

A REVIEW ON *CAMELLIA SINENSIS* (GREEN TEA) AND ITS BENEFICIAL HEALTH EFFECTS

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ABSTRACT

The health benefits of green tea for a wide variety of conditions, including distinct types of cancer, heart disease, and liver disease were reported. Many of the beneficial effect of green tea are due to its (-)-epigallocatechin-3-gallate, content. There is evidence from in vitro and animal studies on the underlying mechanism of green tea catechins and their biological actions. There are also studies on human being on using green tea catechins to treat metabolic syndrome, such as obesity, type II diabetes, and cardiovascular risk factors. Long-term consumption of green tea catechins could be beneficial against type II diabetes and high-fat diet-induced obesity and reduce the risk of coronary disease. Further research is needed to elucidate its mechanism of action and international standards should be performed to monitor the pharmacological and clinical effects of green tea.

KEY WORDS: Green Tea, Catechins, diabetes, polyphenols.

INTRODUCTION

Tea is the most consumed drink in the world after water. Green tea is a 'non-fermented' tea, and contains more catechins, than black tea or oolong tea. The health benefits of consuming green tea, including the anticipation of cancer and cardiovascular diseases, the anti-inflammatory, antiarthritic, reduces atherosclerosis, the hardening and thickening of arteries, antioxidants, antiviral, neuroprotective, and reduces cholesterol level. Increasing interest has led to the inclusion of green tea in the group of beverages mainly due to its health benefits. Since ancient times, green tea has been considered by the traditional Chinese medicine as a healthful beverage. The health benefits and adverse effects of green tea and its catechins were reviewed. Green tea is the nature's treasure to the mankind. It is next to water as the most consumed beverage in the world. Green tea is derived from the leaves of the plant *Camellia sinensis* which is basically an angiosperm dicot plant. The plant is native to Southeast Asia and an evergreen shrub. Its ancestry begins in China. China is credited with introducing tea to the world, though the evergreen tea plant is native to North India, Southern China, Cambodia and Myanmar.

GREEN TEA

The tea industry is one of the oldest organized industries in India and Indian teas are appreciated world over as health drink for their unique flavor, aroma, and medicinal properties. India produces three specialty teas – Darjeeling, Assam and Nilgris, which are exported world over. Tea is grown in 13 states and Assam, West Bengal, Tamil Nadu and Kerala are the largest producers. India is the second largest producer and the fourth largest exporter of tea globally. Tea, from the plant *Camellia sinensis*, is consumed in different parts of the world as green, black, or Oolong tea. However, the most significant effects on human health have been observed with the consumption of green tea. Black tea and green tea are processed differently from their raw materials during manufacturing. To produce green tea, freshly harvested leaves are immediately steamed in order to prevent fermentation, yielding a dry and stable product. Although, in steaming process the enzymes are destroyed, which are responsible for breaking down the color pigments in the leaves and allows the tea to maintain its green color. In this processes natural polyphenols are preserved and having properties of health-promotion. Polyphenol compounds (catechins) in green tea are dimerized to form a variety of theaflavins, such that these teas may have different biological activities.

GREEN TEA COMPOSITION

The chemical composition of green tea varies with climate, season, horticultural practices, and position of the leaf on the harvested shoot. The active constituents in green tea are very strong antioxidants called

polyphenols. Tea is reported to contain nearly about 4000 bioactive compounds. Out of which, one third ($1/3^{\text{rd}}$) is contributed by polyphenols. Among the polyphenols present in tea, a family of compounds are called the flavanoids. Flavanoids and their fraction, catechins are the basic phenolic compounds in green tea responsible for antioxidant activities such as neutralization of free radicals that are formed in the process of metabolism. These flavanoids contains a substance called catechins. Major catechins present in green tea are epicatechin (EC), epigallocatechin gallate (EGCG), epigallocatechins (EGC) and epicatechin gallate (ECG). The most active and abundant catechin in green tea is epigallocatechin-3-gallate. The relative catechins content of green tea depends on how the leaves are processed before drying. Black tea contains much lower concentrations of these catechins than green tea.

Table 1 Composition (%) of green tea and black tea.

| Compound | Green Tea* | Black Tea* |
|---------------------|------------|------------|
| Proteins | 15 | 15 |
| Amino Acids | 4 | 4 |
| Fiber | 26 | 26 |
| Other Carbohydrates | 7 | 7 |
| Lipids | 7 | 7 |
| Pigments | 2 | 2 |
| Minerals | 5 | 5 |
| Phenolic Compounds | 30 | 5 |

* Data refer to dry weight of tea leaves

There are four kinds of catechins mainly present in green tea are epigallocatechin, epicatechin, epicatechin-3-gallate, and epigallocatechin gallate. The method of preparation influence the catechins both quantitatively and qualitatively. The preparation of fresh green tea can't totally extract catechins from the leaves. Therefore, the obtained concentration may be differs from the determined absolute values through the complete extraction of leaves. However, catechins are relatively unstable and could be quantitatively and qualitatively modified during the experiment.

HEALTH BENEFITS OF GREEN TEA

Studies using animal models show that green tea catechins provide some protection against degenerative diseases. Green tea consumption has also been linked to the prevention of many types of cancer, including lung, mouth, colon, oesophagus, , stomach, small intestine, pancreas, kidney, and mammary glands. Several epidemiological studies and clinical trials are conducted and it has been confirmed that green tea may reduce the risk of many chronic diseases. This beneficial effect has been attributed to the presence of high amounts of polyphenols, which are powerful antioxidants. Actually, green tea may lower blood pressure and thus reduce the risk of stroke and coronary heart disease. Some animal's studies also suggested the fact that green tea might protect against the development of coronary heart disease by normalizing blood glucose levels. The antioxidative potency of catechins and crude catechin powder was tested by experiments using the active oxygen method. Crude catechins reduced the formation of peroxides far more effectively than α -tocopherol. Since ancient times, the effectiveness of green tea in treating any type of diarrhoea and typhoid has been known in Asia. The effectiveness of green tea against the influenza virus, especially in its earliest stage, as well as against the Herpes simplex virus has also been demonstrated. Green tea consumption has also been associated with increased bone mineral density, and it has been identified as an independent factor protecting against the risk of hip fractures. Green tea boosts the immune system and provides strength, because it protects it against oxidants and radicals. Recent studies suggested that green tea polyphenols (GTPs) might protect against Parkinson's and Alzheimer's diseases and other neurodegenerative diseases. Green tea has been shown anticarcinogenic effects against breast cancer in experimental studies. However, epidemiologic evidence related to the fact that tea protects against breast cancer has been inconsistent.

ACT AS ANTIOXIDANT

Green tea is a popular nutraceutical as an antioxidant. Antioxidants are compounds that protect cells against the damaging effects of reactive oxygen species, such as singlet oxygen, superoxide, peroxy radicals and hydroxyl radicals. An imbalance between antioxidants and reactive oxygen species results in oxidative stress, leading to cellular damage. Catechins are hypothesized to help protect against these diseases by contributing, along with antioxidant vitamins (i.e., vitamins C and E) and enzymes (i.e., superoxide dismutase and catalase), to the total antioxidant defense system. In vivo studies showed that green tea catechins increase total plasma antioxidant activity. Intake of green tea extracts also increases the activity of superoxide dismutase in serum and the expression of catalase in the aorta. These enzymes are implicated in cellular protection against reactive oxygen species. This action is combined with direct action on oxygen species by a decrease in the nitric oxide plasma concentration. Malondialdehyde, a marker of oxidative stress, also decreases after green tea intake. These results suggest that catechins could have a direct (antioxidant) or indirect (increase of activity or expression) effect. Since catechins can act as antioxidants in vitro, they might prevent the oxidation of other antioxidants.

REDUCE RISK OF CARDIOVASCULAR DISEASE

Intake of green tea can also reduce the risk of cardiovascular diseases. Heart diseases and stroke are associated with a number of risk factors, which includes a diet high in saturated fats and low physical activity. Regular consuming green tea also inhibits atherosclerosis. Green tea has been shown to effectively lower low-density lipoprotein, Cholesterol, triglycerides, lipid peroxides and fibrinogen while improving the ratio of bad / good cholesterol i.e. Ratio of low-density lipoprotein (LDL) to high density lipoprotein (HDL) cholesterol. The potent antioxidant effect of green tea inhibits the oxidation of LDL cholesterol in the arteries which plays a major contributor role in the formation of atherosclerosis.

ACT AS ANTICANCER

In contrast to the consistent results of an inhibitory effect of green tea extracts and tea polyphenols on the development and growth of carcinogen-induced tumors in experimental animal models, results from human studies are mixed. Both observational and intervention studies have provided evidence in support of a protective role of green tea intake in the development of oral–digestive tract cancer or an inhibitory role of oral supplementation of green tea extract on a precancerous lesion of oral cavity. However, evidence in support of green tea intake against the development of liver cancer risk is limited and inconsistent. Current data neither confirm nor refute a definitive cancer-preventive role of green tea intake. Large randomized intervention trials on the efficacy of green tea polyphenols or extracts are required before a recommendation for green tea consumption for cancer prevention should be made.

ACTS AS ANTI-DIABETIC

Green tea has an antidiabetic effect. It lowered glucose levels in the bloodstreams of diabetic mice without affecting insulin levels. Long-term administration of green tea extract to normal rats increased insulin sensitivity. When administered to fructose-fed rats, green tea extract was also found to prevent development of insulin resistance, hyperglycaemia and other metabolic defects.

PROMOTE REHABILITATION OF HEART CELLS

The adherence of monocytes to vascular endothelial cells is an important early event in atherogenesis. Monocyte adherence to endothelial cells is induced by oxidized LDL and mediated by multiple cell-adhesion molecules. Enhanced endothelial expression of these molecules by oxidized LDL has been shown to be a critical step in foam cell formation and the development of atherosclerosis. Recent studies have demonstrated that tea catechin, especially (-)-epigallocatechin-3-gallate, inhibits the expression of these molecules by endothelial cells in response to stimulation with oxidized LDL or inflammatory cytokines and the expression of CD11b by monocytic leukocytes. An in vivo study using apolipoprotein E-deficient mice has demonstrated that tea catechin extracts prevent the development of atherosclerosis and that (-)-epigallocatechin-3-gallate effectively reduces the progression of accelerated atherosclerotic plaque formation induced by cuff injury. However, available data suggest that tea catechin may provide a unique approach to reduce atherosclerosis, although further studies will be necessary to clarify the precise

mechanism of these effects, especially the role of metabolites of catechin and the target sites of these compounds.

MINIMISE THE HIGH BLOOD PRESSURE

It has been found that in the short term, green tea didn't seem to make a difference for blood pressure but long-term tea intake did have a significant impact. It has been reported that intake of green tea for 12 weeks reduce blood pressure by 2.6 mmHg systolic and 2.2 mmHg diastolic. Green tea had the most significant results, while black tea performed the next best.

PREVENT TOOTH DECAY

The nutrient present in green tea may help treat tooth sensitivity—and prevent cavities. Green tea has long been touted for its health benefits. The drink is rich in polyphenols, which have been shown to help slow the growth of bacteria associated with gum disease. Green tea may also prove beneficial in treating tooth sensitivity because of green tea rich in fluoride which helps in formation of tooth enamel—and preventing the formation of cavities in patient.

STRENGTHEN IMMUNITY

Aside from their anti-cancerous properties, the antioxidants in green tea are beneficial in generally strengthening the immune system. By protecting it against damage from compounds known as free radicals and similar compounds in the body, green tea keeps the immune system running normally. Certain antioxidants called polyphenols in green tea have anti-inflammatory properties, resulting in a fundamental change in immune system response that could be beneficial in managing rheumatoid arthritis and other autoimmune diseases.

CONCLUSIONS

Human studies suggest that green tea may contribute to a reduction in the risk of cardiovascular disease and some forms of cancer, as well as to the promotion of oral health and other physiological functions such as antihypertensive effect, body weight control, antibacterial and antivirasic activity, bone mineral density increase, antifibrotic properties and neuroprotective power. Increasing interest in its health benefits has led to the inclusion of green tea in the group of beverages with functional properties. Other traditional uses of green tea include treating flatulence (gas), regulating body temperature and blood sugar, promoting digestion and improving mental processes. As an herbal remedy, green tea is often recommended to ease stomach discomfort, vomiting and to stop diarrhoea. The antibacterial action of tea is useful in treating infections and wounds.

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