P.O. Box 144345 Austin, TX 78714-4345 ▪ 512.926.4900 ▪ Fax: 512.926.2345 ▪ www.herbalgram.org

HerbClip™

FILE: ▪Green Tea (*Camellia sinensis*)
▪Cancer Prevention

HC 100252-306

Date: June 15, 2006

RE: Green Tea's Use to Prevent Cancer

Cooper R, Morré J, Morré D. Medicinal benefits of green tea: part II. Review of anticancer properties. *J Altern Complement Med*. 2005;11(4):639-652.

The authors reviewed the medicinal properties of green tea (*Camellia sinensis*), and published their findings in two parts. Part one was reviewed in HerbClip 080753.300, and described the constituents of green and black tea; its antiviral properties; anticariogenic (prevention of tooth cavities) effect; and potential benefits for weight loss, cardiac health, arthritis, bone density, and stress. Tea's mechanisms of action on inflammatory pathways were also detailed. The current article—part two of this series—reviews the evidence for tea's effectiveness in the prevention of cancer.

The majority of data supporting green tea in the prevention of cancer come from epidemiological studies, in which an inverse association between green tea consumption and cancers of the colon, urinary bladder, stomach, esophagus, lung, and pancreas has been reported. The benefits for green tea were determined to occur in women who drank more than 10 cups of green tea per day. However, the authors conclude, "Because of the many variables in lifestyle inherent to such a study, a definitive link between green tea and its cancer effects could not be concluded." Case control and cohort studies support these conclusions. One case control study, involving 2,226 cancer patients in Shanghai, China, found "green tea consumption lowered the risk of cancer of the colon, rectum, and pancreas by 18%, 28%, and 37%, respectively, in men, and by 33%, 43%, and 47%, respectively, in women.

Green tea polyphenols possess excellent antioxidant activity. These include (-)-epigallocatechin gallate (EGCg), catechin (C), epicatechin (EC), gallocatechin (GC), gallocatechin gallate (GCG), epigallocatechin (EGC) and epicatechin gallate (ECG). These polyphenols bind to metal ions thereby preventing their participating in peroxidase reactions. They also "scavenge reactive oxygen and nitrogen species, reducing their damage to lipid membranes, proteins, and nucleic acids [DNA and RNA] in cell-free systems." Green tea polyphenols protect "in varying degrees" against colon, rectum, bladder, breast, stomach, pancreas, lung, esophagus, and prostate cancers. The authors do not specify whether this evidence comes from in vitro or in vivo studies.

It has been proposed, however, that EGCg has anticancer effects that go beyond preventing oxidation reactions. EGCg's anticancer benefits "may result from a much more specific mechanism, inhibiting the isoform of NADII oxidase (tNOX) at nanomolar potency in vitro." In vitro studies

show EGCg can inhibit cancer cell growth by blocking cell receptors, decreasing the generation of cancer causing chemicals during the body's metabolism of chemicals, and "inhibit[ing] estrogen receptor interaction in mammary [breast] cancer cell lines." Estrogen can stimulate cancer growth in estrogen-positive breast cancers. EGCg also inhibited metastasis (spread of cancer from its original site to distant sites) in experimental lung cancer in animals. In humans, EGCg was associated with a decrease in metastasis in premenopausal women with breast cancer.

EGCg may inhibit tumor grown by decreasing expression of genes involved in tumor development, and by causing the apoptosis (death) of cancer cells. Tea polyphenols inhibited "abnormal angiogenesis" (production of new blood vessels), which is seen in cancer growth and metastasis, and also occurs in rheumatoid arthritis, diabetic retinopathy (eye damage in diabetics). Cancer cells possess the ability to excrete chemotherapy drugs, thereby reducing the effectiveness of treatment. EGCg inhibited the efflux of drugs, which may in the future provide benefit by helping to maintain the efficacy of chemotherapeutic agents. Evidence for these effects comes from both in vitro and in vivo animal studies.

Whether EGCg or other tea polyphenols can be administered in therapeutic doses in humans has yet to be determined. As the authors note, "the majority of mechanistic studies have been performed using nonphysiologic high concentrations." And the ability of EGCg alone to act as a therapy in the prevention of cancer "is still unclear." Again, the epidemiological data support the use of green tea as a beverage, containing its natural mixture of polyphenols, not EGCg alone.

The toxicity of EGCg and green tea extract (GTE; which polyphenols and their ratios were not disclosed in this review) has been studied in animals and humans. One study of 10 cancer patients found that doses up to 1.0 g/m^2 three times daily of GTE was safe. This is equivalent to 7–8 Japanese cups, or 120 mL of green tea, three times daily). The authors also review the pharmacokinetic data (rate of absorption, maximum concentration, and elimination) of EGCg. To maintain therapeutic effects, EGCg concentrations should be maintained at elevated levels. Once the concentration falls, its inhibitory effects on cancer growth decrease. To address this problem, sustained release formulations are being developed.

Although epidemiological evidence strongly supports a possible role of green tea consumption for the prevention of cancer, the amount of green tea that must be drunk each day is too much for most people outside of Asia to sustain over time. Future clinical trials must evaluate the most effective dose and ratio of polyphenols, and potential interactions with chemotherapeutic agents.

—John Neustadt, ND

Enclosure: Referenced article reprinted with permission from Mary Ann Liebert, Inc., 2 Madison Ave., Larchmont, NY 10438; Telephone (914)834-3100; Fax (914)834-3582; email: info@liebert.com.