

Green Tea

Latin Name: Camellia sinensis

STIMULANT; ANTIOXIDANT

Use LEAVES

SAME PLANT:

- Green tea (non-processed)
- Oolong tea (partially fermented)
- Black tea (fully fermented and roasted -highest amount of caffeine)
- White tea (non-processed; immature leaf when white blossoms are out)

Native to southeast ASIA (China, India, Japan, Thailand)

Large evergreen shrub

HISTORY

- 1) 2700 BC: Recorded as a beverage in CHINA
- 2) 1700s: Introduced to Europe

QUALITIES

- 1) Components: Vitamin C; Vitamin E; Fluoride; Chlorophyll; Caffeine; Tannins
- 2) STIMULANT; COGNITIVE Improvement
 - STUDY (memory): "...positive effects on working memory test performance, correlated with enhanced brain connectivity measured by MRI, resulting in improvement in task performance. (Schmidt 2014)
- 3) Weight loss
 - STUDY (weight loss): "In a randomized, placebo-controlled, double-blind parallel trial conducted in 80 overweight and moderately obese subjects, a green tea-caffeine mixture improved weight maintenance through thermogenesis, fat oxidation and sparing fat-free mass." (Hursel 2009)
- 4) HEART; Reduces Cholesterol; Atherosclerosis; reduce risk of HYPERTENSION; blocks PLATELET Aggregation
 - STUDY REVIEW (bp and cholesterol): "...significant effects of lowering blood pressure and moderate reduction of total and LDL blood cholesterol levels." Onakpoya 2014
- 5) - SKIN; Wounds; Gums; Genital warts
 - STUDY (skin): "...increased skin moisture, skin elasticity ratio, and microrelief (less roughness) of the skin on the forearm of human volunteers 15-30 days after a single application. (Gianeti 2013)
 - STUDY (skin UV protection): "...reduced skin erythema [redness] due to UV radiation and reduced production of pro-inflammatory molecules in the skin." (Rhodes 2013)

6) OTHER

- GI Disorders; Antibacterial; anti-diarrheal
 - Powerful ANTI-OXIDANT; protects against DNA damage
 - Diuretic; Blood Sugar levels; Body Temperature
 - Anti-Cancer properties
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Green Tea References

Herb History and General Information

Foster, Steven and Rebecca L. Johnson, *Desk Reference to Nature's Medicine*. Washington, D.C.: National Geographic; 2006; pp 344-345

Grieve, M., *A Modern Herbal, Vol I & II*. New York and London: Hafner Publishing Co.; 1967. See excerpts at www.botanical.com accessed July 22, 2014

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Studies

Gianeti MD, Mercurio DG, Campos PM. The use of green tea extract in cosmetic formulations: not only an antioxidant active ingredient. *Dermatol Ther*. 2013 May-Jun;26(3):267-71. doi: 10.1111/j.1529-8019.2013.01552.x. Epub 2013 Mar 13. [PubMed]

Hursel R, Westerterp-Plantenga MS. Green tea catechin plus caffeine supplementation to a high-protein diet has no additional effect on body weight maintenance after weight loss. *Am J Clin Nutr*. 2009 Mar;89(3):822-30. doi: 10.3945/ajcn.2008.27043. Epub 2009 Jan 28. [PubMed]

Onakpoya I, Spencer E, Heneghan C, Thompson M. The effect of green tea on blood pressure and lipid profile: a systematic review and meta-analysis of randomized clinical trials. *Nutr Metab Cardiovasc Dis*. 2014 Aug;24(8):823-36. doi: 10.1016/j.numecd.2014.01.016. Epub 2014 Jan 31. [PubMed]

Rhodes LE, Darby G, Massey KA, Clarke KA, Dew TP, Farrar MD, Bennett S, Watson RE, Williamson G, Nicolaou A. Oral green tea catechin metabolites are incorporated into human skin and protect against UV radiation-induced cutaneous inflammation in association with reduced production of pro-inflammatory eicosanoid 12-hydroxyeicosatetraenoic acid. *Br J Nutr*. 2013 Sep 14;110(5):891-900. doi: 10.1017/S0007114512006071. Epub 2013 Jan 28. [PubMed]

Schmidt A, Hammann F, Wölnerhanssen B, Meyer-Gerspach AC, Drewe J, Beglinger C, Borgwardt S. Green tea extract enhances parieto-frontal connectivity during working memory processing. *Psychopharmacology (Berl)*. 2014 Oct;231(19):3879-88. doi: 10.1007/s00213-014-3526-1. Epub 2014 Mar 19. [PubMed] [Free PMC article available]

Additional info on Studies:

BP + CHOLESTEROL

Green tea appears to have small but significant effects of lowering blood pressure and moderate effects on the reduction of total and LDL blood cholesterol levels, according to the systematic review and meta-analysis of randomized clinical trials. Onakpoya 2014

META ANALYSIS REVIEW:

Many different dietary supplements are currently marketed for the management of hypertension, but the evidence for effectiveness is mixed. The aim of this systematic review was to evaluate the evidence for or against the effectiveness of green tea (*Camellia sinensis*) on blood pressure and lipid parameters.

METHODS AND RESULTS:

Electronic searches were conducted in Medline, Embase, Amed, Cinahl and the Cochrane Library to identify relevant human randomized clinical trials (RCTs). Hand searches of bibliographies were also conducted. The reporting quality of included studies was assessed using a checklist adapted from the CONSORT Statement. Two reviewers independently determined eligibility, assessed the reporting quality of the included studies, and extracted the data. As many as 474 citations were identified and 20 RCTs comprising 1536 participants were included. There were variations in the designs of the RCTs. A meta-analysis revealed a significant reduction in systolic blood pressure favouring green tea (MD: -1.94 mmHg; 95% CI: -2.95 to -0.93; I(2) = 8%; p = 0.0002). Similar results were also observed for total cholesterol (MD: -0.13 mmol/l; 95% CI: -0.2 to -0.07; I(2) = 8%; p < 0.0001) and LDL cholesterol (MD: -0.19 mmol/l; 95% CI: -0.3 to -0.09; I(2) = 70%; p = 0.0004). Adverse events included rash, elevated blood pressure, and abdominal discomfort.

CONCLUSION:

Green tea intake results in significant reductions in systolic blood pressure, total cholesterol, and LDL cholesterol. The effect size on systolic blood pressure is small, but the effects on total and LDL cholesterol appear moderate. Longer-term independent clinical trials evaluating the effects of green tea are warranted.

MEMORY

A green tea extract administered in a milk whey-based drink had positive effects on working memory test performance, correlated with enhanced connectivity between the right superior parietal lobule and the middle frontal gyrus. Schmidt 2014

It has been proposed that green tea extract may have a beneficial impact on cognitive functioning, suggesting promising clinical implications. However, the neural

mechanisms underlying this putative cognitive enhancing effect of green tea extract still remain unknown.

OBJECTIVES:

This study investigates whether the intake of green tea extract modulates effective brain connectivity during working memory processing and whether connectivity parameters are related to task performance.

MATERIAL AND METHODS:

Using a double-blind, counterbalanced, within-subject design, 12 healthy volunteers received a milk whey-based soft drink containing 27.5 g of green tea extract or a milk whey-based soft drink without green tea as control substance while undergoing functional magnetic resonance imaging. Working memory effect on effective connectivity between frontal and parietal brain regions was evaluated using dynamic causal modeling.

RESULTS:

Green tea extract increased the working memory induced modulation of connectivity from the right superior parietal lobule to the middle frontal gyrus. Notably, the magnitude of green tea induced increase in parieto-frontal connectivity positively correlated with improvement in task performance.

CONCLUSIONS:

Our findings provide first evidence for the putative beneficial effect of green tea on cognitive functioning, in particular, on working memory processing at the neural system level by suggesting changes in short-term plasticity of parieto-frontal brain connections. Modeling effective connectivity among frontal and parietal brain regions during working memory processing might help to assess the efficacy of green tea for the treatment of cognitive impairments in psychiatric disorders such as dementia.

SKIN Improvement

The cosmetic preparation containing *Camellia sinensis* increased skin moisture, skin viscoelastic-to-elastic ratio (Uv/Ue), and microrelief of the skin on the forearm of human volunteers 15-30 days after a single application. Gianeti 2013

Green tea (GT) extracts contain polyphenols, known to be effective free radical scavengers, and other ingredients that could also provide benefits to the skin. This is a report on clinical studies using objective, noninvasive methods to evaluate the effects of cosmetic formulations containing GT. Experimental formulations were supplemented or not (vehicle) with 6% *Camellia sinensis* glycolic leaf extracts (GT). These formulations were applied to the forearm skin of 24 volunteers, and their effects were evaluated before and after 2 hours, 15 and 30 days according to the following parameters: stratum corneum water content, transepidermal water loss, skin viscoelastic-to-elastic ratio (Uv/Ue), and microrelief. The volunteers were instructed not to apply any formulation in an area of the forearm (control area). Experimental formulations (GT) increased skin moisture in the long-term study, indicating that GT has a prolonged moisturizing effect. The Uv/Ue was significantly enhanced after 30 days of topical application of the experimental formulation when compared with vehicle and control. After 15-30 days, skin microrelief was significantly improved due to a reduction in skin roughness. The results suggest that GT-containing cosmetic formulations have pronounced moisturizing effects and improve skin microrelief.

SKIN UV PROTECTION

Green tea catechins (540 mg) with vitamin C (50 mg), administered orally daily for 12 weeks, reduced skin erythema [redness] due to UV radiation and reduced production of pro-inflammatory molecules in the skin. Rhodes 2013

Green tea catechins (GTC) reduce UV radiation (UVR)-induced inflammation in experimental models, but human studies are scarce and their cutaneous bioavailability and mechanism of photoprotection are unknown. We aimed to examine oral GTC cutaneous uptake, ability to protect human skin against erythema induced by a UVR dose range and impact on potent cyclo-oxygenase- and lipoxygenase-produced mediators of UVR inflammation, PGE2 and 12-hydroxyeicosatetraenoic acid (12-HETE), respectively. In an open oral intervention study, sixteen healthy human subjects (phototype I/II) were given low-dose GTC (540 mg) with vitamin C (50 mg) daily for 12 weeks. Pre- and post-supplementation, the buttock skin was exposed to UVR and the resultant erythema quantified. Skin blister fluid and biopsies were taken from the unexposed and the UVR-exposed skin 24 h after a pro-inflammatory UVR challenge (three minimal erythema doses). Urine, skin tissue and fluid were analysed for catechin content and skin fluid for PGE2 and 12-HETE by liquid chromatography coupled to tandem MS. A total of fourteen completing subjects were supplement compliant (twelve female, median 42.5 years, range 29-59 years). Benzoic acid levels were increased in skin fluid post-supplementation (P= 0.03), and methylated gallic acid and several intact catechins and hydroxyphenyl-valerolactones were detected in the skin tissue and fluid. AUC analysis for UVR erythema revealed reduced response post-GTC (P= 0.037). Pre-supplementation, PGE2 and 12-HETE were UVR induced (P= 0.003, 0.0001). After GTC, UVR-induced 12-HETE reduced from mean 64 (sd 42) to 41 (sd 32) pg/ μ l (P= 0.01), while PGE2 was unaltered. Thus, GTC intake results in the incorporation of catechin metabolites into human skin associated with abrogated UVR-induced 12-HETE; this may contribute to protection against sunburn inflammation and potentially longer-term UVR-mediated damage.

WEIGHT REDUCTION

In a randomized, placebo-controlled, double-blind parallel trial conducted in 80 overweight and moderately obese subjects, a green tea-caffeine mixture improved weight maintenance independently through thermogenesis, fat oxidation and sparing FFM. Hursel 2009

Green tea (epigallocatechin gallate + caffeine) and protein each were shown to improve body weight maintenance after weight loss.

OBJECTIVE:

We investigated the effect of a green tea-caffeine mixture added to a high-protein (HP) diet on weight maintenance (WM) after body weight loss in moderately obese subjects.

DESIGN:

A randomized, placebo-controlled, double-blind parallel trial was conducted in 80 overweight and moderately obese subjects [age (mean +/- SD): 44 +/- 2 y; body mass index (BMI; in kg/m²): 29.6 +/- 2.0] matched for sex, age, BMI, height, body mass, and with a habitually low caffeine intake. A very-low-energy diet intervention during 4 wk was followed by 3 mo of WM; during the WM period, the subjects received a green tea-caffeine mixture (270 mg epigallocatechin gallate + 150 mg caffeine/d) or placebo, both

in addition to an adequate protein (AP) diet (50-60 g protein/d) or an HP diet (100-120 g protein/d).

RESULTS:

Subjects lost 7.0 +/- 1.6 kg, or 8.2 +/- 2.0%, body weight ($P < 0.001$). During the WM phase, WM, resting energy expenditure, and fat-free mass (FFM) increased relatively in both the HP groups and in the AP + green tea-caffeine mixture group ($P < 0.05$), whereas respiratory quotient and body fat mass decreased, all compared with the AP + placebo group. Satiety increased only in both HP groups ($P < 0.05$). The green tea-caffeine mixture was only effective with the AP diet.

CONCLUSION:

The green tea-caffeine mixture, as well as the HP diet, improved WM independently through thermogenesis, fat oxidation, sparing FFM, and, for the HP diet, satiety; a possible synergistic effect failed to appear.