

# The Use of Cinnamon Supplementation in Diabetes: Research Evidence and Expert Opinion

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## Abstract

Dietary supplements have increasingly used in the prevention and treatment of a variety of chronic conditions, During the previous decades, cinnamon have been reported to have a beneficial effects diabetes mellitus patients, and in experimental diabetic animals. The aim of this paper is to review cinnamon research findings relevant to its supplementary use in diabetes.

**Keywords:** cinnamon, diabetes, research findings, expert opinion

Cinnamon (*Cinnamomum zeylanicum* and *Cinnamomum cassia*) is an important spice that has been used daily by many people throughout the world. Some therapeutic effects of cinnamon have been reported in the medical literature as early as the 1800s (Thompson JH., 1896; Cavier R & Debelma S, 1950).

Khan et al (2003) reported a placebo controlled clinical study which included sixty patients with type 2 diabetes (30 male and 30 females), aged 52.2 +/- 6.32 years. The study showed that the use of cinnamon 1, 3, or 6 g daily for 40 days lowered the mean fasting serum glucose (18-29%), triglyceride (23-30%), LDL cholesterol (7-27%), and total cholesterol (12-26%) levels. Patients who received placebo didn't experience important changes (Khan A, Safdar M, Ali Khan MM, Khattak KN & Anderson RA., 2003).

Verspohl et al (2005) from Germany reported an experimental study on rats which received *Cinnamomum cassia* bark or extracts from *Cinnamomum cassia* and *zeylanicum*, and challenged by a glucose load (Glucose tolerance test). Cinnamon intake was associated with a reduction in blood glucose levels, and cassia extract had a better effect than *zeylanicum* extract (Verspohl EJ, Bauer K & Neddermann E., 2005).

Kim et al (2006) reported an experimental study on db/db mice with type 2 diabetes which showed that cinnamon extract 50, 100, 150 and 200 mg/kg per day for 6 weeks markedly lowered blood glucose concentration in a dose-dependent manner ( $P<0.001$ ) with the most lowering occurring with 200 mg/kg dose.

Serum insulin levels and HDL-cholesterol levels were considerably higher ( $P<0.01$ ), and the concentration of triglyceride, total cholesterol and intestinal alpha-glycosidase activity were considerably lower after 6 weeks of cinnamon intake. Kim et al attributed the blood glucose-suppressing effect of cinnamon to improving insulin sensitivity or slowing absorption of carbohydrates in the small intestine (Kim SH, Hyun SH & Choung SY., 2006).

Mang et al (2006) from Germany reported a clinical study which included 79 patients with diabetes mellitus type 2, not receiving insulin therapy, but were treated with oral anti-diabetic drugs. They received either aqueous cinnamon extract equivalent to 3 g of cinnamon powder daily or a placebo capsule three times daily for four months. Treated patients experienced considerably higher lowering of plasma glucose (10.3%) than in patients who received placebo (3.4%). Treatment was not associated with adverse effects. This study suggested that cinnamon extract has a moderate effect in lowering fasting plasma glucose concentrations in diabetic patients

who are poorly controlled with oral anti-diabetic drugs (Mang B, Wolters M, Schmitt B, Kelb K, Lichtinghagen R, Stichtenoth DO & Hahn A., 2006).

Ziegenfuss et al (2006) from USA reported a clinical study which included patients with prediabetes and the metabolic syndrome. They received either a water-soluble cinnamon extract supplement [Cinnulin PF(R)] 500 mg daily or a placebo for three months. Supplementation was associated with significant lowering of fasting blood glucose (Ziegenfuss TN, Hofheins JE, Mendel RW, Landis J & Anderson RA., 2006).

Solomon and Blannin (2007) from the United Kingdom reported a study which included 7 lean healthy men (Volunteers) aged 26 (+/- 1) years. Oral glucose tolerance tests were performed three times and were supplemented with either a 5 grams placebo or 5 grams of cinnamon or received 5 grams of cinnamon twelve hours before glucose tolerance test in a randomized-crossover design. Cinnamon intake even when given before twelve hours was associated with improved insulin sensitivity (Assessed by Matsuda's model) (Solomon TP & Blannin AK., 2007).

Roussel et al (2009) from France reported a placebo-controlled study which included 22 obese or overweight (Body mass index: 25-45) individuals who had impaired fasting blood glucose. They received either 250 mg of an aqueous extract of cinnamon capsules or received a placebo two times daily for three months.

The study showed that cinnamon intake was associated with enhanced plasma antioxidant status as indicated by an increase in ferric reducing antioxidant power, and was also associated with reduction in plasma malondialdehyde which is a marker of lipid peroxidation and oxidative stress. Accordingly, Roussel et al suggested that cinnamon supplementation can reduce the risks contributing to the development of diabetes and cardiovascular disease (Roussel AM, Hininger I, Benaraba R, Ziegenfuss TN & Anderson RA., 2009).

Crawford (2009) from the USA reported a controlled study which included 109 diabetic (Type 2) who HbA1C of more than 7.0. Cinnamon supplementation of 1000 mg daily for three months was associated with reduction of 0.83% in HbA1C (95% CI, 0.46-1.20) compared with 0.37% in the controls (95% CI, 0.15-0.59). Therefore, cinnamon was considered to useful for reducing serum HbA1C in type 2 diabetes (Crawford P., 2009).

Shen et al (2011) reported an experimental study on rats with streptozotocin-induced uncontrolled type 1 diabetes which showed that aqueous cinnamon extract at a dose higher than 30 mg/kg/daily given for 22 days saved the diabetic rats from their hyperglycemia and nephropathy. The beneficial effect of cinnamon was associated with upregulation of uncoupling protein-1 (UCP-1) and glucose transporter 4 (GLUT4) rats' brown adipose tissues and muscles. Accordingly, Shen et al suggested that cinnamon has an anti-diabetic effect unrelated to insulin that possibly mediated by upregulation of mitochondrial UCP-1 and augmenting translocation of GLUT4 in adipose tissues and muscle (Shen Y, Fukushima M, Ito Y, Muraki E, Hosono T, Seki T & Ariga T., 2010).

Akilen et al (2010) from the United Kingdom reported a double-blind, placebo-controlled study which included fifty-eight diabetic (Type-2) patients; 25 males and 33 females, their age was 54.9 years ( $\pm$  9.8). They were being treated with hypoglycemic medications and had an HbA1c higher than 7%. The patients received either 2000 mg of cinnamon or placebo daily for three months. Cinnamon supplementation was associated with considerable reduction in the mean HbA1c ( $P < 0.005$ ) and also important reductions in fasting plasma glucose, waist circumference and body mass index, and mean systolic and diastolic blood pressures (Akilen R, Tsiami A, Devendra D & Robinson N., 2010).

Lu et al (2012) from China reported a double-blind, placebo-controlled study which included sixty six diabetic (Type-2) patients treated with gliclazide. The patient received either cinnamon extract 120 mg or cinnamon extract 360 mg daily or placebo for three months. Cinnamon supplementation was associated with considerable reductions in HbA (1c) and fasting blood glucose levels, but no such changes were observed in patients who received placebo. The blood triglyceride level was considerably reduced in patients who received cinnamon extract 120 mg (Lu T, Sheng H, Wu J, Cheng Y, Zhu J & Chen Y., 2012).

Deyno et al (2019) conducted a meta-analysis which included 16 placebo-controlled studies reporting the use of cinnamon in diabetes (Type 2) and pre-diabetes. The meta-analysis revealed that cinnamon can markedly reduce fasting blood glucose and can improve insulin resistance (Deyno S, Eneyew K, Seyfe S, Tuyiringire N, Peter EL, Mulye RA, Tolo CU & Ogwang PE., 2019).

Lira Neto et al (2022) from Brazil a placebo-controlled study which included 160 diabetic (Type 2) patients (Aged 18-80 years) who had glycosylated hemoglobin level above 6% and were being treated with oral anti-diabetics. Eighty patients received 3000 mg cinnamon and eighty patients received placebo for three months. Cinnamon supplementation was associated with considerable reductions of 0.2% of glycosylated hemoglobin and 0.55 mmol/L of fasting glucose (Lira Neto JCG, Damasceno MMC, Ciol MA, de Freitas RWJF, de Araújo MFM & Teixeira CRS, et al., 2022).

**Conclusion:** There is convincing research evidence suggesting that cinnamon has at least a weak hypoglycemic effect and an insulin stimulation effect that can contribute to improving insulin sensitivity and reducing serum glycosylated hemoglobin (HbA1C) in type 2 diabetes. Its antioxidant effect can reduce the risks contributing to the development of diabetes.

**Conflict of Interest:** None.

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