



Diabetes and Herbal Medicine: Understanding Plant-Based Dietary Interventions

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ABSTRACT

The increasing global prevalence of diabetes, particularly in low- and middle-income countries, has highlighted the need for accessible and sustainable therapeutic interventions. Plant-based dietary approaches and herbal medicines have garnered interest due to their potential benefits in managing diabetes and mitigating its complications. This paper examines the scientific and traditional foundations of herbal medicine, emphasizing key mechanisms such as enhanced insulin sensitivity, reduced glucose absorption, and antioxidant activity. Specific herbs, including cinnamon and bitter melon, are examined for their hypoglycemic properties. Despite promising evidence, challenges in clinical validation, regulatory barriers, and integration into modern medical frameworks persist. This review underscores the importance of robust interdisciplinary research to evaluate the efficacy and safety of herbal medicine, fostering its integration into holistic diabetes management strategies.

Keywords: Diabetes management, Herbal medicine, Plant-based diets, Insulin sensitivity, Ethnopharmacology, Blood sugar control.

INTRODUCTION

Diabetes care, its management, and especially alternative therapies such as herbal medicine and plant-based dietary interventions are gaining great attention. The concept of "Food as medicine" is now widely covered by the media and press, and the general population is interested in preventive and therapeutic solutions through diet and/or natural products. Indeed, the general population and international and national organizations are advocating the use of more natural remedies over chemical synthesis. The use of "Herbal remedies" is comprehensive and especially relevant to multiple societies, using local plants sometimes only for local use. Ethnopharmacology, or the study of ethnic medicines, has been well-established across the four continents. Despite varying regional practices, health is a major concern; hence, preventive measures and herbal remedies are part of many cultures [1, 2]. The prevalence of diabetes has been rising more rapidly in middle- and low-income countries, and related deaths account for almost 5 million. This situation seems to be expensive and generally out of reach in these countries; therefore, it may be of value to explore alternative therapies such as herbal medicine. Current clinical research showed that several plant- or herb-based dietary interventions could be used as major dietary constituents; they were shown to possess anti-diabetic effects. The anti-diabetic effects could mainly occur through several mechanisms, including inhibition of lipid peroxidation, generation of superoxide radicals, improved insulin resistance, direct beta-cell insulin secretion, and inhibition of the activity of α -amylase and α -glucosidase [3, 4].

The Role of Plant-Based Dietary Interventions in Managing Diabetes

The majority of drugs currently used to manage diabetes address reduced insulin secretion, and increased hepatic gluconeogenesis, and are later associated with weight gain. Given that diet plays an important role in the cause of diabetes and its management, numerous scientific studies have been devoted to understanding appropriate diets and eating patterns to manage diabetes. Plant-based dietary interventions (such as fruits, vegetables, whole grains, and legumes) have been associated with beneficial

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effects for the prevention and management of diabetes as they are nutritionally dense foods, low in calorie density, and high in antioxidants and fiber. All these characteristics make plant-based diets ideal for better blood sugar control, improving insulin resistance, and decreasing low-grade inflammation, all components seen in diabetes [5, 6, 7, 8]. It has been demonstrated that following these diets there is a better ability of cells to use insulin, resulting in improved metabolic health, such as blood sugar reduction, cholesterol improvement, decrease in blood pressure, and better weight control. In addition, plant-rich diets, either as comprehensive lifestyle changes or as specific eating patterns such as vegetarianism or Mediterranean diets, have been reported to result in lower diabetic complication rates such as retinopathy, proteinuria, neuropathy, or coronary artery disease. The encouragement of a holistic approach to diabetes management, with emphasis on healthful eating and increased physical activity, is notable. A plant-based way of eating seems to have all the characteristics of such a personalized and comprehensive approach, going to a deeper level than current guidelines that have not yet incorporated other alternative dietary options [9, 10].

Key Herbal Medicines and Their Effects on Blood Sugar Levels

There are many herbs used for blood sugar management by traditional or indigenous systems of medicine around the world. Some of the key herbs are listed and discussed below, explaining their main properties, traditionally claimed uses, therapeutic mechanisms, and some data from preclinical and clinical studies. Cinnamon is an evergreen tree that has a long history of traditional use as a medicine. The cinnamon bark is used as a spice and is commonly available in supermarkets. Dry cinnamon bark is consumed as a decoction mixed with tea or water, and it is also available as an extract in tablet or capsule forms. Traditionally, it has been used to treat loss of appetite and control postprandial blood sugar levels, reduce diabetes complications, and in some formulations, increase body weight. It has been found to reduce glucose absorption and to increase insulin sensitivity and glycogen synthase [11, 12]. Bitter melon is a climber with yellow flowers and orange, long, spindle-shaped pulpy fruit that is traditionally used as a daily food. It has digestive, adaptogenic, cardio-protective, and blood-purifying properties. In some cultures, the vine's leaves and immature fruits are traditionally consumed in various food preparations. The seed is also traditionally powdered and added to food to promote weight gain and is used in controlling diabetes. Cucurbitane, steroids, saponins, and cucurbitacins are the bitter compounds in the fruit that have hypoglycemic activity. The fruit contains several bioactive compounds that are tested to be insulin secretagogues, and it reduces glucose absorption, alters insulin sensitivity, and promotes cell glycolysis. In human studies, the hypoglycemic activity of bitter melon has shown varying results based on its differing preparations, low bioavailability, and the differing dosage of the bitter compound in the given preparation. Bitter compounds are sensitive to pH; low pH inactivates them; hence, the unripe fruit was traditionally used, as its potent bitterness is lost when the fruit ripens. A review of the properties of bitter melon related to diabetes management is summarized in many reported case studies. The safety of the hypoglycemic effect of bitter melon is due to food sensitivities and conditions of deficiency. This fruit is contraindicated in pregnancy due to a lack of safety studies [13, 14].

Research Studies and Clinical Evidence on the Efficacy of Herbal Medicine for Diabetes

Given the rapid increase in the prevalence of diabetes worldwide alongside the global trend toward seeking out alternative, natural health remedies, demand for over-the-counter herbal therapies has risen sharply. Estimates range from 12% in the United States to as high as 70% of the general population in India and Pakistan. Healthcare professionals, clinicians, diabetes educators, and people with diabetes wish to know about the available evidence on the potential of herbal interventions to improve diabetes control and reduce the risk of complications. The following is a summary of research studies and trials synthesizing outcomes and suggestions on the promises of herbal medicine for diabetes control. This topic aims to establish a critical review understanding of the potential of plant-based dietary interventions and outline their role in accelerating diabetes treatment to prevent or reduce diabetic complications. Evidence on the potential effects of herbal medicine on postprandial hyperglycemia via inhibition of digestive enzymes is growing [15, 16]. However, in the English literature, relatively few research studies have been conducted to investigate and confirm the efficacy of these plant-based dietary approaches. A review noted that while some evidence for the clinical benefits of herbal medicine for diabetes, primarily in type 2 diabetes, is promising, the majority of it is of tenuous quality. Systematic reviews and meta-analyses of clinical studies relating to the use of herbal medicines for the treatment of diabetes are now being published, highlighting a wide variation in both the quality of data and the findings [17, 18, 19]. The studies are usually based on small sample sizes and/or poorly reported samples, duration, and

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participant characteristics such as diabetes type. Equally, the duration of these studies ranges from less than a week to a year. Insufficient mineral and vitamin content in the diet may be another confounding factor. The measures relating to diabetes care in these studies are either fasting or postprandial blood glucose measures, 2-hour glucose, and/or HbA1c. Close attention should be paid to minimizing potential risks while considering the use of botanicals, including clinically relevant drug-herbal interactions and safety. To date, the scientific evidence supporting the benefits of most herbs is weak, and more rigorous investigations into such claims are needed [20, 21, 22].

Challenges and Future Directions in Integrating Herbal Medicine into Diabetes Management

Integration of Herbal Medicine into Conventional Diabetes Management: Challenges and Future Directions. Herbal medicine has been integral to traditional therapeutic practices and is attracting an increasing amount of attention in the medical and healthcare research fields. However, there are challenges in integrating it into modern medical institutions and treatment practices. There are limited clinical, pharmacological, and toxicological data relating to herbal medicines, and collaboration with traditional practitioners and healers is often haphazard. Several barriers need to be addressed to deploy herbal medicine in conventional practice [23, 24]. These include regulatory hurdles in defining complex herbal interventions in terms of quality, non-chemical active ingredients, and consistency. Widespread skepticism about the clinical efficacy, safety, and sustainability of herbal therapies as adjuncts to polypharmacy regimens remains. Herbal medicine, as an unconventional approach, lacks acceptance as an evidence-based approach documented in the existing medical literature. There is also skepticism about the validity of biomedical studies on animal models and humans due to many issues regarding the reporting of investigations in herbal medicine [25, 26, 27]. This skepticism can only be removed if a commitment is made to enhancing scientific partnerships and conducting robust research by exploiting technological innovations. Further, education and awareness about herbal medicine are required for healthcare professionals historically trained in biomedicine and patients who are generally unaware of these treatments. It creates an opportunity to bridge traditional herbal knowledge with modern scientific practices [28, 29, 30]. Several unmet needs remain as new approaches that offer a holistic understanding of human body systems are emerging. There is a significant opportunity to exploit knowledge-bank collaboration from different paradigms in diabetes management and prevention. These include exploring traditional herbal remedies through interdisciplinary research protocols that could help develop a greater understanding of complex pathophysiology and offer new therapeutic options. The key barriers to integrating traditional herbal medicine and complementary approaches into diabetes management are regulatory oversight and scientific validation [31]. While regulatory conformity can be addressed by proper validation, recent validation efforts have been piecemeal in the form of bioassay and phytochemical assessment of a plant, plant part, and plant extract. Opportunities to investigate a holistic approach to managing diabetes, not only using the plant but the entire preparation, provide an avenue that can benefit patient management. This can lead to a new evidence base for the management of diabetes and support the use of traditional herbal medicine as part of a diabetes management framework. A paradigm shift, however, is required to achieve this [21, 22].

CONCLUSION

The potential of herbal medicine and plant-based dietary interventions to improve diabetes management is promising yet underexplored. Their mechanisms, including improved insulin sensitivity and reduction in oxidative stress, complement existing pharmacological treatments. Herbs like cinnamon and bitter melon showcase significant potential for reducing blood glucose levels, though their clinical efficacy requires further validation through large-scale, rigorous studies. The integration of herbal medicine into conventional diabetes care faces challenges such as limited scientific evidence, regulatory hurdles, and professional skepticism. Bridging traditional knowledge with modern scientific practices through interdisciplinary collaboration and education can pave the way for a paradigm shift in diabetes management. Moving forward, the focus must be on creating standardized, evidence-based frameworks to harness the full potential of these natural therapies while ensuring patient safety and regulatory compliance.

REFERENCES

1. Ansari P, Khan JT, Chowdhury S, Reberio AD, Kumar S, Seidel V, Abdel-Wahab YH, Flatt PR. Plant-based diets and phytochemicals in the management of diabetes mellitus and prevention of its complications: a review. *Nutrients*. 2024 Oct 30;16(21):3709. [mdpi.com](https://doi.org/10.3390/16213709)

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2. Jugran AK, Rawat S, Devkota HP, Bhatt ID, Rawal RS. Diabetes and plant-derived natural products: From ethnopharmacological approaches to their potential for modern drug discovery and development. *Phytotherapy Research*. 2021 Jan;35(1):223-45. [\[HTML\]](#)
3. Al-Kuraishy HM, Al-Fakhrany OM, Elekhawy E, Al-Gareeb AI, Alorabi M, De Waard M, Albogami SM, Batiha GE. Traditional herbs against COVID-19: back to old weapons to combat the new pandemic. *European Journal of Medical Research*. 2022 Sep 26;27(1):186. [springer.com](#)
4. Pin CH, Daniel N. Processing of Herbal-Based Natural Products and Functional Foods: A Review. *Sains Malaysiana*. 2023 Sep 1;52(9):2587-98.
5. Banaszak M, Górna I, Przysławski J. Non-Pharmacological Treatments for Insulin Resistance: Effective Intervention of Plant-Based Diets—A Critical Review. *Nutrients*. 2022 Mar 27;14(7):1400.
6. Schiattarella A, Lombardo M, Morlando M, Rizzo G. The impact of a plant-based diet on gestational diabetes: a review. *Antioxidants*. 2021 Apr 2;10(4):557.
7. Austin G, Ferguson JJ, Garg ML. Effects of plant-based diets on weight status in type 2 diabetes: a systematic review and meta-analysis of randomised controlled trials. *Nutrients*. 2021 Nov 16;13(11):4099.
8. Schlesinger S. Diet and diabetes prevention: is a plant-based diet the solution?. *Diabetes Care*. 2022 Dec 22;46(1):6.
9. Bazshahi E, Pourreza S, Jayedi A, Mirmohammadhani M, Emadi A, Shab-Bidar S. Adherence to plant-based diet during pregnancy and risk of gestational diabetes: a prospective birth cohort study. *BMC nutrition*. 2024 Dec;10(1):1-9. [springer.com](#)
10. Stumpf F, Keller B, Gressies C, Schuetz P. Inflammation and nutrition: friend or foe?. *Nutrients*. 2023 Feb 25;15(5):1159.
11. Nuffer W, Tall Bull S, Bakhach H, Nuffer M. Sweetly Improving Sugars? Reviewing Cinnamon's Effects on Blood Glucose. *Journal of Medicinal Food*. 2023 Jan 1;26(1):68-73.
12. Liu Y, Liu F, Xing D, Wang W, Yang Q, Liao S, Li E, Pang D, Zou Y. Effects of cinnamon powder on glucose metabolism in diabetic mice and the molecular mechanisms. *Foods*. 2023 Oct 20;12(20):3852. [mdpi.com](#)
13. Saeed F, Sultan MT, Riaz A, Ahmed S, Bigiu N, Amarowicz R, Manea R. Bitter melon (*Momordica charantia* L.) fruit bioactives charantin and vicine potential for diabetes prophylaxis and treatment. *Plants*. 2021 Apr 8;10(4):730. [mdpi.com](#)
14. Jane-Frances OA, Chichaya TF. The Effectiveness and Safety of Bitter Melon in the Management of Type 2 Diabetes Mellitus: A Review of Randomized Controlled Trials. *Integrative and Complementary Therapies*. 2023 Dec 1;29(6):277-85. [researchgate.net](#)
15. Zafar A, Alruwaili NK, Panda DS, Imam SS, Alharbi KS, Afzal M, Shalaby K, Kazmi I, Alshehri S. Potential of natural bioactive compounds in management of diabetes: Review of preclinical and clinical evidence. *Current Pharmacology Reports*. 2021 Jun;7:107-22. [researchgate.net](#)
16. Lim WX, Gammon CS, von Hurst P, Chepulis L, Page RA. A narrative review of human clinical trials on the impact of phenolic-rich plant extracts on prediabetes and its subgroups. *Nutrients*. 2021 Oct 22;13(11):3733. [mdpi.com](#)
17. Hartmann AM, Dell'Oro M, Spoo M, Fischer JM, Steckhan N, Jeitler M, Häupl T, Kandil FI, Michalsen A, Koppold-Liebscher DA, Kessler CS. To eat or not to eat—An exploratory randomized controlled trial on fasting and plant-based diet in rheumatoid arthritis (NutriFast-Study). *Frontiers in Nutrition*. 2022 Nov 2;9:1030380. [frontiersin.org](#)
18. Ivanova S, Delattre C, Karcheva-Bahchevanska D, Benbasat N, Nalbantova V, Ivanov K. Plant-based diet as a strategy for weight control. *Foods*. 2021 Dec 8;10(12):3052. [mdpi.com](#)
19. Kleinman A. Indigenous systems of healing: Questions for professional, popular, and folk care. *In Alternative Medicines 2022 Aug 12* (pp. 138-164). Routledge.
20. Liu CX. Overview on development of ASEAN traditional and herbal medicines. *Chinese Herbal Medicines*. 2021 Oct 1;13(4):441-50.
21. Novick D, Afravi M, Martinez O, Rodriguez A, Hinojos LJ. Usability of the Virtual Agent Interaction Framework. *In Virtual, Augmented and Mixed Reality. Design and Interaction: 12th International Conference, VAMR 2020, Held as Part of the 22nd HCI International Conference,*

- HCH 2020, Copenhagen, Denmark, July 19–24, 2020, Proceedings, Part I 22 2020 (pp. 123-134). Springer International Publishing.
22. Mousa HR, Shawkly L, Morsi AA. Rhus coriaria L. ameliorates gentamicin-induced nephrotoxicity in diabetic rats by interference with LRP2 receptor expression and P53/TNF- α downregulation. *Egyptian Journal of Histology*. 2024 Mar 1;47(1):477-90.
 23. Aja PM, IO Igwenyi, PU Okechukwu, OU Orji, EU Alum. Evaluation of anti-diabetic effect and liver function indices of ethanol extracts of Moringa oleifera and Cajanus cajan leaves in alloxan induced diabetic albino rats *Global Veterinaria* 14(3) 439-447 (2015).
 24. Offor CE, OPC Ugwu, EU Alum. The anti-diabetic effect of ethanol leaf-extract of Allium sativum on Albino rats. *International Journal of Pharmacy and Medical Sciences*, 4, (1), 01-03 (2014).
 25. Enechi OC, H Ikenna Oluka, PC Okechukwu Ugwu. Acute toxicity, lipid peroxidation and ameliorative properties of Alstonia boonei ethanol leaf extract on the kidney markers of alloxan induced diabetic rats. *African journal of biotechnology*, 13, 5 (2014).
 26. Adonu CC, OP Ugwu, A Bawa, EC Ossai, AC Nwaka. Intrinsic blood coagulation studies in patients suffering from both diabetes and hypertension. *Int Journal of Pharmaceutical Medicine and Bio Science*, 2 (2), 36-45 (2013).
 27. Okechukwu Paul-Chima Ugwu, Esther Ugo Alum, Michael Ben Okon, Patrick M Aja, Emmanuel Ifeanyi Obeagu, EC Onyeneke Ethanol root extract and fractions of Sphenocentrum jollyanum abrogate hyperglycaemia and low body weight in streptozotocin-induced diabetic Wistar albino rats *Oxford University Press* 2(2) 10 (2023).
 28. Mariam Oyedeji Amusa and Adeyinka Olufemi Adepoju Okechukwu P. C. Ugwu, Esther Ugo Alum, Emmanuel I. Obeagu, Michael Ben Okon, Patrick M. Aja , Awotunde Oluwasegun Samson Effect of Ethanol leaf extract of Chromolaena odorata on lipid profile of streptozotocin induced diabetic wistar albino rats. *IAA Journal of Biological Sciences*, 10, (1), 109-117 (2023).
 29. Alum EU, GU Umoru, DE Uti, PM Aja, OP Ugwu, OU Orji, BU Nwali, NN Ezeani, N Edwin, FO Orinya HEPATO-PROTECTIVE EFFECT OF ETHANOL LEAF EXTRACT OF Datura stramonium in ALLOXAN-INDUCED DIABETIC ALBINO RATS. *Journal of Chemical Society of Nigeria*, 47, 5 (2022)..
 30. Ugwu Okechukwu P.C. and Amasiorah V.I. The effects of the crude ethanol root extract and fractions of Sphenocentrum jollyanum on hematological indices and glycosylated haemoglobin of streptozotocin-induced diabetic. *INOSR Scientific Research*, 6, (1), 61-74 (2020).
 31. Enechi OC, IH Oluka, OPC Ugwu, YS Omeh Effect of ethanol leaf extract of Alstonia boonei on the lipid profile of alloxan induced diabetic rats. World Journal of Pharmacy and Pharmaceutical Sciences (WJPPS), 2013, Vol. 2, No. 3, 782-795(2012).

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