



CODEN [USA]: IAJPBB

ISSN : 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

SJIF Impact Factor: 7.187

<https://doi.org/10.5281/zenodo.17702884><https://www.iajps.com/volumes/volume12-november-2025/87-issue-11-november-25/>Available online at: <http://www.iajps.com>

Review Article

**A REVIEW ON NANOFORMULATION OF PLANT BASED
NATURAL PRODUCTS TARGETING IMPROVED β - CELL
FUNCTION IN DIABETES MELLITUS****Reshma B V**

Delta Pharmacy, Oman

Abstract:

Herbal remedies are used to manage type 2 diabetes mellitus (type 2 DM) as the sole treatment or as a complementary therapy. Limitations of herbal remedies, such as poor stability and limited absorption, impede their development as therapeutic agents, which could be overcome by nanoformulations. This review attempts to summarize the studies reported between 2009 and 2020 in the development of medicinal plant-based nanoformulations for the management of type 2 DM, discuss formulation methods, mechanisms of action, and identify gaps in the literature to conduct future research on nanoparticle-based herbal treatment options targeting type 2 DM.

Nanoformulations of plant-based natural products improve diabetes management by increasing the bioavailability of plant compounds, which can then improve glycemic control, enhance insulin sensitivity, and protect pancreatic beta-cells. Nanotechnology creates formulations like polymeric nanoparticles and liposomes that encapsulate active compounds, leading to better stability, solubility, and targeted delivery compared to the natural plant extracts alone. To retrieve articles published between January 2009 and December 2020, the electronic databases PubMed, Science Direct, and Google Scholar were searched with the keywords nanoparticle, plant, and diabetes in the entire text. Peer-reviewed research articles on herbal nanoformulations published in English-language based on in vitro and/or in vivo models of type 2 DM and/or its complications were included.

Keywords: *herbal remedies; inorganic nanoformulations; lipid-based nanoformulations; polymeric nanoformulations; type 2 diabetes mellitus.*

Corresponding author:**Reshma B V,**

Delta Pharmacy, Oman

QR CODE



Please cite this article in press Reshma B V ., a review on nanoformulation of plant based natural products targeting improved β - cell function in diabetes mellitus, Indo Am. J. P. Sci, 2025; 12(11).

respond very well to conventional therapeutic medication.^[2] Furthermore, other explanations to this fact are the cost of medication, side-effects, accessibility, and availability of health facilities and drugs and the inefficiency of these medicines in certain cases.

In this study we aimed to review the literature on the valuable effects of herbs and plants and their isolated alkaloids compounds as medication for management of diabetes, a prevalent risk factor for several other disorders and illnesses. In the current review, PubMed, ScienceDirect, Springer and google scholar databases were used and the criterion for inclusion was based on the following keywords and phrases: diabetes, hyperglycemia, complications of diabetes, alkaloids, antidiabetic alkaloids, hypoglycemic alkaloids, alkaloids and complications of diabetes mellitus, mechanisms of action and alkaloids.

In the current review, we demonstrate that alkaloids in the form of extracts and isolated molecules obtained from a large variety of species demonstrated their efficiency for improving raises in blood glucose either in animal models via experimental studies or in human subjects via clinical trials. Medicinal species as chillies (*Capsicum annum*), turmeric (*Curcuma longa*), barberry (*Berberis vulgaris*) and cress (*Lepidium sativum*) are among the most common and therapeutic plants used for controlling diabetes that were the subject of several experimental and clinical investigations. Whereas, isolated alkaloids such as berberine, capsaicin and trigonelline have received more interest in this field.^[2] Interestingly, the therapeutic impact of alkaloids against blood glucose pathogenesis is mediated through a variety of signaling cascades and pathways, via inhibiting or stimulating diversity of systems such as inhibition of α -glucosidase enzyme, blockade of PTP- 1B, deactivation of DPP-IV, increasing insulin sensitivity and modulating the oxidative stress. Based on the findings of the present review, alkaloids could be used as preventive and curative agents in the case of endocrine disorders, particularly diabetes and could play a promoting function for the discovery of new antidiabetic agents.

THE USE OF PLANTS IN THE TRADITIONAL MANAGEMENT OF DIABETES : PHARMACOLOGICAL AND TOXICOLOGICAL CONSIDERATIONS

The prevalence of diabetes is on a steady increase worldwide and it is now identified as one of the main threats to human health in the 21st century. In Nigeria, the use of herbal medicine alone or alongside prescription drugs for its management is quite common.^[3] We hereby carry out a review of

medicinal plants traditionally used for diabetes management in Nigeria. Based on the available evidence on the species' pharmacology and safety, we highlight ways in which their therapeutic potential can be properly harnessed for possible integration into the country's healthcare system. Ethnobotanical information was obtained from a literature search of electronic databases such as Google Scholar, Pubmed and Scopus up to 2013 for publications on medicinal plants used in diabetes management, in which the place of use and/or sample collection was identified as Nigeria.^[4] 'Diabetes' and 'Nigeria' were used as keywords for the primary searches; and then 'Plant name - accepted or synonyms', 'Constituents', 'Drug interaction' and/or 'Toxicity' for the secondary searches.

The hypoglycemic effect of over a hundred out of the 115 plants reviewed in this paper is backed by preclinical experimental evidence, either in vivo or in vitro. One-third of the plants have been studied for their mechanism of action, while isolation of the bioactive constituent(s) has been accomplished for twenty three plants. Some plants showed specific organ toxicity, mostly nephrotoxic or hepatotoxic, with direct effects on the levels of some liver function enzymes.^[5] Twenty eight plants have been identified as in vitro modulators of P-glycoprotein and/or one or more of the cytochrome P450 enzymes, while eleven plants altered the levels of phase 2 metabolic enzymes, chiefly glutathione, with the potential to alter the pharmacokinetics of co-administered drugs. This review, therefore, provides a useful resource to enable a thorough assessment of the profile of plants used in diabetes management so as to ensure a more rational use. By anticipating potential toxicities or possible herb-drug interactions, significant risks which would otherwise represent a burden on the country's healthcare system can be avoided.

REFERENCES:

1. Nanof ormulation of Plant-Based Natural Products for Type 2 Diabetes Mellitus: From Formulation Design to Therapeutic Applications Akurange Sujeevi Dammadinna Wickramasinghe¹, Pabasara Kalansuriya², Anoja Priyadarshani Attanayake²
2. Natural Alkaloids and Diabetes Mellitus: A Review Mohammed Ajebli¹, Haroun Khan², Mohamed Eddouks¹
3. Herbal Medicines Targeting the Improved β -Cell Functions and β -Cell Regeneration for the Management of Diabetes Mellitus Akurange Sujeevi Dammadinna Wickramasinghe¹, Pabasara Kalansuriya², Anoja Priyadarshani Attanayake²

4. Diabetes mellitus and its management with medicinal plants: A perspective based on Iranian research. Arezou Rezaei¹, Azad Farzadfard², Atefe Amirahmadi³, Maasoomeh Alemi³, Mitra Khademi⁴
5. The use of plants in the traditional management of diabetes in Nigeria: pharmacological and toxicological considerations. Udoamaka F Ezuruike¹, Jose M Prieto²