

GREEN TEA AND ITS EFFECT ON HEALTH

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Abstract

Green tea in its purest and most unadulterated form has always influenced human health from generations and day by day scientific evidences throughout the world are making people aware of health benefits associated with this herbal drink. Green tea is rich in polyphenols, chemicals with potent antioxidant properties. In fact, the antioxidant effects of polyphenols seem to be greater than vitamin C. Though Green Tea is not officially recognized as a medical agent, it is one of the most researched plant-based remedies whose possible benefits include promotion of cardio-vascular health, cancer prevention, skin protection, and antioxidant activity, to fight high cholesterol levels, infection, impaired immune function, diarrhea, fatigue. Laboratory findings have revealed that notable health benefit of green tea is its powerful antioxidants potential which at the molecular level, helps prevent cellular damage from certain oxidation reactions in the body.

Key words: Green tea, antioxidant, polyphenols, active compound (EGCG), health effect.

Introduction

Green tea is made from the leaves from *Camellia sinensis* that have undergone minimal oxidation during processing. Green tea originates in China, but it has become associated with many cultures throughout Asia. Green tea has recently become more widespread in the West, where black tea

has been the traditionally consumed tea. Green tea has become the raw material for extracts which are used in various beverages, health foods, dietary supplements, and cosmetic items. Green tea extracts can be taken in capsules and are sometimes used in skin products.

Over the last few decades green tea has been subjected to many scientific and medical studies to determine the extent of its long-purported health benefits, with some evidence suggesting that regular green tea drinkers may have a lower risk of developing heart disease and certain types of cancer. Although green tea does not raise the metabolic rate enough to produce immediate weight loss, a green tea extract containing polyphenols and caffeine has been shown to induce thermogenesis and stimulate fat oxidation, boosting the metabolic rate 4 percent without increasing the heart rate.

The mean content of flavonoids in a cup of green tea is higher than that in the same volume of other food and drink items that are traditionally considered of health contributing nature, including fresh fruits, vegetable juices or wine. Flavonoids are a group of phytochemicals present in most plant products that are responsible for health effects such as anti-oxidative and anti-carcinogenic functions. However, the content of flavonoids may vary dramatically amongst different tea products.

History of tea

The Chinese have known about the medicinal benefits of green tea since ancient times, using it to treat everything from headaches to depression. In her book *Green Tea: The Natural Secret for a Healthier Life*, **Nadine Taylor** states that green tea has been used as a medicine in China for at least 5,000 years.

Green tea has been used as traditional medicine in areas such as India, China, Japan and Thailand to help everything from controlling bleeding and helping heal wounds to regulating body temperature, blood sugar and promoting digestion.

Facts about Green Tea Nutrition

The nutritional value of green tea and highly debated, but many experts agreed that the nutritional benefits of green tea is really incredible. Here is some interesting nutritional information about this tea:

- Green tea is a hydrating calorie-free beverage whose consumption is recommended up to eight cups per day.
- Green tea is an exceptionally good source of antioxidants and alkaloids.
- It is believed that there are no calories in green tea without any additives or sweeteners. But all teas and coffees contain some calories - but very few.
- Green tea contains various vitamins like A, D, E, C, B, B5, H and K.
- It is a rich source of Manganese and has many other beneficial minerals as Zinc, Chromium and Selenium.
- The most important active component in green tea epigallocatechin-3-gallate (EGCG) is many times a more powerful antioxidant than vitamin C or vitamin E.

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 epigallocatechin 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.

Active Compounds

The active compounds in green tea are from a group of polyphenols called catechins. Four catechins present in green tea:

- **Epicatechingallate**
- **Epicatechin**
- **Epigallocatechin**
- **Epigallocatechingallate**

Catechins- Family of flavan-3 ; Sub group of flavanoids – technically not a flavanoid due to lack of carbonyl group. Catechins have polyphenyl groups which have been shown to have anti-oxidant and anti-carcinogenic properties. Catechins make up slightly less than 30% of dry weight. Epicatechin and epigallocatechin most commonly found in nature. Epigallocatechin gallate most frequent catechin found in Green Tea. Thought to hold most antioxidant activity.

Other Active Components

- Vitamin C - antioxidant
- B Vitamins- Metabolize carbohydrates
Manufacture fatty acids and amino acids
- Vitamin E - Antioxidant

- Fluoride - Protection of tooth decay and gum disease
- Caffeine (3-4%) - Up to 400 milligrams (mg) of caffeine a day appears to be safe for most healthy adults. That's roughly the amount of caffeine in four cups of brewed coffee, 10 cans of cola or two "energy shot" drinks. Although caffeine use may be safe for adults, it's not a good idea for children. And adolescents should limit themselves to no more than 100 mg of caffeine a day. (Seifert et.al., 2011)

What makes green tea so special?

- The secret of green tea lies in the fact it is rich in catechin polyphenols, particularly epigallocatechin gallate (EGCG). EGCG is a powerful anti-oxidant besides inhibiting the growth of cancer cells, it kills cancer cells without harming healthy tissues. It has also been effective in lowering LDL cholesterol levels, and inhibiting the abnormal formation of blood clots. The latter takes on added importance when you consider that thrombosis (the formation of abnormal blood clots) is the leading cause of heart attacks and stroke.
- For years, researchers were puzzled by the fact that, despite consuming a diet rich in fat, the French have a lower incidence of heart disease than Americans. The answer was found to lie in red wine, which contains resveratrol, a polyphenol that limits the negative effects of smoking and a fatty diet. In a 1997 study, researchers from the University of Kansas determined that EGCG is twice as powerful as resveratrol, which may explain why the rate of heart disease among Japanese men is quite low, even though approximately seventy-five percent are smokers.
- Green, oolong, and black teas all come from the leaves of the *Camellia sinensis* plant. Green tea leaves are steamed, which prevents the EGCG compound from being oxidized. By contrast, black and oolong tea leaves are made from fermented leaves, which results in the EGCG being converted into other compounds that are not nearly as effective in preventing and fighting various diseases.
- New evidence is emerging that green tea can even help dieters. In November, 1999, the *American Journal of Clinical Nutrition* published the results of a study at the University of Geneva in Switzerland. Researchers found that men who were given a combination of caffeine and green tea extract burned more calories than those given only caffeine or a placebo.
- Green tea can even help prevent tooth decay. Just as its bacteria-destroying abilities can help prevent food poisoning, it can also kill the bacteria that causes dental plaque. Meanwhile, skin preparations containing green tea - from deodorants to creams - are starting to appear on the market.

Health Benefits of Green tea

Green tea contains a variety of enzymes, amino acids, carbohydrates, lipids, sterols, polyphenols, carotenoids, tocopherols, vitamins, caffeine and related compounds, phytochemicals and dietary minerals. Numerous claims have been made for the health benefits of green tea based on chemical composition, in vitro and animal studies, though results in humans have been inconsistent and few clear benefits for humans have been demonstrated. There is also evidence suggesting consuming large volumes of green tea, and in particularly green tea extracts, may cause oxidative stress and liver toxicity.

A systematic review concluded the evidence that green tea can prevent cancer "is inadequate and inconclusive" but with some evidence for a reduction in certain types of cancer (breast, prostate, ovarian and endometrial). Green tea may lower blood low-density lipoprotein and total cholesterol levels, though the studies were of short duration and it is not known if these effects result in fewer deaths and evidence does not support green tea reducing coronary artery disease risk. Several randomized controlled trials suggest green tea can reduce body fat by a small amount for a short time, though it is not certain if the reduction would be meaningful for most people. One study has found that green tea may actually damage DNA. Green tea is forbidden for people with Multiple Myeloma (MM) if they use the drug Bortezomib (Velcade) or similar.

Protects against Coronary Artery Disease

An elevation in the amount of free radicals in the arteries is a key event in many forms of cardiovascular disease. The latest research shows that green tea catechins inhibit the enzymes involved in the production of free radicals in the endothelial lining of the arteries. The arterial endothelium is a one-cell thick lining that serves as the interface between the bloodstream and the wall of the artery where plaques can form. By protecting the endothelium from free radical damage, green tea catechins helps prevent the development of cardiovascular disease. **Christopher wiechert, C.N.C.**

Thins the Blood and Helps Prevent Blood Clots

Green tea catechins help thin the blood and prevent the formation of blood clots by preventing the formation of pro-inflammatory compounds derived from omega-6 fatty acids, which are found in meats and polyunsaturated vegetable oils such as corn, safflower and soy oil. These pro-inflammatory compounds - specifically, arachidonic acid from which the inflammatory cytokines thromboxane and prostaglandin are derived - cause platelets to clump together.

Protects the Heart in Patients with Acute Cardiovascular Disease

The primary catechin in green tea, EGCG (epigallocatechin-3-gallate) confers such powerful protection that it can help prevent the death of heart muscle cells following ischemia/reperfusion injury. Ischemia is the medical term for a restriction in blood supply and therefore in oxygen and nutrients. When circulation is restored, oxidative damage occurs, and this is referred to as reperfusion injury.

EGCG prevents heart muscle damage by blocking the activation of inflammation-related compounds that play a critical role in promoting the oxidative damage that kills heart cells in reperfusion injury. Researchers believe EGCG can be used to help minimize damage in patients with acute coronary artery disease.

Minimizes Damage and Speeds Recovery after a Heart Attack

Research conducted over the last several years by Dr. Anastasis Stephanou and his team at the UK's Institute of Child Health and published in the *FASEB Journal*, *the journal of the Federation of Experimental Biology* and *the Journal of Cellular and Molecular Medicine* has focused on EGCG's ability to block the action of the protein, plays a major role in inducing cell death.

Prevention and treatment of neurological diseases

Polyphenols in green tea may help maintain the parts of brain that regulate learning and memory. So, regular consumption of green tea could help in prevention of degenerative and neurological diseases like Alzheimer's and Parkinson's.

Minimizes Damage to the Brain after a Stroke

EGCG has also been shown to protect brain cells by these same mechanisms and thus may help minimize the brain damage that occurs after a stroke. In one animal study, green tea was so effective in reducing the formation of free radicals in brain tissue that the researchers concluded, "Daily intake of green tea catechins efficiently protects the brain from irreversible damage due to cerebral ischemia, and consequent neurologic deficits."

Lowers Blood Pressure and Helps Prevent Hypertension

A study published in the July 2004 issue of the *Archives of Internal Medicine* found that among persons consuming tea regularly for at least one year, the risk of developing high blood pressure was 46 percent lower among those who drank 1/2 cup to 2-1/2 cups per day, and 65% less among those consuming more than 2-1/2 cups per day.

Helps you lose weight

A new study shows that green tea extract increases the rate of calorie burning by the body. It reduces blood fat, cholesterol, bloatedness, detoxifies the body and suppresses untimely food cravings. Enabled with diuretic properties, it also eliminates excess water and thereby reduces excess weight. So the best way to get rid of that paunch is to have green tea along with the right amount of bodily exercise.

Boosts exercise endurance

According to scientists, antioxidants present in green tea extracts increase body's ability to burn fat as fuel which accounts for improved muscle endurance. It also enhances energy levels and boosts your metabolism.

Hydration benefits

Contrary to common belief that tea dehydrates, green tea provides hydration benefits similar to water. Tea not only rehydrates as well as water does, it also has many other health benefits.

Protection from harmful ultraviolet rays

The sun's UV rays in summer act as a constant threat. Green tea is rich in antioxidants that scavenge harmful free radicals in the body according to researches. Also using green tea extracts along with your sunscreen could afford you the greatest level of sun protection.

Keeps Diabetes in check

Green tea can do wonders to a person suffering from diabetes. Green tea apparently helps regulate glucose levels slowing the rise of blood sugar. It also triggers and stimulates insulin production and activates the functioning of pancreas to some extent. Blood sugar level in the body is also normalized and regularized by the use of green tea.

Anti- Ageing benefits

Antioxidants found in green tea fight free radicals thereby keeping a check on ageing and promoting longevity. Because it contains high levels of oligomeric proanthocyanidins one of the most powerful antioxidants, Green Tea is thought to help slow down the premature ageing process.

Boosts your immunity

Polyphenols and Flavonoids present in green tea boost the immune system to make the human body stronger in fighting various infections. Also, Vitamin C present in green tea keeps cold and flu away.

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. 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 tea makers 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.

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.

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.

Protects against Kidney Disease

An animal study published in the January 2005 issue of *Pharmacological Research* suggests yet another beneficial effect of green tea consumption: the prevention of kidney dysfunction in persons who must take powerful immune suppressant drugs, for example, after an organ transplant.

Prevents Osteoporosis and Periodontal diseases

Green tea supports healthy bones and teeth both by protecting osteoblasts (the cells responsible for building bone) from destruction by free radicals, and by inhibiting the formation of osteoclasts (the cells that break down bone).

Another benefit of green tea consumption for those with periodontal disease: green tea short circuits the damaging effects of the bacteria most responsible for gum disease, *Porphyromonas gingivalis*. *P. gingivalis* causes gum damage by producing toxic by products such as phenylacetic acid and by stimulating the activity and production of enzymes called metallo proteinases (MMPs), which destroy both the mineral and organic constituents that make up the matrix of our bones. Epigallocatechin-3-gallate (EGCG) inhibits *P. gingivalis*' production of both phenylacetic acid and MMPs.

Protects the Liver from Alcohol and Other Harmful Chemicals

Alcohol metabolism results in the production of damaging free radicals that can overwhelm the liver's supply of antioxidants, resulting in liver injury. In a study published in the January 2004 issue of

Alcohol in which rats were chronically intoxicated with alcohol for 4 weeks, green tea prevented damage to their livers.

Protects against Cognitive Decline, Alzheimer's disease and Parkinson's Disease

Damage to brain cells in Parkinson's, Alzheimer's and other neurodegenerative diseases seems to result from the combination of a number of damaging factors including excessive inflammation and increased levels of iron, both of which lead to increased free radical production, exhaust the brain's supply of protective antioxidants and trigger the production of certain proteins, such as amyloid-beta, which promote apoptosis (cell suicide).

Green tea catechins, until recently thought to work simply as antioxidants, are now known to invoke a wide spectrum of neuroprotective cellular mechanisms. These include iron chelation, scavenging of free radicals, activation of survival genes and cell signaling pathways, and regulation of mitochondrial function. (The mitochondria are the energy production factories inside our cells. When they are not working properly, they generate many free radicals and little energy.) The end result is a significant lessening of damage to brain cells.

Iron accumulation in specific brain areas and free radical damage to brain cells are considered the major damaging factors responsible for a wide range of neurodegenerative disorders including both Parkinson's and Alzheimer's disease.

In the brain, epigallocatechin-3-gallate (EGCG) has been shown to act as an iron chelator, binding to and removing iron, thus preventing it from contributing to the production of free radicals. In addition to removing iron, EGCG also increases the activity of two major antioxidant enzymes, superoxide dismutase (SOD) and catalase, further helping to decrease free radical damage.

Another active compound in green tea, epicatechin (EC), reduces the formation of a protein called amyloid-beta. Plaque-like deposits of amyloid-beta in the brain are a defining characteristic of Alzheimer's disease.

Conclusion

The beneficial effects of green tea are attributed to the polyphenols, particularly the catechins, which make up 30 percent of the dry weight of green tea leaves. These catechins are present in higher quantities in green tea than in black because of the differences in the processing of tea leaves after harvest. Green tea polyphenols are effective in preventing many chronic diseases such as cancer, diabetes, and heart disease and they are effective in helping to maintain healthy weight.

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