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**File: ■ Cinnamon (*Cinnamomum zeylanicum*, *C. cassia*)
■ Health Benefits**

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RE: More Human Trials Needed to Support Health Benefits of Cinnamon

Gruenwald J, Freder J, Armbruester N. Cinnamon and health. *Crit Rev Food Sci Nutr*. 2010;50(9):822-834.

Cinnamon has long been used for culinary uses, as well as for treating gastrointestinal complaints and other ailments. The volatile oils from the bark, leaf, and root bark of the two major species vary significantly in chemical composition. Each oil has a different primary constituent: cinnamaldehyde in the bark oil, eugenol in the leaf oil, and camphor in the root-bark oil. The major constituents of the bark oils also differ between species: trans-cinnamaldehyde, eugenol, and linalool in *C. zeylanicum* and cinnamaldehyde, cinnamic acid, cinnamyl alcohol, and coumarin in *C. cassia*. This article provides a comprehensive summary of the current scientific literature on the effect of cinnamon bark on several physiological and health-related conditions.

The authors conducted an extensive database search by using PubMed, MEDLINE, EMBASE, BIOSIS, TOXLINE, and Google Scholar. Species of the genus *Cinnamomum* other than *C. zeylanicum* and *C. cassia* were excluded, as well as most studies on plant parts other than the bark, as it is the only part used for medical purposes.

The authors identified more than 200 articles relevant to the efficacy of the two herbs.

Few human trials investigating the efficacy of cinnamon on health-related conditions have been published. Among those trials, the treatment of type 2 diabetes mellitus is the most documented health benefit associated with cinnamon. Of the seven clinical studies cited in this review, four did not report statistically significant beneficial effects; the other three did. The authors cite numerous in vivo and in vitro studies supporting the efficacy of cinnamon in the treatment of types 1 and 2 diabetes mellitus. "The available in vitro and in vivo studies strongly suggest that cinnamon has hypoglycemic properties. However, the available human data are less consistent and indicate that cinnamon may have modest effects on blood glucose in subjects with type 2 diabetes," write the authors. While the ineffective outcomes were obtained in studies using doses of 1-1.5 gm daily, the positive results were shown with daily doses up to 6 gm daily.

Other evidence suggests that cinnamon may be effective in the supportive treatment of cancer and infectious diseases because of its anti-inflammatory, antimicrobial, antioxidant, and antihypertensive effects.

The authors cite several in vitro studies supporting the anti-inflammatory properties of the bark of *C. cassia*, "probably due to its cinnamaldehyde content," and other in vitro studies showing that cinnamon bark oil as well as cinnamaldehyde and eugenol has potent antibacterial effects against a number of bacteria.

Cinnamon's antifungal properties have also been demonstrated in vitro. Cinnamaldehyde has been identified as the fungitoxic constituent of *C. zeylanicum* bark oil.¹ The fungitoxic properties of the oil vapors have been demonstrated against fungi involved in respiratory tract infections. The authors cite a pilot study² of five patients with HIV infection and oral candidiasis to investigate the activity of cinnamon against fluconazole-resistant and -susceptible *Candida* isolates. All patients had pseudomembranous candida infection. After ingesting eight lozenges of a cinnamon candy daily for one week, three of the five patients had improvement of their oral candidiasis.

In vitro data demonstrate that *C. cassia* bark oil as well as aqueous and ethanolic extracts are effective antiviral properties against HIV and influenza virus; however, those properties have not been shown for *C. zeylanicum*. "Further in vitro and in vivo research in addition to human data is needed to confirm the antimicrobial properties of cinnamon in free-living individuals," note the authors.

Several in vitro studies are cited to support the antioxidant properties of both *C. cassia* and *C. zeylanicum*. Dhuley³ examined the antioxidant properties of *C. zeylanicum* in vivo by measuring hepatic and cardiac antioxidant enzymes, glutathione (GSH) content, and lipid conjugated dienes in rats fed a high-fat diet containing 10% cinnamon. The antioxidant enzyme activities were enhanced significantly, whereas the GSH content was markedly restored in rats fed a high-fat diet containing spices. According to the authors, these results suggest that cinnamon exerts antioxidant protection through its ability to activate antioxidant enzymes. "In conclusion, numerous in vitro studies and one in vivo trial demonstrate the antioxidant potential of *Cinnamomum cassia* and *C. zeylanicum*."

The published in vitro and in vivo data, as evidenced by several cited studies, suggest that cinnamon has antitumor properties that are probably related to its antioxidant activity.

C. cassia bark as 8% of the diet affects the cardiovascular system as shown by lowering blood pressure in hypertensive rats,⁴ while an extract has been shown to have beneficial hypolipidemic properties on triglycerides while also increasing high-density lipoprotein (HDL) cholesterol in mice.⁵ A study with cinnamon bark in people with type 2 diabetes found that after 40 days, 1, 3, or 6 gm daily reduced triglycerides 23-30%, low-density lipoprotein (LDL) cholesterol 7-27%, and total cholesterol 12-26% ($P < 0.05$ for each), but had no significant effect on HDL cholesterol.⁶

Regarding its potential gastroprotective properties following an in vitro finding of effective *Helicobacter pylori* inhibition, a pilot study⁷ tested the activity of an alcoholic extract of cinnamon in patients infected with *H. pylori*. It found that cinnamon extract (at a dosage

of 80 mg daily taken as a single agent) was ineffective for eradicating *H. pylori*. The investigators concluded that a combination with other antimicrobials, or a higher concentration of cinnamon extract, may have an effect; further studies are needed to make these determinations.

No human data are available to confirm the in vitro immunomodulatory properties of cinnamon.

"The preponderance of available in vitro and in vivo data suggests that cinnamon has health benefits. However, controlled human studies will be necessary to determine whether these effects have public health implications," conclude the authors.

—Shari Henson

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