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Indian Medicinal Plants Used in Diabetes Treatment: A Comprehensive Review

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ABSTRACT

Diabetes mellitus is a chronic metabolic illness that affects millions of people globally, and its prevalence is increasing in India. Traditional plant-based medicines, particularly those derived from India's Ayurvedic tradition, are gaining popularity due to their potential to manage blood glucose levels and accompanying issues. *Momordica charantia, Gymnema sylvestre, Syzygium cumini,* and *Tinospora cordifolia* are examples of Indian medicinal herbs that have been proven to have considerable hypoglycemic and antihyperglycemic characteristics, often through insulin secretion stimulation, carbohydrate-digesting enzyme inhibition, and antioxidant activity. However, standardization of bioactive components, dosage adjustment, and human clinical studies are required to incorporate these traditional therapies into modern therapeutic frameworks. Future research should concentrate on isolating active chemicals and testing their clinical efficacy in order to produce novel plant-based antidiabetic medicines.

Keywords: Metabolic illness, antioxidant activity, insulin, prevalence, therapeutic.

INTRODUCTION:

Diabetes mellitus (DM) causes chronic hyperglycemia and metabolic problems due to inadequate insulin secretion or activity. Insulin major anabolic hormone role influences protein, fat, and carbohydrate metabolism[1].

Type 1 diabetes:

Type 1 diabetes is caused by the autoimmune destruction of beta-insulin-producing pancreatic cells.

Type 1 diabetes is the result of a combination of random events, primarily unknown environmental effects, and genetic predisposition. Its prevalence has risen dramatically in the last two decades, particularly among children under the age of five, due to a range of factors such as environmental factors, sun exposure, and population hygiene. Although the illness is thought to affect an equal proportion of persons over the age of 18, its prevalence in older adults has received less attention from researchers and the media. The disease most usually affects people under the age of 18 [2].

Type 2 diabetes:

T2 diabetes, which accounts for more than 90% of cases of diabetes mellitus, is characterized by tissue insulin resistance (IR), insufficient compensatory insulin secretory response, and insufficient insulin secretion by pancreatic islet β-cells[3].

The number of people with type 2 diabetes has increased at an unprecedented rate due to the global rise in obesity, physical inactivity, and energy-dense diets [4].

Gestational Diabetes Mellitus (GDM):

In obstetrics, gestational diabetes mellitus, or GDM, is a contentious topic. Glucose intolerance that initially manifests or is identified during pregnancy and goes away after delivery is known as gestational diabetes mellitus (GDM).

After delivery, disappearance is particularly crucial because diabetes mellitus Type II (DMII), which was previously unknown, is frequently confused with GDM[5].

Medicinal plants used in treatment of diabetes:

***Momordica charantia*:**

The study investigated the hypoglycemic effects of *Momordica charantia* seeds extracts on diabetic rats. The extracts, MCSEt1 and MCSEt2, significantly decreased blood glucose levels and increased hemoglobin, glycogen, and hexokinase activities in diabetic rats, demonstrating the antidiabetic properties of *Momordica charantia*[6].

Azadirachta indica:

The study found that using an ethanolic extract of *A. indica* can help cure STZ-induced hyperglycemia and dyslipidemia after diabetes, and that the lipid profile and glucose levels returned to normal after diabetes induction[7].

Trigonella-fenugreaecum:

The hydroalcoholic extract of *Trigonella foenum-graecum* seeds improved glucose homeostasis in rats with type 2 diabetes, reversing symptoms and demonstrating efficient glycemic management[8].

Syzygium cumini:

The methanolic extract of *S. cumini* seeds contains numerous phytochemicals with medicinal significance. These include alkaloids, flavonoids, glycosides, steroids, cardiac glycosides, saponins, resins, phenols, tannins, and terpenoids. The extract also exhibits strong α-amylase inhibitor properties, suggesting strong antidiabetic properties. This study evaluates *S. cumini* seeds' potential for conventional diabetes treatment and suggests the isolation of active compounds could lead to new drug candidates[9].

Gymnema sylvestre:

G. sylvestre can be used as an adjuvant in conjunction with allopathic medicine to treat diabetes and postpone its late consequences because of its strong antidiabetic and hypolipidemic properties[10].

Ocimum sanctum:

Diabetes mellitus can be treated with *Ocimum sanctum* leaves, which have been shown to lower blood glucose levels after 30 days of dietary supplementation. The leaves also decreased peroxiodized lipid levels but increased superoxide dismutase, reduced glutathione, and total thiol levels. *Ocimum sanctum* leaves can scavenge free radicals of both superoxide and hydroxyl, making them effective in reducing blood glucose levels. Their antioxidant qualities are believed to be responsible for the hypoglycemic impact[11].

Murraya koenigii:

Murraya koenigii has been found to prevent hyperglycemia in rats with STZ-induced diabetes. Oral administration of an ethanolic extract of *M. koenigii* reduced blood glucose, glycosylated hemoglobin, urea, uric acid, and creatinine levels in the diabetic group. The extract also stimulated insulin levels, indicating significant hypoglycemic potential. The antidiabetic medication glibenclamide was found to be less effective than the *M. koenigii* extract[12].

***Costus igneus*:**

In rats with dexamethasone-induced hyperglycemia, the leaves of the insulin plant (*Costus igeus*) lowered the fasting and postprandial blood sugar levels, bringing them closer to normal. The reduction in fasting and postprandial blood sugar levels using

insulin plant leaves was similar to that achieved with 500 mg/kg of powdered leaves of the insulin plant (*Costus igeus*) and 500 µg/kg of Glibenclamide at 250 mg/kg/day[13].

Catharanthus roseus:

A study on diabetic rats found that a dichloromethane:methanol extract of *Catharanthus roseus* leaves and twigs showed hypoglycemic action when administered orally for 7 and 15 days. The extract showed 48.6 and 57.6% hypoglycemic effects, while complete protection against streptozotocin (STZ) was provided by previous therapy. After seven days of treatment, diabetic rats' livers showed improved enzymatic activities of glycogen synthase, glucose 6-phosphate-dehydrogenase, succinate dehydrogenase, and malate dehydrogenase, which were reduced compared to normal. The results suggest that treated rats metabolize glucose more readily[14].

Hibiscus rosa sinensis:

The study investigated blood glucose and total lipid levels in streptozotocin-induced diabetic rats following oral administration of an ethanol floral extract of *Hibiscus rosa sinensis*. The results demonstrated a similar hypoglycemia impact after 7 and 21 days of treatment. The extract effectively lowered blood glucose and insulin levels while also decreasing total cholesterol and serum triglycerides by 22 and 30%, respectively. The extract has hypoglycemic effect similar to glibenclamide but is not mediated by insulin release[15].

***Ipomoea aquatic*:**

The study looked at the oral hypoglycemic activity of *Ipomoea aquatica* fractions in streptozotocin-induced diabetic male rats. The rats were placed into four groups: control, diabetic, T-1, and T-2, each receiving IA6-1 and IA9-2 fractions. The findings revealed that oral ingestion of IA6-1 and IA9-2 fractions effectively lowered fasting blood sugar levels in diabetic rats. Most biochemical indicators have restored to normal levels. The study recommends additional research into the mechanism of effect and potential clinical trials for a diabetes supplement[16].

Mangifera indica:

According to the study, giving MI extract to rats with alloxan-induced diabetes caused their fasting blood glucose levels to return to normal. The extract had a dose-dependent reducing impact, and gliclazide and MI extract together produced the best control. Steroids, trepenoids, flavonoids, and tannins are the chemical substances that cause this action. Higher concentrations of phenols and flavonoids, which had stronger antioxidant properties and lessened the risk of diabetes problems, are found in the aqueous extract of MI leaves. Thus, a combination of MI leaf extract and low-dose oral hypoglycemic medications may be utilized to treat diabetes[17].

***Annona squamosa*:**

In experimental diabetic rats, supplementing with *A. squamosa* leaf extract helps regulate blood glucose levels, enhances lipid metabolism, and protects against diabetic consequences from lipid peroxidation and antioxidant systems. This could help avoid diabetes issues or treat them early[18].

Cassia auriculata:

In Indian traditional medicine, *Cassia auriculata*, commonly referred to as "Tanner's cassia," is used to cure diabetes. For 30 days, the floral extract was taken orally at a rate of 0.45 g/kg body weight, which decreased blood glucose and raised plasma insulin levels. Additionally, the extract demonstrated its hypo-glycemic activity by reducing the production of free radicals in tissues. Animals with 0.45 g/kg body weight exhibited the most antioxidant effects, outperforming glibenclamide[19].

***Tinospora cordifolia*:**

An efficient anti-hyperglycemic medication for type 2 diabetes (DM) is *tinospora cordifolia* (TC). TC can be used as a supportive medication, albeit having less potent action than insulin. Increased glucose access into peripheral tissues and organs, such as the liver, may be the cause of its anti-diabetic effects. TC may function similarly to other oral anti-hyperglycemic medications but not like sulfonylureas. According to this study, TC might be a good substitute for various already prescribed medications that have negative side effects[20].

***Asparagus racemosus*:**

Rats were used in the study to investigate the lipid profiles, liver, kidney, and anti-diabetic properties of *Asparagus racemosus* leaf extract. In contrast to the positive metformin, alloxan control, and alloxan + metformin groups, the results indicated a dose-dependent decrease in body weight following alloxan and extract, with only a slight decrease in weight. A significant reduction in blood glucose, SGPT, creatinine, urea, cholesterol, triglycerides, LDL, and HDL values was observed when metformin was taken with a high dose of extract. According to the research, A. racemosus may be used as a standardized phytomedicine for conditions like diabetes, heart disease, liver disease, and kidney disease[21].

***Hemidesmus indicus*:**

By restoring electrolyte and glucose metabolizing enzyme levels to normal, correcting metabolic alterations in diabetic rats, and lowering liver and kidney lipid peroxidation products, the extract of *H. indicus* roots, when taken at a dosage of 500 mg/kg/day, exhibits significant antidiabetic activity, suggesting its potential as an antioxidant and antidiabetic agent[22].

***Pterocarpus marsupium*:**

Wistar albino rats were used to test the antidiabetic effects of the medicinal herb *Pterocarpus marsupium Roxb*. Significant antidiabetic, antihyperlipidemic, and antioxidant actions were demonstrated by the plant's ethanol extracts, which decreased blood glucose, raised HDL-C and antioxidant enzymes, and raised plasma insulin levels in diabetic rats[23].

***Selacia reticulate*:**

In diabetic rats, *Selacia reticulata* root extract has hypoglycemic action, which can be used to treat a number of conditions. Extracts from *Salacia reticulata* Wight demonstrated strong hypoglycemic effects on blood glucose levels as well as scavenging action against hydrogen peroxide, superoxide, and free radicals. For diabetic situations, it is advised[24].

***Picrorrhiza kurroa*:**

Both normal and diabetic rats caused by alloxan can have their blood glucose levels lowered by the alcoholic extract of *Picrorrhiza kurroa*. It prevents leukopenia and body weight loss, raises blood urea nitrogen and serum lipid peroxides, and lowers blood sugar levels. This implies that *P. kurroa* extracts can lessen the metabolic harm that diabetic rats sustain[25].

Eugenia jambolana:

The study found that *Eugenia jambolana* seeds, including whole seed, kernel, and seed coat, significantly reduced blood glucose levels, increased glucose tolerance, and decreased glutamate oxaloacetate and glutamate pyruvate transaminase activities in diabetic rats, compared to standard hypoglycemic drugs like glibenclamide[26].

***Terminila chebula*:**

According to the study, in rats with diabetes generated by alloxan, the alcoholic extract of *T.chebula* fruit pulp has anti-hyperglycemic properties; in models induced by adrenaline, the impact is stronger. It works similarly to insulin, encouraging the production of insulin in reaction to hyperglycemia[27].

***Punica granatum*:**

The study examines how the aqueous extract (PE) of pomegranate fruits affects the metabolism of glucose in male Wistar rats with Alloxan-induced diabetes. The findings indicate that PE treatment modifies hyperglycemia and hyperlipidemia by lowering fasting blood glucose and raising mRNA expression levels[28].

***Laurus nobilis* and *Elettaria cardamomum*:**

According to a study on diabetic rats, a 5% mixture of cardamom seeds and bay leaves dramatically reduced all biochemical indicators, including liver, kidney, TC, TG, LDL, VLDL, and glucose levels. Additionally, consuming these substances enhanced serum glucose, kidney, liver, and HDL-c levels[29].

Caesalpinia bonducella:

In both diabetes-induced hyperlipidemia and alloxan-induced hyperglycemia, *Caesalpinia bonducella* seed extracts shown strong antihyperglycemic and antihyperlipidemic actions. Oral dosing raised LDL and cholesterol levels and decreased BUN levels, presumably as a result of inhibiting glucose absorption[30].

***Ficus bengalensis*:**

The fruit, root, and bark of *Ficus bengalensis Linn* are among the aerial parts whose blood glucose-lowering properties are assessed in this study. In contrast to the common medication glibenclamide, the fruit extract exhibited greater antidiabetic action at 120 mg/kg body weight than the root or bark extract[31].

***Cinnamomum zeylanicum*:**

The methanolic extract of *C. zeylanicum* improves STZ-induced diabetes mellitus by promoting insulin secretion from the pancreatic islets and avoiding damage to the liver, pancreas, and kidney cells[32].

Terminalia arjuna:

In Wistar rats, the study assessed *Terminalia arjuna* leaf (META)'s antioxidant and antihyperglycemic qualities. The findings demonstrated that META restored serum biochemical parameters, lowered lipid peroxidation, recovered GSH levels and CAT activity, and considerably decreased and normalized blood glucose levels[33].

Berberis aristata:

Significant hypoglycemic and hypolipidemic effects were found when the methanolic extract of *Berberis aristata* DC stem was tested in diabetic rats for antidiabetic effects. In diabetic rats, the extract successfully lowered HDL cholesterol and blood glucose levels[34].

***Holarrhena antidysenterica*:**

Alloxan-induced diabetic albino rats were used in the study to test the antidiabetic potential of *Holarrhena antidysenterica* Linn bark powder. Significant antidiabetic action was demonstrated by the results for alcohol, butanol, chloroform, aqueous, and butanone extracts[35].

***Symplocos cochinchinensis*:**

The study examines the antidiabetic potential of *Symplocos cochinchinensis* leaves in type 2 diabetic rats caused by a high-fat diet and low levels of streptozotocin (STZ). Significant drops in plasma glucose levels, enhanced insulin sensitivity, and no negative side effects are demonstrated by the results. This validates the traditional application of leaves from *Symplocos cochinchinensis*[36].

***Acacia catechu*:**

The ethanolic and aqueous extracts of *Acacia catechu* hard wood demonstrated anti-dyslipidemic activity in Syrian golden hamsters and eye lens aldose reductase, and they enhanced oral glucose tolerance in rats and STZ-induced diabetic rats[37].

***Cassia fistula**:*

According to the study, the aqueous extract of *Cassia fistula* flowers (ACF) restored the activities of important antioxidant enzymes and dramatically reduced peroxidation products in rats with diabetes induced by alloxan, suggesting that it may have antioxidant properties[38].

Bauhinia variegate:

Significant anti-hyperglycemic action was demonstrated in rats by the ethanolic extract of *Bauhinia variegata* leaves, with dose-dependent effects observed at 250 and 500 mg/kg. Nevertheless, the reference standard was more effective than the extract. Additionally, glibenclamide decreased blood glucose levels in animals with diabetes. Rats given glucose were used to test the extract's activity utilizing glucose tolerance tests[39].

Andrographis paniculata:

Significant hypoglycemic action was demonstrated by extracts from *Andrographis paniculata* in diabetic rats. While intraperitoneal alloxan administration raised blood sugar levels, oral glucose administration did the same. Rats given glucose had their blood sugar levels lowered by 41.51 and 41.82% by hot water and ethanol extracts, while rats given alloxan-induced diabetes had their blood sugar levels lowered by 46.21 and 45.13%[40].

***Swertia kouitchensis*:**

The ethanol extract from the *Swertia kouitchensis* plant was tested for its anti-diabetic effects in diabetic mice. The results demonstrated that it enhanced antioxidant capacity, increased insulin secretion, and inhibited α-amylase and α-glucosidase activity, all of which supported its use[41].

***Boerhavia diffusa*:**

In alloxan diabetic rats, the antihyperlipidemic action of extract from *Boerhavia diffusa* leaves was examined; oral administration of BLEt decreased triglycerides, cholesterol, free fatty acids, and phospholipids, and was found to be more efficacious than glibenclamide[42].

***Dioscorea bulbifera*:**

The study examined the anti-diabetic effects of *Dioscorea bulbifera* tuber extract in albino rats that had been given alloxan. The plant extract decreased liver signs of damage, raised liver enzymes, and decreased blood glucose levels, according to the results. In diabetic rats, it also lowered LDL, TGs, HDL, and LDL while raising albumin levels[43].

Woodfordia fruticose:

Woodfordia fruticosa leaves and stem barks were tested for their antidiabetic effects in diabetic rats. Due to the presence of saponins and flavonoids, the extracts considerably reduced raised blood glucose levels and boosted body weight in diabetic rats, according to the results[44].

Butea monosperma:

B. monosperma leaves and bark were tested for their antidiabetic effects in rats with severe diabetes induced by streptozotocin. The results showed that both extracts had negligible antihyperglycemic effects. The extracts from the leaves and bark decreased blood sugar by 28% and 11%, respectively, but they had no effect on insulin secretion or synthesis or pancreatic architecture. The results show that in severe experimental diabetes, B. monosperma has no discernible antidiabetic effect[45].

***Cassia auriculata*:**

"Tanner's cassia," or *Cassia auriculata*, is used in Indian traditional medicine to cure diabetes. Taking 0.45 g/kg body weight orally for 30 days decreased the production of free radicals while increasing plasma insulin and lowering blood glucose. Compared to glibenclamide, CFEt was more efficacious and shown antioxidant qualities, especially in animals[46].

Madhuca longifolia:

The methanolic extract of *Madhuca longifolia* bark demonstrated dose-dependent hypoglycemic effect in diabetic rats, which may be attributed to enhanced intestinal glucose absorption, pancreatic function, or glucose uptake. This finding supports the bark's possible usage in traditional medicine[47].

Bombax ceiba:

The study tested *Bombax ceiba* bark extract's hypoglycemic and hypolipidemic effects on diabetic rats. According to the results, the most effective dose was 600 mg/kg, which had a substantial impact and reduced triglyceride and cholesterol levels. There are triterpenoid chemicals in the extract[48].

Abrus precatorius:

The study assessed *Abrus precatorius* leaves methanolic extract's (APME) in vivo antihyperglycemic and insulinotropic properties in diabetic rats. APME potentiated insulin production in MIN6-β cells and dramatically restored body weight, blood glucose, and insulin levels, according to the results[49].

Achyranthes aspera:

A common herb in Ayurvedic medicine, *Achyranthes aspera*, has been demonstrated to have potent anti-diabetic effects. The ethanolic leaf extract significantly lowered blood glucose levels in Streptozotocin-induced diabetic rats, indicating that more study may be possible[50].

Cassia kleinii:

The study sought to determine the efficiency of *Cassia kleinii* leaf (ethanol extract) in streptozotocin diabetic rats, isolate the active fraction, and assess acute and short-term general toxicity in male mice. In streptozotocin-induced diabetic rats, the alcohol extract had considerable antidiabetic characteristics, but had no significant effect on insulin levels. The active fraction was primarily detected in the chloroform fraction, which contained terpenoids, coumarins, and saponins[51].

Discussion:

The review underlines the usefulness of Indian medicinal herbs in diabetes therapy, namely their hypoglycemic and antihyperglycemic characteristics. Plants like *Momordica charantia*, *Gymnema sylvestre*, *Syzygium cumini*, and *Tinospora cordifolia* can lower blood glucose levels through various pathways, including pancreatic β-cell regeneration, increased glucose uptake in peripheral tissues, and lipid metabolism modulation. Other herbs, such as *Ocimum sanctum*, *Trigonella foenum-graecum*, and *Cassia auriculata*, have demonstrated potential results in maintaining glycemic control.

Flavonoids, alkaloids, terpenoids, and polyphenols are important phytochemicals that contribute to these plants' antidiabetic benefits. Some plant extracts' antioxidant characteristics imply they might help reduce oxidative stress, which is a major contributor to diabetic problems *Berberis aristata* and *Terminalia arjuna* plants have been proven to have considerable lipid-lowering benefits, lessening the cardiovascular risk associated with diabetes. However, human clinical studies are limited, and the standardization of bioactive chemicals, appropriate dose, and potential toxicity must all be extensively examined. More study should be done to isolate and characterize active components from these plants in order to create new antidiabetic medicines. Integrating these herbal medicines into mainstream medicine necessitates cross-disciplinary collaboration to assure clinical efficacy while retaining traditional knowledge.

Conclusion:

Although Indian medicinal plants show tremendous potential for diabetes treatment, more systematic research and randomized controlled trials are required to convert these discoveries into practical therapeutic applications that provide comprehensive and sustainable diabetic care.

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REFERENCES:

1. Poznyak A, Grechko AV, Poggio P, Myasoedova VA, Alfieri V, Orekhov AN. The diabetes mellitus–atherosclerosis connection: The role of lipid and glucose metabolism and chronic inflammation. International journal of molecular sciences. 2020 Mar 6;21(5):1835.
2. Bluestone JA, Herold K, Eisenbarth G. Genetics, pathogenesis and clinical interventions in type 1 diabetes. Nature. 2010 Apr 29;464(7293):1293-300.
3. Galicia-Garcia U, Benito-Vicente A, Jebari S, Larrea-Sebal A, Siddiqi H, Uribe KB, Ostolaza H, Martín C. Pathophysiology of type 2 diabetes mellitus. International journal of molecular sciences. 2020 Aug 30;21(17):6275.
4. Chatterjee S, Khunti K, Davies MJ. Type 2 diabetes. The lancet. 2017 Jun 3;389(10085):2239-51.

5. Hollander MH, Paarlberg KM, Huisjes AJ. Gestational diabetes: a review of the current literature and guidelines. Obstetrical & gynecological survey. 2007 Feb 1;62(2):125-36.
6. Sathish Sekar D, Sivagnanam K, Subramanian S. Antidiabetic activity of Momordica charantia seeds on streptozotocin induced diabetic rats. Die Pharmazie-An international journal of pharmaceutical sciences. 2005 May 1;60(5):383-7.
7. Bisht S, Sisodia SS. Anti-hyperglycemic and antidyslipidemic potential of Azadirachta indica leaf extract in STZ-induced diabetes mellitus. Journal of Pharmaceutical Sciences and Research. 2010 Oct 1;2(10):622-7.
8. Kulkarni CP, Bodhankar SL, Ghule AE, Mohan V, Thakurdesai PA. Antidiabetic activity of Trigonella foenumgraecum L. seeds extract (IND01) in neonatal streptozotocin-induced (n-STZ) rats. Diabetologia Croatica. 2012 Mar 1;41(1).
9. Prabakaran K, Shanmugavel G. Antidiabetic activity and phytochemical constituents of Syzygium cumini seeds in Puducherry region, South India. International Journal of Pharmacognosy and Phytochemical Research. 2017;9(7):985-9.
10. Mall GK, Mishra PK, Prakash V. Antidiabetic and hypolipidemic activity of Gymnema sylvestre in alloxan induced diabetic rats. Global Journal of Biotechnology & Biochemistry. 2009;4(1):37-42.
11. Sethi J, Sood S, Seth S, Talwar A. Evaluation of hypoglycemic and antioxidant effect of Ocimum sanctum. Indian Journal of Clinical Biochemistry. 2004 Jul;19:152-5.
12. Arulselvan P, Senthilkumar GP, Sathish Kumar D, Subramanian S. Anti-diabetic effect of Murraya koenigii leaves on streptozotocin induced diabetic rats. Die Pharmazie-An International Journal of Pharmaceutical Sciences. 2006 Oct 1;61(10):874-7.
13. Shetty AJ, Choudhury D, Nair V, Kuruvilla M, Kotian S. Effect of the insulin plant (Costus igneus) leaves on dexamethasone-induced hyperglycemia. International journal of Ayurveda research. 2010 Apr;1(2):100.
14. Singh SN, Vats P, Suri S, Shyam R, Kumria MM, Ranganathan S, Sridharan K. Effect of an antidiabetic extract of Catharanthus roseus on enzymic activities in streptozotocin induced diabetic rats. Journal of Ethnopharmacology. 2001 Aug 1;76(3):269-77.
15. Sachdewa A, Khemani LD. Effect of Hibiscus rosa sinensis Linn. ethanol flower extract on blood glucose and lipid profile in streptozotocin induced diabetes in rats. Journal of Ethnopharmacology. 2003 Nov 1;89(1):61-6.
16. El-Sawi N, Gad MH, Al-Seeni MN, Younes S, El-Ghadban EM, Ali SS. Evaluation of Antidiabetic Activity of Ipomoea Aquatica Fractions in Streptozotocin Induced Diabetic in Male Rat Model N. Sohag Journal of Sciences. 2017 Jan 1;2(1):9-17.
17. Madhuri AS, Mohanvelu R. Evaluation of antidiabetic activity of aqueous extract of Mangifera indica leaves in alloxan induced diabetic rats. Biomedical and Pharmacology Journal. 2017 Jun 20;10(2):1029-35.
18. Kaleem M, Asif M, Ahmed QU, Bano B. Antidiabetic and antioxidant activity of Annona squamosa extract in streptozotocin-induced diabetic rats. Singapore medical journal. 2006 Aug 1;47(8):670.
19. Pari L, Latha M. Antidiabetic activity of Cassia auriculata flowers: Effect on lipid peroxidation in streptozotocin diabetes rats. Pharmaceutical biology. 2002 Jan 1;40(7):512-7.
20. Puranik N, Kammar KF, Devi S. Anti-diabetic activity of Tinospora cordifolia (Willd.) in streptozotocin diabetic rats; does it act like sulfonylureas?. Turkish Journal of Medical Sciences. 2010;40(2):265-70.
21. Mim IJ, Peya FY, Chowdhury MM, Khan TR, Mandal SK, Maliha F, Alam M, Rahman T, Tashin R. An evaluation of anti-diabetic activity of ethanolic extract of asparagus racemosus in alloxan induced rat model. International Journal of Advances in Nephrology Research. 2023 Aug 2;6(1):60-8.
22. Gayathri M, Kannabiran K. Hypoglycemic activity of Hemidesmus indicus R. Br. on streptozotocin-induced diabetic rats. International Journal of Diabetes in Developing Countries. 2008 Jan;28(1):6.
23. Maruthupandian A, Mohan VR. Antidiabetic, antihyperlipidaemic and antioxidant activity of Pterocarpus marsupium Roxb. in alloxan induced diabetic rats. Int J Pharm Tech Res. 2011 Jul;3(3):1681-7.
24. Chandrashekar CN, Madhyastha S, Benjamin S, Gopala Krishna K, Srinivasan KK. Free radical scavenging activities and antidiabetic properties of various extracts of Salacia reticulata. Thai Journal of Physiological Sciences. 2009;21(2):48-57.
25. Joy KL, Kuttan R. Anti-diabetic activity of Picrorrhiza kurroa extract. Journal of Ethnopharmacology. 1999 Nov 1;67(2):143-8.
26. Ravi K, Sivagnanam K, Subramanian S. Anti-diabetic activity of Eugenia jambolana seed kernels on streptozotocin-induced diabetic rats. Journal of medicinal food. 2004 Jun 1;7(2):187-91.
27. Borgohain RA, Lahon KI, Das SW, Gohain KA. Evaluation of mechanism of anti-diabetic activity of Terminalia chebula on alloxan and adrenaline-induced diabetic albino rats. Drugs. 2002;19(5).
28. Gharib E, Kouhsari SM. Study of the antidiabetic activity of Punica granatum L. fruits aqueous extract on the alloxan-diabetic wistar rats. Iranian journal of pharmaceutical research: IJPR. 2019;18(1):358.
29. El-Kholie E, El-Eskafy A, Hegazy N. Effect of Bay Leaves (Laurus nobilis, L) and cardamom seeds (Elettaria cardamomum, L.) as anti-diabetic agents in alloxan-induced diabetic rats. J Home Econ Menofia Univ. 2023 Jan 1;33(1):77-88.
30. Kannur DM, Hukkeri VI, Akki KS. Antidiabetic activity of Caesalpinia bonducella seed extracts in rats. Fitoterapia. 2006 Dec 1;77(7-8):546-9.
31. Sharma S, Chaturvedi M, Edwin E, Shukla S, Sagrawat H. Evaluation of the phytochemicals and antidiabetic activity of Ficus bengalensis. Int J Diab Dev Ctries. 2007 Jun;27(2):56-9.
32. Singh R, Parasuraman S, Kathiresan S. Antioxidant and antidiabetic activities of methanolic extract of bark of Cinnamomum zeylanicum in diabetic rats. Free Radicals and Antioxidants. 2020 Aug 1;10(1):16-23.

33. Biswas M, Kar B, Bhattacharya S, Kumar RS, Ghosh AK, Haldar PK. Antihyperglycemic activity and antioxidant role of Terminalia arjuna leaf in streptozotocin-induced diabetic rats. Pharmaceutical biology. 2011 Apr 1;49(4):335-40.
34. Upwar N, Patel R, Waseem N, Mahobia NK. Hypoglycemic effect of methanolic extract of Berberis aristata DC stem on normal and streptozotocin induced diabetic rats. Int J Pharm Pharm Sci. 2011;3(1):222-4.
35. Jalalpure SS, Bamne S, Patil MB, Shah B, Salahuddin M. Anti-diabetic activity of Holarrhena antidysenterica (Linn.) Wall, bark on alloxan induced diabetic rats. Journal of Natural remedies. 2006 Jan 1:26-30.
36. Sunil C, Ignacimuthu S, Agastian P. Antidiabetic effect of Symplocos cochinchinensis (Lour.) S. Moore. in type 2 diabetic rats. Journal of ethnopharmacology. 2011 Mar 24;134(2):298-304.
37. Srivastava SP, Mishra A, Bhatia V, Narender T, Srivastava AK. Acacia catechu hard wood: potential anti-diabetic cum anti-dyslipidemic. Medicinal chemistry research. 2011 Dec;20:1732-9.
38. Manonmani G, Bhavapriya V, Kalpana S, Govindasamy S, Apparanantham T. Antioxidant activity of Cassia fistula (Linn.) flowers in alloxan induced diabetic rats. Journal of Ethnopharmacology. 2005 Feb 10;97(1):39-42.
39. Gurjar H, Pandey H, Verma A, Irchhaiya R, Singh PP. Antidiabetic activity of Bauhinia variegata extracts in alloxan-induced diabetic rats. Journal of Drug Delivery and Therapeutics. 2018 Jan 1;8(1):29-32.
40. Hossain MA, Roy BK, Ahmed K, Chowdhury AS, Rashid MA. Antidiabetic activity of Andrographis paniculata. Dhaka University Journal of Pharmaceutical Sciences. 2007;6(1):15-20.
41. Wan LS, Chen CP, Xiao ZQ, Wang YL, Min QX, Yue Y, Chen J. In vitro and in vivo anti-diabetic activity of Swertia kouitchensis extract. Journal of Ethnopharmacology. 2013 Jun 3;147(3):622-30.
42. Pari L, Amarnath Satheesh M. Antidiabetic effect of Boerhavia diffusa: effect on serum and tissue lipids in experimental diabetes. Journal of Medicinal Food. 2004 Dec 1;7(4):472-6.
43. Sarkiyayi S, Solomon H. Antidiabetic effects of air potatoes (Dioscorea bulbifera) on alloxan induced Diabetic rats. Bagale Journal of Pure and Applied Sciences. 2014;9(2):64-74.
44. Beck NR, Namdeo KP. Anti diabetic activity of aqueous extracts of leaves and stem barks of Woodfordia fruticosa in animal model. World Journal of Pharmaceutical Sciences. 2015 Mar 5:468-74.
45. Ahmed F, Siddaraju NS, Harish M, Urooj A. Effect of Butea monosperma Lam. leaves and bark extracts on blood glucose in streptozotocin-induced severely diabetic rats. Pharmacognosy research. 2012 Jan;4(1):33.
46. Pari L, Latha M. Antidiabetic activity of Cassia auriculata flowers: Effect on lipid peroxidation in streptozotocin diabetes rats. Pharmaceutical biology. 2002 Jan 1;40(7):512-7.
47. Dahake AP, Chakma CS, Chakma RC, Prashant Bagherwal PB. Antihyperglycemic activity of methanolic extract of Madhuca longifolia bark.
48. Bhavsar C, Talele GS. Potential anti-diabetic activity of Bombax ceiba. Bangladesh journal of pharmacology. 2013 Feb 26;8(2):102-6.
49. Umamahesh B, Veeresham C. Antihyperglycemic and insulin secretagogue activities of Abrus precatorius leaf extract. Pharmacognosy research. 2016 Oct;8(4):303.
50. Kumar A, Gnananath K, Gande S, Goud E, Rajesh P, Nagarjuna S. Anti-diabetic Activity of Ethanolic Extract of Achyranthes aspera Leaves in Streptozotocin induced diabetic rats. Journal of Pharmacy Research. 2011 Jul;4(7):3124-5.
51. Sundaram EN, Singh KP, Reddy PU. A COMPARATIVE EVALUATION OF HYPOCHOLESTEROLAEMIC AND HYPOTRIGLYCERIDAEMIC ACTIVITY OF INDIAN MEDICINAL PLANTS IN STREPTOZOTOCIN DIABETIC RATS. Journal of Research and Education in Indian Medicine. 2015 Jun 13;15(1):33.

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