

Review Article

Effects of Cumin Seeds on Diabetes Mellitus

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Abstract

Diabetes mellitus (DM) is a global metabolic disorder characterized by chronic hyperglycemia due to insulin deficiency, resistance, or both, leading to complications such as neuropathy, retinopathy, and nephropathy. The rising prevalence of diabetes has intensified interest in alternative and complementary therapies, including herbal remedies like *Nigella sativa* (black seed). *N. sativa* is rich in bioactive compounds, particularly thymoquinone, known for its antioxidant, anti-inflammatory, and antidiabetic properties. Clinical and preclinical studies have shown that *N. sativa* supplementation significantly improves glycemic control in type 2 diabetes mellitus (T2DM) patients. Reported benefits include reductions in fasting blood glucose (FBG), postprandial glucose levels (2hPG), glycated hemoglobin (HbA1c), and improved insulin sensitivity. Additionally, *N. sativa* exhibits lipid-lowering effects, reducing cholesterol and triglyceride levels, which may help prevent diabetes-related cardiovascular complications. Dosage across studies ranged from 0.7 g to 5 g per day in various forms such as oil, capsules, powder, and tea, with 2 g/day considered optimal. While *N. sativa* generally shows good tolerability, mild side effects like gastrointestinal discomfort and hypoglycemia have been reported. Compared to conventional antidiabetic drugs, *N. sativa* offers a natural, multi-targeted approach with fewer adverse effects but still requires standardization and further large-scale clinical trials to confirm its efficacy and safety. Overall, *N. sativa* holds promise as an adjunctive therapy in diabetes management.

Introduction

Diabetes mellitus (DM) is a group of metabolic disorders that are characterized by hyperglycemia. It is caused by either decreased insulin secretion from pancreatic β cells, decreased action of insulin at the periphery, or both. Generally, hyperglycemia causes the release of reactive oxygen species (ROS), which stimulate cellular damage and lead to complications like peripheral neuropathy, retinopathy, and nephropathy. In 2019, it was estimated that 463 million people worldwide had diabetes, and it is projected that the global prevalence of diabetes will reach 578 million cases by 2030 and 700 million by 2045. Patients with type 2 diabetes are typically treated with oral antidiabetic medications, such as metformin, sulfonylureas, meglitinides, a class of drugs (TZDs), dipeptidyl peptidase 4 (DPP4) inhibitors, SGLT2 inhibitors, and SGLT2 inhibitors [1].

Diabetes and Black Seeds (*Nigella Sativa*)

Due to worries about the side effects, expense, accessibility, and alleged limitations of allopathic treatments, the use of herbal medications for the management of chronic illnesses such as diabetes, high blood pressure, and cancer is growing. Herbal treatments are especially well-liked by diabetic patients; according to a survey, 7.3% of Jordanian diabetes patients manage their condition by using *Nigella sativa*, or black seeds [2]. The medicinal potential of *N. sativa*, a plant

belonging to the Ranunculaceae family, is enhanced by the presence of bioactive substances like niguldipine, thymoquinone (DTQ), and thymoquinone (TQ). Given that *N. sativa* is frequently used by patients with type 2 diabetes as a supplementary or unconventional therapy, this review looks at its antidiabetic effects [3].

Chinese medicine, Ayurveda, and Unani are among the traditional medical systems that make extensive use of *Nigella sativa*. Its antidiabetic qualities, which are mainly ascribed to its active ingredient, thymoquinone, have been shown in both clinical and preclinical investigations. To find studies that support the use of *N. sativa* in the management of diabetes, a comprehensive literature search was conducted across a number of the form of databases, including Medline, which is PubMed Central, PubMed, Google Scholar, ScienceDirect, a company Scopus, World Wide Web of Science, EMBASE, and the Directory of Open Access Journals (DOAJ), along with pertinent references [4].

Clinical Studies of *N. Sativa*

The Studies Showed that NS Significantly Improved Glycemic Markers, Including

Fasting blood glucose (FBG): Six studies reported a significant reduction after NS treatment.

Blood glucose 2 hours postprandial (2hPG): Three studies showed a decrease in post-meal glucose levels [5]. Glycated hemoglobin (HbA1c): Six studies found NS lowered HbA1c, indicating improved long-term glucose control.

Insulin levels and resistance: Four studies noted increased insulin levels and reduced insulin resistance [6].

NS was tested in various forms—oil, capsules, powder, and tea—at doses ranging from 0.7 g to 5 g per day. The results suggested NS improved pancreatic β -cell function and reduced oxidative stress, possibly through its key bioactive compound, thymoquinone [7].

Phytochemical Composition and Antidiabetic Mechanisms of *Nigella sativa*: Review of Clinical and Experimental Evidence

Phytochemical Composition of *Nigella Sativa*

Bioactive Constituents and Their Role in Diabetes Management: The systematic review, *Nigella sativa L. and Its Active Compound Thymoquinone in the Clinical Management of Diabetes: A Systematic Review*, provides a comprehensive analysis of the phytochemical profile of *Nigella sativa*. This review highlights the presence of key bioactive compounds, including thymoquinone, alkaloids, flavonoids, saponins, and essential oils, elucidating their potential mechanisms in diabetes management.

Mechanisms of Antidiabetic Action

Regulation of Glucose Metabolism

A placebo-controlled, participant-blinded clinical trial, *Nigella sativa Improves Glycemic Control and Ameliorates Oxidative Stress in Patients with Type 2 Diabetes Mellitus*, examines the role of *Nigella sativa* in enhancing insulin sensitivity, improving pancreatic beta-cell function, and mitigating insulin resistance [8].

Antioxidant and Anti-inflammatory Properties

The aforementioned study further explores the antioxidant and anti-inflammatory effects of *Nigella sativa*, detailing its capacity to reduce oxidative stress and inflammation within pancreatic cells, thereby contributing to glycemic control.

Modulation of Lipid Profiles

A systematic review and meta-analysis, *Nigella sativa Supplementation Improves Cardiometabolic Indicators in Populations with Prediabetes and Type 2 Diabetes Mellitus*, evaluates the impact of *Nigella sativa* on lipid metabolism. The findings indicate a significant reduction in cholesterol and triglyceride levels, suggesting its potential role in preventing cardiovascular complications associated with diabetes.

Clinical Evidence on *Nigella Sativa* and Diabetes

Overview of Human and Animal Studies

A systematic review by Hamdan et al. synthesizes data from both human and animal studies, demonstrating the effects of *Nigella sativa* on fasting blood glucose (FBG), glycated hemoglobin (HbA1c), postprandial glucose levels, and insulin resistance [9].

Analysis of Dosage and Treatment Duration

A meta-analysis conducted by Saadati et al. provides insights into the various dosages and durations of *Nigella sativa* supplementation examined in clinical trials, evaluating their efficacy in diabetes management.

Variability in Study Outcomes

The systematic review *Nigella sativa L. and Its Active Compound Thymoquinone in the Clinical Management of Diabetes* discusses discrepancies in study results, noting that while some investigations report significant reductions in blood glucose levels, others demonstrate only moderate effects.

Comparative Evaluation with Conventional Antidiabetic Agents

A review by Monomodally et al. compares the efficacy of *Nigella sativa* with standard antidiabetic medications, such as Metformin. The analysis highlights the advantages of *Nigella sativa*, including its natural origin, multi-targeted action, and lower incidence of adverse effects. However, the review also emphasizes limitations such as the need for standardization and further long-term clinical investigations.

Recommended Dosage and Tolerability

A clinical trial by Kaatabi et al. suggests an optimal daily intake of *Nigella sativa* at 2 g/day, while also noting potential mild side effects, including gastrointestinal discomfort and hypoglycemia [10-12].

Conclusion and Future Directions

A review by Mahomoodally et al. concludes that *Nigella sativa* presents a promising adjunctive therapeutic approach for diabetes management. However, the authors stress the necessity for large-scale, long-term human clinical trials to further establish its efficacy and safety profile.

The possible benefits of black cumin grains (*Nigella sativa*) for the treatment of diabetes have been investigated. According to research, these seeds may assist people with diabetes who have type 2 diabetes manage their blood sugar levels and lipid profiles. It is thought that thymoquinone, the active ingredient, is mostly responsible for these results. To completely comprehend its mechanisms and effectiveness, more research is necessary.

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