



A Review on Abelmoschus Esculentus Linn Act as an Antidiabetic Agent

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Abstract: The aim of this review article is to highlight the anti-diabetic properties of Okra. Diabetes Mellitus is a leading cause of morbidity and mortality. While it remains as incurable disease, there is ongoing research on natural remedies to minimize toxic effects and provide simplest treatments. As plant-based resources become a major focus for discovering of new drugs. Abelmoschus esculentus (Okra) is being explored as a potential alternative drug to current diabetes medications, though further research is needed for analysing its great potentials. Belonging to the Malvaceae family, Okra is a nutritional plant used for both medicinal and cooking purposes. Okra (*Abelmoschus esculentus* Linn.) is an annual medicinal herb rich in antioxidants, bioactive polysaccharides and fibers. Traditionally it has been used in Indian medicine system to treat diabetes mellitus disease. The seeds of *Abelmoschus esculentus*, known as "monech" seeds, they show potential in the development of antidiabetic drugs due to its ability to reduce hyperglycaemia. Diabetes is a global health issue due to its numerous adverse effects on human health. Several studies have shown that okra seeds can help to control hyperglycaemia and potentially prevent the onset of action of diabetes.

IndexTerms: *Abelmoschus Esculentus, Medicinal Plants, natural remedies, Anti-diabetic Properties, hyperglycaemia.*

INTRODUCTION:

Abelmoschus esculentus Linn. (Malvaceae) is commonly known as okra or ladyfinger. It is broadly found in Africa and the Asian subcontinent, particularly in India, Bangladesh and Pakistan. It is a prevalent vegetable in the Indo-Pak subcontinent. Diabetes mellitus is a metabolic disorder marked by hyperglycaemia and disturbances in carbohydrate, fat and protein metabolism, caused by absolute or relative deficiencies related to insulin secretion. While oral hypoglycaemic agents and insulin are commonly used for treatment. Interest in herbal remedies is rising due to their potential effectiveness, less side effects and lower cost, despite limited knowledge about their active compounds. (1)

Diabetes management mainly relies on insulin therapy and oral hypoglycaemic drugs. However, insulin therapy has disadvantages like insulin resistance, hypoglycaemia, anorexia, brain atrophy and fatty liver with prolonged use. Similarly, oral hypoglycaemic drugs, such as sulfonylureas and biguanides, can cause side effects like hepatotoxicity, abdominal pain and flatulence. Synthetic hypoglycaemic agents frequently cause serious side effects and are unsuitable for use during pregnancy. (2)

Prolonged use of current diabetes medications, such as insulin and oral hypoglycaemic drugs, can lead to side effects like diarrhoea, hypoglycaemia and drug resistance. These challenges, coupled with the rising occurrence of diabetes, highlights the vital need for new and cost-effective treatments. Traditional medicines used by 80% of the global population, especially in developing countries, offers a promising substitutes. Phytochemicals from herbal medicinal plants have opportunities for developing innovative formulations. (3)



Fig. 1. Abelmoschus Esculentus linn



Fig. 2. Flower of Abelmoschus Esculentus

Abelmoschus esculentus (okra) is a notable example, valued for its nutritional and therapeutic benefits its hypoglycaemic, antioxidant, antimicrobial and anti-inflammatory effects. Okra is rich in dietary fiber, vitamins and minerals. (4)

Okra's high fiber content helps to stabilize blood sugar level by regulating sugar absorption in the intestines. Its shells are mucilaginous, low in calories, nutrient-rich and a good source of dietary fiber. (5) Okra is beneficial for individuals who are weak or depressed. It is used to treat ulcers, lung inflammation, sore throat and irritable bowel disease. Studies reveal that the okra shells contain bioactive compounds like carotene, folic acid, thiamine, riboflavin, niacin, vitamin C, oxalic acid and amino acids. (6)

Okra is effective to lower the blood sugar by slowing sugar absorption in the intestines, potentially preventing kidney disease. It also exhibits the cholesterol-lowering properties, may prevent cancer by binding to bile acids and has hypoglycaemic activity. Additionally the okra seeds can regulate the blood glucose levels and improve lipid levels in diabetic conditions.

Description: (7)

Synonyms: Lady's Finger, Bhindi, Gumbo, Ochro, Okro

Biological name: *Hibiscus esculentus*, *Abelmoschus esculentus*.

Taxonomical classification:

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Malvales

Genus: *Abelmoschus*

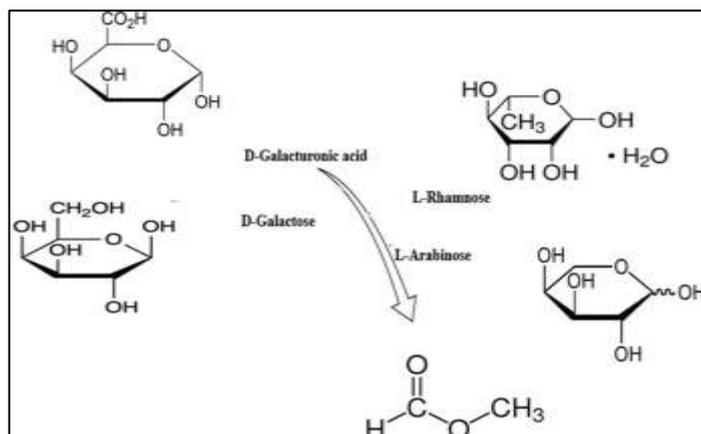
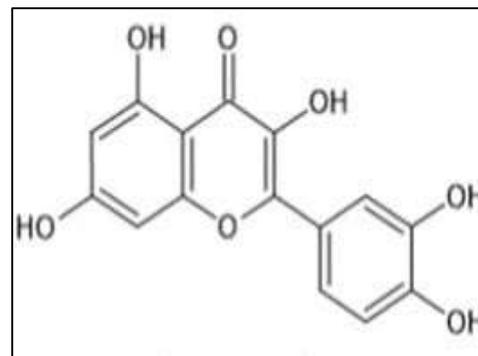
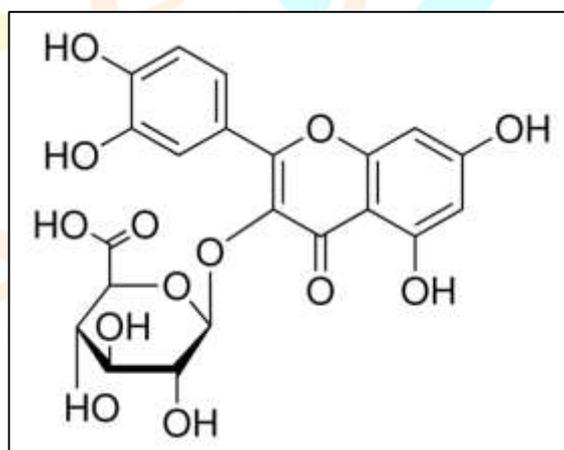
Species: *A. Esculentus*

Binomial name: *Abelmoschus esculentus*

Other Names: Kacang Bendi, Okra, Okro, Gumbo, Bamia, Ladies Fingers, Bendi, Bhindi, Quingombo.

Chemical Composition:

The petals of *Abelmoschus esculentus* contain 13 flavonoid glycosides, including gossypetin and hibiscetin glucosides. (8) Fresh fruits are rich in pectin, mucilage and contain oxalic acid, protein, fat, minerals (potassium, sodium, magnesium, sulfur, copper, manganese, iodine), carbohydrates, calcium and phosphorus. (9) They are a good source of vitamins A, thiamine, riboflavin, ascorbic acid and niacin. (10) The mucilage includes compounds like d-galactose, 1-rhamnose and d-dalacturonic acid. The fruits also have flavonoids and the essential oil extracted from the shells and seeds contains aliphatic alcohols, cyclohexanol, p-tolualdehyde, α -terpenylacetate and citral. (11) The non-volatile components include β -sitosterol and its 3β -galactoside in seeds. The leaves have similar constituents as shells and ripe seeds contain 10–22% edible oil. (12)

Chemical Structures: (13)**Okra Mucilage****Quercetin****5,7,3,4'-tetrahydroxy-4''-O-methylflavonol-3-O- β -D-glucopyranoside****Geographical Source:**

Found in Asia (India, Bangladesh, Pakistan and China), Africa (Central and West Africa), America (Southern United States, Caribbean and Brazil) etc.

Cultivation & collection:

Abelmoschus esculentus, is grown in tropical and warm temperate regions. It is highly tolerant of heat, drought and various soil conditions, including heavy clay, though frost can damage the shells. For the cultivation, seeds are soaked overnight and planted 1–2 cm deep, with germination occurring within 6 days to 3 weeks, depending on the seed's soaking time. The plant grows in soil temperatures above 20°C (68°F) and prefers slightly acidic soil with a pH of 5.8 to 7. Okra requires adequately of sunlight and water, with the shells being harvested, about 2–3 inches long, naturally within two months of planting.

Physical Characteristics:

Abelmoschus esculentus is an annual herb that normally grows up to 2 meters tall. Its leaves are large, with long petioles and broad, rough, palmate lobed structures, measuring about 10–20 cm in length. The plant produces solitary, axillary flowers, about 4–8 cm in diameter, with five petals that are white to yellowish in colour. Often marked with a red or purple spot at the base. The fruits are elongated, 10–25 cm long and 1.5–3 cm in diameter. Fruits containing many seeds. Depending on the variety, fruits mature in 60–180 days after sowing. The plant grow well in moist, well-drained soil and requires full sunlight to grow.



Figure 3. Fruit of *Abelmoschus esculentus*

Macroscopic Character:

Shape: Spherical to sub-spherical

Size: Small, about 3–6 mm in diameter

Colour: Dark green, brown, gray or black, depending on the variety and maturity.

Surface Texture: Rough, slightly ridged and may have a fine hairy or wrinkled appearance.

Hardness: Hard and firm, requiring soaking or scarification for germination.

Odour and Taste: Generally odourless; mild, nutty taste when chewed.

Microscopic Character:

Seed Coat (Testa)

Epidermal Cells: Polygonal to irregularly shaped, covered with a cuticle.

Surface Texture: Rough with a wavy and reticulated pattern.

Endosperm and Cotyledons

Endosperm: Thin, mostly absorbed by the large cotyledons.

Cotyledons: Large, containing storage reserves such as proteins, oils and carbohydrates.

Cell Structure: Parenchymatous cells with numerous starch grains and oil droplets.

Hilum and Micropyle

Hilum: A slightly depressed scar where the seed was attached to the pod.

Micropyle: A small opening near hilum, important for water absorption during the germination.

Pharmacological Activity:

Antidiabetic activity:

The antidiabetic potential of okra fruit extract was estimated in rabbits (2.5 kg body weight) using an Alloxan-induced diabetes model. Both the extract and standard drug Metformin were liquified in saline and administered orally. A slow reduction in blood glucose levels was observed with consistent administration of the extract over a period of 10 days. Further studies examined the blood sugar-lowering effects of ethanol and aqueous extracts of okra fruit. From that, the aqueous extract at a dose of 300 mg/kg exhibited important activity in comparison to the ethanol extract-treated group. (14)

A novel polysaccharide isolated from okra was examined for antidiabetic properties in mice induced with type 2 diabetes through a high-fat diet and an intraperitoneal injection of streptozotocin (100 mg/kg). (15) Oral administration of this polysaccharide at doses of 200 or 400 mg/kg for eight weeks led to a distinguished decrease in blood glucose, triglycerides, total cholesterol and low-density lipoproteins, while increasing high-density lipoproteins, body weight, and food and water intake. The treatment also improved liver glycogen content and mitigated liver fibrosis in diabetic mice. Additionally, it reduced reactive oxygen species and malondialdehyde levels while enhancing the activity of antioxidant enzymes such as catalase, glutathione peroxidase and superoxide dismutase. (16) The underlying mechanism was linked to the activation of the phosphoinositide 3-kinase (PI3K)/protein kinase B (AKT)/glycogen

synthase kinase 3 beta pathway and increased nuclear factor erythroid-2 (Nrf2) expression, which stimulated heme oxygenase-1 (HO-1) and superoxide dismutase 2 (SOD2) production. (17)

In another study, the antidiabetic efficiency of okra fruit extract was evaluated in Alloxan-induced diabetic rats following sucrose, starch and glucose administration. To develop an insulin-resistant animal model, a lipid emulsion was given and in vitro inhibitory activity of α -amylase and α -glucosidase enzymes was assessed. The extract-treated group exhibited a decline in blood glucose levels. Both the standard drug, Glibenclamide and the extract significantly reduced blood sugar in experimental animals. In insulin-resistant models, Metformin and the extract consistently improved insulin tolerance. Additionally, α -amylase and α -glucosidase inhibition assays yielded positive results. These findings suggest that okra fruit extract exerts substantial antidiabetic activity by promoting insulin secretion, enhancing insulin sensitivity and inhibiting carbohydrate absorption in the intestine. (18)

Other pharmacological activities:

Antioxidant Properties: (19)

Okra is rich in antioxidants, including phenolic compounds and flavonoids. They work to neutralize free radicals and decrease oxidative stress. This antioxidant activity is related with the prevention of numerous diseases caused by the cellular damage.

Anti-inflammatory Property: (20)

Okra's anti-inflammatory properties help to regulate inflammatory pathways. That may provide benefits for conditions associated to the chronic inflammation.

Anti-Cancer Properties: (21) (22)

Emerging research suggests that the okra may have anticancer properties, such as studies indicate its potential to reduce the growth of certain cancer cells. These effects are largely recognised to its richness of bioactive compounds.

Anti-Bacterial Properties: (23) (24)

Okra has antibacterial properties making it a promising a natural remedy for treating bacterial infections. This effect is primarily due to presence of flavonoid, glycosides and other bioactive phytochemicals.

Hepatoprotective Effects: (25) (26)

Several research indicates that the okra may offer protective benefits to the liver, possibly helping in prevention of liver diseases. This hepatoprotective activity is related with its antioxidant and anti-inflammatory actions.

Cardiovascular Activity: (27)

Okra has been shown to have a protective effect on the heart of human. A study state that it helps to lower serum cholesterol levels, reducing the risk of heart-related disorders. Additionally, it contains a chemical constituent pectin, which lowers the blood cholesterol by inducing the intestinal production of bile.

Anti-Adhesive Activity: (28)

Polysaccharide-rich extracts from undeveloped okra fruits confirmed an antiadhesive effect, preventing the bacteria *Helicobacter pylori* from adhering to stomach tissues. An aqueous extract of the fruit treated with ammonium sulphate and produced two fractions that exhibited a significant antiadhesive effect against *H. pylori* strain J99 after pre-incubation of the bacteria. Sequential extraction of okra fruits resulted in products that showed a dose-dependent antiadhesive effect, when tested on strain J99 and its isolates, with pre-incubation of the bacteria leading to reduced binding.

For Eyesight Improvement: (29)

Okra shells are useful for eyesight due to their high content of vitamin A and beta carotene. Both are essential for maintaining good vision.

Conclusion:

Despite the availability of antidiabetic drugs, such as oral medications and exogenous insulin, natural resources remain as a promising source for drug discovery and play a vital role in emerging treatments for diabetes. Many traditional plants are used globally to manage the disease. They are considered less toxic and free from side effects commonly compared with synthetic drugs. Plants from the Malvaceae family show potential as antidiabetic agents. Researchers

believe that bioactive compounds in these plants, such as flavonoids and glycosides, are responsible for their hypoglycaemic effects. These plants may help to regulate blood sugar by enhancing the pancreatic function, boosting production of insulin or reducing glucose absorption in the intestine. Ongoing research into plant-based alternatives for diabetes treatment from the Malvaceae family and other plant continues globally, as this disease remains significant challenge for both physicians and researchers.

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