

Green Tea as an Antioxidant- A Short Review

S. Aafrin Thasleema

BDS

Saveetha Dental College, Chennai, India.

Abstract

Tea has been cultivated for centuries beginning in India and China. Today tea is the most widely used beverage next to water. Many studies suggest that green tea has many beneficial effects. Green tea is made from unfermented leaves and reportedly contains the highest concentration of powerful antioxidants called polyphenols. Antioxidant are substance that fight free radicals- damaging compounds in the body that change cells, damage DNA, and even cause cell death. Many scientist believe that free radicals contribute to the aging process as well as the development of a number of health problems including cancer and heart disease. Antioxidants such as polyphenols in green tea can neutralize free radicals and may reduce or even help prevent some of the damage they cause. Since green tea beneficial health effects are being increasingly proved, it could be advisable to encourage the regular consumption of this widely available, tasty and inexpensive beverage as an interesting alternative to other drinks, which do not only show the beneficial effects of green tea, but are also more energetic.

INTRODUCTION

There are three different types of tea- black tea, oolong tea and green tea. In this review we would be dealing with the effects of green tea. **Green tea** is made from leaves of *camellia sinensis* that have undergone minimal oxidation during processing. Green tea originates from china(1). Over the last few decades green tea has been subjected to many scientific and medical studies to determine the extent of its long purported health benefits, with some evidence suggesting that regular tea drinkers may have a lower risk of developing heart disease(2) and certain types of cancer(3).

Although green tea does not raise the metabolic rate enough to produce immediate weight loss, green tea extract containing **polyphenols and caffeine** has been shown to reduce thermo genesis and stimulate fat oxidation, boosting the metabolic rate without increasing the heart rate(4).

Flavanoid are a group of phytochemicals present in most plant products that are responsible for health effects such as **anti oxidative and anti carcinogenic** functions(5). Polyphenols found in tea are mostly flavanoid(6). The polyphenols are a large groupof plant chemicals that include the catechins, are thought to be responsible for health benefits that have traditionally been attributed to tea, especially green tea(7).

GREEN TEA PROCESSING

The assan type has a high content of polyphenols which would make green tea excessively bitter(8). The production of green tea is characterized by an initial heating process which kills the enzyme polyphenol oxidase, which is responsible for the conversion of flavanoids in the leaf into the dark polyphenolic compounds that colour black tea. The other important process is rolling in which the leaves are cut and twisted.

Polyphenols constitute the most interesting group of green tea leaf components and in consequence green tea can be considered as an important dietary source of polyphenols, particularly flavanoids. The final form of green tea depends on the particular variant being produced. The rolling stage is very similar to the operation with the same name in black tea production.

GREEN TEA COMPOSITION

Green tea chemical composition is complex protein whose enzymes constitute an important fraction. Amino acids such as teanine or 5-N-ethylglutamine, glutamic acid, tryptophan, glycine, serine, aspartic acid, tyrosine, valine, leucine, threonine, arginine, lysine. Carbohydrates such as cellulose, pectins, glucose, fructose, sucrose; lipids as linoleic and α -linolenic acids; sterols as stigmasterol. Vitamins (B, C, E) xanthic bases such as caffeine and theophylline pigments as chlorophyll and carotenoids volatile compounds as aldehydes, alcohols, esters, lactones, hydrocarbons. Minerals and trace elements such as Ca, Mg, Cr, Mn, Fe, Cu, Zn, Mo, Se, Na, P, Co, Sr, Ni, K, F and Al. Polyphenols constitute the most interesting group of green tea leaf components, and in consequence, green tea can be considered an important dietary source of polyphenols, particularly flavonoids. Flavonoids are phenol derivatives synthesized in substantial amounts and variety (more than 4000 identified), and widely distributed among plants(9).

EFFECTS OF GREEN TEA IN HUMAN HEALTH

Green tea has been considered a medicine and a healthful beverage since ancient times. It has been recommended for headaches, body aches and pains, digestion, depression, detoxification, as an energizer and, in general, to prolong life.

- i. Antioxidant Activity.
- ii. Antimutagenic and Anticarcinogenic Potential.
- iii. Anti-Hypertensive Effect And Cardiovascular Disease Risk.
- iv. Oral Health.
- v. Solar Ultraviolet Protection.
- vi. Body Weight Control.
- vii. Intestinal Dysbiosis and Infection

And many other effects can be seen by consuming green tea. Here, in this review we would be dealing with the **anti oxidant effect of green tea**.

GREEN TEA AS AN ANTIOXIDANT

The major hypothesis of the beneficial health effects of tea is associated with its antioxidant properties(10). However it was determined that theaflavins in black tea and **catechins** in green tea are equally effective as antioxidant(11,12). Green tea is rich in polyphenols (catechins and gallic acid, particularly), but it also contains carotenoids, tocopherols, ascorbic acid (vitamin C), minerals such as Cr, Mn, Se or Zn, and certain phytochemical compounds.

They may also function indirectly as antioxidants through:-

- 1) inhibition of the redox-sensitive transcription factors
- 2) inhibition of 'pro-oxidant' enzymes, such as inducible nitric oxide synthase, lipoxygenases, cyclooxygenases and xanthine oxidase
- 3) induction of antioxidant enzymes, such as glutathione-S-transferases and superoxide dismutases.

Using the oxygen radical absorbance capacity (ORAC) assay found that green tea has a much higher antioxidant activity against peroxy radicals than vegetables such as garlic, kale, spinach and Brussels sprouts. Using the ferric reducing ability of plasma (FRAP) assay. Langley-Evans(13) found that the total antioxidant capacity of green tea is more potent than that of black tea.

Nevertheless, a substantial number of human intervention studies with green tea demonstrate a significant increase in plasma antioxidant capacity in humans after consumption of moderate amounts there are also initial indications which show that the enhanced blood antioxidant potential leads to a reduced oxidative damage in macromolecules such as DNA and lipids(14-18).

Many chronic disease states and inflammatory conditions are a result of oxidative stress and subsequent generation of free radicals. Some of these include heart disease (resulting from LDL oxidation), renal disease and failure, several types of cancer, skin exposure damage caused by ultraviolet (A and B) rays, as well as diseases associated with aging. Green tea polyphenols are potent free radical scavengers due to the hydroxyl groups in their chemical structure.

The antioxidant capacity of catechins depends on the number of hydroxyl groups(19). Antioxidant capacity of various teas and tea polyphenols has been investigated in many studies(20-27)

Total antioxidant capacity of different teas using FRAP assays.(28)

No	Type of tea	Number of experiments	Value in mol/g (dry powder)
1	Green	13	571
2	Oolong	5	373
3	Black	8	365

CONCLUSION

Green tea has been consumed in China and other Asian countries since ancient times in order to maintain and improve health. It possess **antioxidant**, antimutagenic, antidiabetic, anti-inflammatory, antibacterial and antiviral, and above all, cancer-preventive properties. Green tea also acts positively on neurodegenerative diseases such as Parkinson and Alzheimer disease Since green tea beneficial health effects are being increasingly proved. Antioxidant activity of green tea is effected by many natural polyphenols, catechins, oxyaromatic acids, tannins, flavonols etc. tasty and inexpensive beverage as an interesting alternative to other drinks, which do not only show the beneficial effects of green tea, but are also more energetic, do contain more caffeine. Taking all this into account, it would be advisable to consider the regular consumption of green tea in our daily diets.

REFERENCE

- 1) *Green Teas: A (very) Brief History*, teaguardian.com, retrieved 20 December 2010
- 2) *Tea & Cardiovascular Health*, teaguardian.com, retrieved 20 December 2010
- 3) *Green tea's cancer-fighting allure becomes more potent*, sciencedaily.com, 2003
- 4) Dulloo AG, Duret C, Rohrer D, Girardier L, Mensi N, Fathi M, Chantre P, Vandermander J (1999), "Efficacy of a green tea extract rich in catechin polyphenols and caffeine in increasing 24-h energy expenditure and fat oxidation in humans", *Am. J. Clin. Nutr.* **70** (6): 1040-5, PMID 10584049
- 5) USDA Database for the Flavonoid Content of Selected Foods, Release 2.1 (2007)
- 6) Sumpio, B.E., A.C. Cordova, D.W. Berke-Schlessel, F. Qin and Q.H. Chen, 2006. Green tea, the AsianParadox and cardiovascular disease. *J. Am. Coll.Surg.*, 202: 813-20.
- 7) Cabrera, C., R. Artacho and R. Gimenez, 2006 Beneficial effects of green tea-a review. *J. Am. Coll. Nutr.*, 25(2): 79-99.
- 8) Willson KC: "Coffee, Cocoa and Tea." New York: CABI Publishing,1999 .
- 9) Vison J, Dabbagh Y, Serry M, Jang J: Plant flavonoids, especially tea flavonols, are powerful using an *in vitro* oxidation model for heart disease. *J Agric Food Chem***43** :2800- 2802,1995 .
- 10) Su X., Duan J., Jiang Y., Duan X., Chen F. Polyphenol Profile and Antioxidant Activity of Brewed Oolong Tea at Different Conditions. *Int. J. Mol. Sci.* 2007, v. 8, p. 1196-1205. DOI: 10.3390/i8121196
- 11) Stewart A. J., Mullen W., Crozier A. On-line HPLC Analysis of the Antioxidant Activity of Phenolic Compounds in Green and Black Tea. *Mol. Nutr. Food Res.* 2005, v. 49, p. 52-60.DOI: 10.1002/mnfr.200400064
- 12) Leung L. K., Su Y., Chen R. et al. Theaflavins in Black Tea and Catechins in Green Tea are Equally Effective Antioxidants. *J. Nutr.* 2001, v. 131, p. 2248-2251.
- 13) Katiyar SK, Mukthar H. Tea antioxidant in cancer chemoprevention. *J. Cell Biochem* 1997;**27**:S59-S67
- 14) Rietveld A, Wiseman S: Antioxidant effects of tea: Evidence from human clinical trials. *J Nutr***133** :3275- 3284,2003 .
- 15) McKay DL, Blumberg JB: The role of tea in human health: An update. *J Am Coll Nutr***21** :1- 13,2002 .
- 16) Henning SM, Fajardo-Lira C, Lee HW, Youssefian AA, Go VLW, Heber D: Catechin contents of 18 teas and green tea extract supplement correlates with the antioxidant capacity. *Nutr Cancer***45** :226- 235,2003 .
- 17) Higdon JV, Frei B: Tea catechins and polyphenols: health effects, metabolism, and antioxidant functions. *Crit Rev Food Sci Nutr***43** :89- 143,2003 .
- 18) Xu JZ, Yeung SY, Chang Q, Huang Y, Chen ZY: Comparison of antioxidant activity and bioavailability of tea epicatechins with their epimers. *Br J Nutr***91** :873- 881,2004 .

- 19) Abdullin I.F., Turova E.N., Budnikov G.K. Coulometric Evaluation of the Antioxidant Capacity of Tea Extracts. *J. Anal. Chem. (Russian)*. 2001. V.56. p.627-629
- 20) Kumamoto M., Sonda T., Nagayama K., Tabata M. Influence of pH and Metal Ions on the Antioxidant Activity of Catechins. *Biosci. Biotechnol. Biochem.* 2001, v. 65, p. 126-132. DOI: 10.1271/bbb.65.126
- 21) Kondo K., Kurihara M., Fukuhara K. Mechanism of Antioxidant Action of Catechins. *Methods Enzymol.* 2001, v. 335, p. 203-217. DOI: 10.1016/S0076-6879(01)35244-8
- 22) Cabrera C., Gimenez R., Lopez C. M. Determination of Antioxidant Activity of Tea Components. *J. Agric. Food Chem.* 2003, v. 31, p. 4427-4435. DOI: 10.1021/jf0300801
- 23) Wachira F. N., Kamunya S. Kenyan Teas are Rich in Antioxidants. *Tea*, 2005, v. 26, p. 81-89
- 24) Hara Y. Antioxidant Activity of Tea Polyphenols. *Intern. Biotechn. Lab.* 1994, №2, p.14.
- 25) Satoh E., Tohyama N., Nishimura M. Comparison Between the Antioxidant Activity of Toasted Tea and that of Green, Oolong, and Black Tea. *Int. J. Food Sci. Nutr.* 2005, v. 56, p. 551-559. DOI: 10.1080/09637480500398835
- 26) Yen G. C., Chen H. Y. Antioxidant Activity of Different Tea Extracts in Connection with their Antimutagenicity. *J. Agr. Food Chem.* 1995, v. 43, p. 27-32. DOI: 10.1021/jf00049a007
- 27) Khokhar S., Magnusdottir S. G. M. Total Phenol, Catechin, and Caffeine Contents of Teas Most Often Consumed in the United Kingdom. *J. Agric. Food Chem.* 2002, v. 50, p. 565-570. DOI: 10.1021/jf0101531
- 28) Benzie J. F. F., Szeto Y. T. Total Antioxidant Capacity of Teas Analyzed by the FRAP Method. *J. Agr. Food Chem.* 1999, v. 47, No. 2, p. 633-636. DOI: 10.1021/ef9807768