Green Tea and Cancer Prevention in Humans: A Review

Raseen Tariq¹, Sahrish Hina²

¹Final Year Medical Student, Nishtar Medical College, Multan, Pakistan
²Final Year Medical Student, University Medical and Dental College, Faisalabad, Pakistan

ABSTRACT

Epidemiological studies have been inconsistent in finding a protective association of green tea with risk of different cancers. We conducted an extensive literature review to assess the current evidence examining the association of green tea consumption with different types of cancers. In several studies, high intake of green tea was associated with reduced risk of gastrointestinal cancers. The small number of studies that examined the association of green tea consumption on lung, kidney and bladder cancer also found a protective association. Further human studies are needed to establish the role of green tea as an anti-cancer agent.

Keywords: Green Tea; Lung Cancer; Epigallocatechin Gallate

INTRODUCTION

Green tea, a commonly consumed beverage prepared from dried leaves of the plant Camellia sinensis, has recently obtained significant importance due to its potential role in cancer prevention. Many experiments have shown that extracts of green tea block the formation and development of tumors in different organs in animal models. Green tea contains polyphenolic compounds called as catechins. These green tea catechins (GTC) comprise four major epicatechin derivatives;

- epicatechin (EC),
- epigallocatechin (EGC),
- epicatechin gallate (ECG),
- epigallocatechin gallate (EGCG).

Among green tea catechins, EGCG, an ester of epigallocatechin and gallic acid, is the most important. The anti-oxidant activity of green tea is mostly attributed to EGCG. EGCG has anti-angiogenic and anti-tumor effects. While the exact mechanism is unclear, EGCG may act through induction of apoptosis and cell growth arrest by altering the expression of cell cycle regulatory proteins. Furthermore, it activates caspases and decreases the expression of oncogenic transcription factors [1]. While there is large body of consistent evidence from animal studies suggesting a role of green tea consumption in the prevention of cancer, the evidence from epidemiological studies have been inconsistent. In this review, we explore the evidence from epidemiological studies examining the association of green tea consumption with human cancers.

EPIDEMIOLOGICAL STUDIES

Green tea and pancreatic cancer:

Pancreatic cancer, a cancer difficult to diagnose at an early stage, has been attributed to be the fourth most common cause of cancer-related deaths across the world [2]. Any preventive strategy will be useful and green tea offers such an opportunity. Ji and co-workers performed a comprehensive case-control study in Japan and found that there was a significant decrease in the risk of pancreatic cancer associated with regular green tea consumption among men and women. The study was conducted in China with 451 pancreatic cancer cases and 1552 population controls. The results indicated that the risk of cancer was significantly decreased in both men and women with increased amount and duration of green tea intake [3]. In another study conducted, Goto and colleagues also found an inverse relationship between green tea consumption and the risk of pancreatic cancer. The study was conducted in Japan with 71 pancreatic cancer cases and 142 community controls. The results showed a decrease in pancreatic cancer incidence with green tea intake [4]. Another study conducted in Japan with 124 cases and 124 controls found no association of
pancreatic cancer and green tea [5].

**Green tea and prostate cancer:**
Four cohort studies were conducted in Japan to examine the link between green tea intake and the risk of prostate cancer. One of these studies showed a dose-dependent decrease in the risk of prostate cancer in persons consuming more than five cups per day. On the other hand, the remaining three studies found no association between green tea and prostate cancer [6].

**Green tea and breast cancer:**
A population-based case-control study of breast cancer in Chinese, Japanese and Filipino American women found that intake of green tea was associated with decreased risk of breast cancer [8]. A population-based cohort study in China with 74,942 women found that regular green tea drinking delays the onset of breast cancer. A study conducted on women with age less than 50 years found that those who consumed more than three cups of green tea per day had 37% less chances of developing breast cancer than those who did not consume green tea at all. Green tea has been associated with lower circulatory levels of estrogen. This could be the possible mechanism through which it could protect against postmenopausal breast cancer [7, 8]. Certain studies have shown the relationship of COMT (catechol-O-methyltransferase) gene and breast cancer. Wu at al reported that those women who had one low activity COMT allele have an inverse relation between green tea consumption and breast cancer risk. In contrast, in those women who were homozygous for high activity COMT allele, there was equal risk of breast cancer for drinker and non-drinker of green tea [9].

**Green tea and leukemia:**
A case-control study was conducted in a hospital in China with 107 leukemia patients and 110 control patients. The results showed that green tea consumption was associated with 50% decreased risk of leukemia. The risk decreased significantly as the number of cups per day and the years of green tea consumption increased suggesting a dose dependent inverse association between green tea consumption and leukemia [10].

**Green tea, temperature and esophageal cancer:**
A majority of studies have shown an increased risk of esophageal cancer with increased intake of hot beverages. The risk increases with increase in temperature of beverage and was maximum for drinking boiling hot tea. A study conducted in Hong Kong with 400 cases that were compared with 800 hospital and 798 general practice controls showed the positive association with about 1.45 times increased risk of cancer [11]. However, the study did not elaborate whether the association was for black or green tea. Blot and co-workers modified the study and found that the association was with green tea [12]. In a study conducted in China with 112 cases and 112 hospital controls showed 5.63 times increased risk of cancer with consumption of hot tea [13]. Another study conducted in Iran with 344 cases and 181 population controls also showed increased risk of esophageal cancer with intake of hot tea [14]. All these studies suggest that the hot thermal effects of green tea are associated with increased risk of esophageal cancer. Wu at al demonstrated reduced risk of esophageal cancer among non-smokers and non-alcoholics that consumed green tea but not among smokers and alcoholics, suggesting that alcohol and tobacco masks the protective effect of green tea [15]. In a recent analysis of six cohort studies that included more than 21800 men and women of 40 years or more, an inverse risk of esophageal cancer was found in non-smoker women [16].

**Green tea and urinary bladder cancer:**
The number of epidemiological studies on green tea and urinary bladder cancer are very limited. In a study conducted in Japan with 293 cases of urinary bladder cancer and 589 controls, a protective association of green tea with bladder cancer was found in women but not in men [17].

**Green tea and lung cancer:**
The study of green tea intake and lung cancer among non-smokers showed significant protective effects. Ohno and co-workers reported that Okinawan tea intake (a kind of tea that is similar to green tea but is in fragmented form) was associated with a decreased risk of lung cancer, especially among non-smoker women [18]. Another population-based cohort study in Japan among 41,440 men and women between 40-70 years found no evidence of association between green tea consumption and protection against the risk of lung cancer [19]. These studies showed relatively equivocal results with slight inclination towards protective association of green tea and lung cancer.

**Green tea and colorectal cancer:**
Kono and colleagues found an inverse but statistically insignificant association between green tea consumption and adenomatous colon polyps in 80 Japanese patients and 1148 controls [20]. Another study enrolling 885 colon and 843 rectal cancer Chinese patients and 1522 population controls found that increased green tea consumption was associated with a 0.99 and 0.77 times decreased risk of colon and rectal cancer in men and women, respectively [3].

**CONCLUSION**

The epidemiological data do not provide a definitive confirmation of cancer preventive role of green tea intake but the overall evidence favor a protective role in certain types of cancer. The inconsistent results are likely due to relatively low levels of green tea polyphenols consumption by humans as compared with high doses used in experimental studies. Thus, well-designed epidemiological studies are needed to demonstrate cancer preventive activity of green tea in humans.

**REFERENCES**