



# IMAGE AWARENESS WELLNESS INSTITUTE

## TEA AND POLYPHENOLS

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### INTRODUCTION

There are thousands of polyphenols in nature being investigated for their medical potential. These are water soluble anti-inflammatory molecules with powerful antioxidant activity. They are found in abundance in some foods including teas, berries, chocolate, grapes, and pomegranate.

Tea has been consumed as a beverage for over 2,000 years. Consumption was begun in China and after being adopted by the British the habit was spread over the world. Today tea is the second most commonly consumed beverage after water. Consumption is far ahead of coffee, beer, wine, and sodas. Tea is consumed both as a beverage and as a therapeutic for illness.

There are three types of teas sold for consumption: green tea, oolong tea, and black (or red) teas. Green teas are not fermented. This is accomplished by drying and steaming to destroy an enzyme called polyphenol oxidase. Oolong tea is partially fermented before drying. Black tea is fermented.

Almost 80% of the tea consumed in the world is fermented. About 20% is consumed as green tea, while only about 2% is consumed as oolong tea.

Research has focused on green tea polyphenols which appear to have a strong ability to reduce the risk of heart disease and cancers. Research also suggests benefits with regard to

bone density, brain function, tooth decay, prevention of Alzheimer's and Parkinson's, slowing of cataract formation and reducing risk of kidney stones.

Tea can accumulate fluoride (often promoted to prevent tooth decay) and aluminum if soil levels are high. Both are undesirable in excess and are lower in better quality teas. Green tea has lower levels of these minerals than does black tea. Natural sources of fluoride are much less dangerous than the form of fluoride added to drinking water.

The primary interest in teas is the content of flavonoids and polyphenols. The primary polyphenols in tea are four catechins: (EGCG (59%), EGC (19%), ECG (13.6%), and EC (6.4%). Tea contains a wide variety of other polyphenols and related compounds as well.

The flavonoids in green tea are different in structure and function from those in fermented black tea. The fermentation process turns the catechins in green tea into theaflavins and thearubigins with different properties which are also beneficial and more



easily absorbed than some of the catechins in green tea.

The benefit of the catechins in tea depends not only upon the quantity of the substances in the tea, but also upon potency and bioavailability. The primary catechin in green tea (EGCG) appears to be less bioavailable than some of the other catechins but much more biologically active.

### REFERENCE:

Cabrera, Carmen, et al., Beneficial effects of green tea-A review, *Journal of the American College of Nutrition*, 2006;25(2):79-99.

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### TRADITIONAL MEDICINE

The Chinese have recommended green tea for a variety of health benefits. This includes fighting fatigue, treatment for body aches and pains, headache, depression, digestive disorders, detoxification and the prolongation of life.

### ACTIVE INGREDIENTS

Green tea has three main components which act upon human health. These are xanthic bases (basically caffeine and theophylline), essential oils, and polyphenols.

Caffeine has its primary effect upon the central nervous system decreasing fatigue, stimulating wakefulness, and promoting thinking by aiding in the association of ideas.



Theophylline promotes brain activity, but also has a pronounced effect upon the respiratory system. This compound has a dilating effect upon the circulatory system improving breathing and circulation. It also has a stronger diuretic effect than caffeine, which means that it promotes urination. Theophylline both stimulates and relaxes the respiratory tract.

The essential oils in green tea promote digestion. They are quite volatile and will disappear if the tea is brewed for a long period of time.

By far the most interesting component of tea is the presence of a blend of polyphenols. The primary polyphenols in green tea consist of four catechins: EGCG, EGC, ECG, and EC. Green tea also contains a number of other important compounds including caffeic acid, gallic acid, chlorogenic acid, quercetin, myricetin, and kaempferol.

#### REFERENCES:

Cabrera, Carmen, et al., Beneficial effects of green tea-A review, *Journal of the American College of Nutrition*, 2006;25(2):79-99.

## HEALTH BENEFITS

Studies have shown that tea polyphenols are antimutagenic, antidiabetic, antibacterial, antiviral, and anti-inflammatory. They have cholesterol lowering properties. These polyphenols also promote dental health by reducing cavities, gum disease, and tooth loss. The catechins and gallic acid are the primary drivers of these health benefits.

Tea contains a spectrum of an-

tioxidants including carotenoids, vitamin C, vitamin E tocopherols, and the polyphenols. Tea also contains chelating agents that can bind with iron and copper reducing their ability to generate free radicals in the body. Green tea has a higher antioxidant activity than black tea.

Studies involving consumption of 1-6 cups of green tea for seven days indicate significantly reduced oxidative damage to DNA and fats (lipids).

## CANCER

Green tea has been shown to reduce the risk of a wide variety of cancers including that of the skin, mouth, lung, esophagus, stomach, liver, kidney, prostate and other tissues. Tea promotes suicide of cancer cells (apoptosis), and also inhibits the growth of cancer cells.

Green tea is generally accepted as an anti-cancer agent today. The National Cancer Institute has begun developing tea compounds as chemo-preventive agents against human cancers.

The primary mechanisms of the action of tea against cancer involve the ability to prevent oxidative damage to the DNA of cells and the ability to reduce the inflammatory response. EGCG has a direct inhibitory effect upon the growth of cancer cells.

EGCG when administered with tamoxifen worked synergistically to kill breast cancer cells. EGCG by itself was shown to slow breast cancer cell growth in another study by about 80% without any damage to normal cells. There is an inverse association between the consumption of green tea and the risk of developing breast cancer among women. In other words, the more frequent the consumption of green tea, the lower the risk of developing breast cancer. The suggestion has been made that soy phytochemicals work synergistically with green tea in the prevention of breast cancer.

Consumption of tea protects skin

from exposure to ultraviolet light in animal models of the development of skin cancer from sun exposure. Topical application of tea to the skin as in sun screens has been shown to be protective from sun exposure as well.

#### REFERENCES:

Zhou, Jim-Rong, et al., Combined inhibition of estrogen-dependent human breast carcinoma by soy and tea bioactive components in mice, *Int. J. Cancer*, 2004; 108:8-14.

## HEART DISEASE

Due to antioxidant and anti-inflammatory activity green tea appears to reduce the risk of developing heart disease. Tea promotes the health of the inner lining of the arteries and also tends to decrease the absorption of cholesterol from foods. It also works to keep down blood pressure.

Hertog and associates did a follow up study of 12,763 men from seven countries for 25 years and found an inverse correlation between death from heart disease and catechin intake.

#### REFERENCES:

Stensvold, Inger, et al., Tea consumption. Relationship to cholesterol, blood pressure, and coronary and total mortality, *Preventive Medicine*, 1992; 21(4):546-553.

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## TEETH AND BONES

Research studies show that both black and green tea reduce incidence of tooth decay even with the presence of sugar in the diet. Adding sugar to the tea appears to reduce the benefit. Tea inhibits the enzyme alpha-amylase which breaks down starch to sugars providing food for bacteria that cause tooth decay.

Tea also inhibits the ability of bacteria to attach to the teeth. Bacteria form colonies or cities called biofilms on the teeth which are resistant to brushing. Tea inhibits biofilm formation.



Green tea also promotes the health of the gums preventing periodontal disease. This may be a result of inhibition of bacteria which promote gum disease. Tea is often added to tooth pastes due to its ability to reduce tooth decay and promote gum health.

Tea and other flavonoids have been shown to improve bone density decreasing the risk of hip fractures. One study ended as follows: "In conclusion, total flavonoid intake was positively associated with BMD (bone mineral density), with effects observed for anthocyanins and flavones at both the hip and spine, supporting a role for flavonoids present in plant-based foods on bone health."

#### REFERENCES:

Barroso, Helena, Inhibitory activity of a green and black tea blend on *Streptococcus mutans*, *Journal of Oral Microbiology*, 2018; 10:1481322.

Welch, Ailsa, et al., Habitual flavonoid intakes are positively associated with bone mineral density in women, *Journal of Bone and Mineral Research*, September 2012;27(9):1872-1878.

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## WEIGHT CONTROL

The ability of tea to inhibit digestion of starch and to impair cholesterol absorption has already been mentioned. Catechins also impair the functioning of fat digesting enzymes (lipases). Catechins combined with caffeine also increase energy expenditure promoting burning of more calories. There appears to be an inverse relationship between body fat and long term tea consumption.

A study by Wu and associates con-

cluded, "An inverse relationship may exist among habitual tea consumption, BF% (percent of body fat), and body fat distribution (as measured by waist to hip ratio), especially for subjects who have maintained the habit of tea consumption for more than 10 years."

#### REFERENCES:

Wu, Chih-Hsing, et al., Relationship among habitual tea consumption, percent body fat, and body fat distribution, *Obesity Research*, September 2003; 11(9): 1088-1095.

## GLUCOSE AND INSULIN

The primary active compound in green tea that increases insulin activity is EGCG. The addition of milk to the tea decreased the insulin benefit by 90%.

A summary of randomized, controlled trials concluded the following: "Seventeen trials comprising a total of 1133 subjects were included in the current meta-analysis....green tea significantly lowered fasting glucose and Hb A1c concentrations, and the results of our stratified analyses suggested that green tea may also reduce fasting insulin concentrations."

A study of rats showed that green tea intake for 12 weeks also reduced triglycerides and free fatty acids in the blood. EGCG may also rehabilitate damaged beta cells which produce insulin in the pancreas.

#### REFERENCES:

Liu, Kai, et al., Effect of green tea on glucose control and insulin sensitivity: a meta-analysis of 17 randomized controlled trials, *The American Journal of Clinical Nutrition*, August 2013;98(2):340-348.

Cabrera, Carmen, et al., Beneficial effects of green tea-A review, *Journal of the American College of Nutrition*, 2006;25(2):79-99.

Wu, Liang-Yi, et al., Effect of Green Tea Supplementation on Insulin Sensitivity in Sprague-Dawley Rats, *J. Agric. Food Chem.* 2004, 52, 3, 643-648

## MICROBIAL INFECTION

Compounds in tea inhibit a wide variety of bacterial pathogens. Tea helps prevent diarrhea and fight typhoid. It inhibits *H. pylori*, the bacteria responsible for causing ulcers. Green tea catechins also have antifungal activity against *Candida albicans*,

a common fungal pathogen. Tea works well with antifungal medications.

Zhu showed that a variety of different polyphenols in green tea, chocolate, and muscadine grapes have potentially powerful antiviral effects.

Tea is inhibitory of the common *Herpes simplex* virus. Carniero and associates found that EGCG, found in green tea, reduced the ability of Zika virus to enter host cells by about 90%. An advantage of EGCG was that it appeared to be safe for pregnant women to use. Weber and associates showed the potential of green tea catechins against adenovirus infection.

A study by Song and associates found that the catechins in green tea were inhibitory of the growth of a wide variety of influenza viruses, especially at the early stages of infection. Studies with EGCG have shown antiviral activity against hepatitis, HIV, chikungunya, West Nile Virus, Dengue fever, influenza A/H1N1 and A/H3N2, influenza B, rotavirus, and ebola.

Mahatre and associates whose primary concerns were Covid-19 wrote, "As evident from the mechanisms of action of EGCG in various viruses, it is a wide spectrum antiviral agent with its mechanism differing from infection to infection." Mahatre also notes that the theaflavins found in black tea also strongly inhibit viral activity.

Regarding COVID-19 Mahatre wrote, "The highlight of this study was that EGCG exhibited better binding with the viral proteins and hence, is expected to show better antiviral activity than the reference drugs, remdesivir and chloroquine."

Similar studies are going on with the theaflavins. Theaflavin 3 has been shown to directly bind to the ACE2 receptor which is the doorway the COVID-19 virus uses to enter the cell suggesting it may be a valuable preventative against serious infection.

The primary problem with the use of green tea compounds as antiviral





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substances is the difficulty of absorbing EGCG and its instability. At the present time, the best way to obtain the immune enhancing effects of polyphenols is with a blend of a variety of polyphenol substances. Since study in this area is only beginning other substances in the polyphenol family may prove to be even more powerful anti-virals than EGCG.

Recent research suggests that one of the possible preventatives for serious Covid-19 infection is a combination of zinc and catechins. Studies note that green tea helps get zinc into cells where it has antiviral properties. Zinc also stabilizes catechins and helps them get into cells where they have antiviral activity of their own. The combination of green tea and zinc may be even more effective than pharmaceuticals like remdesivir and chloroquine.

There is very low mortality from Covid-19 among nations with a high consumption of green tea including China, Japan, and Vietnam. The exception is Indonesia with a high mortality from Covid 19, but Indonesia has one of the highest rates of zinc deficiency in the world. Green tea provides little or no benefit if zinc deficiency exists.

One study reports, “In summary, we have presented evidence supporting that interaction of catechins and procyanidins with zinc cations modulate zinc absorption and metabolism, resulting in increased levels of cytoplasmic labile zinc.”

### REFERENCES:

Mhatre S, Srivastava T, Naik S, Patravale V. Antiviral activity of green tea and black tea polyphenols in prophylaxis and treatment of COVID-19: A review [published online ahead of print, 2020 Jul 17]. *Phytomedicine*. 2020;153286. doi:10.1016/j.phymed.2020.153286

Zhu, Yue, et al., Docking characterization and in vitro inhibitory activity of flavan-3-ols and dimeric proanthocyanidins against the main protease activity of SARS-Cov-2, *Frontiers in Plant Science*, November 2020;11: Article 601316.

Song, Jae-Min, et al., Antiviral effect of catechins in green tea on influenza virus, *Antiviral Research* 68 (2005) 66–74.

Carniero, Bruno M., The green tea molecule EGCG inhibits Zika virus entry, *Virology*, September 2016;496:215-218.

Weber, Joseph M., et al., Inhibition of adenovirus infection and adenain by green tea catechins, *Antiviral Research*, April 2003;58(2):167-173.

Quesada, Isabel M., et al., Dietary catechins and procyanidins modulate zinc homeostasis in human HepG2 cells, *Journal of Nutritional Biochemistry*, 2011; 22:153–163.

### SUPPLEMENTS

NeoLife supplements filled with flavonoids and polyphenols including those discussed above would be NeoLife Tea, Tre, and Flavonoid Com-

plex. NeoLife is a founding member and remains a major contributor to the Polyphenols in Human Health Research Interest Group (PhenHRIG). Zinc is available separately or as part of any of the multiple vitamins. NeoLife zinc is double chelated which greatly improves absorption and bioavailability.

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