

## **Green Tea Catechins Reduce Body Fat and LDL-Oxidation In Clinical Studies**

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Recently, the catechins found in green tea have been shown to promote weight loss and reduction in body fat in human subjects, independent of any effects of caffeine. The study by T Nagao et al, reported in the American Journal of Clinical Nutrition in 2005, showed that decaffeinated green tea provided significant weight loss and body fat reduction outcomes in subjects administered a catechin-enriched rich green tea product compared to a very low-dose-catechin green tea product. These and other authors have examined the possible mechanisms of action through which green tea catechins promote fat burning and weight loss, without producing adverse stimulation to the central nervous system.

### **Green Tea Catechins: An Overview Of Their Properties**

Green tea contains low-molecular-weight polyphenols consisting mainly of flavanol (flavan-3-ol) monomers, which are referred to as catechins. There are several isomers of this compound: catechin, catechin gallate (Cg), gallic catechin, gallic catechin gallate (GCg), epicatechin, epicatechin gallate (ECg), epigallocatechin, and epigallocatechin gallate (EGCg).

Under experimental conditions, the ingestion of catechins exhibit antioxidant, antiviral, and antiplaque-forming activities, while epidemiological evidences suggest that green tea catechins are associated with decreased risk of certain cancers and experimentally demonstrate important anticancer properties. Animal studies also suggest a role in reducing high blood pressure and high blood sugar.

Lipid metabolism studies in animals, tissues, and cells have found that catechins reduce blood levels of triglycerides and total cholesterol. As well, catechins have also been shown to inhibit fat accumulation in the liver as well body fat, and stimulate thermogenesis (increased fat-burning and calorie burning at rest).

### **Catechins and Body Fat Reduction**

In one open trial with human subjects, individuals ingesting catechins showed a reduction in body weight and waist circumference, but no comparative controls were included in the study. As a follow-up to this initial study, T Nagao et al, investigated the effect of green tea catechins on body fat reduction, waist circumference and other end points. Nagao et al supplemented one group of men with a catechin-enriched, decaffeinated green tea product (yielding 690 mg per day of catechins) and the control group received a decaffeinated green tea product that contained only 22 mg of catechins. All men had similar body mass index scores and were either at the upper limit of their normal weight or slightly above.

After 12 weeks the men receiving the catechin-enriched decaffeinated green tea product showed a significant reduction in body weight, waist circumference and body fat, compared to men ingesting the catechin-depleted decaffeinated green tea product.

The average weight loss in the catechin-enriched group was 5.3 lbs, compared to 2.9 lbs in the catechin-depleted product. Waist circumference was reduced by 3.4 cm

(1.36 inches) in the catechin-enriched group compared to a reduction of 1.6 cm (0.64 inches) in the catechin-depleted group. Decrease in hip circumference was also greater in the catechin-rich group compared to the catechin depleted group. In addition, the group receiving the catechin-enriched product showed a reduction in LDL-cholesterol from 3.38 mmol/L (130 mg/dl) to 2.99 mmol/L (115 mg/dl) during the 12- week trial period. They also realized a rise in their HLD-cholesterol. LDL-cholesterol reduction in the catechin-depleted group was much less pronounced.

The study by CK Maki et al (2008) showed that during a 12-week trial of overweight subjects (males and females) that a catechin-enriched supplement (daily dosage of 625 mg per day) enhanced the weight reduction effects of exercise (180 minutes per week) compared to the control group. Reduction in abdominal fat was more noteworthy, and a more significant reduction in serum fasting triglycerides was also seen in the catechin-enriched group.

### **Fat-Burning Effects Of Catechins**

Experimental studies suggest a number of ways in which green tea catechins can reduce body fat and act as a weight loss aid for clinical purposes:

1. Dulloo et al, reported that certain green tea catechins (GTE) increase thermogenesis in brown fat tissue of rat. They also found that consumption of GTE increased energy expenditure in a human study. The authors suggested that one of the effects of catechins is due to its *inhibitory activity of catechol-O-methyltransferase (COMT)*, which is a catecholamine-degrading enzyme. As a result, more sustained activity of catecholamines, such epinephrine and norepinephrine, may encourage greater release of fat from fat cells and may up-regulate the activity of brown fat, increasing the total amount of fat burned at rest and increasing the total number of calories burned on a daily basis.

2. Catechins have been shown to decrease lipid oxidation in the body via their antioxidant properties. Studies suggests that obesity might be related to an increase in lipid oxidizability, as oxidized lipids have been shown to activate certain transcription factors (nuclear factor- $\kappa$  B and peroxisome proliferator-activated receptors), which regulate body fat metabolism.

As such, green tea catechins may discourage fat accumulation in fat cells and liver, by decreasing fat oxidation in the body.

An indirect marker for fat oxidation (lipid peroxidation) in the blood is malondialdehyde-modified LDL-cholesterol (MDA-LDL).

A number of studies link higher MDA-LDL blood levels with higher incidence of obesity.

The study by T Nagao et al showed that the catechin-enriched group showed a reduction in lipid oxidation end-products (MDA-LDL) in their blood compared to the catechin-depleted group, which may, through signal transduction pathways involving transcription factors (nuclear factor- $\kappa$  B and peroxisome proliferator-activated receptors), have been a factor in suppressing fat accumulation and triggering body fat reduction. The authors conclude that further investigation is needed to clarify the relation between a

redox regulatory system (lipid oxidation signaling mechanism) and the body fat-reducing mechanism.

## Summary

In conclusion, catechin ingestion has been shown to inhibit the formation of oxidized lipids such as MDA-LDL, which is an established risk factor for developing arteriosclerosis. Moreover, catechin intake has been shown to decrease body fat in human and animal studies in the absence of any untoward side effects and adverse events.

Importantly, studies suggest that catechins contribute to the prevention of and improvement in various lifestyle-related diseases, particularly obesity and cardiovascular disease. The mechanism through which catechins promote reduction of body fat may be related to their ability to inhibit the catechol-O-methyltransferase enzyme, thus boosting the effects of the body's own adrenaline on fat metabolism, and/or by inhibiting lipid oxidation, which appears to be related to key steps in fat regulation. As such, high yielding catechin green tea extract products, which are caffeine reduced (or decaffeinated) represent an intervention through which to help patients reduce body fat, improve other anthropometric indices and improve biomarkers related to atherosclerosis, namely MDA-LDL and cholesterol.

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