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File: ▪ Cinnamon (*Cinnamomum verum*, Lauraceae)
▪ Obesity
▪ Systematic Review/Meta-analysis

HC 082015-662

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RE: Systematic Review and Meta-analysis of the Effect of Cinnamon on Body Weight

Yazdanpanah Z, Azadi-Yazdi M, Hooshmandi H, Ramezani-Jolfaie N, Salehi-Abargouei. Effects of cinnamon supplementation on body weight and composition in adults: a systematic review and meta-analysis of controlled clinical trials. *Phytother Res*. March 2020;34(3):448-463. doi: 10.1002/ptr.6539.

Obesity is a global health concern and a risk factor for several diseases, such as cardiovascular disease (CVD), diabetes, sleep apnea, dyslipidemia, and certain cancers. While an energy-restricted diet is the mainstay of obesity treatment, functional foods like cinnamon (*Cinnamomum verum*, Lauraceae) may help with weight loss. The main bioactive compounds in cinnamon – cinnamic acid, cinnamaldehyde (CIN), and eugenol – may increase insulin sensitivity and have anti-obesity effects. Still, studies have demonstrated conflicting results regarding the anti-obesity effects of cinnamon. The purpose of this systematic review and meta-analysis was to investigate the effects of cinnamon on body weight and composition.

The databases PubMed, Web of Science, Scopus, Google Scholar, and the Cochran library were searched from inception up to August 5, 2019 using keywords related to inflammatory markers, blood pressure, blood lipids, and glucose. Randomized controlled trials (RCTs) conducted in adults aged 18 years and older that reported the effects of cinnamon alone on anthropometric indices were included. The risk of bias was assessed using the Cochrane Collaboration's Risk of Bias assessment tool. The weighted mean difference (WMD) and its corresponding 95% confidence intervals (CIs) were calculated using the random-effects model. Inter-study heterogeneity was assessed using the Cochran's Q test and I-squared statistic.

A total of 4,656 articles were identified. Following the removal of duplicates (n = 1,046), irrelevant articles based on titles or abstract (n = 3,473), and studies not meeting inclusion criteria (n = 116), 21 studies were included for analysis. The mean age of the patients ranged from 22.4 to 64.4 years, and the sample size ranged from 15 to 175 patients, with the intervention period varying from six to 16 weeks. Most studies (n = 17) used cinnamon powder in the form of capsule, while the others (n = 4) used cinnamon extract. The dose of cinnamon ranged between 336 mg per day of cinnamon extract to 10,000 mg per day of cinnamon powder. Trials were conducted in patients with type 2 diabetes mellitus (T2DM; n = 11), polycystic ovarian syndrome (POCS; n = 3), metabolic syndrome (MetS) and prediabetes (n = 3), nonalcoholic fatty liver disease (NAFLD; n = 1), rheumatoid arthritis (RA; n = 1), and in those who were overweight (n = 2). Seven trials had a low risk of bias, 12 trials had an unclear risk of bias, and two studies were identified as a high risk.

Twenty trials reported the effects of cinnamon on body mass index (BMI) in 1,458 patients. Cinnamon supplementation demonstrated a reduction in BMI by −0.40 kg/m^2 (95% CI: −0.58, −0.23 kg/m^2; $P < 0.001$) with significant heterogeneity observed (Q statistic = 99.32; $P < 0.001$; $I^2 = 78.9\%$). Subgroup analysis revealed a greater effect for BMI with cinnamon supplementation at a dose of 2,000-3,000 mg per day (WMD = −0.81 kg/m^2 ; 95% CI: −1.16, −0.45 kg/m^2 ; $P < 0.001$) and for a duration of 12 weeks or more (WMD = −0.53, 95% CI: −0.80, −0.26; $P < 0.001$).

Fourteen trials reported the effects of cinnamon on body weight in 867 patients. A significant reduction in body weight was observed after cinnamon supplementation (WMD = −0.92 kg; 95% CI: −1.51, −0.33 kg; P = 0.002) with significant inter-study heterogeneity observed (Q statistic = 95.22, $P < 0.001$, $I^2 = 84.2\%$). A significant effect was observed for supplementation at doses of 2,000-3,000 mg per day (WMD = −1.84 kg, 95% CI: −2.63, −1.05 kg; $P < 0.001$) and for a duration of 12 weeks or more (WMD = −1.72 kg, 95% CI: −2.68, −0.77 kg; $P < 0.001$). The subgroup analysis also revealed a significant reduction in body weight in patients without T2DM (WMD = −1.1 kg, 95% CI: −1.83, −0.37 kg; P = 0.003)

Seven trials in 431 patients revealed a marginal effect with cinnamon for WC (WMD = –1.76 cm, 95% CI: −3.57, −0.045 cm; P = 0.056; Q statistic = 65.17; $P < 0.001$; $I^2 = 90.8\%$). Subgroup analysis for sex found that cinnamon significantly reduced WC in women (WMD = −2.42 cm, 95% CI: −4.03, −0.80 cm; P = 0.003) with no heterogeneity. Pooled analysis from three trials with 351 patients indicated that cinnamon supplementation significantly decreased WHR (WMD = −0.02, 95% CI: −0.038, −0.018; $P < 0.001$; Cochran's Q test, Q statistic = 2.44; P = 0.48; $I^2 = 0\%$).

Pooled analysis from five trials with 349 patients found no significant effect of cinnamon supplementation on body fat percentage (WMD = −0.88%, 95% CI: −1.87, 0.025%; P = 0.057; Cochran's Q test = 23.38, $P < 0.001$, $I^2 = 78.6\%$). Supplementation for 12 weeks or more, however, had a favorable effect on body fat compared with control (WMD = −1.70%, 95% CI: −2.29, −1.10%; $P < 0.001$; Cochran's Q test = 0.24; P = 0.88; $I^2 = 0\%$).

Meta-regression demonstrated no significant association for BMI, body weight, WC, WHR, or body fat percentage for cinnamon dose. A significant association was found for the intervention duration for body weight ($\beta = -0.23$, P = 0.04) but not the other anthropometric indices. The sensitivity analysis indicated no alteration to the meta-analysis results for BMI and body weight with the removal of any of the trials. The removal of one study from the pooled effect of cinnamon on WHR changed the overall effect to nonsignificant, whereas the removal of three studies from the pooled effect on cinnamon on WC changed the overall effect to significant. With the exception of an incidence of a skin allergy, no adverse effects were reported following cinnamon supplementation.

This systematic review and meta-analysis showed that cinnamon supplementation leads to significant but clinically modest decreases in BMI, weight, and WHR in patients with chronic conditions. A greater effect was observed in patients who were overweight or obese that supplemented with 2,000-3,000 mg of cinnamon powder per day for 12 weeks or longer. The authors discuss several potential anti-obesity mechanisms for cinnamon and its bioactive constituents – namely cinnamaldehyde – related to satiety, thermogenesis, fatty acid oxidation, and enhanced insulin sensitivity. Limitations cited by the authors include the considerable heterogeneity among studies and the limited information on the dietary intakes, cinnamon species, and patients' adherence to the interventions. Consequently, the authors call for additional RCTs with an appropriate duration and large sample size that explore the effects of different cinnamon supplementation doses and species. Inclusion of the exact species in clinical trial articles is necessary as the constituents in species differ. Some trials seem to or did use cassie (*C. aromaticum* syn. *C. cassia*) which has a different chemical profile than *C. verum*. Other articles do not seem to have precisely identified the species of cinnamon used in the study which may skew the results if the different species have different levels of activity. They also recommend studying the efficacy of cinnamon supplementation for weight loss in metabolically healthy people who are overweight or obese. The authors declare no conflicts of interest.

–*Gavin Van De Walle, MS, RDN*

The American Botanical Council has chosen not to reprint the original article.