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Therapeutic Role of Green Tea on Human Body Function, Some Diseases and Weight loss: A Review

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Abstract

After water, tea is the most consumed nutrient on the planet. However, black tea accounts for 78% of global tea consumption, while green tea accounts for only 20%. Except for flavored tea, all types of tea are made from the dried leaves of the tea bush. The type of tea is determined by the degree of oxidation of the leaves. Unoxidized tea leaves are used to make tea leaf, which is one of the less processed varieties of tea. It therefore, contains the most powerful antioxidants and beneficial polyphenols. Green tea polyphenols include epigallocatechin gallate (EGCG), epicatechin gallate, epicatechins, and flavanols, all of which are being studied in the lab for their potential in vivo effects. Kaempferol, quercetin, and myricetin are three types of flavonoids found in various parts. Although the caffeine in green tea can improve mental alertness, there is only weak, inconclusive evidence that it reduces the risk of most cancers or cardiovascular diseases, and there is no evidence that it aids weight loss. Using green tea as a health supplement has been linked to a slight improvement in general well-being. In a 2020 review, the Cochrane Collaboration identified a few potential negative effects, including gastrointestinal issues, higher levels of liver enzymes, and, more rarely, insomnia, elevated blood pressure, and skin reactions. Its anticancer and anti-inflammatory properties are well-known. Catechins are the main antioxidant dealers among the biologically active compounds found in Camellia sinesis. According to recent medical studies, the presence of function structural agencies and the range of hydroxyl agencies have a major impact on catechins' antioxidant activity. Unfermented inexperienced tea is the best source of those compounds.

The review on green tea and its catechins focused on language literature in English. The literature search was conducted in the following databases: Pubmed (1997-2020), EMBASE (1997-2020), Allied and complementary Medicine Database (AMED, 1997-2020) and China Journals Full Text Database (1997-2020). The keywords used were selected from the following terms: green tea, catechins, anticancer, diabetes, polyphenols, in vivo studies, general pharmacology and toxicology. The health benefits and adverse effects of green tea and its catechins were reviewed.

Keywords Green Tea, Human, diseases, weight loss

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List of abbreviations: ALT = Alanine aminotransferase, EGCG = (-)-epigallocatechin-3-gallate, GTE = Green tea extract, IQ = 2-amino-3-methylimidazol (4,5-f)quinoline, LDL = Low-density lipoprotein

Green tea

Tea is a type of tea made from *Camellia sinensis* leaves and buds that haven't been subjected to the constant withering and oxidation process used to make tea leaf teas and black teas [(1)]. Tea originated in China, but it is now grown and manufactured in a number of East Asian countries. Green tea comes in a variety of styles, each of which is well supported by the variety of *Camellia sinensis* used, growing conditions, farming methods, production processing, and harvest time [(2)]. Though there has been extensive

research into the possible health benefits of drinking strong tea on a regular basis, there is very little evidence that drinking inexperienced tea has any health benefits [3].

Kinds of green tea

There are many different types of green tea, each with its own style and inhibitor properties. Sencha is the most popular type of green tea, and it's most commonly made in Japan [4]. Sencha tea is used to make Bancha, Matcha, and Gyokuro species after proper treatment [5]. When compared to Sencha infusion, Bancha infusion contains significantly less caffeine, as well as L-theanine, the organic compound responsible for the formation of proteins responsible for neurotransmitter assembly, internal secretion, and vasoconstrictor function [6]. In comparison to other types of infusions, Matcha tea leaves infusion has the highest amount of alkaloid and L-theanine [7]. Tea comes in a variety of forms, including bottled and sweetened with sugar or artificial sweetener, single tea bags, loose-leaf, instant-powder, and green tea supplements, which are available in capsule form or liquid extracts [8].

Structure of inexperienced tea

Though many catechins are found in small amounts, (-)-epigallocatechin-3-gallate or EGCG is by far the most abundant of the inexperienced tea polyphenols by weight [9]. EGCG consists of a benzenediol ring (category A) joined to a tetrahydropyran moiety (C), a pyrogallol ring (B), and a galloyl organization (with the B' ring) and is thought to contain approximately 80–100 mg of polyphenols in a single bag of inexperienced tea [10]. The basic torsional angles that determine the orientation of the earrings and the conformers of the molecule are also divided into three categories φ, θ, and γ. EGCG has been defined as the most effective of the inexperienced tea catechins and is the most important component of inexperienced tea extract, which is commonly found in health food stores as a supplement [11]. As a result, the majority of research into the effects of inexperienced tea has focused on this molecule [12]. Despite the fact that catechins are much less abundant, three different representatives for comparison were chosen [13]. These are distinguished by one-of-a-kind businesses that result in one-of-a-kind capacity interactions with the solvent or organic environment [14]. They are (-)-epicatechin-3-gallate (ECG), which lacks a hydroxyl organization at the pyrogallol B ring; (-)-epigallocatechin-3-O-(3-O-methyl)-gallate (EGCMG), which has a methoxyl organization at the galloyl B' ring rather than a hydroxyl organization; and (-)-epigallocatechin (EGC), which has a [15]. The number and positions of the hydroxyl businesses (or their substituents) at the earrings, which determine their capacity to interact with organic count number via hydrogen bonding, or electron and hydrogen switch strategies within their antioxidant activities, are structural features of green tea catechins that significantly contribute to their organic motion [16]. As a result, the catechins chosen are a significant group to study and compare [17]. Antioxidants, such as polyphenols found in green tea, will neutralize free radicals, reducing or even preventing some of the damage they cause [18]. Polyphenols, chemicals with potent inhibitor properties, are largely responsible for green tea's health benefits [19]. Polyphenols appear to have greater antioxidant properties than vitamin C. Catechins are a type of polyphenol found in teas [20]. Catechin, gallaocatechin, epicatechin, epigallocatechin, ECG, and EGCG are the six primary catechin compounds found in tea leaves [21]. EGCG is the most researched polyphenol in tea leaves [22]. The ability of catechin and epicatechin molecules to scavenge is determined by their atomic number 1 donating ability. Polyphenols have an undeniable inhibitory effect on the production of reactive oxygen species (ROS) as well as the discharge of lysosomal enzymes [23]. Catechins' anti-oxidant effects include scavenging reactive element species, inhibiting the formation of free radicals, and preventing

supermolecule peroxidation [24]. According to market literature, catechins in green tea have inhibitory activity and have a significant impact on the interference of civilization diseases due to the presence of structural teams within the molecules, as well as the variety of hydroxyl radical groups [25]. Lung, esophageal, stomach, intestinal, pancreatic, breast, prostate, and bladder cancers are among the cancers that tea leaf may help to prevent [26]. However, it is worth considering catechins' aerobic potential, for example, when using green tea in the form of dietary supplements, because there's a chance for the formation of incredibly highly reactive metabolites with compound structure [27]. Quinones have the potential to produce large amounts of reactive element species as a result of oxidation-reduction reactions [28].

Role of tea on body operate and forestall some disease

Tea has been shown to increase blood flow while also lowering cholesterol levels. Tea has been shown to help with a variety of heart-related issues, ranging from high vital signs to symptoms of heart failure. What's good for the heart isn't always good for the brain; your brain craves healthy blood vessels [29].

Tea with cancer

Green tea does not appear to help people prevent or treat cancer, according to research [30]. Because of inconsistencies or insufficient evidence, the link between green tea consumption and the risk of certain cancers such as stomach cancer and non-melanoma skin cancers is unclear [31]. According to the National Cancer Institute, the polyphenols in tea have been shown to reduce tumor growth in laboratory and animal studies and will protect against ultraviolet B radiation injury [32]. Cancer rates are lower in countries where tea consumption is high, but it is impossible to know whether it's the green tea or other lifestyle factors that prevent cancer in these specific populations [33]. Tea has also been shown to have beneficial effects on the following types of cancer: breast, bladder, ovarian, body part (bowel), passage (throat), lung, prostate, skin, and abdomen in some studies [34-37]. Tea's high polyphenol content, according to researchers, aids in the killing and stopping of cancerous cells. The precise mechanisms by which tea interacts with cancerous cells, however, are unknown [38]. Tea, on the other hand, has not been shown to reduce the risk of cancer in various studies. In addition, the amount of tea required for cancer prevention varies widely in studies, ranging from 2 to 10 cups per day [39]. “There isn't any credible evidence to support qualified health claims for tea consumption and a reduced risk of gastric, lung, colon/rectal, esophageal, pancreatic, ovarian, and combined cancers,” the Food and Drug Administration (FDA) stated [40].

Green tea with decrease low-density lipoprotein (LDL) cholesterol

In 2012, a review of published research found that drinking green tea, either as a beverage or as a tablet, was linked to significant but modest reductions in total and LDL (or “bad”) cholesterol [41]. Green tea is made from both unfermented and fully fermented leaves of the same plant and can aid in the reduction of LDL cholesterol levels [42]. Researchers agree that catechins, a type of antioxidant found in tea, are responsible for the lowering of LDL cholesterol [43,44]. According to the researcher, the effects of inexperienced tea on LDL cholesterol are due to chemical compounds known as catechins, which reduce the absorption of LDL cholesterol within the gut [45]. Another study of 14 randomized, placebo-controlled studies found that inexperienced tea significantly reduced LDL cholesterol and triglyceride levels [46,47].

Green tea with cardiovascular disorder

An observational study discovered a minor link between daily inexperienced tea consumption and a 5% lower risk of dying from cardiovascular disease [48,49]. A rise in a single

cup of inexperienced tea per day was linked to a marginally lower risk of dying from cardiovascular reasons, according to some research [50]. Green tea consumption has been linked to a reduced risk of stroke [51,52]. Meta-analyses of randomized controlled trials discovered that drinking green tea for three to six months can result in small reductions in systolic and diastolic blood pressures (roughly 2-3 mmHg each) [53,54]. A separate systematic review and meta-analysis of randomized controlled trials discovered that drinking 5-6 cups of green tea per day was associated with a small reduction in systolic blood pressure (2 mmHg), but not with a significant difference in diastolic blood pressure [55]. A study of 40,530 Japanese adults discovered that those who drank more than 5 cups of green tea per afternoon had a 26% lower risk of dying from a coronary heart attack or stroke, and a 16% lower risk of dying from any cause than those who drank less than one cup of green tea per afternoon [56]. A meta-analysis of observational studies found that those who drank the most inexperienced tea had a 28% lower risk of coronary artery disease than those who drank the least inexperienced tea. Thirteen studies were conducted in inexperienced tea drinkers and five in black tea drinkers. Black tea had no effect on the risk of coronary heart disease [57].

Green tea with diabetes mellitus

Most studies on the effects of green tea on people with diabetes have focused on type 2 diabetes, which is far more common, accounting for 90-95% of diabetes seen in the United States [58]. The evidence for a link between inexperienced tea and diabetes has been mixed. Some studies have found a lower risk of developing type 2 diabetes in inexperienced tea drinkers than in non-tea drinkers, while others have found no link between tea consumption and diabetes at all [59]. There are signs that inexperienced tea may reduce the risk of developing diabetes. According to a study published in Japan's Trusted Source, people who drank six or more cups of green tea per day were 33% less likely to develop type 2 diabetes than those who drank only one cup per week [60]. However, tea's benefits do not stop at prevention; in people who have already been diagnosed with diabetes, green tea can help them manage their blood sugar levels [61,62]. According to a comprehensive review by trusted source, inexperienced tea consumption is linked to lower fasting glucose and glycated hemoglobin (HbA1c) levels, as well as lower fasting insulin levels, which is a dimension of diabetes health. While not all studies have confirmed those positive outcomes, inexperienced tea has been shown to be beneficial in a variety of ways [63].

Green tea with inflammatory skin diseases

Tea leaf has the potential to be a replacement treatment for skin disorders such as eczema and dandruff [64]. Researchers looked at an animal model for inflammatory skin diseases, which are marked by patches of dry, red, flaky skin caused by inflammation and skin cell production [65,66]. Green tea treatment resulted in slower skin cell growth as well as the presence of a factor that controls cell life cycles [67,68]. It also shows promise in treating inflammatory skin conditions like dandruff, lupus-induced lesions, and psoriasis, according to a new study. Skin cells multiply out of control in diseases like psoriasis, causing the skin to thicken and flake off. Immune cells in the body are also activated, resulting in inflammation [69].

Tea leaf with liver toxicity

Green tea consumption has not been linked to liver injury or increased levels of liquid body substance transferase; in fact, cross-sectional studies show that regular green tea consumption is linked to lower serum alanine aminotransferase (ALT) and asparate amniotransferase (AST) values. Nonetheless, case studies and a scientific review by the United States Pharmacopeia have raised concerns about the possibility of green tea extract (GTE) causing hepatotoxicity [70]. GTE

was linked to elevations in 6.7% of patients in a large prospective study of biological time girls in danger of breast cancer, compared to 0.7% of controls. Although no clinically apparent liver injury was observed in these studies, the extract was quickly stopped in patients with elevated ALT levels [71]. In some patients, restarting GTE was followed by a rapid recurrence of ALT elevations, which resolved when the GTE was stopped. The incidence of acute liver injury with symptoms or jaundice caused by tea leaf extract is unknown, but it is low when compared to the widespread use of these products [72,73]. Liver injury usually occurs one to six months after starting the product, but longer and shorter latencies (especially with re-exposure) have been reported. Acute hepatitis-like syndrome and a markedly hepatocellular pattern of liquid body substance accelerator elevations are seen in the majority of cases [74]. Although fatal cases of acute liver failure have been reported, most patients recover quickly after stopping the extract or herbal and dietary supplements (HDS). The results of the diagnostic assay reveal necrosis, inflammation, and eosinophils in a pattern that resembles acute hepatitis. Immunoallergic and response options are not always available or are limited [75]. A small number of similar cases have also been reported when tea leaf "infusions" were consumed instead of oral preparations of green tea extracts [76].

Green tea with weight loss

Tea leaves contain a number of beneficial compounds. Caffein is one of the compounds found in tea. Though a cup of green tea contains less caffeine (24-40 mg) than a cup of black tea (100-200 mg), it still has enough to have a light effect [77]. Caffeine is a well-known stimulant that has been shown in studies to aid fat burning and improve exercise performance. Green tea, on the other hand, shines in terms of its inhibitor content. Drinking a cup of green tea increases the amount of antioxidants in your blood, according to studies [78]. Catechins, which are potent inhibitors, are abundant in this healthy beverage. The most important of these is EGCG, a metabolism-boosting substance. Tea has gained widespread attention as a weight-loss product around the world, making it the second most popular beverage after water [79]. Green tea has been linked to a variety of health benefits, including weight loss, due to its organic process and antioxidant content. It's been used in traditional Chinese medicine for centuries to treat a variety of ailments [80]. The process by which your body converts your food and drink into usable energy is known as metabolism. Tea is thought to be beneficial for weight loss because it aids in the body's metabolism becoming more efficient. It's the flavonoid catechin, which acts as an inhibitor and boosts metabolism [81]. According to some research, green tea supplements containing caffeine or catechins have a minor but positive impact on weight loss programs. The most effective weight loss strategy is to use elbow grease frequently and eat a healthy diet rich in fruits and vegetables. Green tea, on the other hand, when used in these ways, will boost the positive outcome [82]. According to a study conducted by the University of Maryland Medical Centre, drinking two to three cups of tea in the future is sufficient for supplementing weight loss. The exact amount varies from person to person depending on their natural metabolism [83]. Except for weight loss, inexperienced teas are available in a variety of types, with little distinction between them. The richest organic process content is found in plain, minimally processed green teas, which are thought to be the best for weight loss and other health benefits. Another advantageous feature of green tea is that it contains almost no calories in comparison to the amount of nutrients it contains [84].

Effects on drug-metabolizing enzymes

long-term consumption of green tea enhances uridine di-phospatase (UDP)-glucuronosyl transferase activity in rats, and catechins are processed by drug-metabolizing enzymes in

several organs following absorption [85-89]. Accordingly, it is hypothesized that the enhanced glucuronidation caused by UDP-glucuronosyl transferase activation helps green tea's anticarcinogenic impact by promoting the conversion of chemical carcinogens into inert byproducts that are easily eliminated. The relationship between green tea catechin metabolism and 2-amino-3-methylimidazol (4,5-f) quinoline (IQ) was investigated [90]. IQ is a precarcinogen that was first discovered in a fried beef extract. Cytochrome P450 is the primary pathway for rat IQ biotransformation, which is then coupled to a sulfate and a glucuronide conjugate. Rats with altered IQ metabolism produce more IQ glucuronides, which are then eliminated in the urine. Green tea catechins may also protect against malignancies brought on by polycyclic aromatic hydrocarbons by inhibiting their cytochrome P450 metabolism, however this depends on the specific form of green tea consumed. In normal rats, long-term green tea drinking enhances cytochrome P450 1A1 and 1A2 activities but not 2B1 and 2E1 activities. Conclusions regarding a protective effect of green tea against carcinogens involving solely this metabolic pathway's modification, however, are challenging to establish [91].

Conclusion

Tea leaf is thought to improve blood flow and lower cholesterol levels. Several studies found that inexperienced tea prevented a variety of heart-related issues, ranging from sickness to symptom. The effects of green tea on disease have been mixed in studies. More and more emphasis is being placed to define events at the cellular level. Much interest has been centered on the role of oxidant/antioxidant activity in regards to the aging process and degenerative diseases like cancer, cardiovascular disease and diabetes. There are some signs that green tea may aid in the elimination of cancer cells, but this research is still in its early stages. On the other hand, the National Cancer Institute's website states that it "doesn't recommend" the use of tea to reduce the risk of cancer. Future study is required to determine the precise quantity of health benefits, establish the safe range of tea consumption associated with these advantages, and clarify the mechanisms of action because the human clinical data is currently limited. A deeper knowledge of how green tea interacts with endogenous systems and other external elements will be possible with the development of more precise, sensitive, and representative approaches with more representative models. Only carefully planned observational epidemiological research and intervention trials will be able to draw definitive findings about the preventive impact of green tea. Future research in this field will be made easier by the creation of biomarkers for green tea consumption and molecular markers for its biological effects.

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