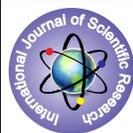


Effect of Green Tea on Periodontium-Review Article



Medical Science

KEYWORDS : green tea catechin, periodontium, inflammatory response

Dr. Rhutuja Bhosale

PG, Department of Periodontology, Bharati Vidyapeeth Deemed University, Pune

Dr. Amit Choudhari

Asso. Professor, Bharati Vidyapeeth Deemed University Dental College and Hospital, Pune

**Dr. Prajakta
valhavanakar**

PG, Bharati Vidyapeeth Deemed University Dental College and Hospital, Pune.

ABSTRACT

Periodontal diseases are the chronic inflammatory diseases of the periodontium, characterised by inflammatory destruction of gingival & periodontal ligament, now it is clear that the eating habits & nutrition affect the periodontal disease. Green tea is one of the commonly ingested drinks in day-to-day routine. The effect of green tea on various lifestyle-related disorders such as diabetes mellitus & obesity have been widely investigated. The ingredients of green tea like epicatechin (EC), epigallocatechin (EGC), Epigallocatechin gallate (EGCG), and epicatechin gallate (ECG) have also been studied for their preventive effects on cancer development & and epidemiological studies have suggested the inhibition of periodontal pathogens and destructive periodontal diseases by green tea. Epigallocatechin-3-gallate (EGCG), a major ingredient of green tea catechins (GTC), has been reported to exert a variety of biological effects, including antioxidant, antibacterial, anti-inflammatory & anticarcinogenic activities. Additionally, it has been reported that EGCG inhibits lipopolysaccharides (LPS)-induced inflammatory cytokine production. so there is a positive relationship between intake of green tea & periodontal parameters.

Introduction:

Green tea is one of the most popular beverages in the world, and it has received considerable attention because of its many scientifically proven beneficial effects on human health.

Several epidemiological and experimental observations have confirmed that there is a close relationship between green tea consumption and the prevention of both cancer development and cardiovascular disease¹. These effects have been largely attributed to the most prevalent polyphenol contained in green tea, namely epigallocatechin gallate. Epigallocatechin gallate is known to induce apoptosis in various type of tumor cells, but has little or no effect on normal cells^{2,3}. Recently, it has been reported that epigallocatechin gallate could induce the apoptotic cell death of osteoclasts⁴. Thus, it can prevent alveolar bone resorption by inhibiting osteoclast survival through the caspase-mediated apoptosis and can be beneficial to periodontal health. This article reviews the beneficial aspects of green tea as well as on periodontal health.

Origin:

The tea plant is believed to have originated in the landmass encompassing Tibet, western China and northern India. According to ancient Chinese legend, tea was discovered by the Chinese emperor Shen-Nung in 2737 BC, when leaves from a wild tea bush accidentally fell into a pot of water that he was boiling. The drink name derives from the Chinese Amoy dialect word "t'e," pronounced "tay," which has developed into a fine art. Today, "cha" means tea in Chinese. As this word moved westward into the Middle Eastern languages, it sometimes became altered to "chai".

India attributes the discovery of tea to the Buddhist monk Siddhartha in the 6th century. Inspired by divine intervention, he picked and chewed the leaves of a nearby tree, discovering, to his delight, a great sense of alertness and well being. The tree whose health-giving properties enabled him to keep his vow was, of course, *Camellia sinensis*.

Growing Green Tea:

Green tea is extracted from the leaves of *Camellia sinensis*. *Camellia sinensis* is shrub-like and is grown in a semi tropical environment on plantations in Southeast Asia. Heavy rainfall of 3000-7000 ft elevation is required. It is cloned or grown from

seed from cuttings obtained from the mother bush and rooted and grown in a nursery for 1 or 2 years. Green tea is grown in rows or on terraces.

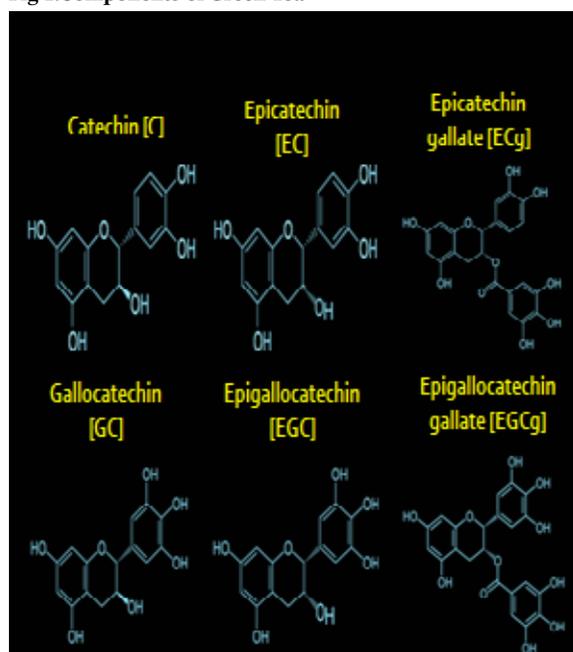
Leaves are usually picked by hand. Leaves are steamed, rolled and dried immediately and completely. Then, these are picked in foil-lined chests, which prevents absorption of unpleasant odours and also prevent loss of aroma. Severe warm, but not hot, to keep the medicinal value intact.

Components of Green tea:

The active compounds in green tea are from a group of polyphenols called catechins. Four catechins present in green tea are: Epicatechin gallate (ECg), epicatechin, epigallocatechin and epigallocatechin gallate (EGCG).

Caption

Fig 1. Components of Green Tea



Active compounds in green tea

Green tea also contains carotenoids, tocopherols, ascorbic acid and minerals like chromium, magnesium, selenium and zinc.

Green tea also contains caffeine, although half of that found in coffee. The amount of caffeine in a cup of green tea will vary according to the amount of tea used, the length of time the leaves are infused and if a person drinks the first or second infusion. Most of the caffeine in green tea is extracted into water the first time the is infused. A study found that the caffeine content of 1g of black tea ranged from 22 to 28 mg, while the caffeine content of 1 g of green tea ranged from 11 to 20 mg, reflecting a significant difference⁵.

The safety of caffeine consumption remains topic of major debate in the research literature. No studies have shown problems with caffeine consumption of less than 75 mg per day. Most studies have shown potentially problematic effects of caffeine consumption on intakes above 200 mg. In addition, there appears to be a significant difference in people's sensitivity to caffeine⁵.

Two beneficial components in green tea, i.e. catechins and amino acid L-theanine, lessen the impact of its caffeine. When green tea is brewed, its caffeine combines with catechins in the water, reducing the caffeine's activity compared with that of coffee or cocoa. In addition, L-theanine, which is only found in tea plants and some mushrooms, directly stimulates the production of alpha brain waves, calming the body while promoting a state of relaxed awareness.

Mechanism of action:

The endoplasmic reticulum and mitochondria releases oxygen. This oxygen gets converted into hydrogen peroxide, which in turn releases reactive oxygen species molecules. These reactive oxygen species molecules can lead to damage of DNA, RNA, oxidize proteins (enzymes, histones), oxidize lipids and can also activate cell suicide.

Intake of green tea can stop all these degenerative changes by inhibiting the action of the reactive oxygen species molecule.

Roll of Green Tea:

Periodontal implication

Various authors have studied the inhibitory effects of catechin contained in green tea on periodontal pathogens, may provide the basis for beneficial effect of daily intake of green tea on periodontal health.

Green tea catechins inhibit the growth of *P.gingivalis*, *Prevotella intermedia* and *Prevotella nigrescens* and adherence of *P.gingivalis* on to human buccal epithelial cells⁷.

Green tea catechins inhibit production of toxic end metabolites of *P.gingivalis* and inhibit the activity of *P.gingivalis*-derived collagenase and the expression of MMP-9 in osteoblasts and formation of osteoclast¹⁰.

Green tea catechin showed a bactericidal effect against black-pigmented, gram-negative anaerobic rods, *Porphyromonas gingivalis* and *Prevotella* species, and the combined use of mechanical treatment and the application of green tea catechin using slow-release local delivery system was effective in improving the periodontal status. The peptidase activities in the gingival fluid were maintained at lower levels during the experimental period in the test sites, while reached 70% of that at baseline in the placebo sites⁹.

Oxidative stress plays an important role in Pathogenesis of periodontal disease as well as many other disorders, and it is be-

lieved that antioxidants can defend against inflammatory diseases⁶.

Daily intake of green tea was significantly associated with bleeding on probing (BOP), probing depth (PD) and clinical attachment loss (CAL), such that the more frequently subjects drank green tea, better was their periodontal condition. As in a study in which the author involved 940 men, examined their PD, CAL and BOP, the relationship between the intake of green tea and periodontal parameters was examined. The intake of green tea was defined as the number of cups per day. Results showed that the intake of green tea was inversely correlated with the mean PD, mean CAL and BOP¹¹.

Smoking habit and frequency of tooth brushing, which are important lifestyle factors for periodontal disease, were significantly associated with periodontal parameters and were also found to be associated with intake of green tea.

Halitosis:

Halitosis is caused mainly by volatile sulfur compounds (VSCs) such as H₂S and CH₃SH produced in the oral cavity. Oral microorganisms degrade proteinaceous substrates to cysteine and methionine, which are then converted to VSCs. Because tea polyphenols have been shown to have antimicrobial and deodorant effect, researchers investigated whether green tea powder reduces VSCs in mouth air, and compared its effectiveness with that of other foods that are claimed to control halitosis. Immediately after administering the products, green tea showed the largest reduction in concentration of both H₂S and CH₃SH gases, especially CH₃SH, which also demonstrated a better correlation with odour strength than H₂S; however, no reduction was observed at 1, 2 and 3 h after administration. In an in vitro study, toothpaste, mints and green tea strongly inhibited VSCs production in a saliva-putrefaction system, but chewing gum and parsley seed oil product could not inhibit saliva putrefaction. Toothpaste and green tea also demonstrated strong deodorant activity of mints, chewing gum or parsley-seed oil product were observed. Therefore, it was concluded that green tea was very effective in reducing oral malodour temporarily because of its disinfectant and deodorant activities, whereas other foods were not effective¹².

Dosage:

Most green tea products are sold as dried leaf tea. The best way to get the catechins and other flavonoids in tea is to drink it freshly brewed. The recommended consumption is three to four cups of tea a day. The average cup of green tea contains about 50–150 mg polyphenols. However, some research suggests that up to 10 cups per day is needed to receive enough polyphenols to notice a marked increase in health.

In one study, the author recorded the daily intake of green tea as number of cups, and found that every one cup/day increment in green tea intake was associated with a 0.023-mm decrease in the mean PD ($P < 0.05$), a 0.028-mm decrease in the mean CAL ($P < 0.05$) and a 0.63% decrease in the BOP ($P < 0.05$)¹¹.

Tips for preparing

Green tea should be handled tenderly, just as you would fresh green leafy vegetables. Spring water is the ideal choice for brewing tea, followed by filtered water. Distilled water should never be used; the brew it produces will be flat as the minerals removed from it are essential to bringing out the tea's flavor.

Use 3 g of tea to 5 ounces of water if brewing tea in a small teapot; 4 g of tea to 8 ounces of water for other methods.

Although heartily boiling water is used to brew black and oolong teas, green tea needs much lower temperatures (160–170°F; 79–

85°C), and should be brewed for a lesser time.

Let the water barely reach the boiling point to liberate its oxygen, then allow it to cool slightly before pouring over the tea.

Possible interactions:

The possible interaction of green tea can be seen with the following drugs: Green tea may inhibit the actions of adenosine. Green tea may increase the effectiveness of beta-lactam antibiotics by reducing the bacterial resistance to treatment. Caffeine has been shown to reduce the sedative effects of benzodiazepines. Caffeine may increase blood pressure in people taking propranolol and metoprolol. People who take warfarin, a blood-thinning medication, should not drink green tea. Because green tea contains vitamin K, it can make warfarin ineffective. The combination of green tea and chemotherapy medications, specifically doxorubicin and tamoxifen, increased the effectiveness of these medications in laboratory tests. On the other hand, there have been reports of both green and black tea extracts stimulating a gene in prostate cancer cells that may cause them to be less sensitive to chemotherapy drugs. Given this potential interaction, people should not drink black and green tea (as well as extracts of these teas) while receiving chemotherapy for prostate cancer in particular. The antipsychotic effects of the medication clozapine may be reduced if taken fewer than 40 min after drinking green tea. When taken together with ephedrine, green tea may cause agitation, tremors, insomnia and weight loss. Green tea has been shown to reduce the blood levels of lithium (a medication used to treat manic/depression). Oral contraceptives can prolong the amount of time caffeine stays in the body and may increase its stimulating effects. A combination of caffeine and phenylpropanolamine can cause mania and a severe increase in blood pressure.

Side-effects of green tea

The risks associated with a high dose of green tea are:

- Increased bleeding time
- Green tea contains caffeine, catechins and tannic acids. All three substances have been linked to pregnancy risks. In addition, drinking a large amount may cause neural tube birth defect in babies due to folic acid antagonism and, therefore, pregnant women should not take green tea

- Increased risk of bladder cancer
- If a person is sensitive to caffeine, symptoms to watch out for are: Restlessness, irritability, sleeping problems, tremor, heart palpitations, loss of appetite, upset stomach, nausea, frequent urination and skin rash
- Stomach upset is the second most common complaint after caffeine. A 1984 study concluded that “tea is a potent stimulant of gastric acid, and this can be reduced by adding milk and sugar”
- Tea is known as a “negative calories” beverage. Not only does it contain virtually no calories, it also blocks the absorption of certain nutrients like iron and thiamine (Vitamin B).
- Drinking tea or coffee stains or discolors the dental plaque, but not the teeth itself. If the plaque is not completely brushed and flossed away within 24 h, it begins to harden and becomes what is commonly known as tartar.

Conclusion

Periodontists believe that maintaining healthy gums is absolutely critical to maintain a healthy body; that is why it is so important to find simple ways to boost periodontal health, such as regularly drinking green tea that is already known to possess health-related benefits.

By interfering with the body's inflammatory response to periodontal bacteria, green tea may actually help promote periodontal health and ward off further disease.

Continuous use of green tea catechin on a daily basis may be a useful and practical method for the prevention of periodontal disease, but should be carried out with caution to avoid side-effects. Therefore, let us start sipping green tea and grow healthier.

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