

## Make a Habit of Green Tea Drinking for Prevention of Cancer

Manoranjan Adak\*

Professor of Biochemistry, Anna Medical College and Research Center, Solitude, Mauritius

### Abstract

Tea is one of the most widely consumed beverages in the world today, second only to water, and its medicinal properties have been widely explored. The tea plant, *Camellia sinensis*, is a member of the Theaceae family, and black, oolong, and green tea are produced from its leaves. Since ancient times, green tea has been considered by the traditional Chinese medicine as a healthful beverage. Recent human studies suggest that green tea may contribute to a reduction in the risk of cardiovascular disease and some forms of cancer, as well as to the promotion of oral health and other physiological functions such as anti-hypertensive effect, body weight control, antibacterial, solar ultraviolet protection, bone mineral density increase, anti-fibrotic properties, and neuroprotective power. Increasing interest in its health benefits has led to the inclusion of green tea in the group of beverages with beneficial effects on cancer prevention.

**Keywords:** Green tea; Polyphenol; Catechins; Cancer

### Introduction

Tea, a product made up from leaf and bud of the plant *Camellia sinensis*, is the second most consumed beverage in the world, well ahead of coffee, beer, wine and carbonated soft drinks [1,2]. Originating from China, tea has gained the world's taste in the past 2000 years. The economic and social interest of tea is clear and its consumption is part of many people daily routine, as an everyday drink and as a therapeutic aid in many illnesses.

It is an evergreen shrub or tree and can grow to heights of 30 feet, but is usually pruned to 2-5 feet for cultivation. The leaves are dark green, alternate and oval, with serrated edges, and the blossoms are white, fragrant, and appear in clusters or singly.

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 the flavanols in the leaf into the dark polyphenolic compounds that colour black tea. The other important process is rolling, in which leaves are cut and twisted. 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 production is restricted mainly to China and Japan [3].

The polyphenols found in tea are more commonly known as flavanols or catechins [4]. The main catechins in green tea are epicatechin, epicatechin-3-gallate, epigallocatechin, and epigallocatechin-3-gallate (EGCG). Other polyphenols in green tea include flavanols and their glycosides and depsides such as chlorogenic acid, quinic acids, carotenoids, trigalloylglucose, lignin, protein, chlorophyll, minerals (aluminum or manganese, depending on the soil content), caffeine and a very small amount of methylxanthines [5].

### Green Tea with Anticancer Property

Many epidemiological, case-control, and cohort studies have been conducted to investigate the effects of green tea consumption on human cancer incidences [6,7]. In a Japanese cohort study, a negative association was found between green tea consumption and total cancer incidence, especially among females drinking more than 10 cups per day [8]. The effect of tea on stomach cancer has been the most extensively studied. Of 15 studies, five case control studies showed a protective effect of green tea on the risk of stomach cancer [9,10]. A recent study

on middle-aged Finnish men indicated a positive association between increased green tea consumption and colon cancer risk [11]. A large study of pancreatic, colon, and rectal cancers indicated decreased incidents of these cancers with consumption of tea [12]. The results from the epidemiological studies regarding tea intake and lung cancer are unclear because smoking factor was not taken into account in the study design. There is also some evidence that green tea polyphenols have a chemopreventive effect against cancers in smokers [13].

Early studies have linked tea drinking to both increased and decreased risks of esophageal cancers, but recent studies have shown that the positive association between tea and esophageal cancer was because of the high temperature at which the tea is consumed. Findings from the largest study of esophageal cancer conducted in China suggested that, barring the effect of temperature, drinking green tea decreases the risk of esophageal cancer [14]. Two population-based case-control studies of 3,049 subjects found a protective effect of green tea drinking against esophageal cancer among women [15,16]. A hospital-based case-control study of 124 patients and 124 controls demonstrated a positive association of drinking five cups or more green tea per day and pancreatic cancer [17]. A population-based cohort study involving 102,137 participants with 11 years of follow-up did not find any association of the risk of pancreatic cancer and drinking green tea [18]. Study of 1,043 subjects showed 39% decrease of risk of esophageal cancer among alcoholic drinkers and 31% decrease among smokers [19]. A population-based case-control study involving 204 patients and 415 controls reported that drinking green tea reduced the risk of liver cancer by 78% among alcoholic drinkers and by 43% among smokers [19]. A randomized, double-blinded, placebo controlled trial in 124 individuals with sero-positive HBsAg and aflatoxin-albumin adducts showed a significant decrease of 8-hydroxydeoxyguanosine after three months of green tea polyphenols intake [20].

\*Corresponding author: Manoranjan Adak, Professor of Biochemistry, Anna Medical College and Research Center, Solitude, Mauritius, Tel: +23058605831; E-mail: [itsmradak@gmail.com](mailto:itsmradak@gmail.com)

Received April 28, 2014; Accepted April 29, 2014; Published May 15, 2014

Citation: Adak M (2014) Make a Habit of Green Tea Drinking for Prevention of Cancer. Biochem Pharmacol 3: e162. doi:10.4172/2167-0501.1000e162

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Two case-control studies involving 2,036 patients with colorectal cancer and 2,130 controls found that drinking green tea reduced the risk of colorectal cancer [21,22]. A prospective cohort study that followed over 60,000 subjects for an average of 8.9 years found no statistically significant difference between green tea drinkers and non drinkers [23]. One case-control study showed significantly reduced risk of breast cancer by regular drinking a large amount of green tea [24] and two cohort studies showed reduced recurrence of breast cancer among patients at stage I and II with high consumption of green tea (more than three cups per day) [25,26].

A double-blind, placebo-controlled trial testing green tea catechins (600 mg per day for one year) significantly reduced the incidence of prostate cancer in a group of 60 volunteers with high-grade prostate intraepithelial neoplasia; no significant adverse effect was reported [27]. A case-control study found prostate cancer risk declined with increasing frequency, duration and quantity of green tea consumption [28]. A cohort study in 19,561 Japanese men showed that green tea intake was not associated with a lower risk of prostate cancer between men drinking five or more cups and less than one cup per day [29]. The risk of urinary bladder cancer was significantly reduced in women who consumed a powdered green tea in a case-control study ( $n=882$ ) [30]. A population-based case-control study ( $n=2082$ ) suggested that regular green tea drinking reduced the risk of endometrial cancer in premenopausal women [31]. Another cohort study ( $n=254$ ) suggested that increasing the post-diagnosis consumption of green tea may boost the survival of patients of epithelial ovarian cancer [32].

### Possible Mechanism of Action

While green tea contains numerous potential cancer-fighting compounds, studies suggest that its anti-cancer activity is primarily associated with the catechins known as EGCG. As to how green tea prevents cancer, the research to date indicates that green tea has several chemopreventive mechanisms of action:

#### Promoting cancer cell apoptosis

Bettuzzi and his colleagues found that EGCG specifically targeted prostate cancer cells for programmed cell death, or apoptosis, without damaging the benign controls [33]. Clusterin, the most important gene involved in apoptosis, might be a mediator for catechin action, according to the researchers. Laboratory base studies have shown that apoptosis prevents metastasis, while tumor promoters often inhibit apoptosis [34]. Thus, if EGCG induces apoptosis specifically in cancer cells, it may be very useful in the management and therapy of metastatic cancer.

#### Inhibiting 5-alpha reductase and DHT

Other studies of green tea have shown that EGCG and epicatechin-3 gallate, known as ECG, are effective in inhibiting the enzyme 5-alpha reductase type 1, thus reducing the synthesis of dihydrotestosterone (DHT), a potent form of testosterone implicated in contributing to prostate enlargement and cancer [35].

#### Preventing angiogenesis

In order to grow, tumors must have an adequate blood supply provided by local blood vessels. Numerous studies show that green tea catechins, particularly EGCG, block the development of new blood vessels, a process known as angiogenesis [36].

### Inhibiting enzymes

In-vitro data show that in human cell lines, EGCG and ECG may inhibit enzymes that are associated with an elevated risk of colon cancer; one of the most prevalent cancers in both men and women [37]. In a Japanese study, researchers found that green tea catechins inhibited secretion of collagenase enzymes by highly metastatic lung cancer.

### Conclusion

Some epidemiological studies demonstrated protective effects of green tea consumption on gastrointestinal, breast, lung and prostate cancer. The polyphenols present in tea can also decrease the risk factor of specific type of cancers by inducing phase I and phase II metabolic enzymes that increase the formation and excretion of detoxified metabolites of carcinogens.

Most modern medicines used to treat cancer have serious side effects, high costs, and other associated risks. Green tea, on the other hand, is safe and widely available as a beverage and a nutritional supplement. Furthermore, growing scientific evidence suggests that green tea is effective in preventing many diseases associated with aging, including prostate and other cancers.

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