

Anti-Diabetic Management: Eugenia Jambolana**Ashok Kumar Sharma¹, Akriti Agrawal² Kshitiz Kant², Vatsal Khandelwal², Madhvi Agrawal², Azaz Ahmed²**¹Asso. Professor, Arya College of Pharmacy, Jaipur, Rajasthan²Research Scholar, Arya College of Pharmacy, Jaipur, Rajasthan

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Abstract

Diabetes is a global health issue that affects millions of people worldwide. As of 2019, an estimated 463 million people had diabetes worldwide accounting for 8.8% of the adult population. It is a condition when either insufficient or ineffective insulin production occurs in the body. The pancreatic beta-cells produce more insulin as a result of insulin resistance in conditions like diabetes or obesity. There are several types of diabetes, including type 1, type 2, type 3, and gestational. 90–95% of people with diabetes have type 2, which is characterized by both decreased insulin synthesis by the pancreatic beta cells and impaired insulin release in response to high blood glucose level. Eugenia jambolana, also known as black plum or jamun, is a fruit bearing tree that has been traditionally used in Ayurvedic and Unani medicine for the treatment of diabetes. Several studies have investigated the anti-diabetic properties of Eugenia jambolana and have found that it may have potential as a natural treatment for diabetes. According to reports, eugenia jambolana has a hypolipemic effect: it lowers blood triglycerides, free fatty acids, and cholesterol. This analysis demonstrates that Eugenia jambolana significantly affects blood sugar regulation. Additionally, it has good potential for managing diabetic mellitus as it is defined in conventional medical systems, and that too without suffering any severe adverse effects. Eugenia jambolana contains several bioactive compounds, including jambosine, which has been shown to have hypoglycemic effects by promoting the uptake of glucose by cells and inhibiting the breakdown of carbohydrates into glucose. The fruit also contains antioxidants, which can help protect against oxidative stress and inflammation, both of which are associated with the development and progression of diabetes. Overall, while more research is needed to fully understand the potential anti-diabetic properties of Eugenia jambolana, it shows promise as a natural treatment option that may help improve blood sugar control and reduce the risk of diabetes-related complications. However, it is important to speak with a healthcare professional before using Eugenia jambolana or any other supplements to treat diabetes or any other medical conditions.

Keywords: Diabetes, Insulin, Eugenia Jambolana, Hypoglycemic.

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Introduction

Diabetes mellitus (also known as Hyperglycemia) is a chronic metabolic disorder characterized by high blood glucose levels due to impaired insulin

secretion, insulin action, or both. There are several types of diabetes, with the most common ones being type 1 diabetes, type 2 diabetes, and gestational diabetes.[1, 2]

Type 1 diabetes is an autoimmune disease in which the body's immune system mistakenly attacks and destroys the insulin-producing beta cells in the pancreas. As a result, individuals with type 1 diabetes require lifelong insulin therapy to regulate their blood sugar levels.[4]

Type 2 diabetes is the most prevalent form and is primarily characterized by insulin resistance, meaning that the body's cells do not respond effectively to insulin. Over time, the pancreas may also come unfit to produce enough insulin. Type 2 diabetes is often associated with obesity, sedentary lifestyle, and genetic predisposition. It can be managed through lifestyle modifications, oral medications, injectable therapies, and sometimes insulin.[3]

Diabetes can lead to various complications affecting the eyes (diabetic retinopathy), kidneys (diabetic nephropathy), nerves (diabetic neuropathy), and cardiovascular system (diabetic cardiomyopathy, stroke, and peripheral arterial disease). Long-term uncontrolled diabetes can also increase the risk of developing other serious health conditions, such as heart disease, stroke, and kidney disease.

Diagnosis of diabetes is typically based on blood tests that measure fasting plasma glucose levels, oral glucose tolerance tests, or glycated hemoglobin (HbA1c) levels. Early detection and intervention are important to prevent complications and manage the disease effectively.

Treatment goals for diabetes focus on achieving and maintaining optimal blood glucose control. This involves a combination of healthy eating, regular physical activity, blood glucose monitoring, medication or insulin therapy, and self-management education. Lifestyle modifications, such as maintaining a balanced diet, losing weight if necessary, and engaging in regular exercise, are fundamental aspects of diabetes management.

The therapies comprise.

(1) Substances that cause the pancreas to release more insulin.

(2) Substances that make target organs more sensitive to insulin,

(3) Substances that slow down the pace at which the gastrointestinal system absorbs glucose.

Eugenia Jambolana

The *Eugenia jambolana* or *Syzygium cumini* belongs to the Myrtaceae family. Other common names are Jambul, Black Plum, Java Plum, Indian Blackberry, Jamblang, Jamunetc.

Scientific classification of *Eugenia jambolana* is.

Kingdom Plantae

Division Magnoliophyta

Class Magnoliosida

Family Myrtaceae

Genus *Eugenia*

Species *jambolana* Lam.

Trees of Jamun are set up growing throughout the Asian key, Eastern Africa, South America, Madagascar and have also naturalized to Florida and Hawaii in the United States of America. The ripe fruits are used for health drinks, making preserves, squashes, jellies and wine. In association to its salutary use, all corridors of the tree and, importantly the seeds are used to treat a range of affections, the most important being diabetes mellitus. When they are unripe, they are purplish black rather than green. The ripe fruits have a sweetish-sour flavour and are used to make squash, juice, jellies, health drinks, and wine. According to studies, berries also include minerals, flavonoids, terpenes, and other phytochemicals that are pharmacologically active. Plants with known ethnomedical use include jamun. Jamun was useful for treating diabetes before insulin was discovered, and it is a key component of some alternative medical systems.[5]

Numerous extracts of jamun have been found to have a variety of pharmacological properties, including antibacterial, antifungal, antiviral, antigenotoxic, anti-inflammatory, anti-ulcerogenic, cardioprotective, antiallergenic, anticancer, chemo

preventive, radioprotective, free radical scavenging, antioxidant, hepatoprotective, anti-diarrheal, hypoglycemic, and antidiabetic effects. The current paper examines these elements as well as the gaps in the body of knowledge.[7]

According to reports, *Eugenia jambolana* has a hypolipidemic effect.

It lowers blood triglycerides, free fatty acids, and cholesterol. This analysis demonstrates that *Eugenia jambolana* significantly affects blood sugar regulation. Additionally, it has good potential for managing diabetic mellitus as it is defined in conventional medical systems, and that too without suffering any severe adverse effects.[6]

Jambolana (*E. jambolana*) seed kernel is a common domestic diabetes preparation and a main component of a number of herbal anti-diabetic preparations.

Chemical Composition

Eugenia jambolana is a rich source of bioactive compounds, including anthocyanins, ellagitannins, flavonoids, and alkaloids. These phytochemicals contribute to the plant's medicinal properties and may play a significant role in its anti-diabetic effects. Anthocyanins, responsible for the fruit's dark purple color, have been extensively studied for their potential health benefits.[8]

Mechanism of Action

While numerous investigations have looked into the mechanism of action of *Eugenia jambolana*, which has hypoglycaemic properties, no precise mechanism of action has been found. The plant is abundant in chemicals that contain anthocyanins, glucoside, ellagic acid, isoquercetin, kaemferol, and myrecetin, according to pharmacological investigations. The alkaloid jambosine and glycoside jambolin or antimellin, which are purported to be present in the seeds are said to stop the diastatic conversion of starch into sugar.

It is thought that the jambolin, a glycoside found in *Eugenia jambolana* seeds, has the ability to stop the pathological conversion of starch into sugar in situations where

there is an excessive generation of glucose. The saponins found in the ethanolic extracts of *Eugenia jambolana* seeds appear to be involved in stimulating pancreatic beta-cells and causing them to secrete insulin antimellin, which prevents the diastatic conversion of starch into sugar.

One of the key mechanisms by which *Eugenia jambolana* may exert its anti-diabetic effects is by promoting the uptake of glucose by cells and inhibiting the breakdown of carbohydrates into glucose. This is due to the presence of bioactive compounds such as jambosine and ellagic acid in *Eugenia jambolana*. Jambosine has been shown to stimulate glucose uptake and utilization by cells, while ellagic acid has been shown to inhibit the activity of an enzyme called alpha-glucosidase, which is responsible for the breakdown of carbohydrates into glucose.

Eugenia jambolana has also been shown to improve insulin sensitivity, which is important for people with diabetes as it can help improve blood sugar control. Insulin sensitivity refers to the ability of cells to respond to insulin and take up glucose from the bloodstream. When cells become insulin resistant, they are less able to respond to insulin, which can lead to high blood sugar levels. Additionally, *Eugenia jambolana* contains antioxidants, which can help protect against oxidative stress and inflammation, both of which are associated with the development and progression of diabetes.

Overall, the anti-diabetic action of *Eugenia jambolana* may be due to its ability to promote glucose uptake, inhibit carbohydrate breakdown, improve insulin sensitivity, and provide antioxidant protection. However, more research is needed to fully understand the mechanisms of action of *Eugenia jambolana* and its potential as a natural treatment option for diabetes. It is important to speak with a healthcare professional before using *Eugenia jambolana* or any other supplements to treat diabetes or any other medical condition.[10, 11]

Biological Activities

Anti-Hyperglycemic Effects:

Numerous preclinical studies have demonstrated the anti-hyperglycemic effects of *Eugenia jambolana*. Animal models treated with *Eugenia jambolana* extracts showed significant reductions in fasting blood glucose levels and improved glucose tolerance. These effects were attributed to increased insulin secretion, enhanced glucose uptake by cells, and inhibition of intestinal glucose absorption. Anthocyanins and flavonoids present in *Eugenia jambolana* extracts have been found to contribute to these anti-hyperglycemic properties. They promote insulin secretion by pancreatic beta-cells, increase glucose uptake in peripheral tissues, and inhibit carbohydrate-digesting enzymes in the intestine, thereby reducing postprandial glucose levels.[9]

Insulin-Sensitizing Effects:

Insulin resistance, a hallmark of type 2 diabetes, can be addressed through improved insulin sensitivity. *Eugenia jambolana* extracts have shown potential in enhancing insulin sensitivity. Animal and in vitro studies have demonstrated increased expression of glucose transporters (GLUT-4), improved insulin signaling, and modulation of key enzymes involved in glucose metabolism. These effects contribute to improved insulin sensitivity and reduced insulin resistance, thereby aiding in glycemic control.[12]

Beta-Cell Protection and Regeneration:

Pancreatic beta-cell dysfunction is a key factor in the development and progression of diabetes. *Eugenia jambolana* extracts have exhibited protective effects on beta-cells in various experimental models. The presence of antioxidants and anti-inflammatory compounds in *Eugenia jambolana* helps prevent beta-cell damage induced by oxidative stress and chronic inflammation. Moreover, these bioactive compounds promote beta-cell regeneration and increase insulin production, contributing to improved glycemic control.

Antioxidant and Anti-inflammatory Effects:

In addition to its anti-diabetic effects, *Eugenia jambolana* possesses potent antioxidant and anti-inflammatory properties. Oxidative stress and chronic inflammation are associated with the development of diabetes and its complications. The antioxidants present in *Eugenia jambolana* scavenge free radicals, reduce oxidative stress, and protect against cellular damage. Its anti-inflammatory properties help mitigate chronic inflammation, which plays a role in insulin resistance and beta-cell dysfunction.[12]

Lipid-Lowering Effects:

Dyslipidemia is a common complication of diabetes, and managing lipid levels is essential in diabetes management. *Eugenia jambolana* extracts have demonstrated lipid-lowering effects in animal studies and clinical trials. They decrease total cholesterol, triglycerides, and LDL cholesterol levels while increasing HDL cholesterol levels. These lipid-modulating effects contribute to cardiovascular protection and overall metabolic improvement in individuals with diabetes.[13]

Clinical Studies:

Clinical trials investigating the effects of *Eugenia jambolana* in individuals with diabetes have reported encouraging results. These studies have shown improvements in glycemic control, insulin sensitivity, lipid profiles, and antioxidant status in participants treated with *Eugenia jambolana* extracts or supplements. However, the available clinical evidence is limited, and further well-designed studies are necessary to establish optimal dosages, long-term safety, and potential interactions with other medications.[14, 15]

Conclusion

In conclusion, the review project on the antidiabetic action of *Eugenia jambolana* has provided evidence that this plant has potential as a natural treatment for diabetes. *Eugenia jambolana* may exert its anti-diabetic effects through a variety of mechanisms, including promoting glucose

uptake, inhibiting carbohydrate breakdown, improving insulin sensitivity, and providing antioxidant protection.

The available evidence suggests that *Eugenia jambolana* may help improve blood sugar control and reduce the risk of diabetes related complications. However, more research is needed to fully understand the mechanisms of action of *Eugenia jambolana* and its potential as a natural treatment option for diabetes.

It is important to note that while *Eugenia jambolana* may have potential benefits for

References

1. World Health Organization, World Health Organization. Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia: report of a WHO/IDF consultation. Geneva: World Health Organization, 2010; 1-50.
2. Jacobs AM. Diabetes mellitus. Clin Podiatr Med Surg. 1993 Apr;10(2):231-48.
3. IDF Diabetes Atlas:2013/http://www.idf.org/diabetesatlas
4. Mayfield J. Diagnosis and classification of diabetes mellitus: new criteria. Am Fam Physician. 1998 Oct 15; 58(6): 1355-62, 1369-70.
5. Rizvi MK, Rabail R, Munir S, Inam-Ur-Raheem M, Qayyum MMN, Kieliszek M, Hassoun A, Aadil RM. Astounding Health Benefits of Jamun (*Syzygium cumini*) toward Metabolic Syndrome. Molecules. 2022 Oct 24;27(21):7184.
6. Qamar M, Akhtar S, Ismail T, Wahid M, Abbas MW, Mubarak MS, Yuan Y, Barnard RT, Ziora ZM, Esatbeyoglu T. Phytochemical Profile, Biological Properties, and Food Applications of the Medicinal Plant *Syzygium cumini*. Foods. 2022 Jan 28;11(3):378.
7. Baliga MS. Anticancer, chemopreventive and radioprotective potential of black plum (*Eugenia jambolana* lam.). Asian Pac J Cancer Prev. 2011;12(1):3-15. PMID: 21517226.
8. Aqil F, Gupta A, Munagala R, Jeyabalan J, Kausar H, Sharma RJ, Singh IP, Gupta RC. Antioxidant and antiproliferative activities of anthocyanin/ellagitannin-enriched extracts from *Syzygium cumini* L. (Jamun, the Indian Blackberry). Nutr Cancer. 2012 Apr;64(3):428-38.
9. Nadkarni AK. Indian Materia Medica, Popular Prakashan, Bombay. 1954; 1:1331.
10. Yadav D, Lalit A, Singh S, Galgut J M, Beg M A. Evaluation of antidiabetic and phytochemical activity of 50% methanolic extract of jamun seed (*syzygium cumini*)., 2013; 3: 13-16.
11. Xu J, Liu T, Li Y, Yuan C, Ma H, Seeram NP, Liu F, Mu Y, Huang X, Li L . Hypoglycemic and hypolipidemic effects of triterpenoid-enriched Jamun (*Eugenia jambolana* Lam.) fruit extract in streptozotocin-induced type 1 diabetic mice. Food Funct. 2018 Jun 20;9(6):3330-3337.

12. Baliga MS, Fernandes S, Thilakchand KR, D'souza P, Rao S. Scientific validation of the antidiabetic effects of *Syzygium jambolanum* DC (black plum), a traditional medicinal plant of India. *J Altern Complement Med.* 2013 Mar;19(3):191-7.
13. Srivastava B, et al, Study of hypoglycaemic and hypolipidemic activity of *Eugenia jambolana* pulp and seed extract in Streptozotocin induced diabetic albino rats, *Asian Journal of Pharmacy and Life Science*, 2012; 2(1): 10-19.
14. Sridhar S.B, et al, Preclinical evaluation of the antidiabetic effect of *Eugenia jambolana* seed powder in streptozotocin-diabetic rats, *AB nratizdiliaabne J toicurenffaelcotfo Mfe Eduigceanliaanjdam Biboololagniac asle Research.*, 2005; 38: 463-468.
15. Arun R, Prakash MV, Abraham SK, Premkumar K. Role of *Syzygium cumini* seed extract in the chemoprevention of in vivo genomic damage and oxidative stress. *J Ethnopharmacol.* 2011 Mar 24; 134(2): 329-33.