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Review on green tea constituents and its negative effects

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Abstract

Objective: to review and discuss the negative effects of green tea.

Green tea is obtained from *Camellia sinensis* and belongs to the family theaceae and is used most popularly as beverage all over the world. Although there are beneficial effects of green tea, but it has also side effects. We have search different research articles and found that by consuming large amounts of green tea nausea, vomiting, dehydration, lethargy, central nervous system stimulation such as dizziness, insomnia, tremors, restlessness, confusion, diuresis, heart rate irregularities and psychomotor agitation may occur. Most side effects are due to high consumption of caffeine. Epigallocatechin-3-gallate (EGCG) has anti-folate activity so to prevent folate deficiency it should not used in excessive quantity and it may reacts with some drugs like aspirin and MAOI so used with caution if high level of green tea is used.

Keywords: Green tea, side effects, caffeine, drug interactions, anti-folate activity

1. Introduction

Tea is one of the most popular beverages, which are commonly used all over the world. Tea is mostly used in countries such as China and Japan, and green tea accounts for 20% of tea consumption worldwide [1]. Today, green tea is cultivated commercially in Asia, Africa and South America [2].

Green tea is derived from *Camellia sinensis*, an evergreen plant of the Theaceae family. Dissimilar black tea, which is fermented, green tea is produced in a non-fermented procedure. Green tea may be used in the form of a brewed drink or capsular extract. Tea may be used as dietary supplements. In China, consumption of green tea and the medicinal use of green tea was begun more than 4,700 years ago. Presently, there is no proper dose suggested for green tea extract. Researchers examined the effects of consistently green tea drinking on cancer prevention; however, evidence has not been corroborated [3-5].

The main active ingredients of green tea include polyphenolic compounds such as epicatechin (EC), epicatechin-3-gallate (ECG), epigallocatechin (EGC) and epigallocatechin-3-gallate (EGCG), all of which may be responsible for the anti-carcinogenic and anti-mutagenic activities of green tea. Other polyphenols in green tea include flavanols and their glycosides and depsides such as chlorogenic acid, quinic acids, carotenoids, trigalloylglucose, lignin, protein, chlorophyll, minerals (aluminum or manganese, depending on the soil content), caffeine and a very small amount of methylxanthines [6]. The constituents of green tea have a broad array of biological activities [7]. EGCG is one of the major components in green tea [8], and its pharmacology has been intensively studied [9, 10, 11, 12, 13, 14, 15].

Drinking green tea has several benefits, but there are potential side effects associated with excessive use of green tea.

Green tea contains about 30 to 60 mg of caffeine per 6 to 8 oz. cup. This is normal and less than the average 100 mg caffeine contained in a cup of coffee. But green tea is generally consumed in greater amounts when used for weight loss and this increases the consumption of caffeine. And if more than five cups of tea per day are used, it will raise caffeine intake to unsafe levels, and may increase risk for insomnia, restlessness, tremors, and upset stomach.

Tannins are present in large quantities in a green tea Tannins bind with non-heme iron in the body. Nonheme iron is the type of iron that is contained in plants and iron-fortified foods. It is not as easily absorbed in the body as heme iron, however most iron in the diet is typically nonheme iron. Tea specialist Lindsey "Vee" Goodwin of Vee Tea comments that "the tannins in green tea can form irresolvable bonds with iron in the body, rendering the iron hard to digest. According to Goodwin, "The typical reduction in iron absorption from a food with a cup of tea in clinical studies is approximately 30-60 percent."

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This hindrance with iron absorption can lead to iron deficit anemia. Iron deficiency anemia can account feelings of weakness, shortness of breath, irritability, headaches and alter heartbeat.

American Association of Cancer Research study on the anti-folate activity of tea showed that EGCG can interfere with folate use in cells. Folate is needed to make DNA and prevent negative changes to DNA from cancers. Folate also helps to make red blood cells, protect against heart disease and prevent anemia. It is important to be aware of green tea intake to prevent folate deficiency. According to the website World's Healthiest Foods, one cup of green tea supplies 20 to 35 mg of EGCG.

Green tea is a natural diuretic so; by drinking extreme amounts of green tea (more than five cups /day) it can cause excessive urination leading to dehydration and electrolyte disproportion. Dehydration can also leads to headaches, lethargy, changed heart rate and distress.

According to the University of Maryland Medical Center, green tea can interfere with the absorption and effects of certain medications. This can lessen or intensify the effects of medications, which could put your health at risk. Some medications that might be affected include MAOI inhibitors, lithium, adenosine and blood thinners [16].

A Cochrane review on green tea preparations and weight loss has showed a non significant loss of weight in obese or overweight adults likely not of clinical relevance [17].

In diabetic patients green tea may lower the fasting glucose levels, but no significant HbA1c changes are observed [18].

A cohort study of 8, 552 people with nine years of follow-up showed a negative association of green tea consumption with cancer incidence, especially among Japanese women drinking more than ten cups a day (RR 0.59; 95% CI, 0.35–0.98) [19, 20]. However, a larger cohort study with 38,540 people in Japan did not show an association between green tea consumption and the sum incidence of all cancers (RR 1.0; 95% CI, 0.91–1.1 for those drinking two to four times per day; RR 0.98; 95%CI, 0.88–1.1 for those drinking five times or more per day, both compared with those drinking one time or less per day) [21].

Depending on the brand, two to three 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 [22]. There is evidence that dietary components rich in polyphenols may cause tooth staining [23].

Herbs contain active substances that can trigger side effects and interact with other herbs, supplements, or medications. However, pharmacological and toxicological evidence does indicate that green tea polyphenols can in fact cause oxidative stress and liver toxicity *in vivo* at certain concentrations. Patients on Warfarin should not take green tea because green tea having vitamin K. Green tea must not to be delivering with aspirin in light of the fact that it keeps platelets from coagulation. Too much amount of caffeine (including caffeine from green tea), may cause nausea, vomiting, diarrhea, headache, and loss of appetite, and so it should be skipped [22].

Utilization of high dosages of green tea or green tea extract (i.e. 5–6 liters for /day) may causes, nausea, spitting, stomach bloating/ache, dyspepsia, flatulence and diarrhea [24, 25]. Excessive consumption of caffeine from green tea may also cause central nervous system stimulation such as dizziness, insomnia, tremors, restlessness, confusion, diuresis (i.e. increasing urine output), heart rate irregularities and psychomotor agitation [25].

Inoue et al reported that a diet containing high dose green tea polyphenols disrupts renal function in both mice with dextran sulfate sodium-induced colitis and normal mice [26]. They assumed that high-dose green tea polyphenols down-adjust antioxidant enzymes, prompting kidney impairment. In any case, in human subjects, as far as anyone is concerned, there is no robust proof reporting valuable impacts of green tea utilization on renal capacity. A clinical trial reported that green tea consumption does not increase GFR in 19 healthy young adults, while coffee consumption increases it [27].

2. Results and discussion

Green tea is obtained from *Camellia sinensis*, and belongs to the Theaceae family. Green tea mostly consists of polyphenolic compounds such as epicatechin (EC), epicatechin-3-gallate (ECG), epigallocatechin (EGC) and epigallocatechin-3-gallate (EGCG) (shown in Fig.1), all of which may be responsible for the anti-carcinogenic and anti-mutagenic activities of green tea. It also contains flavanols and their glycosides and depsides such as chlorogenic acid, quinic acids, carotenoids, trigalloylglucose, lignin, protein, chlorophyll, minerals (aluminum or manganese, depending on the soil content), caffeine and a very small amount of methylxanthines.

Green tea has beneficial effects, but there are potential side effects which are showed on high consumption of green tea. Caffeine is a major constituent and if more than five cups of green tea are consumed daily it may cause insomnia, restlessness and upset stomach. It has been observed that for reducing weight, green tea is consumed so if high levels of caffeine is used it may cause severe side effects. It is necessary to used green tea for this purpose cautiously. Tannins present in green tea like catechin, epicatechin etc. bind with non heme iron in the body. This interferes with iron absorption, which can lead to iron deficiency anemia. Iron deficiency anemia can cause feelings of weakness, shortness of breath, irritability, headaches and irregular heartbeat. So anemic patient should use it cautiously, if taken in high amount. Epigallocatechin-3-gallate (EGCG) has anti-folate activity so to prevent folate deficiency it should not used in excessive quantity. Since green tea is a diuretic and it can cause excessive urination which may lead to dehydration and electrolyte imbalances. If severe dehydration occurs, it may cause headaches, lethargy, altered heart rate and shock. Green tea contains poly phenols; the researchers showed that it may stain the teeth.

Nausea, vomiting, loss of appetite, abdominal bloating/pain, dyspepsia, flatulence and diarrhea are other side effects reported that are caused by the use of green tea. Excessive consumption of caffeine from green tea may also cause central nervous system stimulation such as vertigo, insomnia, tremors, impatience, distraction, agitation and psychomotor agitation [25]. It also contain vitamin k that's why should be avoided excessive intake of green tea, patient who on warfarin, aspirin and anticoagulants may prevent clotting of blood.

3. Conclusion

We have studied the side effects of green tea through literature and research papers and observed that green tea is beneficial for health, but it has side effects which are found on excessive consumption of green tea. Possible side effects include nausea, vomiting, dehydration, lethargy, central nervous system stimulation such as dizziness, insomnia, tremors, restlessness, confusion, diuresis, heart rate irregularities and psychomotor agitation. Polyphenols present in green tea may stain the teeth.

So, peoples who are consuming green tea in large amounts or peoples who are using it to reduce weight should use it cautiously to prevent the side effects associated with green tea. Large consumption of green tea should be avoided in patients who taken anticoagulants.

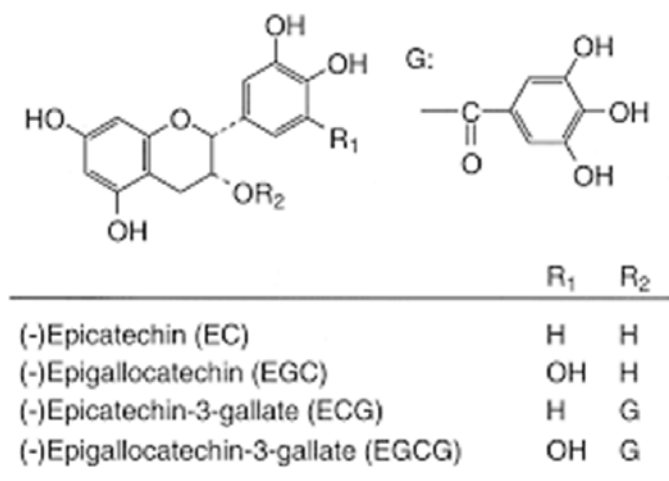


Fig 1: Flavonoids founds in green tea

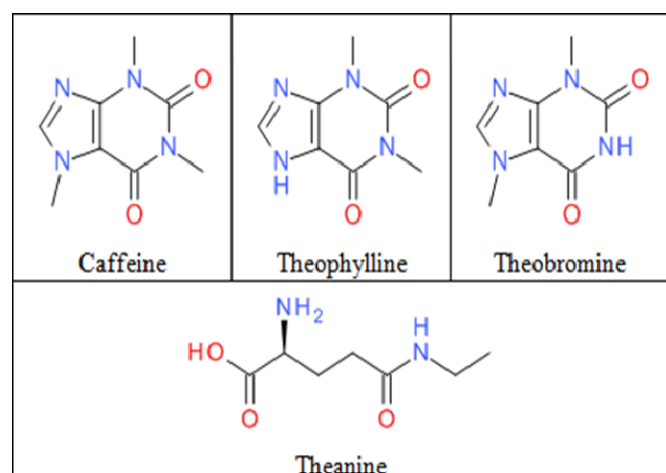


Fig 2: components of green tea

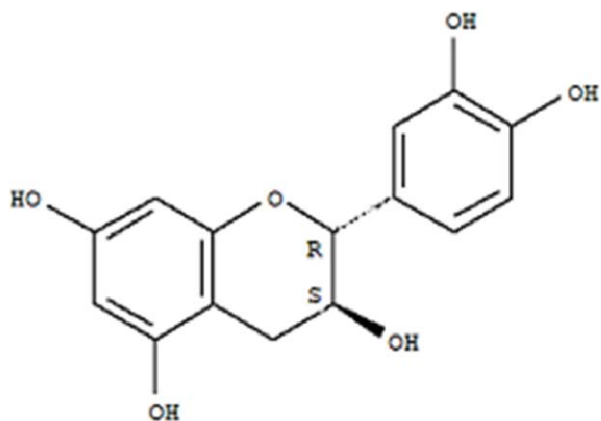


Fig 3: structure of catechin.

Table 1: Principle components of green tea [28]

Components	Green Tea (% weight of extract solids)
Catechins	30-42
Flavonols	5-10
Other flavonoids	2-4
Theogallin	2-3
Other depsides	1
Ascorbic Acid	1-2
Gallic Acid	0.5
Quinic acid	2
Other organic acids	4-5
Theanine	4-6
Other amino acids	4-6
Methylxanthines	7-9
Carbohydrates	10-15
Minerals	6-8
Volatiles	0.02

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