Jiunn- Jye chuu. Differential antidiabetic effects and mechanism of action of charantin rich extract of Taiwanese Momordica charantia between type 1 and type 2 diabetic mice.