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**FILE: ■ Green Tea (*Camellia sinensis*)
■ Health Benefits**

HC 010371-322

Date: February 15, 2007

RE: Review of Health Benefits of Green Tea

Pastore RL, Fratellone P. Potential health benefits of green tea (*Camellia sinensis*): a narrative review. *Explore*. November/December 2006;2(6):531-539.

Second only to water, tea is the most common beverage consumed worldwide, with a per capita consumption of approximately 0.12 liter per day. White, green, and black teas are all harvested from the plant *Camellia sinensis*. Much research is available on the health benefits of green tea for various implications, including different types of cancer, heart disease, and liver disease. These authors present a thorough review of animal and human studies of the health benefits of green tea.

The major components of green tea are its polyphenols. The major polyphenols in green tea are flavonoids: catechins epicatechin (EC), epigallocatechin (EGC), epicatechin gallate (ECG), and epigallocatechin gallate (EGCG).

The authors cite numerous studies of green tea and its anti-inflammatory, anticarcinogenic, and antioxidative properties, as well as its uses in the prevention of various diseases. Below are findings from some of those studies.

- Antiviral properties — EGC and ECG were found to be potent inhibitors of influenza virus replication in cell culture. Quantitative analysis revealed that, at high concentration, EGCG and ECG also suppressed viral RNA synthesis in cells; EGC failed to show such an effect.
- Antioxidant properties — Green tea may help prevent atherosclerosis, particularly coronary artery disease. Japanese researchers have shown that green tea reduces the levels of low-density lipoprotein cholesterol. One study showed that those who drank green tea regularly had a 36% lower risk for heart disease than nondrinkers. Another Japanese population-based study found that men who drink green tea are more likely to have lower total cholesterol than those who do not drink green tea. In a cross-cultural study of 16 cohorts, known as the Seven Countries Study, the higher polyphenol intake of green tea was inversely correlated with mortality rates of coronary heart disease after 25 years of follow-up.^{1,2}
- Autoimmune disorders — The authors cited a study of cells in salivary glands and skin tissue that found that those cells exposed to EGCG showed RNA and protein levels, indicating that autoantigen levels were suppressed in the normal cells.
- Arrhythmias — Tea drinkers have a lower rate of death following a heart attack than those who do not drink tea. A study presented at the Heart Rhythm Society's 25th Annual Scientific sessions

in 2004 found that EGCG could help prevent ventricular arrhythmias, which can follow heart attacks.³

- Anticarcinogenic properties — One study suggests that EGCG and other tea catechins suppress tumor promotion by inhibiting the release of tumor necrosis factor-alpha, which is believed to stimulate tumor promotion and progression of initiated cells as well as premalignant cells.⁴ The authors also cite a study of mice that were transplanted with non-Hodgkin's lymphoma cells. Green tea prevented 50% of the tumors from taking hold and significantly inhibited tumor growth.
- Bladder cancer — A few studies have examined the relationship between bladder cancer and green tea consumption. In one study of people with and without bladder cancer, women who drank black tea and powdered green tea were less likely to develop bladder cancer.
- Breast cancer — EGCG, EGC, and ECG reduce the proliferation of human breast cancer cells in vitro and decrease breast tumor growth in rodents. In Japanese studies, EGCG decreased both the severity of the initial diagnosis and the likelihood of recurrence; green tea consumption was associated with lower risk of the cancer spreading to the lymph nodes; and an overall lower incidence of cancer was seen among people who drank 10 or more cups of green tea a day.
- Cervical cancer — The authors cite one study that suggests that EGCG can inhibit cervical cancer cell growth through induction of apoptosis (programmed cell death) and cell cycle arrest, as well as regulation of gene expression in vitro. In vivo antitumor effects of EGCG were also observed. "EGCG likely provides an additional option for a new and potential drug approach for cervical cancer patients," say the authors.
- Colorectal cancer — The authors cite a study at Oregon State University on mice that were genetically predisposed to develop intestinal tumors. After 12 weeks of treatment, the mice that were given green tea had significantly fewer tumors than mice that received no treatment.
- Esophageal cancer — Although studies in laboratory animals have found that green tea polyphenols inhibit the growth of esophageal cancer cells, the results of studies in humans are mixed. The hotter the tea (or any other hot beverage), the greater the risk for developing esophageal cancer, suggests some evidence. However, the authors cite one Chinese study that showed that green tea consumption yielded a reduced risk of up to 60% for developing esophageal cancer.
- Lung cancer — Green tea consumption has been found to be associated with a reduced risk of lung cancer among nonsmokers.
- Other cancers — Numerous studies support the beneficial health effects of green tea on the following types of cancer: osteosarcoma; pancreatic, prostate, skin, and stomach cancer; and leukemia.
- Human immunodeficiency virus (HIV) infection — EGCG prevents the binding of HIV to human T cells, the first step in HIV infection. Additional research is needed for the clinical application of EGCG as an anti-HIV drug, say the authors.
- Hair and skin health — A study of mice showed that anti-inflammatory and stress-inhibiting effects of green tea polyphenols may influence hair regrowth. EGCG reactivates dying skin cells.
- Endurance — In combination with naturally occurring polyphenols, EGCG boosted endurance exercise performance in lab rats.
- Arthritis — ECGC may inhibit cartilage resorption in arthritic joints and has been shown to protect cartilage destruction in test-tube models that mimic arthritic joints.
- Intestinal disorders — Green tea may help reduce inflammation associated with Crohn's disease and ulcerative colitis.
- Diabetes — Animal studies suggest that green tea may help prevent type 1 diabetes and slow the progression once it has developed. EGCG has been found to increase insulin sensitivity and may repair damaged beta cells.

- Liver disorders — Population-based studies and animal studies have shown that green tea consumption helps protect against liver disorders. Green tea also appears to protect the liver from the damaging effects of toxic substances such as alcohol.
- Neurodegenerative diseases — The authors suggest that the brain-penetrating property of green tea polyphenols, as well as their antioxidant and iron-chelating properties, may make green tea compounds an important class of drugs to be developed to treat neurodegenerative diseases for which oxidative stress has been implicated.
- Fungal infections — EGCG acts as an antifolate compound on *Candida albicans*, disturbing its folic acid metabolism. According to the authors, this could represent a starting point for therapies involving anti-folates and azoles used as an alternative for the treatment of *C. albicans* infections.
- Obesity — EGCG improved weight loss in animal and human studies.

Regarding contraindications, the authors note that green tea contains vitamin K and may interfere with warfarin (based on one person consuming a gallon of green tea daily while on the medicine). Also, people sensitive to caffeine should use caffeine-free green tea or caffeine-free green tea extract.

"The years of safe consumption of green tea, backed up by the numerous studies showing health benefits, warrant a general recommendation to consume it regularly. Although the human clinical data is still limited, this abstract shows that green tea has its place in both the conventional and alternative medical communities," say the authors.

—Shari Henson

References

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³Kelemen K, Kiesecker C, Zitron E, et al. Green tea flavonoid inhibits "human-ether-a-gogo related gene" (HERG) potassium channels. Paper presented at: Heart Rhythm Society's 25th Annual Scientific Sessions; May 19-22, 2004; San Francisco, Calif.

⁴Fujiki H, Suganuma M, Kurusu M, et al. New TNF-alpha releasing inhibitors as cancer preventive agents from traditional herbal medicine and combination cancer prevention study with EGCG and sulindac or tamoxifen. *Mutat Res.* 2003;523-524:119-125.

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