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Camellia Sinensis (Green Tea) Health Benefits (Review)

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A B S T R A C T

Tea is one of the most widely consumed beverages worldwide, and is available in various forms. Green tea is richer in antioxidants compared to other forms of tea. Tea is composed of polyphenols, caffeine, minerals, and trace amounts of vitamins, amino acids, and carbohydrates. The composition of the tea varies depending on the fermentation process employed to produce it. Camellia sinensis is a species of Camellia. Fresh leaves or a leaf extract for therapeutic use may have a variety of systemic effects on your health. Green tea includes hundreds of bioactive compounds, including tannic acid, ellagitannins, and phenols such as flavonoids and catechins, which are highly antioxidant in vitro and in vivo and virtually have polyphenols, which play a major role in preventing and treating many diseases. Green tea also contains minerals and vitamins, which boost the tea's antioxidant capacity. Furthermore, Camellia sinensis may help reduce the risk of cardiovascular disease and certain types of cancer, as well as promote oral health and other physiological functions such as antihypertensive effects, weight management, antibacterial and antiviral activity, solar protection, increased bone mineral density, and anti-fibrotic properties, according to a new study. While having all of the information from the green tea study is highly encouraging, further research is needed to fully understand its contributions to human health.

كاميليا سينينسيس (الشاي الأخضر) الفوائد الصحية (مراجعة)

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الملخص

يعتبر الشاي من أكثر المشروبات إستهلاكا في جميع أنحاء العالم، وهو متوفر بأشكال مختلفة. بالإضافة الى استخدام التفكير في المشروبات (من غير الماء)، المتذوق يفضل استهلاك الشاي الأخضر الذي يحوي على العديد من الفوائد الطبية، حيث انتشر استخدامه شعبيا والطلب عليه بشكل واسع. نبتة كاميليا الطبيعية الخضرية هي أحد اصناف كاميليا، وهو نبات دائم الخضرة، اوراقها الخضراء أو مستخلص الأوراق الذي يستخدم طبيا لأغراض مختلفة للتأثيرات الجهازية على صحة الجسم. الشاي الأخضر يشمل مئات المركبات ذات النشاط الحيوي، تشمل حامض التينيك، الليكتانين الذي يتكون من تحلل التنين وهو نوع من أنواع متعدد الفينول (فينول حامض الكربوليك) ، وكذلك يحوي على الفينول (حامض الكربوليك) مثل فلافينويد والكاتيكين المادة القابضة تشبه الفلافون، وهي مواد عالية مضادة الأكسدة خارج الجسم وداخل الجسم وواقعيا يمتلك متعدد الفينول ، التي تلعب دورا في منع وعلاج العديد من الأمراض. كذلك يحوي الشاي على معادن وفيتامينات والتي تعزز من استيعاب مضادات الأكسدة، والأكثر من ذلك نبتة الكميليا قد تساعد في تقليل أمراض القلب والأوعية

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الدموية ، وأنواع أخرى من السرطانات، اضافة الى ذلك تحسن صحة الفم والوظائف الفسيولوجية الأخرى مثل تأثيرات مضادات ارتفاع الضغط ، رعاية الوزن ، مضادات البكتريا، ومضادات نشاط الفيروسات ، الحماية من أشعة الشمس المؤذية ، زيادة كثافة معادن العظام ، وكمضادات ضد خصائص التليف. واعتمادا على دراسات حديثة للشاي الأخضر واعتمادا على جميع المعلومات فهي تشجع بشكل كبير، اضافة الى حاجة البحث للفهم بشكل كامل والذي له علاقة بصحة الأنسان .
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Introduction

The availability of tea in a variety of forms and the rising cost of prescription medications have caused people to turn to natural goods like green tea, which is one of the most extensively drank beverages in the world Green tea is richer in antioxidants compared to other forms of tea. Tea is composed of polyphenols, caffeine, minerals, and trace amounts of vitamins, amino acids, and carbohydrates. Green tea contains a variety of phytochemicals, depending on the fermentation method used to make it. The leaves and leaf buds of this plant are used to make Chinese tea. It belongs to the Camellia genus, which is a flowering plant genus in the Theaceae family. Instead of leaves, Camellia sinensis uses twigs and branches. Tea is the popular name for this plant [1].

The two most common forms of tea are green tea and black tea, which differ in terms of antioxidant content and fermentation degree [2], [3]. Due to the fact that the tea is grown on the six continents, it is currently used in nearly every country on the earth, with China, India, and Kenya being the leading producers [4],[5].

Green tea has been studied for its health advantages [6], including cancer prevention [7], cardiovascular disease prevention [8], and anti-inflammatory disease [9]. Green tea contains anti-arthritic [10], antibacterial [11], antiangiogenic [12], antioxidant [13], antiviral [14], and neuroprotective [15].

Chemical Composition of Green Tea:

First of all, fresh leaves contain 3-4% alkaloids known as methylxanthines, such as caffeine, theobromine, or theophylline on average [2]. There are phenolic acids specific to longevity, such as gallic acid, which therefore attribute amin water brash such as theanine current stability [2]. Green tea contains polyphenols, which include flavanols, flavandiols, flavonoids, and phenolic acids, as well as flavanols, flavandiols, and flavonoids.

Young tea's chemical administration is complicated: Proteins, of which enzymes make up a significant portion; also, amino acids such as theanine and 5-N-ethylglutamine, glutamic acid, tryptophan, glycine, serine, aspartic acid, tyrosine, valine, cellulose, pectins, glucose, fructose, or sucrose. In addition to minerals or trace elements such as calcium, magnesium, chromium, manganese, iron, copper, zinc, molybdenum, selenium, sodium, phosphorus, cobalt, strontium, nickel, potassium, fluorine, and aluminum; Finally, trace amounts of lipids (linoleic and a-linolenic acids), sterols (stigmasterol), vitamins (B, C, E), xanthic [16].

Furthermore, (GTPs) are flavonols that are ten times as strong as catechins. Products generated from inexperienced tea are, in general, extracts of inexperienced tea in a fluid or lime shape that vary in polyphenol and caffeine content proportions. Green tea's main flavonoids are a few catechins, which are found in higher concentrations in inexperienced tea than in fuscous or Oolong tea [16].

Epicatechin, epigallocatechin, epicatechin-3-gallate, and EGCG are the four types of catechins found in green tea [17]. The catechins are influenced by the guidance tactics both quantitatively and qualitatively; the total catechins in the authentic tea leaves also fluctuate due to changes in variety, origin, and thriving requirements [18]. The concentration seen differs from the absolute values established during total leaf extraction because catechins cannot be completely removed from the leaves during the preparation of fresh green tea [19]. Additionally, catechins are also relatively unstable and can be altered quantitatively and qualitatively during an experiment [20].

Medicinal Properties:

Antibacterial activity:

Camellia sinensis (green tea) crude extract was tested for antibacterial efficacy against multidrug-resistant microorganisms. The antibacterial activity of green tea was tested using multidrug-resistant *Escherichia coli staphylococcus*, as well as their reference strains. Cefoxitin, ciprofloxacin, chloramphenicol, clindamycin, oxacillin, tetracycline, gentamicin, ceftazidime, and vancomycin resistance were found in MDR *Escherichia coli* and *Staphylococcus aureus*. [21]. Several multidrug-resistant (MDR) infections were used to test plant extracts and their purified components for synergistic antibacterial action. The researchers want to see if green tea (Camellia sinensis) and its purified component Egallocatechingallate have antimicrobial properties (EGCG). The compound's synergistic relationship with antibiotics was discovered against a variety of possible Gram-positive and Gram-negative bacteria.

Antifungal activity

C. Albicans strains were examined and EGCG was found to decrease growth by 90%. Pyrogallol catechin was found to have more antifungal activity than catechol catechin against Candida albicans. Antifungal activity of amphotericin B or fluconazole is enhanced by EGCG against antimycotic-susceptible and resistant *Candida albicans.*

Anti-viral effects:

EGCG and ECG were found to be potent inhibitors of influenza virus replication in cell culture. This effect was observed in all influenza virus sub-types tested, including A/H1N1, A/H3N2, and B viruses. Quantitative analysis revealed that, at high concentrations, EGCG and ECG also suppressed viral RNA synthesis in cells, whereas EGC failed to show a similar effect. Similarly, EGCG and ECG inhibited neuraminidase activity more effectively than the EGC. Neuraminidase is an antigenic glycoprotein enzyme found on the surface of the influenza virus. Neuraminidase has functions that aid in the efficiency of virus release from cells [22].

Antioxidants Activity:

Green tea is a famous antioxidant neutraceutical. Green tea contains polyphenols, which include flavanols, flavandiols, flavonoids, and phenolic acids, as well as flavanols, flavandiols, flavonoids, and flavonoids. The most frequent antioxidant components discovered in plant sources are flavonoids. Flavonoids are the most abundant antioxidants in the diet, and they have been shown to reduce the oxidation of low-density lipoproteins, which protects against cardiovascular disease. Some of the most prevalent flavonoids are apigenin, chrysin, luteolin, datiscetin, quercetin, myricetin, morin, and kaempferol [23]. The most frequent antioxidant components discovered in plant sources are flavonoids. Flavonoids are the most abundant antioxidants in the diet, and they

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Antioxidants are chemicals that protect cells from reactive oxygen species such as singlet oxygen, superoxide, peroxyl radicals, hydroxyl radicals, and peroxynitrite, which can cause cell damage. Oxidative stress that caused by an imbalance between antioxidants and reactive oxygen species, which leads to cellular damage. Catechins are potent antioxidants both in vitro and in vivo. Green tea's antioxidant capacity is also enhanced by the presence of specific minerals and vitamins. Green tea catechins have been shown to boost total plasma antioxidant activity in vivo experiments. Oxidative stress is caused by an imbalance between antioxidants and reactive oxygen species, which leads to cellular damage. Catechins, along with antioxidant vitamins (such as vitamins C and E) and enzymes (such as superoxide dismutase and catalase), are thought to contribute to the whole antioxidant defense system, which may help protect against certain diseases [24].

Anti-Alzheimer Activity:

Although there is no epidemiological evidence in human studies of the benefit of green tea for Alzheimer's disease, several studies in animal and cell culture models suggest that EGCG from green tea may affect several potential targets associated with Alzheimer's disease progression. EGCG protects antioxidant properties [25].

Anti-Parkinson Activity:

Various studies have shown that green tea and EGCG significantly prevent these pathologies in animal models [26]. EGCG administered orally in doses as low as 25 mg/kg, prevented loss of dopaminergic neurons in the substantia nigra and preserved striatal levels of dopamine [27]. EGCG is attributed to antioxidant activity and iron-chelating, and the consumption of green tea has been shown to lower Parkinson's incidence from 5-10fold in the Asian population [28],[29].

A recent study of the transgenic mouse with Alzheimer's showed EGCG modulation of sand to lower cerebral amyloid β peptides (*Aβ*) and APP [30]. Another in-vitro study showed a reduction in the cerebral deposit of Aβ in a combination of green tea extracts with fish oil [31]. The use of green tea was significantly documented in the clinical study with a decrease in oxidative markers (such as malondialdehyde (MDA), 8-oxyguanide-dioxide-guanidine (8-OGdG), and carbonyl and increased mental state examination (MM-SE) values and total plasma antioxidant capabilities. These guarantee protection against Alzheimer's disease on its cognitive function [32]. Another animal study facilitated the pathways of synaptic dopamine in the hippocampal area and improved recollection [33]. Cerebral deposits of the Aβ decreased in an in vivo study that combined green tea with fish oil [34].

A study assessment of transgenic Alzheimer's mice revealed that green tea might ease synaptic hippocampal transmission via a D1/5 receptor-protein kinase A (PKA) pathway, increase the amount of hippocampal dopamine and improve the memory. It has been shown that the protein kinase B protein pathway can be activated, which is neuroprotective to prefrontal neurons. The beta-amyloid component can be impeded by hat accumulation [35]. The negative consequences of β-amyloid peptides, such as the phosphatidylcholine metabolism dysregulation, can also be reversed by green tea. A further study of hyperhomocysteinemia rats indicated that green tea and EGCG could enhance memory deficits and exert anti-neuro inflammatory, anti-oxidant, and anti-neurodegenerative

characteristics [36]. Parkinson's disease is one of the main motor symptom problems (PD).

According to Aarsland & Kurz [37], this malaise affects more than 10 million people worldwide. An in vivo study has suggested that green tea polyphenols can play a protective role in the dopamine neurons by inhibiting nitric oxides and reactive oxygen species that are crucial to Parkinson's disease pathogenesis. In it, GTP can protect the effects of 6-OHDA, midbrain and striatal dopaminergic neurons as a potent neuroprotective antioxidant. GTP may reduce lipid peroxidation, nitrate/nitrate content, nitric acid synthase, and 3-nitro-tyrosine protein [38]. Another study indicated that EGCG may reduce cell death induced by dichlorodiphenyltrichloroethane (DDT) in dopaminergic human neuroblastoma cell lines (SH-SY5Y) and may be beneficial for Parkinson's disease [39].

Cardiovascular diseases:

The use of green tea, due to its antithrombotic and anti-inflammatory effects, is linked with protection against stroke [40], [41]. Blood levels of the total amount of cholesterol, LDL-c, and their oxidation are decreased. The explanation is very complex and most studies are focused on the role of EGCG on the lipid profile [42][43]. It has been shown that green tea reduces cholesterol's micelles solubility at the intestinal level, and reduces its absorption. At the same time, it improves the endothelial function and protects LDL from oxidation, increases the lipoprotein level (HDL) in high-density levels, and increases the total plasma antioxidant ability [44],[45].

On the other hand, gallic acid in remarkable amounts can be used to interact with the function of P-selectin. Seventy Human studies have shown that oral intakes of high Catechin content green tea extracts improve the oxidation resistance of LDL plasma [46]. As a medication, lifestyle modification, and consumption of certain seed products are the main strategies for modifying the profile of blood lipids, green tea, and white tea consumption is options that should be taken into consideration and may offer interesting opportunities for further research. The effects of administering Catechin concentrations corresponding to the content of 8–10 cups of green tea have been studied in experimental animals. The enzyme that transforms angiotensin I into angiotensin II, a powerful vasoconstrictor, appears to be inhibited by catechins, and so its effect is decreased.

However, even if the caffeine content of green tea is minimal, it has been suggested that it may counteract the impact of catechins by raising blood pressure [47]. Green tea catechins have been shown in most experiments with experimental animals to lower blood pressure. According to Yang *et al*., drinking 120 mL of green tea each day for a year considerably lowers the chance of getting hypertension [48]. Another study conducted in China with 1507 participants found that drinking 600 mL of green tea every day for a year lowered the risk of hypertension compared to a control group of patients with similar BMI, food, and lifestyle [45]. This impact could be attributed to its vasodilator characteristics, endothelial diffusion protection, antioxidant, and lipid-lowering qualities.

Anti-cancer activity

In vivo studies confirmed that the number of green teas catechins increases the volume of plasma antioxidant exercise [46]. Intake of green tea extracts additionally increases the undertaking over superoxide dismutase among serum or the disclosure on catalase of the aorta; these enzymes are implicated in cell protection towards active oxygen species [46]. A decrease in nitric oxide plasma concentration combines this action with direct action on oxygen species [49]. Green tea consumption reduces malondialdehyde; an oxidative stress marker [45], [48]. These consequences suggest up to the expectation catechins should bear a direct (antioxidant) or oblique (an increase over undertaking and expression) effect.

Since catechins perform, object namely antioxidants within vitro, they may stop the oxidation of vile antioxidants, certain as much vitamin E. However, ingestion of inexperienced tea catechins no longer modifies the plasma repute on nutritional vitamins E or C of Vivo [49], [50]. Pilipenko et al investigated the tolerance of tableted green tea and its effect on antioxidant status indices. The study comprised twenty-five individuals with various gastrointestinal disorders who were separated into treatment and control groups. The treatment group had a high tolerance for drinking green tea, and they had higher quality-of-life indices, particularly on scales of physical discomfort and social functioning. Biochemical examination revealed no significant differences between the groups, suggesting that this product is safe. The treatment group had lower levels of all antioxidant status indicators, as evidenced by a significant decrease in the lipid peroxidation index from 4.63 to 4.14, according to the results [51].

Anti-diabetic Activity:

Green tea has an Antidiabetic effect by lowering the level of glucose level in the bloodstream. [52]. Waltner-Law et al have provided strong in vitro evidence that the production of H4IIE hepatoma cells by EGCG decreases glucose production [53]. The studies showed that insulin is imitated by EGCG and tyrosine phosphorylation increases the receptor and substrate of the insulin, and the glucose enol pyruvate carboxykinase gene is reduced. In recent years, green tea and green teas have been found in the experimental models of type II diabetes mellitus to alter the metabolism of glucose [52], [54] in an effective manner. Further, EGCG improves in vitro the damage to b cells caused by cytokine [55], and prevents the decrease of mass isolate induced by multiple low-dose in vivo streptozotocin [22].

Lambert *et al.* showed that intragastric EGCG administered at a 75 mg/kg dose resulted in a total plasma Cmax of 128mg/l EGCG and an 83-minute terminal half-life [56]. In addition, an oral intake of 50 mg of EGCG in humans resulted in an EGCG total plasma Cmax 130 mg/l and an in al term of 112 minutes of a half time. In humans [57]. These results show that rodents should be administered orally between 100 and 600-. Fold more EGCG to produce the same plasma concentrations as those found in humans (depending on whether they are administered by gavage or feed admixture). Intake of low to moderate doses of EGCG in humans, and total plasma concentrations were shown to be effective in mice and rats can be achieved.

Skin disorder:

Green tea extract has shown when taken orally or applied locally on the skin inhibits skin tumour formation induced by chemical carcinogens or ultra-violet, or Ultraviolet radiation (UVB). Many cosmetic and pharmaceutical companies contain green tea extract [58].

Discussion

Camellia sinensis with antioxidants has several health benefits, including avoiding cancer [59] and cardiovascular illnesses [60], [61], regulating cholesterol [62], mediating weight reduction [63][64] regulating aging, lowering inflammation, and managing neurodegenerative diseases [65]. Green tea polyphenols have also been shown to have antibacterial, antioxidant, and anticancer activities, as well as the ability to prevent tooth decay and lower blood pressure [66], [67], [68]. According to Chikara, EGCG has been shown to play a role in cancer chemoprevention [69]. Green tea lowers oxidative stress levels [70] and blocks glucose uptake through the insulin route [71].

Due to the presence of high content catechin, specifically epigallocatechin gallate, EGCG, green tea extract from the leaves of *Camellia sinensis* (green tea) has been demonstrated to exhibit a wide range of antimicrobial activities [72]. Green tea has a high

concentration of polyphenols, primarily catechins and their derivatives, which are thought to protect against cancer and cardiovascular disease [73]. Inhibiting developing drug-resistant infections with a combination of tea and antibiotics may be successful, particularly among enteropathogens.

Previous research [74] found that eating green tea on a daily basis eliminated *Staphylococcus aureus*, *Vibrio parahemolyticus*, *Clostridium perfringens*, *Bacillus cereus*, *Pleisomonas shigelloides*, and other bacteria. However, nothing is known regarding the synergistic action of green tea crude extract and its components.

Green tea polyphenols are responsible for illness prevention and treatment as natural products [75], [76]. Terpenes, nitrogen, and sculpture-containing chemicals are other active secondary metabolites in addition to polyphenols [77]. To avoid misinterpreting polyphenol bioactivity results, an appropriate approach for separating polyphenols from other types of secondary metabolites for subsequent biological activity analysis must be developed.

Polyvinyl poly pyrrolidone (PVPP) is an adsorbent that is used in the industry to remove unwanted colours [78], [79], [80]. PVPP has also been used to purify polyphenol oxidase, beneficial chemicals from brewery waste streams, and DNA from polyphenol-rich coconuts [81], [73]. To reduce matrix effects in the assessment of pesticides present in tea leaves after usage by farmers, Hou and coinvestigators employed PVPP suspension with anhydrous sodium sulphate to extract polyphenols from tea [82]. After vigorous shaking of the plant extract with PVPP, the polyphenols in Terminalia arjuna bark extract were identified [83]. PVPP adsorption and liquid-liquid partition using aqueous NaCl were shown to be the most effective approach to extracting polyphenol in comparison to polyamide SPE and gel permeation chromatography using Sephadex LH-20 in a recent study [84].

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Conclusion

Green tea's medical properties have been demonstrated in laboratory studies, making it a worldwide important plant. In research, human green tea is used to reduce the risk of a variety of diseases, including cardiovascular disease and cancer, as well as improve dental and other blood pressure functions. Truffles are antibacterial and antiviral, and they help to maintain body weight by boosting bone mineral density and safeguarding nerves. Green tea is also a traditional beverage for relieving flatulence, boosting the digestive system, and enhancing cerebral functions. It is also good for preventing stomach distress; - diarrhoea and vomiting. According to a study, green tea can also be used as an antibacterial treatment for infections and wounds.

We need to examine and conduct future research to determine the true degree of health advantages and the safe amount of tea consumption associated with those benefits because human clinical data is ambiguous and studies are not integrated. Developing more specific, sensitive methodologies and models that are more representative of how green tea interacts with internal systems and other external elements, in addition to developing effective predictive biomarkers, will provide a better understanding of how green tea interacts with internal systems and other external elements. Finally,

well-designed observational epidemiological research and intervention trials must be conducted to evaluate whether green tea has a protective effect. The discovery of biomarkers of drank green tea and molecular indicators of its biological effect will aid future studies on this subject. The benefits of green tea for health care are based on epidemiological findings.

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