# James L. Holly, M.D.

**Green Tea - Healthy Choice for Preventive Health**

**by James L. Holly, MD**

**Your Life Your Health**

**October 31, 2002**

One of the most exciting health developments of the 1990s was the discovery of the extraordinary health benefits of green tea. Epidemiological observations have shown that people in green-tea consuming countries mainly Japan and China have very low rates of cancer. The rates of breast, colon, skin, pancreatic, esophageal and stomach cancer have been found to be lower among drinks of green tea. Those Japanese smokes who consume a lot of green teak seem to enjoy protection against lung cancer. In fact, the Japanese have both the highest smoking rate and the lowest lung cancer rate in the industrialized world. Western epidemiological studies have also tended to confirm that higher consumption of tea and coffee is associated with a lower risk of breast cancer.

**What is green tea?**

Just like black tea, green tea comes form the Camelia sinesis plant. Black tea is fermented and green tea is not. Some of the chemical compounds in green tea are:

Polyphenols and flavonoids

Alkaloids, such as caffeine and theobromine

Carbohydrates

Tannins

Minerals, such as fluoride and aluminum

Like Green tea, Oolong and black tea also come from the leaves of the *Camellia sinensis*, or tea plant. Oolong and black tea are processed and oxidized in different manners. Of the three, green tea contains the highest levels of polyphenols, the antioxidant substance that is believed to be beneficial in protecting against both cancer and atherosclerosis.

The tea plant is actually a variation of evergreen bush, with glossy green leaves and small white to pink flowers. The plants can reach a height of 30-40 ft (9-12 m) or taller in the wild, but are generally kept to a height of 6 ft (1.2 m) or less on the tea plantations and gardens where they are grown in China, Argentina, Japan, India, Indonesia, Kenya, Malawi, Sri Lanka, Turkey, Pakistan, Bangladesh, and Tanzania. Tea plants are cultivated in countries where warm, rainy growing conditions are abundant, and are also frequently grown in high altitude areas.

When tea plants reach maturity at three or four years of age, the young leaves and leaf buds -- the parts of the plant highest in polyphenols -- are harvested. Green tea is produced by steaming or roasting the leaves as soon as they are picked, and then rolling and drying the tea leaves to remove any moisture.

**Definition of Terms:**

Here are some terms which you should know I order to understand some of the health benefits of all antioxidants and particularly green tea:

Antioxidants: enzymes that bind with free radicals to neutralize their harmful effects.

Atherosclerosis: a type of arteriosclerosis, or hardening of the arteries, caused by fatty deposits of cholesterol and calcium that build up on the interior walls of the blood vessels and arteries.

Chemopreventative: a chemical or drug that is thought to prevent a disease.

Flavonoids: polyphenol substances in tea that act as antioxidants.

Free Radicals: reactive molecules created during cell metabolism that can cause tissue and cell damage like that which occurs in aging and with disease processes such as cancer.

Phytochemical: a naturally occurring chemical substance in a plant.

Polyphenols: a phytochemical that acts as an antioxidant, protecting cells against damaging free-radicals.

**Various reports have shown and/or suggested that green tea consumption of two to four cups a day will benefit:**

1. The immune system green tea is 30-40% polyphenols by weight. It is estimated that the necessary daily intake of polyphenols is from 300-400 mg, which translates to about 4 cups of green tea a day.

2. Dental health tea contains fluoride and other minerals. It is a good cavity fighter and helps maintain hard teeth. In addition, the polyphenols of tea exhibit anti-plaque properties that can help fight bacteria in the mouth. Green tea appears to block the attachment of bacteria to the teeth. Children can drink one cup of green tea a day to aid in reducing cavities.

3. Weight loss aide tea has been used as an aid for weight loss as it only has 4 calories pre serving. Green tea is most healthy when it is consumed with nothing added. Polyphenols seem to aid in the digestion of fats.

4. Cancer Prevention As mentioned previously, green tea appears to have benefit in preventing cancer. Later, we will discuss how green tea may benefit patients being treated for cancer. Green tea has been shown to benefit white blood cells during chemotherapy treatment.

5. Helping your heart Green tea has been show to decrease cholesterol. We will discuss this in more detail below. Green tea may also promote fat oxidation positively impacting both weight loss and cardiac health.

6. Osteoporosis The University of Cambridge School of Medicine compared 1,134 tea drinkers to 122 non-tea drinks and concluded that drinking caffeinated tea may protect against osteoporosis even though high caffeine intake has been linked with an increased risk of reduced bone density.

7. Green tea has also been recommended to ease stomach discomfort, vomiting and to stop diarrhea. It can often help in the nausea and vomited associated with pregnancy.

**How should you prepare and drink green tea?**

Green tea leaves and tea bags can be purchased at most grocery, drug and health food stores. Green tea is graded by leaf size, with tea containing whole leaves and leaf tips considered the highest quality tea. Tea should be stored in a cool place for no longer than six months before use.

The most common method of preparing green tea is as an infusion. The tea is mixed with boiling water, steeped for several minutes, and then strained or removed from the infusion before drinking. Approximately two teaspoons of loose tea, or a single tea bag, should be used for each cup of boiling water.

Flavonoids polyphenols with antioxidative properties are released into the infusion as the tea steeps. The longer the steeping time, the more flavonoids are released by the tea leaves, although most will infuse into the water during the first five minutes of brewing. Longer steeping time also results in higher caffeine content in the brewed tea.

**Precautions:**

The US FDA includes tea on their list of generally recognized as safe substances. However, pregnant women and women who breast feed should consider limiting their intake of green tea because of its caffeine content. Tea can pass into breast milk and cause sleep disorders in nursing infants.

**Side Effects:**

Green tea contains caffeine, a central nervous system stimulant that can cause restlessness, irritability, difficulty sleeping, tremor, heart palpitations, loss of appetite and upset stomach. To avoid side effects, caffeine intake should be limited to 300 mg or less a day (the equivalent of 4-8 cups of brewed hot tea). Caffeine-free green tea preparations are available commercially.

Decaffeinated tea is available which eliminates most of the side effects and precautions, but decaffeination can also removed most of the health benefits of green tea. Tea that has been decaffeinated with a solvent (such as Ethyl Acetate) is going to have a much lower level of antioxidants, than a tea that has been processed with a water/carbon dioxide method. Water decaffeinated tea will retain almost 95% of its health benefit.

**More on Green Tea and Cancer The Active Ingredient: Catechin, epigallocatechin gallate**

Research aimed at finding the active compounds in green tea revealed that its protective effects are due chiefly to catechins. Powerful polyphenolic antioxidants, catechins are astringent, water-soluble compounds that can be easily oxidized. They are a subgroup of flavonoids, weak phytoestrogenic compounds widely available in vegetables, fruit, tea, coffee, chocolate and wine. The antioxidant potential of both green and black teas, as measured by the Phenol Antioxidant Index, was found to be significantly higher than that of grape juice and red wines.

Green tea is manufactured from fresh, unfermented tea leaves; the oxidation of catechins is minimal, and hence they are able to serve as antioxidants. While the fermentation of tea leaves needed for the production of black tea produces some unique antioxidants such as theaflavins, bisflavonols and thearubigens (polymers of simple polyphenols), such fermentation reduces the catechin content, especially the strongly bioactive catechin called epigallocatechin gallate.

Epigallocatechin gallate has been singled out by many researchers as particularly important for cancer prevention.

So far, most research has been done on green tea and the activity of its various catechin components; the research on complex polymeric polyphenols found in black tea is still in an early stage.

The latest good news about green tea comes from a study done at the Karolinska Institute in Stockholm. A team of researchers headed by Dr. Yihai Cao found that green tea can block angiogenesis -- the development of new blood vessels that tumors need in order to grow and metastasize. The authors gave mice the equivalent of two-to-three cups of green tea a day. When lung cancer was induced, the mice supplemented with green tea showed significantly less tumor growth. The scientists found that green tea suppressed the development of new blood vessels and prevented metastasis. They hypothesize the epigallocatechin gallate is the compound responsible for the suppression of angiogenesis.

In an interview, Dr. Cao explained that all solid tumors depend on angiogenesis for their growth. If green tea polyphenols can prevent angiogenesis, then this would go a long way toward explaining why green tea is effective in preventing so many kinds of cancer. Dr. Cao stressed that it takes long-term consumption of green tea in order to obtain these chemopreventive benefits.

The anti-angiogenic potential of green tea could also be used for the prevention and possibly even the treatment of degenerative eye disorders, such as diabetic retinopathy, that also depend on the development of new blood vessels. In addition, inhibition of angiogenesis may be another mechanism in which green tea helps prevent heart disease, since atherosclerotic plaque also needs to develop microcirculation to keep growing.

Green tea has also been shown to help prevent metastasis. Cancer cells secrete special enzymes called collagenases in order to penetrate and colonize various tissues. It is the metastatic process that is lethal, not the primary tumor. Hence finding substances that can prevent metastasis is of prime importance in fighting cancer. A study done at the University of Shizuoka in Japan found that epigallocatechin gallate does in fact inhibit the secretion of collagenases by tumor cells (in this study, highly metastatic lung cancer cells), thus arresting their ability to invade normal tissue. Black tea theaflavins were also effective. There is also additional evidence that green tea polyphenols help inhibit angiogenesis, or the growth of new blood vessels that nourish the tumor.

Two of the green tea polyphenols, epigallocatechin-3-gallate and epicatechin-3- gallate, have been found to be effective inhibitors of 5 alpha-reductase type I, reducing the synthesis of DHT, a potent form of testosterone implicated in causing prostate enlargement and prostate cancer.

**Green Tea and Breast Cancer:**

A recent Japanese study explored in greater detail the epidemiological findings on green tea's protection against breast cancer. In this case, women with stage I, II and III breast cancer were assessed in terms of their green tea consumption. It was found that "premenopausal women who consumed more green tea had a lower number of lymph node metastases. In postmenopausal women greater consumption of green tea correlated with increased expression of the estrogen and progesterone receptor, which implies more differentiated tumor cells and better prognosis." Finally, in a seven-year follow it was found that "women with stage I or II cancer who consumed five or more cups of green tea a day had approximately half the recurrence rate of those women who consumed four cups or less."

**Anti-carcinogenic Mechanisms:**

Obviously, the anti-cancer mechanisms of green tea polyphenols are complex, and not yet completely understood. Research at the level of molecular genetics is particularly promising. We already do know enough to state with certainty that green tea is an effective chemopreventive agent. And we also know that it is best to use several anti-cancer agents (including all the major antioxidants) for synergistic prevention along all the possible pathways. Green tea works along so many pathways that it may become an indispensable part of any serious cancer-prevention program.

**Your Life Your Health:**

No herb or tea should be substituted for the best medical care available. However, in consultation with your health care provider, it is becoming more and more obvious that antioxidant substances like green tea provide enormous health benefits. And, don't ever forget to remember, it is your life and it is your health.