UNIVERSITY of MARYLAND MEDICAL SYSTEM

Green tea

Overview

Tea has been cultivated for centuries, beginning in India and China. Today, tea is the most widely consumed beverage in the world, second only to water. Hundreds of millions of people drink tea, and studies suggest that green tea (*Camellia sinesis*) in particular has many health benefits.

There are three main varieties of tea -- green, black, and oolong. The difference is in how the teas are processed. Green tea is made from unfermented leaves and reportedly contains the highest concentration of powerful antioxidants called polyphenols. Antioxidants are substances that fight free radicals -- damaging compounds in the body that change cells, damage DNA, and even cause cell death. Many scientists believe that free radicals contribute to the aging process as well as the development of a number of health problems, including cancer and heart disease. Antioxidants such as polyphenols in green tea can neutralize free radicals and may reduce or even help prevent some of the damage they cause.

In traditional Chinese and Indian medicine, practitioners used green tea as a stimulant, a diuretic (to help rid the body of excess fluid), an astringent (to control bleeding and help heal wounds), and to improve heart health. Other traditional uses of green tea include treating gas, regulating body temperature and blood sugar, promoting digestion, and improving mental processes.

Green tea has been extensively studied in people, animals, and laboratory experiments. Results from these studies suggest that green tea may help treat the following health conditions:

Atherosclerosis

Clinical studies that look at populations of people indicate that the antioxidant properties of green tea may help prevent atherosclerosis, particularly coronary artery disease. Population-based studies are studies that follow large groups of people over time or studies that compare groups of people living in different cultures or with different diets.

Researchers aren't sure why green tea reduces the risk of heart disease by lowering cholesterol and triglyceride levels. Studies show that black tea has similar effects. In fact, researchers estimate that the rate of heart attack decreases by 11% with consumption of 3 cups of tea per day.

In May 2006, however, the U.S. Food and Drug Administration (FDA) rejected a petition from teamakers to allow tea labels to claim that green tea reduces the risk of heart disease. The FDA concluded that there is no credible evidence to support that claim.

High cholesterol

Research shows that green tea lowers total cholesterol and raises HDL ("good") cholesterol in both

animals and people. One population-based clinical study found that men who drink green tea are more likely to have lower total cholesterol than those who do not drink green tea.

Results from one animal study suggest that polyphenols in green tea may block cholesterol from being absorbed in the intestine and also help the body get rid of cholesterol. In another small study of male smokers, researchers found that green tea significantly reduced blood levels of harmful LDL cholesterol.

Cancer

Several population-based clinical studies have shown that both green and black teas may help protect against cancer. For example, cancer rates tend to be low in countries such as Japan where people regularly consume green tea. However, it is not possible to know for sure from these population-based studies whether green tea actually prevents cancer in people.

Early clinical studies suggest that the polyphenols in tea, especially green tea, may play an important role in the prevention of cancer. Researchers also believe that polyphenols help kill cancerous cells and stop them from growing.

Bladder cancer. Only a few clinical studies have examined the relationship between bladder cancer and drinking tea. In one study that compared people with and without bladder cancer, researchers found that women who drank black tea and powdered green tea were less likely to develop bladder cancer. A follow-up clinical study by the same group of researchers revealed that people with bladder cancer -- particularly men -- who drank green tea had a better 5-year survival rate than those who did not.

Breast cancer. Clinical studies in animals and test tubes suggest that polyphenols in green tea inhibit the growth of breast cancer cells. In one study of 472 women with various stages of breast cancer, researchers found that women who drank the most green tea had the least spread of cancer. It was especially true in premenopausal women in the early stages of breast cancer. They also found that women with early stages of the disease who drank at least 5 cups of tea every day before being diagnosed with cancer were less likely to have the cancer come back after they finished treatment. However, women with late stages of breast cancer had little or no improvement from drinking green tea.

There is no clear evidence one way or the other about green tea and breast cancer prevention. In one very large study, researchers found that drinking tea, green or any other type, was not associated with a reduced risk of breast cancer. However, when the researchers broke down the sample by age, they found that women under the age of 50 who consumed 3 or more cups of tea per day were 37% less likely to develop breast cancer compared to women who didn't drink tea.

Ovarian cancer. In a clinical study done with ovarian cancer patients in China, researchers found that women who drank at least one cup of green tea per day lived longer with the disease than those who didn’t drink green tea. In fact, those who drank the most tea, lived the longest. But other studies found no beneficial effects.

Colorectal cancer. Clinical studies on the effects of green tea on colon or rectal cancer have showed conflicting results. Some studies show decreased risk in those who drink the tea, while others show increased risk. In one study, women who drank 5 or more cups of green tea per day had a lower risk of colorectal cancer compared to non-tea-drinkers. There was no protective effect for men, however. Other studies show that drinking tea regularly may reduce the risk of colorectal cancer in women. More research is needed before researchers can recommend green tea for the prevention of colorectal cancer.

Esophageal cancer. Studies in laboratory animals have found that green tea polyphenols inhibit the

growth of esophageal cancer cells. However, studies in people have produced conflicting findings. For example, one large-scale population-based clinical study found that green tea offered protection against the development of esophageal cancer, particularly among women. Another population-based clinical study found just the opposite -- green tea consumption was associated with an increased risk of esophageal cancer. In fact, the stronger and hotter the tea, the greater the risk. Given these conflicting results, more research is needed before scientists can recommend green tea for the prevention of esophageal cancer.

Lung cancer. While green tea polyphenols have been shown to inhibit the growth of human lung cancer cells in test tubes, few clinical studies have looked at the link between drinking green tea and lung cancer in people. And even these studies have been conflicting. One population-based study found that Okinawan tea -- similar to green tea but partially fermented -- was associated with lower lung cancer risk, particularly among women. But a second clinical study found that green tea and black tea increased the risk of lung cancer. More studies are needed before researchers can draw any conclusions about green tea and lung cancer.

Pancreatic cancer. In one large-scale clinical study researchers compared green tea drinkers with non-drinkers and found that those who drank the most tea were less likely to develop pancreatic cancer. This was particularly true for women -- those who drank the most green tea were half as likely to develop pancreatic cancer as those who drank less tea. Men who drank the most tea were 37% less likely to develop pancreatic cancer.

However, it is not clear from this population-based study whether green tea is solely responsible for lowering pancreatic cancer risk. More studies in animals and people are needed before researchers can recommend green tea for the prevention of pancreatic cancer.

Prostate cancer. Laboratory studies have found that green tea extracts prevent the growth of prostate cancer cells in test tubes. In a large clinical study in Southeast China researchers found that the risk of prostate cancer went down with increasing frequency, duration and quantity of green tea consumption. However, both green and black tea extracts also stimulated genes that cause cells to be less sensitive to chemotherapy drugs. People who are undergoing chemotherapy should ask their doctors before drinking green or black tea, or taking tea supplements.

Skin cancer. The main polyphenol in green tea is epigallocatechin gallate (EGCG). Scientific studies suggest that EGCG and green tea polyphenols have anti-inflammatory and anticancer properties that may help prevent the development and growth of skin tumors.

Stomach cancer. Laboratory studies have found that green tea polyphenols inhibit the growth of stomach cancer cells in test tubes, but studies in people have been less conclusive. In two studies that compared green tea drinkers with non-drinkers, researchers found that people who drank tea were about half as likely to develop stomach cancer and stomach inflammation as those who did not drink green tea. However, a clinical study with more than 26,000 men and women in Japan found no association between green tea and stomach cancer risk. Some studies even suggest that green tea may increase the risk of stomach cancer.

More clinical studies are underway to see whether green tea helps reduce the risk of stomach cancer.

Inflammatory Bowel Disease (IBD)

Green tea may help reduce inflammation associated with Crohn's disease and ulcerative colitis, the two types of IBD. If green tea proves to help prevent colon cancer, it would also help those with IBD because

they are at higher risk for colon cancer.

Diabetes

Green tea has been used traditionally to control blood sugar levels. Animal studies suggest that green tea may help prevent the development of type 1 diabetes and slow the progression once it has developed. In people with type 1 diabetes, their bodies make little or no insulin, which helps convert glucose or sugar into energy. Green tea may help regulate glucose in the body.

A few small clinical studies have found that taking a green tea extract daily lowered the hemoglobin A1c level in people with borderline diabetes.

Liver disease

Population-based clinical studies have shown that men who drink more than 10 cups of green tea per day are less likely to develop liver problems. Green tea also seems to protect the liver from the damaging effects of toxic substances such as alcohol. Animal studies have shown that green tea helps protect against liver tumors in mice.

Results from several animal and human studies suggest that one of the polyphenols in green tea, known as catechin, may help treat viral hepatitis, an inflammation of the liver. In these studies, catechin was used by itself in very high amounts. It is not clear whether green tea, which has a lower concentration of catechins, would have the same benefits.

10 cups of green tea a day could cause problems because of the high level of caffeine consumed. Ask your doctor about the best way to include green tea in your treatment.

Weight loss

Clinical studies suggest that green tea extract may boost metabolism and help burn fat. One study found that the combination of green tea and caffeine improved weight loss and maintenance in people who were overweight and moderately obese. Some researchers think that substances in green tea known as catechins are responsible for the herb's fat-burning effect.

Other uses

One small study found that drinking green tea helped prevent dental cavities. More studies need to be done. Green tea may also be useful in inflammatory diseases, such as arthritis. Research suggests that green tea may help arthritis by reducing inflammation and slowing the breakdown of cartilage. Chemicals in green tea may also be help treat genital warts and prevent symptoms of colds and flu. Studies also show that drinking green tea is associated with reduced risk of dying from any cause.

Plant Description

Green, black, and oolong tea are all derived from the leaves of the *Camellia sinensis* plant. Originally cultivated in East Asia, this plant grows as large as a shrub or tree. Today, *Camellia sinensis* grows throughout Asia and parts of the Middle East and Africa.

People in Asian countries more commonly consume green and oolong tea while black tea is most popular in the United States. Green tea is prepared from unfermented leaves, the leaves of oolong tea are partially fermented, and black tea is fully fermented. The more the leaves are fermented, the lower the

polyphenol content (See: "What's It Made Of?") and the higher the caffeine content. Green tea has the highest polyphenol content while black tea has roughly 2 - 3 times the caffeine content of green tea.

What's It Made Of?

Researchers think the health-giving properties of green tea are mostly due to polyphenols, chemicals with potent antioxidant properties. In fact, the antioxidant effects of polyphenols seem to be greater than vitamin C. The polyphenols in green tea also give it a somewhat bitter flavor.

Polyphenols contained in teas are classified as catechins. Green tea contains six primary catechin compounds: catechin, gallaogatechin, epicatechin, epigallocatechin, epicatechin gallate, and apigallocatechin gallate (also known as EGCG). EGCG is the most studied polyphenol component in green tea and the most active.

Green tea also contains alkaloids including caffeine, theobromine, and theophylline. They provide green tea's stimulant effects. L-theanine, an amino acid compound found in green tea, has been studied for its calming effects on the nervous system.

Available Forms

Most green tea dietary supplements are sold as dried leaf tea in capsule form. Look for standardized extracts of green tea. There are also liquid extracts made from the leaves and leaf buds. The average cup of green tea contains 50 - 150 mg polyphenols (antioxidants). Decaffeinated green tea products contain concentrated polyphenols. Caffeine-free supplements are available.

How to Take It

Pediatric

Green tea has not been studied in children, so it is not recommended for pediatric use.

Adult

Depending on the brand, 2 - 3 cups of green tea per day (for a total of 240 - 320 mg polyphenols) or 100 - 750 mg per day of standardized green tea extract is recommended. Caffeine-free products are available and recommended.

Precautions

The use of herbs is a time-honored approach to strengthening the body and treating disease. However, herbs contain active substances that can trigger side effects and interact with other herbs, supplements, or medications. For these reasons, people should take herbs with care, under the supervision of a practitioner knowledgeable in the field of botanical medicine.

People with heart problems or high blood pressure, kidney problems, liver problems, stomach ulcers, and psychological disorders, particularly anxiety, should not take green tea. Pregnant and breastfeeding women should also avoid green tea.

People with anemia, diabetes, glaucoma, or osteoporosis should ask their health care provider before

drinking green tea or taking an extract.

People who drink large amounts of caffeine, including caffeine from green tea, for long periods of time may experience irritability, insomnia, heart palpitations, and dizziness. Caffeine overdose can cause nausea, vomiting, diarrhea, headaches, and loss of appetite. If you are drinking a lot of tea and start to vomit or have abdominal spasms, you may have caffeine poisoning. If your symptoms are severe, lower your caffeine intake and see your health care provider.

Possible Interactions

If you are being treated with any of the following medications, you should not drink green tea or take green tea extract without first talking to your health care provider:

Adenosine -- Green tea may inhibit the actions of adenosine, a medication given in the hospital for an irregular and usually unstable heart rhythm.

Beta-lactam -- Green tea may increase the effectiveness of beta-lactam antibiotics by making bacteria less resistant to treatment.

Benzodiazepines -- Caffeine, including caffeine from green tea, may reduce the sedative effects of these medications commonly used to treat anxiety, such as diazepam (Valium) and lorazepam (Ativan).

Beta-blockers, Propranolol, and Metoprolol -- Caffeine, including caffeine from green tea, may increase blood pressure in people taking propranolol (Inderal) and metoprolol (Lopressor, Toprol XL). These medications are used to treat high blood pressure and heart disease.

Blood Thinning Medications -- People who take warfarin (Coudamin) should not drink green tea. Since green tea contains vitamin K, it can make this medication ineffective. You should not mix green tea and aspirin because they both prevent blood from clotting. Using the two together may increase your risk of bleeding.

Chemotherapy -- The combination of green tea and chemotherapy medications, specifically doxorubicin and tamoxifen, increased the effectiveness of these medications in laboratory tests. However, the same results have not been found in studies on people. On the other hand, there have been reports of both green and black tea extracts affecting a gene in prostate cancer cells that may make them less sensitive to chemotherapy drugs. For that reason, people should talk to their doctors before drinking black and green tea or taking tea extracts while undergoing chemotherapy.

Clozapine (Clozaril) -- The effects of the clozapine may be reduced if taken within 40 minutes after drinking green tea.

Ephedrine -- When taken with ephedrine, green tea may cause agitation, tremors, insomnia, and weight loss.

Lithium -- Green tea has been shown to reduce blood levels of lithium, a medication used to treat bipolar disorder. That can make lithium less effective.

Monoamine Oxidase Inhibitors (MAOIs) -- Green tea may cause a severe increase in blood pressure, called a "hypertensive crisis," when taken together with these drugs used to treat depression. Examples of MAOIs include:

- Isocarboxazid (Marplan)
- Moclobemide (Manerix)
- Phenelzine (Nardil)
- Tranylcypromine (Parnate)

Birth control pills -- Oral contraceptives can prolong the amount of time caffeine stays in the body, which may increase its stimulating effects.

Phenylpropanolamine -- A combination of caffeine, including caffeine from green tea, and phenylpropanolamine, used in many over-the-counter and prescription cough and cold medications and weight loss products, may cause mania and a severe increase in blood pressure. The FDA issued a public health advisory in November 2000 to warn people of the risk of bleeding in the brain from use of this medication and urged all manufacturers of this drug to remove it from the market. Most drugs that contained phenylpropanolamine have been reformulated without it.

Quinolone antibiotics -- Green tea may makes these medications more effective and also increase the risk of side effects. These medications include:

- Ciprofloxacin (Cipro)
- Enoxacin (Penetrex)
- Grepafloxacin (Raxar)
- Norfloxacin (Chibroxin, Noroxin)
- Sparfloxacin (Zagam)
- Trovafloxacin (Trovan)

Other medications -- Green tea, especially caffeinated green tea, may interact with a number for medications, including:

- Acetaminophen (Tylenol)
- Carbamazepine (Tegretol)
- Dipyridamole (Persatine)
- Estrogen
- Fluvoxamine (Luvox)
- Methotrexate
- Mexiletine (Mexitil)
- Phenobarbital
- Theophylline
- Verapamil (Bosoptin, Calan, Covera- HS, Verelan, Verelan PM)

To be safe, check with your health care provider before drinking or taking green tea if you also take other medications.

Supporting Research

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Alternative Names

Camellia sinensis

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