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Journal home page: <http://www.pharmasm.com>**GREEN TEA AS A WONDERFUL AND GRATEFUL DRINK FOR PROMOTING HEALTH**

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ABSTRACT

Tea is the most popular drink after water, consumed everyday by millions of people around the world. Tea is generally consumed in the forms of green, oolong and black tea, all of which originate from the leaves of the plant *Camellia sinensis*. Green tea has been considered by the traditional Chinese medicine as a healthful beverage. It was used medicinally to treat various illnesses. Health benefits are believed to be largely due to the presence of high levels of flavonoids. Recent 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. In addition, green tea possesses significant antioxidant, anti-inflammatory, antimicrobial, antihypertensive, thermogenic properties. The human studies on using green tea catechins to treat metabolic syndrome, such as obesity, type II diabetes and cardiovascular risk factors. Long-term consumption of tea catechins could be beneficial against high-fat diet-induced obesity and type II diabetes and could reduce the risk of coronary disease. Green tea is used to improve mental alertness and thinking; it is also used for weight loss and to treat stomach disorders, vomiting, diarrhea, headaches, bone loss (osteoporosis) and solid tumor cancers. The present review focuses on the beneficial effects of tea consumption on human health.

KEYWORDS: Green tea, Chemistry and Composition, Health Benefits, Toxicity.

INTRODUCTION

Today Tea is one of the most widely consumed beverages in the world, second only to water, well ahead of coffee, beer, wine and carbonated soft drinks. 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. The tea plant, *Camellia sinensis* (Figure.1), is a member of the Theaceae family and black, oolong and green tea are produced from its leaf and buds. It is an evergreen shrub or tree that can grow to a height of 30 feet but is usually clipped to a height of 2.5 feet in cultivation. The tree or shrub is heavily branched with dark-green, hairy, oblong, ovate leaves cultivated and preferentially picked as young shoots. Green tea is produced from steaming fresh leaves at high temperatures, thereby inactivating the oxidizing enzymes and leaving the polyphenol content intact. In USA, the 80% of tea consumed is black ice tea. Tea leaves as well as the resulting beverage tea are known to possess high amounts of polyphenols, especially flavanols catechins. Chemical analyses revealed that green tea contains significant amounts of vitamins and minerals such as ascorbic acid, riboflavin, niacin, folic acid, pantothenic acid, magnesium, potassium, manga-

nese and fluoride. To produce green tea, freshly harvested leaves are immediately steamed to prevent fermentation, yielding a dry, stable product. This steaming process destroys the enzymes responsible for breaking down the colour pigments in the leaves and allows the tea to maintain its green color during the subsequent rolling and drying processes. These processes preserve natural polyphenols with respect to the health-promoting properties. As green tea is fermented to Oolong and then to black tea, polyphenol compounds (catechins) in green tea are dimerized to form a variety of theaflavins, such that these teas may have different biological activities. Several epidemiological studies and clinical trials showed that green tea might reduce the risk of many chronic diseases, including cardiovascular disease, reduce the risk of stroke and coronary heart disease.

Some people use green tea to prevent various cancers, including breast cancer, prostate cancer, colon cancer, gastric cancer, lung cancer, solid tumor cancers and skin cancer related to exposure to sunlight. Some women use green tea to fight human papilloma virus (HPV), which can cause genital warts, the growth of abnormal cells in the cervix (cervical dysplasia) and cervical cancer. Green tea is also used for Crohn's disease, Parkinson's disease, diseases of the heart and blood vessels, diabetes, low blood pressure, chronic fatigue syndrome (CFS), dental cavities (caries), kidney stones, and skin damage.



Figure.1

CHEMISTRY AND COMPOSITION OF TEA:

To produce green tea, freshly harvested leaves are rapidly steamed or pan-fried to inactivate enzymes, thereby preventing fermentation and producing a dry, stable product. They also showed that epicatechins are the main compounds in the green tea and accounting for its characteristic colour and flavour. Green tea chemical composition is complex: proteins (15- 20% dry weight) whose enzymes constitute an important fraction; amino acids (1–4% dry weight) such as teanine or 5-N-

ethylglutamine, glutamic acid, tryptophan, glycine, serine, aspartic acid, tyrosine, valine, leucine, threonine, arginine, lysine; carbohydrates (5-7% dry weight) such as cellulose, pectins, glucose, fructose, sucrose; lipids as linoleic and linolenic acids; sterols as stigmaterol; vitamins (B, C, E); bases such as caffeine and theophylline; pigments as chlorophyll and carotenoids; volatile compounds as aldehydes, alcohols, esters, lactones, hydrocarbons, etc.; minerals and trace elements (5% dry weight) such as Ca, Mg, Cr, Mn, Fe, Cu, Zn, Mo, Se, Na, P, Co, Sr, Ni, K, F and Al^[14]. The composition of the tea depends on a variety of factors, including climate, season, horticultural practices, the type and age of the plant. Green tea contains two groups of compounds, polyphenol and alkaloids. Fresh leaves contain, on average, 3-4% of alkaloids known as methylxanthines, such as caffeine, theobromine, and theophylline provide the stimulant effects of tea and build prominently in the experience of tea drinking, although they are not thought to be central to tea medicinal effects.



Figure.2-The appearance of green tea in three different stages (from left to right): the infused leaves, the dry leaves and the liquid. Notice that the infused leaves look greener than the dry leaves.

VARIETIES OF GREEN TEA ²³

The number of varieties of green tea as follows,

1. Chinese green tea
E.g.; Longjing, Huiming, Long Ding, Hua Ding, Qing Ding, Gunpowder, Rain Flower etc.
2. Japanese green tea
E.g.; Sencha, Gyokuro, Kabusecha, Tamaryokucha, Bancha, Kamairicha, Shincha, Aracha etc.
3. Other green teas
 - a) Green tea from Ceylon
 - b) Kahwah



HEALTH BENEFITS OF GREEN TEA

Consumption of green tea provides a protection against stroke, liver disease, bacterial infection, cancer, viral infection and lowers the risk of osteoporosis. Green tea catechins were reported to have a protective effect on mammalian hepatic cells, leading to its therapeutic use for hepatitis. Green tea catechins inhibit the growth of various bacteria. Catechins and green tea extracts show minimal inhibitory concentrations ranging from 100 to 1000 $\mu\text{mol} / \text{L}$ against various bacteria.

The health benefits of green tea is discussed one by one as below,

1) Anti-inflammatory effects of tea:

The polyphenolic fraction from green tea was shown to protect against inflammation caused by certain chemicals, such as 12-O-tetradecanoylphorbol-13-acetate, a principle irritant in croton oil ^[3], or by ultraviolet radiation. Green tea has also been shown to be effective against the immunosuppression caused by ultraviolet radiation. Green tea polyphenols are potent anti-inflammatory agents and have been shown to inhibit nitric oxide (NO) production in tumor cell lines. Haqqi et al. ^[4] suggested that green tea polyphenol (GTP), that is potent antioxidant, might be useful in the prevention of onset and severity of arthritis.

2) Anticancer effects of tea:

Worldwide interest in green tea as a cancer preventive agent for humans has increased, because it is non-toxic and it is effective in wide range of organs. Consumption of green tea is a practical and effective cancer preventive both before cancer onset and after cancer treatment ^[6]. The consumption of tea and its polyphenolic constituents affords protection against chemical carcinogen or ultraviolet radiation-induced skin cancer in the mouse model. Tea consumption also affords protection against can-

cers induced by chemical carcinogens that involve the lung, fore stomach, esophagus, duodenum, pancreas, liver, breast, colon, and skin in mice, rats, and hamsters [5].

Gupta et al. [7] reported that 0.1 % green tea polyphenols provided to transgenic adenocarcinomas of the mouse prostate (TRAMP) mice resulted in significant delay in primary tumor incidence and tumor burden, (ii) significant decrease in prostate (64%) and genitourinary (72%) weight, (iii) significant inhibition in serum insulin-like growth factor-I and restoration of insulin-like growth factor binding protein-3 levels, and (iv) marked reduction in protein expression of proliferating cell nuclear antigen (PCNA) in the prostate compared with water-fed TRAMP mice.

Today Now, researchers have new clues about how it may work to help prevent or slow the growth of prostate and breast cancers. Men with prostate cancer who drank green tea had less prostate tissue inflammation, linked to cancer growth and other changes than those who didn't drink it. Prostate cancer is typically a slow-growing cancer²⁴.

3) Effect of green tea on coronary heart disease:

Coronary heart disease is most prevalent in the Western world, probably as a diet high in saturated fats and low physical activity and the large proportion of the population who smoke cigarettes and have high blood pressure. A variety of epidemiologic studies showed the preventive effect of green tea consumption against atherosclerosis and coronary heart disease. Tea consumption has also been shown to reduce the risk of high blood cholesterol concentration and high blood pressure. Priyadarshi et al. [9] reported that green tea extract appears to block the development of cardiac hypertrophy in experimental renal failure.

4) Effect of green tea on blood pressure:

Hodgson et al. [10] concluded that tea ingestion caused larger acute increases in blood pressure than caffeine alone. However, any acute effects of tea on blood pressure did not translate into significant alterations in ambulatory blood pressure during regular tea consumption.

5) Effect of green tea on thyroid glands:

The green tea extract catechins was confirmed to have antithyroid and aromatase inhibition effects [11], that is obvious when 5% polyphenone-60 (P-60), green tea extract catechins, was administered to male rats for 2-8 weeks induced goiters and decreased weights of the body. Endocrinologically, elevating plasma thyroid stimulating hormone (TSH), luteinizing hormone (LH) and testosterone levels and decreasing tri-iodothyronine (T3) and thyroxine (T4) levels were induced by this treatment.

6) Effect of green tea on liver:

The polyphenolic compound initiated its inhibitory action by rapidly blocking the phosphorylation of tyrosine in platelet-derived growth factor-beta receptor (PDGF-βR) elicited by PDGF in serum. This action was short-lived, persisting for a couple of hours.

7) Effect of green tea on brain:

Hong et al. ^[12] suggested that the minimizing effect of green tea extract on the eicosanoid accumulation and oxidative damage in addition to the reduction of neuronal cell death could eventually result in protective effect on ischemia/reperfusion-induced brain injury and behavior deficit.

8) Effect of green tea on obesity:

Bell and Goodrick ^[13] reported that overweight or obesity is strongly associated with complications such as type-II diabetes mellitus, hypertension, heart disease, gall bladder disease and sleep apnea. Several nutrients like low-glycemic-index carbohydrates, 5-hydroxytryptophan, green tea extract and chromium have been identified that may promote weight loss. The first two nutrients decrease appetite, green tea increases the 24-h energy expenditure and chromium promotes the composition of the weight lost to be fat rather than lean tissue.

9) Effects on drug-metabolizing enzymes:

Long-term ingestion of green tea increases UDP-glucuronosyl transferase activity in rats and after being absorbed, catechins are metabolized by drug-metabolizing enzymes in various organs. Thus, the increased glucuronidation through UDP-glucuronosyl transferase induction is postulated to contribute to the anticarcinogenic effect of green tea by facilitating the metabolism of chemical carcinogens into inactive products that are readily excreted^[17].

10) Effect of Green Tea on Cholesterol²⁶

Green tea is "possibly effective" for decreasing high levels of cholesterol, according to the National Institutes of Health (NIH)²⁷. Scientists sized up the available research on green tea and cardiovascular health and found that green may help keep cholesterol in check. Several short-term clinical trials included in the review determined that drinking green tea may protect against postmeal increases in blood fats among people with high cholesterol. Green tea has been found to fight the absorption of cholesterol in the digestive tract.

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.

11) Effect on Body Weight (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.

ADVERSE EFFECTS OF GREEN TEA OR TOXICITY OF GREEN TEA

Although green tea has several beneficial effects on health, the effects of green tea and its constituents may be beneficial up to a certain dose yet higher doses may cause some unknown adverse effects. EGCG of green tea extract is cytotoxic, and higher consumption of green tea can exert acute cytotoxicity in liver cells, a major metabolic organ in the body. Another study found that higher intake of green tea might cause oxidative DNA damage of hamster pancreas and liver.

At a high dose (5% of diet for 13 wk), green tea extract induced a thyroid enlargement (goiter) in normal rats. This high-level treatment modified the plasma concentrations of the thyroid hormones. However, drinking even a very high dietary amount of green tea would be unlikely to cause these adverse effects in humans.

Harmful effects of tea overconsumption (black or green) are due to three main factors: (1) its caffeine content, (2) the presence of aluminum, and (3) the effects of tea polyphenols on iron bioavailability. Green tea should not be taken by patients suffering from heart conditions or major cardiovascular problems. Pregnant and breast-feeding women should drink no more than one or two cups per day, because caffeine can cause an increase in heart rhythm. Also In high doses, teas that contain caffeine may lead to restlessness, insomnia, and tachycardia.

CONCLUSIONS

Green tea has been consumed everyday by millions of people around the world since ancient times in order to maintain and improve health. Nowadays, green tea is considered one of the most promising dietary agents for the prevention and treatment of many diseases. Available data suggests that aqueous extract of the green tea designed as catechins (EGCG, EGC, ECG and EC) possess antioxidant, antimutagenic, antidiabetic, anti-inflammatory, antibacterial and antiviral, and cancer-preventive properties. Green tea consumption has beneficial effects and it shows a significant rate of protection against the development of some oral diseases and against solar radiations. It also contributes to body weight control and to the rise of bone density as well as being able to stimulate the immune system. The development of biomarkers for green tea consumption, as well as molecular markers for its biological effects, will facilitate future research in this area.

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