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File: ■ Green Tea (*Camellia sinensis*)
■ Energy Expenditure
■ Fat Metabolism

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RE: Green Tea Consumption Aids in Fat Reduction

Thavanesan N. The putative effects of green tea on body fat: an evaluation of the evidence and a review of the potential mechanisms. *Br J Nutr.* 2011 Nov;106(9):1297-1309.

Tea (*Camellia sinensis*), reportedly the second most consumed beverage worldwide, is known to have antiobesity, antidiabetic, anticarcinogenic, antibacterial, and antiviral properties. In this review, the author concentrates on the effects of green tea ingestion on energy expenditure (EE) and fat metabolism.

Reported evidence demonstrating an apparent increase in EE after green tea consumption has led pharmaceutical and nutraceutical manufacturers to incorporate green tea extract (GTE) into purported weight management products for gym goers, athletes, and the general public. The author aimed to evaluate the validity of the evidence, considering its potential applications, along with providing a synthesis of putative modes of action.

Of the polyphenols in green tea, epigallocatechin-3-gallate has been suggested to be the most pharmacologically active, with the largest effect.

Among the studies on the short-term effects of green tea was a study aimed at determining whether ingesting GTE would increase 24-hour EE in humans and whether the effects could be explained by the caffeine content alone.¹ The investigators found that compared with a placebo, the GTE elicited a statistically significant 4% increase in 24-hour EE, as well as a decrease in the respiratory quotient (RQ), indicating an increase in fuel oxidation, with a shift from carbohydrate to fat. They found no change in nitrogen levels in urine samples and an increase in urinary noradrenaline in the GTE group. Treatment with caffeine alone exhibited no effect on EE, RQ, or urinary excretion of nitrogen or catecholamines. Other studies on the short-term effects of green tea on EE are cited.

Amidst the studies cited on the long-term effects on body weight in humans was a study of obese Thai men and women that reported a 3.8% drop in body fat percentage with an associated drop of 2.7 kg in body weight.² Used in the study was a GTE dosage of 750 mg daily, of which 142 mg were catechins.

The author points out that current literature is unable to definitively elucidate any specific variation between males and females; however, this is in part because most studies have not

specifically investigated any difference in response based solely on sex or baseline weight. The studies cited in this review suggest that there might be less of an effect in obese females than in obese males, coupled with a decreased effect in females below a dose of 600 mg GTE daily in a dose-dependent manner.

The author cites animal studies that also support the role of catechins in weight modulation and others that have yielded strong evidence for green tea's role in suppressing the accumulation of fat mass and, indirectly, body weight.

In his evaluation of the evidence, the author notes that an important issue is "the difficulty in arriving at a coherent consensus mode of action by which green tea might perpetrate the effects that we have described." Another limitation is the manner in which the GTE is administered and the bioavailability of catechins after they are ingested. The effects on long-term health might build up over months or even years, thus eliciting a need for more longitudinal studies to determine the extent of any effects on habitual green tea consumption.

The author discusses some of the published unimodal mechanisms of action of green tea and its catechins: the inhibition of the enzyme catechol-*O*-methyltransferase (COMT); the mobilization of fatty acid stores for oxidation mediated by a lowering of malonyl-CoA; the inhibition of lipid absorption; and the uptake of metabolic enzymes.

Examining the proposed mechanisms, the author writes that, "It seems that no individual suggestion is able to account for the full extent of effects reported." He proposes a model by which green tea might act, and perhaps account for, the full effect seen in the studies discussed. The model is based on an accumulation of marginal gains, each component contributing to the global reduction in fat accumulation and the simultaneous inhibition of the enzymes COMT and acetyl-CoA carboxylase, fatty acid synthase, and impeding absorption of fat via the gut.

The author concludes that green tea does seem to aid the reduction of fat, either through increased EE or decreased absorption. "Given the relatively low cost of this beverage, it suggests a useful household-based approach to modulating obesity, with such target demographics being reflected in studies using obese test subjects."

For athletes, the author says, a more functional application might be a boost in muscle endurance to prolong physical activity regimens before the onset of muscle fatigue and soreness.

—Shari Henson

References

¹Dulloo A, Duret C, Rohrer D, et al. Efficacy of a green tea extract rich in catechin polyphenols and caffeine in increasing 24-h energy expenditure and fat oxidation in humans. *Am J Clin Nutr.* 1999;70(6):1040-1045.

²Auvichayapat P, Prapocharung M, Tunkamnerdthai O, et al. Effectiveness of green tea on weight reduction in obese Thais: a randomized, controlled trial. *Physiol Behav.* 2008;93(3):486-491.

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