

Green Tea

A Review of Potential Health Benefits

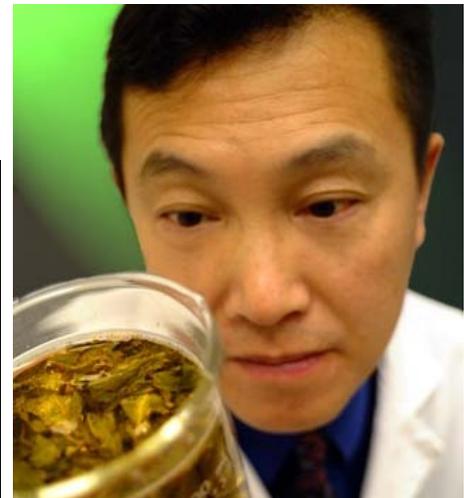


- Green tea is one of four types of tea (white, green, black, and oolong) that come from the plant *Camellia sinensis*.
- White tea is the least processed form of tea, while black tea leaves are fermented. Green tea leaves are steamed, not fermented and hence preserve more polyphenols.
- The **beneficial effects** of green tea are attributed to the polyphenols, particularly the catechins, which make up 30% of the dry weight of green tea leaves.
- These catechins are present in **higher quantities** in green tea than in black or oolong tea, because of the differences in the processing of tea leaves after harvest.

Green Tea and Chronic Diseases

Many studies have found beneficial effects associated with the consumption of green tea. In fact, green tea has been shown to play a beneficial role in six different areas:

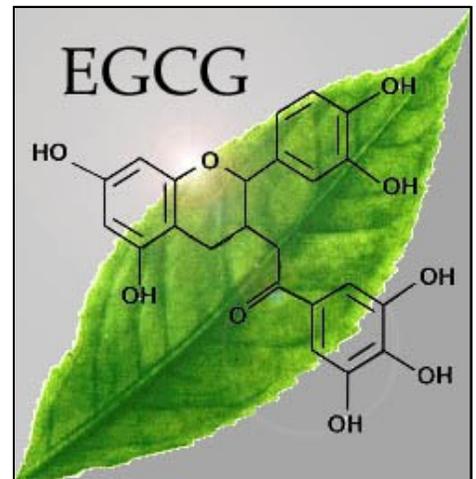
- **Cardiovascular diseases**
- **Obesity and weight loss**
- **Diabetes**
- **Cancer**
- **Microbial diseases**
- **Neurodegenerative diseases**
 - Aging
 - Parkinson's disease
 - Alzheimer's disease



Tea has been consumed as a beverage for thousands of years, first in the Orient and then Europe and the Americas. Green tea has been used in oriental medicine because of its beneficial effects.

ECCG

Green tea has polyphenolic catechins, of which **(-)-epigallocatechin-3-gallate (EGCG)** is one of six. EGCG is the most abundant catechin, accounting for 65% of green tea's catechin content, and seems to produce most of the beneficial effects found in green tea. One cup of green tea contains approximately 100-200 mg of EGCG. Other components found in green tea include: caffeine, theanine, theaflavins, theobromine, theophylline, and phenolic acids such as gallic acid.



Cardiovascular Disease

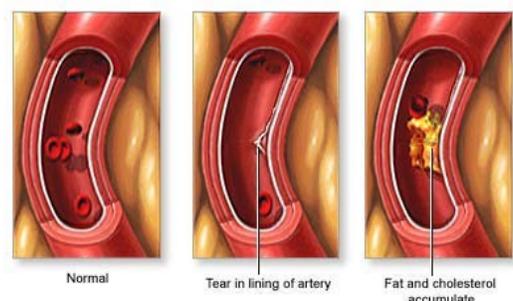
Overview: Green tea polyphenols (catechins) are potent antioxidants which reduce free radical damage to cells and prevent the oxidation of LDL cholesterol. Preventing oxidation of the LDL particle inhibits the formation of atherosclerotic plaques. Therefore the consumption of green tea is believed to be linked to a lower risk of heart disease.

- In a study of over 8,000 Japanese men and women for 12 years, increased consumption of green tea was associated with greater health benefits. In fact, those who consumed ~32 ounces a day over a 12 year period had a 58% lower risk of dying from coronary heart disease than those who consumed about ~10 ounces a day.
- Consumption of black tea, which is notably lower in catechins, was also shown to provide significant benefits. In a 6-yr Dutch study of over 4,500 men and women, those who consumed more than 3 cups (~13 ounces a day) of black tea daily had a 68% lower risk of myocardial infarction (a heart attack) than those who did not drink tea. Therefore, even moderate amounts of tea consumption can potentially provide significant cardiovascular protection.

Diabetes

- Green tea consumption can also benefit diabetics. In a study on human subjects, the consumption of green tea was shown to improve glucose tolerance. Basal blood glucose levels did not change.
- In laboratory animals, long-term administration of green tea extract increased insulin sensitivity.
- In cell culture studies, EGCG was the most active catechin in increasing insulin sensitivity and glucose uptake in isolated fat cells.

Progression of plaque build-up in coronary artery



Cancer

- In the scientific world, green tea is probably **best known and most studied for** its effects on **cancer prevention**. Although epidemiological studies have not shown a clear link between cancer prevention and green tea, animal studies have been very convincing. They have clearly demonstrated the preventative effects of green tea and EGCG against liver, stomach, breast, prostate, lung and skin cancers at any stage (initiation, promotion or progression).
- Tea catechins act as powerful inhibitors of cancer growth in several ways. They:
 - scavenge oxidants before cell injuries occur,
 - reduce the incidence and size of chemically induced tumors, and
 - inhibit the growth of tumor cells.
- The National Cancer Institute (NCI) has funded extensive research with green tea as a potential cancer chemopreventive agent. A study is underway to see the chemopreventive effect of POLYPHENON E (a decaffeinated green tea extract currently in Phase II clinical trials).



Some of the cancer preventive activity of green tea is due to its antioxidant activity. Smoking increases oxidative damage in cells. In a study, smokers were encouraged to consume several cups of green tea each day. The consumption of green tea was associated with decreases in the levels of 8-OHdG, a marker of oxidative DNA damage in smokers.

Neurodegenerative Diseases

Free Radical Theory of Aging

According to the free radical theory of aging, increased free radical generation and oxidative stress are the basis for changes that lead to age-associated functional deterioration and neurodegeneration. Several age-associated diseases such as cancer, Parkinson's disease, Alzheimer's disease, cardiovascular disease, and diabetes have their etiologies linked to free radical damage. Because of the antioxidant properties of green tea and its extracts, several studies have examined the effects of green tea consumption on these age-related conditions.

- **Parkinson's disease**

Oxidative stress, especially the death of dopaminergic neurons, is believed to be a major contributor to the pathogenesis of Parkinson's disease. Recently, misregulated iron metabolism in the brain has also been implicated as a potential contributor. Several studies using green tea have shown significant protection against the development of this disease. Because of its antioxidant and iron-chelating properties, EGCG was believed to be the protective agent responsible these results.

- **Alzheimer's disease**

Although there is currently no epidemiological evidence on the benefit of green tea for Alzheimer's disease in humans, there have been several studies in laboratory animals and cell cultures which suggest that EGCG may delay this disease.

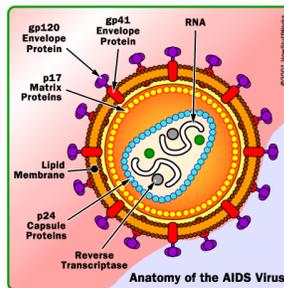
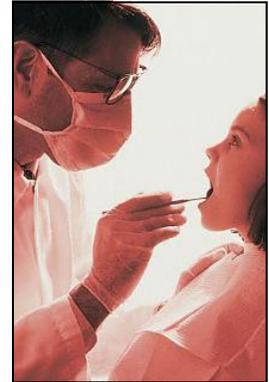
- **Stroke**

In laboratory animals, EGCG had a significant antioxidant effect and protected against neurological deficits.

Microbial Diseases

Green tea has been known to prevent dental caries (cavities) by preventing the attachment of the bacteria associated with dental caries to the teeth. Green tea increases the resistance of tooth enamel to acid induced erosion, and displays anti-inflammatory properties by reducing gum disease (gingivitis).

Recently, green tea has been successful in increasing antibiotic effectiveness in multi-drug resistant *Staphylococcus aureus* infections. In addition, EGCG has been shown to be effective in preventing HIV infection at the initial step in the HIV-1 infection process.



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