



**INTERNATIONAL JOURNAL OF
PHARMACEUTICAL SCIENCES**
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: <https://www.ijpsjournal.com>



Review Article

A Comprehensive Review of Role of Herbal Medicines in Management of Diabetics Activity

Vaishnavi Shindikar*, Priyanka Pachorkar, Rishikesh Bacchav, Santosh Deshmukh

R.G Sapkal College of Pharmacy, Sapkal Knowledge Hub, Kalyani Hills, Anjaneri, Trimbakeshwar Rd, Nashik, 422213, Maharashtra, India.

ARTICLE INFO

Published: 14 Jun 2026

Keywords:

Diabetes Mellitus, Herbal Antidiabetic Agents, Medicinal Plants, Glycemic Control, Phytochemicals and Antidiabetic Activity

DOI:

10.5281/zenodo.20689503

ABSTRACT

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from impaired insulin secretion, insulin action, or both. Despite the availability of conventional antidiabetic drugs, their long-term use is often associated with adverse effects, prompting interest in herbal medicines as safer alternatives. Numerous medicinal plants have demonstrated significant antidiabetic potential through mechanisms such as enhancing insulin secretion, improving insulin sensitivity, inhibiting carbohydrate-digesting enzymes, reducing oxidative stress, and protecting pancreatic β -cells. This comprehensive review summarizes the antidiabetic activities of commonly used medicinal plants, including *Syzygium cumini*, *Zingiber officinale*, *Acorus calamus*, *Symplocos racemosa*, *Piper longum*, and other herbal species. The review highlights their phytochemical constituents, pharmacological actions, experimental and clinical evidence, and underlying mechanisms involved in glycemic control. Available studies indicate that herbal medicines may effectively reduce blood glucose levels and improve associated metabolic abnormalities. These findings support the potential role of medicinal plants as complementary therapeutic agents in diabetes management. However, further clinical studies are required to establish their safety, efficacy, and standardized therapeutic use.

INTRODUCTION

Over the past several years, the use of herbal medicines has increased significantly worldwide. These remedies have become increasingly popular in both developed and developing nations due to

their natural sources and relatively fewer adverse effects. A large number of traditional therapeutic preparations are obtained from medicinal plants, minerals, and various natural organic substances [1]. Traditional healthcare practitioners often prepare and provide their own herbal formulations

***Corresponding Author:** Vaishnavi Shindikar

Address: R.G Sapkal College of Pharmacy, Sapkal Knowledge Hub, Kalyani Hills, Anjaneri, Trimbakeshwar Rd, Nashik

Email ✉: vaishnavishindikar2111@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



based on established therapeutic practices[3] . According to the World Health Organization (WHO), approximately 21,000 plant species are utilized for medicinal purposes globally. Of these, around 2,500 species are found in India, with nearly 150 being used extensively for commercial applications. Owing to its rich diversity of medicinal plants and large-scale production of herbal resources, India is widely recognized as a major producer of medicinal herbs and is often referred to as the "Botanical Garden of the World." Diabetes mellitus (DM) represents a heterogeneous group of metabolic disorders characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The disease is associated with disturbances in carbohydrate, lipid, and protein metabolism and remains one of the leading causes of morbidity and mortality worldwide. The persistent elevation of blood glucose levels contributes to progressive damage of various organs including the pancreas, kidneys, liver, eyes, nervous system, and cardiovascular system, ultimately leading to severe complications and reduced quality of life

Medicinal Plant with Antidiabetic Activity

Plumbago zeylanica (chitrak) :

Among the various species, *Plumbago zeylanica* L. is the most widely recognized because of its significant medicinal value. In Ayurveda, it is commonly known as Chitrak or Chitramula. Chitrak is a perennial medicinal herb that is often grown in shaded garden areas due to its attractive flowering clusters. The plant is extensively found across different regions of India and also occurs naturally in Sri Lanka. *Plumbago zeylanica* root contains plumbagin (15 and 30 mg/kg bw), a bioactive compound that showed significant antidiabetic activity in streptozotocin-induced diabetic rats. Oral administration of plumbagin for 28 days reduced blood glucose levels, improved

insulin levels, normalized biochemical markers, enhanced liver glycogen content, and increased GLUT4 expression in skeletal muscles, indicating improved glucose uptake and carbohydrate metabolism[7]. The similar study conducted by (Vishwanathan and Kumar in 2010) The ethanolic root extract of *Plumbago zeylanica* demonstrated significant antidiabetic activity in streptozotocin-induced diabetic rats. Treatment reduced blood and urine glucose levels and improved hepatic enzyme activity, including hexokinase and glucose-6-phosphatase. The extract also showed hepatoprotective effects, suggesting its potential role in managing diabetes and associated liver dysfunction.[8] Ethanolic extract (100mg -200mg /kg) different doses of *Plumbago zeylanica* extract modulate antidiabetic activity in rat thereby providing a strong defence hyperglycemic effect . Oral administration of the extract reduced blood glucose levels, improved lipid profiles, enhanced antioxidant enzyme activities (superoxide dismutase, catalase, and glutathione), and decreased oxidative stress markers. Histopathological studies also demonstrated protection of pancreatic tissue. The findings suggest that *P. zeylanica* may serve as a promising natural therapeutic agent for diabetes management[9].

Piper longum L.(pippali) :

Piper longum L., commonly known as long pepper or Pippali, is a perennial medicinal climber belonging to the Piperaceae family. The fruit is a distinctive elongated spike made up of numerous tiny berries embedded closely together. As the fruit matures, its color changes from green to dark brown. The fruits have a characteristic pungent flavor mainly due to piperine, an important bioactive alkaloid[12].

This study investigated the antidiabetic and antihyperlipidemic effects of the aqueous root



extract of *Piper longum* in streptozotocin (STZ)-induced diabetic rats. Diabetes was experimentally induced in Wistar rats, and the piper longum 200mg/kg extract was administered to evaluate its therapeutic potential. The results showed that treatment with *Piper longum* significantly reduced elevated blood glucose levels and improved lipid abnormalities associated with diabetes. The extract also lowered total cholesterol, triglycerides, LDL, and VLDL levels while increasing HDL cholesterol [13]. Similarly study done by (zod and ingale 2024) This study examined the blood glucose-lowering effect of *Piper longum* dried fruit extract in diabetic rats. Administration of the ethanolic extract with different doses (100mg/kg, 200mg/kg) significantly reduced elevated glucose levels and improved overall diabetic status. The findings highlight the plant's potential as a natural antidiabetic remedy and suggest that it may help manage hyperglycemia [14]

Piperlongumine is an important bioactive alkaloid compound mostly present in the roots and fruits of the *Piper longum* plant. A study investigated the protective effect of piperlongumine in streptozotocin-induced diabetic rats. Rats received streptozotocin (45 mg/kg, intraperitoneally) to induce diabetes, followed by piperlongumine treatment for 8 weeks. Piperlongumine improved blood glucose and insulin levels, reduced kidney injury markers, and lessened renal tissue damage. The findings suggest that piperlongumine may help prevent diabetic kidney complications and support kidney function [15].

***Acorus calamus*(vekhand) :**

Acorus calamus L. (Sweet flag or Vacha) is a perennial, aromatic, semi-aquatic herb belonging to the family Acoraceae. The plant commonly grows in marshy and wetland habitats.

This study evaluated the antidiabetic activity of the ethyl acetate fraction of *Acorus calamus* (ACE). Oral administration of ACE at 100 mg/kg significantly reduced fasting blood glucose levels in streptozotocin-induced diabetic mice and improved glucose tolerance. ACE enhanced GLP-1 secretion, promoted insulin release, and activated signaling, suggesting its potential role in improving glycemic control and pancreatic function [16].

Prislila et al. investigated the antidiabetic potential of methanolic rhizome extract of *Acorus calamus* in streptozotocin-induced diabetic rats. The extract was administered orally at a dose of 200 mg/kg for 21 days. Treatment significantly lowered blood glucose levels, improved lipid abnormalities, increased insulin and glycogen content, and promoted pancreatic tissue recovery. The findings suggest that *A. calamus* possesses promising antihyperglycemic activity and may support diabetes management [17].

Prashanth et al. evaluated the hypoglycemic activity of methanolic root extract of *Acorus calamus* in alloxan-induced diabetic rats. Oral administration of 150 mg/kg showed significant blood glucose reduction and improved glycemic control over 28 days. Its effect was comparable to glibenclamide in later stages of treatment, indicating that *A. calamus* may be a promising natural option for diabetes management [18].

***Symplocos racemosa* Roxb (lodhra) :**

Symplocos racemosa Roxb., commonly known as Lodhra, is a small to medium-sized evergreen tree belonging to the family Symplocaceae. The species is widely distributed in the tropical and subtropical forests of India.

Jaha et al. investigated the antidiabetic and hepatoprotective effects of methanolic bark extract



of *Symplocos racemosa* in alloxan-induced diabetic rats. Oral treatment (200 and 400 mg/kg/day for 30 days) significantly reduced blood glucose levels and improved pancreatic tissue architecture. The extract also protected against paracetamol-induced liver injury, demonstrating promising antidiabetic and liver-protective properties comparable to standard therapy[19]. Sneha et al. evaluated the antidiabetic potential of silver nanoparticles synthesized using *Symplocos racemosa* (Lodhra) and *Cinnamomum cassia* bark extracts. The nanoparticle formulation demonstrated stronger α -amylase inhibitory activity than the crude herbal extracts, indicating enhanced antidiabetic efficacy. The findings suggest that plant-mediated silver nanoparticles may serve as a promising approach for developing novel antidiabetic therapeutics[22].

***Zingiber officinale*(Ginger) :**

Zingiber officinale belongs to the Zingiberaceae family. It is a perennial herb with aromatic rhizomes. Ginger exhibits antidiabetic activity by reducing blood glucose levels, enhancing insulin sensitivity, improving glucose metabolism, and decreasing oxidative stress, thereby helping prevent diabetes-related complications and metabolic disorders. Al-Amin et al. investigated the antidiabetic and hypolipidaemic effects of raw ginger (*Zingiber officinale*) in streptozotocin-induced diabetic rats. Daily administration of ginger extract (500 mg/kg for 7 weeks) significantly reduced blood glucose, cholesterol, triglycerides, and urinary protein levels while helping maintain body weight. The findings suggest ginger may be beneficial in managing diabetes and associated metabolic complications[23]. Alshathly et al. evaluated the protective effects of ginger (*Zingiber officinale*) against streptozotocin-induced diabetic liver injury in rats. Ginger treatment significantly

reduced blood glucose levels, improved antioxidant status, restored body and liver weights, and normalized liver enzyme markers. Histological and ultrastructural analyses confirmed reduced liver damage, suggesting that ginger may help protect hepatic function and alleviate diabetes-related complications[24].

***Syzygium cumini* (L.) Skeels (Black plum)**

Syzygium cumini (L.) Skeels, commonly known as Jamun in India, belongs to the family of Myrtaceae and has a wide distribution in the Indian sub-continent, eastern Africa and Southeast Asian countries [24]. Stem bark decoction is being consumed by the tribes of Sikkim and Darjeeling Himalaya, India, for the treatment of diabetes mellitus. Oral administration of ethanolic and aqueous extracts of the bark of *S. cumini* (500 mg/kg for 21 days) showed significant blood glucose lowering effects in diabetic Wistar rats [25]. Administration of aqueous extract of *S. cumini* seeds in high-fat-diet-streptozotocin-induced type 2 diabetic rats exhibited significant insulin sensitizing, anti-oxidant, anti-dyslipidemic, anti-inflammatory and β -cell protective effects by overexpression of PPAR α and PPAR γ activity [26]. Administration of ethanolic extract of the seeds of *S. cumini* significantly decreased the blood sugar level accompanied by an increased body weight in alloxan-induced diabetic rats [27]. The aqueous seed extract of *S. cumini* (100 mg/kg for 21 days) exerts a modulatory effect on the hyperglycemic and inflammatory conditions observed in diabetes mellitus. It also exerts a protective effect against the pathophysiological manifestations triggered by the early stages of diabetes mellitus [28].

***Allium sativum* L :**

Allium sativum L., commonly known as garlic, belongs to the *Allium* genus in the family



Alliaceae that are known to contain a high concentration of non-protein sulfur amino acids that are responsible for their medicinal features [29]. Administration of *A. sativum* extract along with the commercially available drug glibenclamide resulted in increased weight and exhibited better hypoglycemic effect in streptozotocin-induced diabetic rats [30]. Similar results were observed in a study where diabetic patients when treated with combination of commercially available drug metformin and garlic supplementation exhibited improved glycemic control in addition to antihyperlipidemic activity [31]. Treatment with fresh garlic homogenate (250 mg/kg b.w.) for 6 weeks resulted in better modulation of antioxidant status in blood and cardiac tissues of streptozotocin-induced diabetic-induced Wistar rats [32]. Administration of garlic extract resulted in reduction of blood glucose concentration accompanied by downregulation of the adrenal and renal expression of angiotensin AT1 receptor in STZ-induced diabetic rats which explains its potential in reversing the harmful consequences of excessive Ang II signaling, manifested by the development of hypertension and nephropathy [33]. The anti-diabetic effect of garlic extract has been reported to be more effective than the standard drug glibenclamide [34].

CONCLUSION

Medicinal plants have emerged as promising therapeutic agents for the management of diabetes mellitus due to their diverse bioactive constituents and multifaceted mechanisms of action. Herbal species such as *Syzygium cumini*, *Zingiber officinale*, *Acorus calamus*, *Symplocos racemosa*, *allium sativum* and *Piper longum* have demonstrated significant antidiabetic potential in experimental studies by reducing blood glucose levels, enhancing insulin secretion and sensitivity,

mitigating oxidative stress, and protecting pancreatic β -cells. In addition to glycemic control, many of these plants exhibit antioxidant, anti-inflammatory, hypolipidemic, and organ-protective properties that may help prevent diabetes-associated complications. Although the available evidence supports their therapeutic value, most findings are based on preclinical studies. Therefore, well-designed clinical trials, standardization of herbal formulations, and comprehensive safety evaluations are necessary to validate their efficacy and facilitate their integration into modern diabetes management. Herbal medicines may serve as valuable complementary therapies for improving the overall treatment and quality of life of diabetic patients.

REFERENCES

1. Grover JK, Yadav S, Vats V. Medicinal plants of India with antidiabetic potential. *J Ethnopharmacology*. 2002;81(1):81-100.
2. Seth SD, Sharma B. Medicinal plants of India. *Indian J Med Res*. 2004;120(1):9-11.
3. Chitrak (*Plumbago zeylanica*) - Properties, Benefits & Dosage. 2019. <https://www.planetayurveda.com.>
4. Vattakaven T, George R, Balasubramanian D, Réjou-Méchain M, Muthusankar G, Ramesh B, et al. India biodiversity portal: an integrated, interactive and participatory biodiversity informatics platform. *Biodiversity Data J*. 2016;4:e10279. <https://doi.org/10.3897/BDJ.4.e10279>.
5. Jijhotiya A, Madhuri. Goyal S. qualitative and quantitative phytochemical estimation of leaves extracts of plant *Plumbago zeylanica*. *Int J Recent SciRes*. 2018;9(1):23249–52.
6. Herbal medicinal plant- Chitrak. www.dabur.com/in/en-us/about/science-of-ayurveda/herbal-



- medicinal-plants/chitrak-plant. Accessed 21 Sept 2020.
7. Sunil C, Duraipandiyam V, Agastian P, Ignacimuthu S. Antidiabetic effect of plumbagin isolated from *Plumbago zeylanica* L. root and its effect on GLUT4 translocation in streptozotocin-induced diabetic rats. *Food Chem Toxicol.* 2013;56:401-8. doi:10.1016/j.fct.2013.02.028.
8. Zarmouh MM, Subramaniam K, Viswanathan S, Kumar PG. Cause and effect of *Plumbago zeylanica* root extract on blood glucose and hepatic enzymes in experimental diabetic rats. *Afr J Microbiol Res.* 2010;4(24):2674-2677.
9. Zia G, Gupta T, Garg V, Chauhan M, Dutt R. Antidiabetic and antioxidant activities of *Plumbago zeylanica* roots in streptozotocin-induced diabetic rats. *World J Tradit Chin Med.* 2024;10(0):1-10. doi:10.4103/2311-8571.395060.
10. Jijhotiya A, Singhal M, Goyal S. Qualitative and quantitative phytochemical estimation of leaves extracts of plant *Plumbago zeylanica*. *Int J Recent Sci Res.* 2018;9(6):23249-23252.
11. Rajakrishnan R, Lekshmi R, Benil PB, Thomas J, AlFarhan AH, Rakesh V, et al. Phytochemical evaluation of roots of *Plumbago zeylanica* L. and assessment of its potential as a nephroprotective agent. *Saudi J Biol Sci.* 2017;24(4):760-766. doi:10.1016/j.sjbs.2015.09.017.
12. Biswas P, Ghorai M, Mishra T, Gopalakrishnan AV, Roy D, Mane AB, et al. *Piper longum* L.: A comprehensive review on traditional uses, phytochemistry, pharmacology, and health-promoting activities. *Phytother Res.* 2023;37(1):28-56. doi:10.1002/ptr.7649.
13. Nabi SA, Kasetti RB, Sirasanagandla S, Tilak TK, Kumar MVJ, Rao CA. Antidiabetic and antihyperlipidemic activity of *Piper longum* root aqueous extract in STZ induced diabetic rats. *BMC Complement Altern Med.* 2013;13:37. doi:10.1186/1472-6882-13-37.
14. Zod NL, Ingle RG. Anti-hyperglycemic activity of the *Piper longum* dried fruit extract on the experimental animal model. *Int J Pharm Qual Assur.* 2024;15(2):645-648. doi:10.25258/ijpqa.15.2.14.
15. Xu Y, Zheng X, Hao Z. Nephroprotective effects of piperlongumine against streptozotocin-induced diabetic kidney disease in rats. *Indian J Pharm Educ Res.* 2025;59(3):1118-1127. doi:10.5530/ijper.20251645.
16. Liu YX, Mei MS, Wei W, Zhang LX, Zhou CX, Deng SL, et al. Effects and molecular mechanisms of the antidiabetic fraction of *Acorus calamus* L. on GLP-1 expression and secretion in vivo and in vitro. *J Ethnopharmacology.* 2015;166:168-175. doi:10.1016/j.jep.2015.03.014.
17. Prislila DH, Balamurugan R, Shah HR. Antidiabetic activity of methanol extract of *Acorus calamus* in STZ induced diabetic rats. *Asian Pacific Journal Tropical Biomedicine.* 2012;2 941-946. doi:10.1016/S2221-1691(12)60341-4.
18. Prashanth D, Ahmed FZ. Evaluation of hypoglycemic activity of methanolic extract of *Acorus calamus* (Linn.) roots in alloxan induced diabetes rat model. *International Journal of Basic & Clinical Pharmacology.* 2017;6(11):2665-2670. doi:10.18203/2319-2003.ijbcp20174785.
19. jaha SK, Mohammed S, Krishnan AS, Komirelli S, Bhavani B. Evaluation of anti-diabetic and hepatoprotective activity of methanolic bark extract of *Symplocos racemosa* Roxb bark extract in alloxan induced diabetic rats. *J Pharm Insights Res.* 2025;3(4):46-54. doi:10.69613/dy9py274.

20. Kalidass C. Distribution and population status of a critically endangered tree species *Symplocos racemosa* Roxb. in Eastern Ghats of Odisha. *Int J Adv Res.* 2014;2(11):27-32.
21. Balakumbahan R, Rajamani K, Kumanan K. *Acorus calamus*: An overview. *J Med Plants Res.* 2010;4(25):2740-2745.
22. Sneha S, Cecil A, Rajeshkumar S. Antidiabetic activity *Symplocos racemosa* (Lodhra) and *Cinnamomum cassia* (Cinnamon bark) formulation synthesised silver nanoparticles. *J Pharm Negat Results.* 2022;13(Special Issue 8):3114-3118. doi:10.47750/pnr.2022.13.S08.386.
23. Al-Amin ZM, Thomson M, Al-Qattan KK, Peltonen-Shalaby R, Ali M. Anti-diabetic and hypolipidaemic properties of ginger (*Zingiber officinale*) in streptozotocin-induced diabetic rats. *Br J Nutr.* 2006;96(4):660-666. doi:10.1079/BJN20061849.
24. Alshathly MR. Efficacy of ginger (*Zingiber officinale*) in ameliorating streptozotocin-induced diabetic liver injury in rats: Histological and biochemical studies. *J Microsc Ultrastruct.* 2019;7(2):91-101. doi:10.4103/JMAU.JMAU_16_19.
25. Tripathi, Akhilesh K. and Kohli, Seema. "Pharmacognostical standardization and antidiabetic activity of *Syzygium cumini* (Linn.) barks (Myrtaceae) on streptozotocin-induced diabetic rats" *Journal of Complementary and Integrative Medicine*, vol. 11, no. 2, 2014, pp. 71-81. <https://doi.org/10.1515/jcim-2014-0011>
26. Raza A, Butt MS, Qayyum MMN, Suleria HAR. Jamun (*Syzygium cumini*) seed and fruit extract attenuate hyperglycemia in diabetic rats. *Asian Pac J Trop Biomed.* 2017;7(8):750-754. doi:10.1016/j.apjtb.2017.07.006.
27. Singh N, Gupta M. Effects of ethanolic extract of *Syzygium cumini* (Linn) seed powder on pancreatic islets of alloxan diabetic rats. *Indian J Exp Biol.* 2007 Oct;45(10):861-7. PMID: 17948734.
28. Bitencourt PER, Bona KS, De Cargnelutti LO, Bonfanti G, Pigatto A, Boligon A, Athayde ML, Pierezan F, Zanette RA, Moretto MB (2015) *Syzygium cumini* seed extract ameliorates adenosinedeaminase activity and biochemical parameters but does not alter insulin sensitivity and pancreas architecture in a short-term model of diabetes. *J Complement Integr Med* 12:187–193 <https://doi.org/10.1515/jcim-2015-0008>.
29. 1. Ovesná J, Mitrová K, Kučera L. Garlic (*Allium sativum* L.) alliinase gene family polymorphism reflects bolting types and cysteine sulfoxides content. *BMC Genet.* 2015;16:53. doi:10.1186/s12863-015-0214-z.
30. Poonam T, Prakash GP, Kumar LV. Influence of *Allium sativum* extract on the hypoglycemic activity of glibenclamide: an approach to possible herb-drug interaction. *Drug Metab Drug Interact.* 2013;28(4):225-230. doi:10.1515/dmdi-2013-0031.
31. Ashraf R, Khan RA, Ashraf I. Garlic (*Allium sativum*) supplementation with standard antidiabetic agent provides better diabetic control in type 2 diabetes patients. *Pak J Pharm Sci.* 2011;24(4):565-570.
32. Naderi R, Mohaddes G, Mohammadi M, Alihemmati A, Badalzadeh R, Ghaznavi R, et al. Preventive effects of garlic (*Allium sativum*) on oxidative stress and histopathology of cardiac tissue in streptozotocin-induced diabetic rats. *Acta Physiol Hung.* 2015;102(4):380-390. doi:10.1556/036.102.2015.4.5.
33. Mansour MH, Al-Qattan K, Thomson M, Ali M. Garlic (*Allium sativum*) down-regulates the expression of angiotensin II AT1 receptor in adrenal and renal tissues of streptozotocin-induced diabetic rats.

Inflammopharmacology. 2013;21(2):147-159. doi:10.1007/s10787-012-0139-3.

34. Eidi A, Eidi M, Esmaeili E. Antidiabetic effect of garlic (*Allium sativum* L.) in normal and streptozotocin-induced diabetic rats. *Phytomedicine*. 2006;13(9-10):624-629. doi:10.1016/j.phymed.2005.09.010

HOW TO CITE: Vaishnavi Shindikar, Priyanka Pachorkar, Rishikesh Bacchav, Santosh Deshmukh, A Comprehensive Review of Role of Herbal Medicines in Management of Diabetics Activity, *Int. J. of Pharm. Sci.*, 2026, Vol 4, Issue 6, 3339-3346. <https://doi.org/10.5281/zenodo.20689503>

