



Green tea (*Camellia sinensis*)

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While some complementary and alternative techniques have been studied scientifically, high-quality data regarding safety, effectiveness, and mechanism of action are limited or controversial for most therapies. Whenever possible, it is recommended that practitioners be licensed by a recognized professional organization that adheres to clearly published standards. In addition, before starting a new technique or engaging a practitioner, it is recommended that patients speak with their primary healthcare provider(s). Potential benefits, risks (including financial costs), and alternatives should be carefully considered. The below monograph is designed to provide historical background and an overview of clinically-oriented research, and neither advocates for or against the use of a particular therapy.

Related Terms

- Anthocyanins, árbol del té (Spanish), arbre à thé (French), caffeine, čaj (Czech, Russian, Slovenian), čaje zelené (Czech), čajnoe derevo (Russian), čajovník čínský (Czech), camellia, *Camellia assamica*, *Camellia sinensis*, camellia tea, *Camellia thea*, *Camellia theifera*, catechins, çay (Turkish), cha (Chinese, Thai, Japanese, Korean, Sinhalese, Urdu), chá (Portuguese - Brazil), cha no ki (Japanese), chaa (Hindi), chaay (Hindi, Sinhalese), chá-da-Índia (Portuguese), chá-preto (Portuguese - Brazil), chaha (Kannada), chai (Hindi, Russian), chainoe derevo (Russian), chay (Persian, Urdu), chaya (Tamil), Chinese tea, Chinesischer Thee (German), chiya (Nepali), EGC, EGCG, epicatechin gallates, epicatechins, epigallocatechins, green tea extract, GTE, herbata chińska (Polish), hiina teepõõsas (Estonian), ichibi (Japanese), Japanese tea, kamelia (Polish), lignin, lotus-f3, L-theanine, matcha, matcha green tea, matsu-cha tea, methylxanthine, nok cha (Korean), organic acids, phenolic acids, phytochemicals, pianta del tè (Italian), planta del té (Spanish), Poly E, polyphenols, Polyphenon E®, proanthocyanidins, shay (Arabic), sincatechins, tannins, te (Danish, Kannada, Norwegian, Sinhalese, Swedish), té (Spanish), tea (Hungarian), tea green, tebusk (Danish), tebuske (Swedish), tee (Finnish, German), teekameelia (Estonian), teepensas (Finnish), Teestrauch (German), teestruik (Dutch), teh (Hebrew, Malay), teyaku (Telugu), thayilai (Tamil), thé (French), *Thea bohea*, *Thea sinensis*, *Thea viridis*, Theaceae (family), theanine, theesoortt (Dutch), Theestrauch (German), theestruik (Dutch), théier (French), theifers, theobromine, theophylline, Veregen®, vitamins.
- **Examples of combination products:** AR25 (Exolise®), FertilityBlend™ (chasteberry extract, green tea extracts, L-arginine, vitamins, and minerals), LipoKinetix® (norephedrine, caffeine, yohimbine, diiodothyronine, and sodium usnate), Metabolife 356® (caffeine, plus extracts of green tea, *Garcinia cambogia*, and yerba mate), Nature's Bounty® Green Tea Extract, PhosphoLEAN™ (85mg of N-oleyl-phosphatidylethanolamine extracted from soya lecithin and 121mg of a dry green tea extract), Puritan's Pride® Green Tea Extract.

Background

- Green tea is made from the leaves of *Camellia sinensis*, an evergreen shrub native to Southeast Asia. Both green tea and black tea are made from the same plant species. Green tea is produced by lightly steaming the leaves. Black tea is produced by allowing the leaves to ferment.

- Green tea is rich in the class of polyphenol compounds known as catechins. Polyphenols may have health benefits for humans. Many of the effects of green tea are thought to be due to its most abundant catechin, epigallocatechin gallate (EGCG).
- Green tea also contains caffeine. One cup of tea contains approximately 50 milligrams of caffeine, while coffee typically contains 65-175 milligrams of caffeine per cup.
- Traditional health claims for green tea include improved urine flow, relief of joint pain, and improved resistance to diseases. Historically, green tea bags have been applied to the body to soothe sunburn, headache, and tired eyes. Green tea is an accepted cancer prevention treatment in Japan and Fiji.

Scientific Evidence

Uses	<u>Grade</u> *
<i>These uses have been tested in humans or animals. Safety and effectiveness have not always been proven. Some of these conditions are potentially serious, and should be evaluated by a qualified healthcare provider.</i>	
<p><u>Genital warts</u> Polyphenon E® ointment, containing an extract of green tea, has been approved in the United States for treatment of genital warts caused by human papillomavirus. Although this shows promise, further research is needed before a stronger conclusion can be made.</p>	<u>B</u>
<p><u>Allergy</u> Limited study suggests that <i>benifuuki</i> green tea may reduce allergic reaction to the Japanese cedar tree. Additional studies are needed before a conclusion can be made.</p>	<u>C</u>
<p><u>Anxiety</u> L-theanine is an amino acid found in green tea. Preliminary research suggests that L-theanine may improve symptoms of anxiety. Additional studies on the effects of green tea are needed before a conclusion can be made.</p>	<u>C</u>
<p><u>Arthritis</u> Research suggests that green tea may improve the symptoms of arthritis by reducing inflammation and slowing cartilage breakdown. Further studies are required before a conclusion can be made.</p>	<u>C</u>
<p><u>Cancer (general)</u> Several studies have investigated whether green tea can help prevent cancer, especially cancer of the digestive system. However, additional research is needed before any conclusion can be made.</p>	<u>C</u>
<p><u>Cardiovascular conditions</u> Preliminary evidence suggests that drinking green tea on a regular basis may reduce the risk of heart attack or atherosclerosis (hardening of the arteries). Further well-designed clinical trials are needed before a firm conclusion can be made in this area.</p>	<u>C</u>
<p><u>Common cold prevention (general)</u> Preliminary research suggests that a preparation of green tea may help prevent cold and flu symptoms. Further well-designed clinical trials are needed before a conclusion can be made.</p>	<u>C</u>
<p><u>Dental caries (cavities)</u> Limited study suggests that gargling with green tea may help prevent cavities. Further study is needed before a conclusion can be made.</p>	<u>C</u>
<p><u>Diabetes</u> Green tea has been studied to determine if it has beneficial effects on symptoms of diabetes. Additional research is needed before a conclusion can be made.</p>	<u>C</u>
<p><u>Fertility</u> Preliminary research suggests that a combination product called FertilityBlend™ may help women get pregnant. Further well-designed research on green tea alone is needed before a strong conclusion can be made.</p>	<u>C</u>



<u>Gum disease (periodontitis)</u>	
Limited study suggests that drinking green tea may help prevent gum disease. Additional clinical trials are needed before a conclusion can be made.	<u>C</u>
<u>High cholesterol</u>	
Although not well studied in humans, some research suggests that green tea may have a beneficial effect on cholesterol levels. Additional human trials are needed before a conclusion can be made.	<u>C</u>
<u>Hypertension (high blood pressure)</u>	
Several studies suggest that green tea may have an effect on blood pressure. Additional research is required before a firm conclusion can be made.	<u>C</u>
<u>Hypertriglyceridemia (high triglyceride levels)</u>	
Although not well studied in humans, some research suggests that green tea may reduce triglyceride levels in the blood after meals. Further human studies are needed before a conclusion can be made.	<u>C</u>
<u>Liver disease</u>	
Limited study suggests that green tea may reduce the risk of liver disease. Additional research is necessary before a conclusion can be made.	<u>C</u>
<u>Menopausal symptoms</u>	
Limited study suggests that a preparation containing green tea may improve the symptoms of menopause. Additional research on the effect of green tea alone is necessary before a conclusion can be made.	<u>C</u>
<u>Mental performance/alertness</u>	
Preliminary studies have investigated the effect of tea on memory and awareness. Additional research is need before a conclusion can be made.	<u>C</u>
<u>Obesity</u>	
Several studies have explored the effect of green tea on obesity in children and adults. Further study is needed in this area before a conclusion may be made.	<u>C</u>
<u>Osteoporosis (bone loss)</u>	
Green tea has been studied to determine if it has an effect on osteoporosis. More well-designed trials are needed before a conclusion can be made.	<u>C</u>
<u>Photoprotection (protection from the damaging rays of the sun)</u>	
Limited research has investigated the effect of green tea in protecting the skin from sun damage. Additional well-designed studies are needed before a firm conclusion can be made.	<u>C</u>
<u>Pneumonia</u>	
Although not well studied in humans, limited research suggests that catechins, which are the main polyphenol in green tea, may have activity against some disease-causing bacteria. Additional research is needed before a conclusion can be made.	<u>C</u>
<u>Tuberculosis (management of oxidative stress)</u>	
Limited study suggests that green tea catechins may have a beneficial effect on some markers of tuberculosis. Additional research on the effect of green tea alone is needed.	<u>C</u>
<u>Viral infection</u>	
Preliminary research suggests that green tea may reduce the amount of human T cell leukemia virus in the blood of carriers (people who are infected with the virus but have no symptoms). Further study is necessary before a conclusion can be made.	<u>C</u>

Tradition/Theory

The below uses are based on tradition, scientific theories, or limited research. They often have not been thoroughly tested in humans, and safety and effectiveness have not always been proven. Some of these conditions are potentially serious, and should be evaluated by a qualified healthcare provider. There may be other proposed uses that are not listed below.

- Age-related macular degeneration (eye disease), alcohol intoxication, Alzheimer's disease (prevention), amyotrophic lateral sclerosis (ALS, or Lou Gehrig's disease), anthrax, antibacterial, antifungal, anti-inflammatory, antioxidant, antiviral, astringent, atherosclerosis (hardening of the arteries), bleeding of gums or tooth sockets, blood thinner, bone density improvement, cancer treatment side effects, cardiostimulant (improves heart function), cataracts (eye disease), dementia, diarrhea, digestion, diuretic (increases urine flow), elimination of toxins, exercise performance, fibrosarcoma (connective tissue tumor), flatulence (gas), food preservative, foul body odor (prevention), gastritis (inflammation of the stomach), gastrointestinal disorders, glaucoma (eye disease), gum swelling, hair growth, headache, *Helicobacter pylori* infection (bacterial infection), hepatocellular carcinoma, HIV/AIDS, improving blood flow, improving resistance to disease, improving urine flow, inflammation (autoimmune encephalomyelitis), inflammatory bowel disease (Crohn's disease), inhibition of platelet aggregation, ischemia-reperfusion injury protection, joint pain, kidney stone prevention, leukoplakia (white patches on the mucous membranes of the mouth and other tissues), longevity/antiaging, lymphocytic leukemia, malignant melanoma, memory, metabolic disorders, neuroprotection (nerve protection), Parkinson's disease (prevention), protection against asbestos lung injury, sepsis (blood infection), stimulant, stroke prevention, sunburn, tired eyes, tumors, vomiting, wounds.

Dosing

The below doses are based on scientific research, publications, traditional use, or expert opinion. Many herbs and supplements have not been thoroughly tested, and safety and effectiveness may not be proven. Brands may be made differently, with variable ingredients, even within the same brand. The below doses may not apply to all products. You should read product labels, and discuss doses with a qualified healthcare provider before starting therapy.

Adults (18 years and older)

- Traditionally, an average of three cups of green tea has been taken by mouth daily. For medicinal purposes, as many as 10 cups daily have been consumed.
- For allergy, *benifuuki* tea has been taken by mouth daily for approximately 1-3 months prior to pollen season.
- For cancer, 1-10 cups of green tea have been taken by mouth daily. Two hundred milligrams of green tea catechins daily has been taken by mouth daily for one year. Green tea extract (GTE) tablets equal to six to more than 10 cups have been used daily for 12 months. Capsules containing 250 milligrams of GTE have been taken by mouth twice daily for four months. Six grams of green tea has been taken by mouth daily in six divided doses for two months. One daily dose of GTE (starting with a dose of 0.5 grams per square meter and increasing) has been taken by mouth. Five milligrams of decaffeinated green tea has been taken by mouth daily for 12 months. GTE at a dose of 500, 750, or 1,000 milligrams per square meter of body mass has been taken by mouth three times daily for 12 weeks. One 200-milligram capsule of the green tea catechin epigallocatechin gallate (EGCG) has been taken by mouth and used with Poly E ointment for up to 12 weeks.
- For cardiovascular health, green tea containing 75-576 milligrams of catechins has been taken by mouth once daily for 24 weeks. Greater than 10 cups of green tea daily has been taken by mouth.
- For prevention of the common cold, green tea capsules of an unknown dose have been taken by mouth twice daily for three months.
- In a study on cavities, a solution of 0.61% GTE, containing about 30% catechins, has been used for 60 seconds for rinsing of the mouth.
- For diabetes, green tea containing 582.8 milligrams of catechins has been taken by mouth daily for 12 weeks. A packet of green tea extracts containing 544 milligrams of polyphenols (456 milligrams of catechins) has been taken by mouth daily for two months.
- For DNA damage, four cups (960 milliliters) of green tea daily was used to decrease DNA damage among GSTM1-positive smokers.

- For genital warts, 10-15% Polyphenon E® ointment has been applied to the skin three times daily for up to 16 weeks. Sin catechins ointment (10% or 15%) has been applied to the skin three times daily for a maximum of 16 weeks.
- For viral infection (carriers of human T cell lymphocytic virus), nine capsules of GTE (equal to 10 cups of green tea) have been taken by mouth daily.
- For high cholesterol, a dose of 375 milligrams of theaflavin-enriched (polyphenol-enriched) GTE has been taken by mouth for 12 weeks. Three grams of green tea in 500 milliliters of water has been taken by mouth daily for 90 days.
- For high blood pressure, five servings (200 milliliters each) of green tea have been taken by mouth daily for seven days.
- For hypertriglyceridemia (high triglycerides in the blood), a dose of 224 or 674 milligrams of green tea catechins has been taken by mouth with a meal.
- For obesity, a capsule containing 400 milligrams of GTE has been taken by mouth three times daily for 12 weeks. GTE containing 583 milligrams of catechins has been taken by mouth. Two capsules of AR25 (Exolise®) have been taken by mouth twice daily for 12 weeks. Green tea containing 582 milligrams catechins has been taken by mouth daily for 12 weeks. Green tea containing 573 milligrams catechins has been taken by mouth for 13 weeks. A single dose of 500 milligrams of GTE has been taken by mouth.
- For photoprotection (protection from the damaging rays of the sun), a combination regimen of 300 milligrams of green tea by mouth and 10% green tea cream applied to the skin twice daily has been used daily for eight weeks.
- For tuberculosis (management of oxidative stress), 500 micrograms of catechin has been taken by mouth three days weekly for four months.

Children (under 18 years old)

- In general, green tea is not indicated for infants or children, due to its caffeine content.
- For cardiovascular conditions, green tea containing 576 milligrams of catechins has been taken by mouth once daily for 24 weeks.
- For obesity, green tea containing 576 milligrams of catechins has been taken by mouth once daily for 24 weeks.

Safety

The U.S. Food and Drug Administration does not strictly regulate herbs and supplements. There is no guarantee of strength, purity or safety of products, and effects may vary. You should always read product labels. If you have a medical condition, or are taking other drugs, herbs, or supplements, you should speak with a qualified healthcare provider before starting a new therapy. Consult a healthcare provider immediately if you experience side effects.

Allergies

- Avoid with known allergy or hypersensitivity to green tea, its constituents, caffeine, tannins, or members of the Theaceae family. Allergic and sensitivity reactions following use of Polyphenon E® ointment on genital warts have been reported.

Side Effects and Warnings

- Many of the side effects and warnings listed below are based on the caffeine content of green tea. Green tea can contain 50 milligrams of caffeine per cup.
- Caffeine may have a variety of side effects, such as increased energy and mental alertness, headache, or dizziness.

- Caffeine is considered an addictive substance and may be associated with dependence. Quitting caffeine may produce symptoms of withdrawal.
- Green tea may lower blood sugar levels. Caution is advised when using medications that may also lower blood sugar. Patients taking drugs for diabetes by mouth or insulin should be monitored closely by a qualified healthcare professional, including a pharmacist. Medication adjustments may be necessary.
- Green tea may increase the risk of bleeding when taken with drugs that increase the risk of bleeding. Some examples include aspirin, anticoagulants (blood thinners) such as warfarin (Coumadin®) or heparin, antiplatelet drugs such as clopidogrel (Plavix®), and nonsteroidal anti-inflammatory drugs such as ibuprofen (Motrin®, Advil®) or naproxen (Naprosyn®, Aleve®).
- Caution is advised in patients with uncontrolled high blood pressure or those taking drugs that also affect blood pressure.
- Use cautiously in patients using benzodiazepines, including lorazepam, diazepam, and midazolam, because the caffeine in green tea may counteract their effects.
- Use cautiously in patients using medications, herbs, or supplements, because the caffeine in green tea may interact with the body's drug-processing cytochrome P450 enzyme system and the p-glycoprotein system.
- Use with caution in patients with cardiac arrhythmias (irregular heartbeat), blood disorders, breast disease, gastrointestinal disorders, glaucoma, impaired iron metabolism, iron deficiency, liver disorders, mitral valve prolapse, or psychiatric disorders.
- Use with caution in postmenopausal women, patients prone to headaches, those at risk for prostate cancer or osteoporosis, and those undergoing magnetic resonance imaging (MRI) of the gastrointestinal tract.
- Use with caution in individuals with an empty stomach, or those using alcohol, analgesics (painkillers), antifungals, birth control pills, decongestants, diuretics, drugs that affect the gastrointestinal system, drugs that affect the nervous system, drugs that may damage the liver, drugs that may lower seizure threshold, drugs to treat glaucoma, estrogen, iron, monoamine oxidase inhibitors (MAOIs), and other agents containing caffeine.
- Use with caution in elderly women, because high caffeine intake may worsen an unstable bladder.
- Use of green tea extract Polyphenon E® ointment may result in skin irritation or sun sensitivity.
- Avoid in excessively high amounts by mouth.
- Avoid in pregnant women, because caffeine crosses the placenta, and tea decreases folic acid availability. Avoid in breastfeeding women, because caffeine is transferred to breast milk, and tea decreases folic acid availability.
- Avoid in children, due to the caffeine content of green tea.

Pregnancy and Breastfeeding

- Avoid during pregnancy and breastfeeding, due to the caffeine content, and because tea decreases folic acid availability.

Interactions

Most herbs and supplements have not been thoroughly tested for interactions with other herbs, supplements, drugs, or foods. The interactions listed below are based on reports in scientific publications, laboratory experiments, or traditional use. You should always read product labels. If you have a medical condition, or are taking other drugs, herbs, or supplements, you should speak with a qualified healthcare provider before starting a new therapy.

Interactions with Drugs

- **Note:** Many of the drug interactions listed below are based on the caffeine content of green tea.
- Green tea may lower blood sugar levels. Caution is advised when using medications that may also lower blood sugar. Patients taking drugs for diabetes by mouth or insulin should be monitored closely by a qualified healthcare professional, including a pharmacist. Medication adjustments may be necessary.
- Green tea may increase the risk of bleeding when taken with drugs that increase the risk of bleeding. Some examples include aspirin, anticoagulants (blood thinners) such as warfarin (Coumadin®) or heparin, antiplatelet drugs such as clopidogrel (Plavix®), and nonsteroidal anti-inflammatory drugs such as ibuprofen (Motrin®, Advil®) or naproxen (Naprosyn®, Aleve®).
- Green tea may affect blood pressure. Caution is advised in patients taking drugs that also affect blood pressure.
- Green tea may interfere with the way the body processes certain drugs using the liver's cytochrome P450 enzyme system or using p-glycoprotein. As a result, the levels of these drugs may change in the blood and may cause increased or decreased effects or potentially serious adverse reactions. Patients taking any medication should check the package insert and speak with a qualified healthcare professional, including a pharmacist, about possible interactions.
- Green tea may also interact with adenosine, agents that widen or narrow blood vessels, alcohol, Alzheimer's agents, analgesics (painkillers), antiarthritic agents, antiasthma drugs, antibiotics, anticancer agents, anticonvulsant agents, antiestrogens, antiseizure agents, antifungals, antiglaucoma agents, anti-inflammatory agents, antiobesity agents, antiulcer agents, antiviral agents, barbiturates, benzodiazepines, beta-agonists, birth control pills, caffeine, calcium salts, cholesterol-lowering agents, cimetidine (Tagamet®), clozapine, corticosteroids, decongestants, dipyridamole, disulfiram, diuretics, doxorubicin, drugs that affect sex hormone levels, drugs that affect the cardiovascular system, drugs that affect the gastrointestinal system, drugs that affect the immune system, drugs that affect the nervous system, drugs that affect the respiratory system, drugs that affect the teeth and gums, drugs that may damage the liver, drugs that may lower seizure threshold, drugs used to treat blood disorders, enoxacin, ephedrine, ergot derivatives, estrogens, fertility agents, fluvoxamine, hormonal agents, iron salts, levodopa, lithium, mexiletine, monoamine oxidase inhibitors (MAOIs), methoxsalen, nervous system agents, nicotine, nonsteroidal antiinflammatory agents (NSAIDs), phenylpropanolamine, quinolones, riluzole, stimulants, sulfotransferase 1A3 (SULT1A3) substrates, tamoxifen, terbinafine, and theophylline.

Interactions with Herbs and Dietary Supplements

- **Note:** Many of the herb and supplement interactions listed below are due to the caffeine content of green tea.
- Green tea may lower blood sugar levels. Caution is advised when using herbs or supplements that may also lower blood sugar. Blood glucose levels may require monitoring, and doses may need adjustment.
- Green tea may increase the risk of bleeding when taken with herbs and supplements that are believed to increase the risk of bleeding. Multiple cases of bleeding have been reported with the use of *Ginkgo biloba*, and fewer cases with garlic and saw palmetto. Numerous other agents may theoretically increase the risk of bleeding, although this has not been proven in most cases.
- Green tea may affect blood pressure. Caution is advised in patients taking herbs or supplements that also affect blood pressure.
- Green tea may interfere with the way the body processes certain herbs or supplements using the liver's cytochrome P450 enzyme system or using p-glycoprotein. As a result, the levels of other herbs or supplements may change in the blood. It may also alter the effects that other herbs or supplements potentially may have on the P450 system.
- Green tea may also interact with analgesics (painkillers), anti-Alzheimer's herbs, antiarthritis herbs and supplements, antibacterials, anticancer herbs and supplements, antiestrogens, antifungals, antiobesity herbs and supplements, antioxidants, antiulcer herbs and supplements, antivirals, anti-inflammatory herbs, ascorbic acid, birth control herbs and supplements, bitter orange, blood vessel-dilating and -narrowing herbs and supplements, caffeine-containing herbs, calcium, cholesterol-lowering herbs and supplements, cola nut, diuretics, ephedra (ma huang), fertility agents, folic acid, grapes, guarana, herbs

and supplements that affect intraocular (within the eye) pressure, herbs and supplements that affect sex hormone levels, herbs and supplements that affect the cardiovascular system, herbs and supplements that affect the gastrointestinal system, herbs and supplements that affect the immune system, herbs and supplements that affect the nervous system, herbs and supplements that affect the respiratory system, herbs and supplements that lower seizure threshold, herbs and supplements that may damage the liver, herbs and supplements used to treat blood disorders, hormonal herbs and supplements, iron, L-theanine, monoamine oxidase inhibitors (MAOIs), minerals, mushrooms, N-acetyl cysteine, nervous system agents, potassium, quercetin, red onion, resveratrol, selenium, sulfotransferase 1A3 (SULT1A3) substrates, stimulants, tannin-containing herbs, tobacco, vitamin K, yerba mate, *Zizyphus jujuba*.

Author Information

- This information is based on a systematic review of scientific literature edited and peer-reviewed by contributors to the Natural Standard Research Collaboration (www.naturalstandard.com).

References

Natural Standard developed the above evidence-based information based on a thorough systematic review of the available scientific articles. For comprehensive information about alternative and complementary therapies on the professional level, go to www.naturalstandard.com. Selected references are listed below.

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