

Cancer Prevention by Green Tea: Evidence from Epidemiological Studies

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Green tea contains high concentrations of tea polyphenols including (-)-epigallocatechin-3-gallate (EGCG) at the highest concentration. Both tea extracts and EGCG have shown inhibitory effect against the development, progress, and growth of carcinogen-induced tumors in animal models at various organ sites including the oral-digestive tract, lung, prostate, mammary glands, and urinary bladder. Although epidemiological studies have provided inconclusive results on the effect of green tea consumption against the development of cancers in humans overall, the inverse association between high consumption of green tea and risk of oral-digestive tract cancers is more consistently observed in studies with adequate control for potential confounders. Green consumption was associated with statistically significantly reduced risk of esophageal cancer in men and women who did not consume either alcohol or tobacco or (1). Biomarker studies showed that individuals with high levels of tea polyphenols in urine samples collected many years before cancer diagnosis experienced significantly reduced risk of esophageal, gastric and colon cancers (2, 3). Randomized clinical trial showed that oral supplementation of green tea extract significantly reduced the size or progression of precancerous lesion of oral cavity in patients (4, 5). A randomized phase II clinical trial supported a protective role of green tea extract against the liver damage by aflatoxin exposure and hepatitis B, two established risk factors for liver cancer, suggesting a protective role of liver cancer (6). Epidemiological studies also have demonstrated an inverse, albeit moderate, association between green tea consumption and lung cancer. Intake of 2 cups of green tea per day would result in a statistically significant, approximately 20% decrease in the risk of developing lung cancer (7). This protective effect of green tea consumption on lung cancer was more pronounced in nonsmokers than in smokers (8). Although observational studies do not support a beneficial role of tea intake against the development of prostate cancer, a phase II clinical trials have demonstrated an inhibitory effect of green tea extract against the progression of prostate pre-malignant lesions to malignant tumors, and the protective effect lasted for at least 2 years after termination of green tea supplementation (9, 10). Evidence from epidemiological studies that examined the association between green tea consumption and risk of breast cancer was inconsistent. An inverse association was reported in case-control studies whereas a null association was found in prospective cohort studies (11). Given the important role of O-methylation by catechol-O-methyltransferase (COMT) in the conjugation reaction of tea catechins, several studies examined the modifying role of *COMT* genotype on the green tea-breast cancer association and also produced inconsistent results (12, 13). There is no sufficient evidence that supports a protective role of green tea intake on the development of urinary bladder cancer. The difference between results from animal and human studies is likely to be due to (a) the relatively weak cancer preventive effect in humans because the lower quantities of green tea consumed by a healthy individual as compared to the doses used in animal studies, and (b) the confounding factors in the epidemiological studies that could reduce or even mask the true protective effect of green tea whereas in animal experimental studies the conditions are well controlled to maximize the likelihood to detect a protective effect. Future prospective observational studies with biomarkers of exposure and phase III clinical trials are required to provide definitive evidence for the hypothesized beneficial effect of tea consumption on cancer development in humans.

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