Introduction to the Proceedings of the Fourth International Scientific Symposium on Tea and Human Health¹⁻³

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The Fourth International Scientific Symposium on Tea and Human Health was held September 18, 2007 at the U.S. Department of Agriculture in Washington, DC. The symposium was organized by the Tea Council of the U.S.A. and cosponsored by the American Cancer Society, American College of Nutrition, American Medical Women’s Association, American Society for Nutrition, and the Linus Pauling Institute at Oregon State University. The symposium was cochaired by Lenore Arab (UCLA) and Jeffrey Blumberg (Tufts University). The proceedings of the first 3 symposia reflect the increasing rigor and productivity of research on the topic of tea and health (1–3). The organization of this symposium was prompted in part by the increase in publications on the topic since 2000, with over 330 in the last 3 y, and the value in considering not only the substantial and ongoing research efforts about the effect of tea on the risk for cardiovascular disease and cancer but the recently evolving investigations into other areas of health promotion and disease prevention.

The history of tea as both a beverage and a medicine dates from 2737 BC, when Chinese legend describes Emperor Shen Nung’s discovery of tea not only as flavorful but producing vigor of body, contentment of mind, and determination of purpose.

Indeed, for centuries, tea was used principally as a medicinal drink before becoming a popular beverage during the Tang dynasty (AD 618–906). Modern investigations into the putative benefits of tea (Camellia sinensis) began only 50 y ago with attention first directed largely by investigators in China, India, and Russia to its actions on blood pressure, carcinogenesis, central nervous system stimulation, gastrointestinal function, and iron bioavailability (4–7). The last 2 decades have seen tea research extending beyond cancer and cardiovascular disease to explore as well dental caries and plaque, bone mineral density and osteoporosis, and cognitive function and mood (8–10). Interestingly, if substantiated, the breadth of potential outcomes for tea consumption could contribute as 1 approach to health as defined by the World Health Organization as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (11). The goal of this symposium was to review the state of scientific advances relevant to the impact of tea consumption on physical health, mental performance, and disease prevention.

Experimental models and human studies have consistently shown that cardiovascular disease risk factors reduce the production of endothelium-derived nitric oxide and impair endothelium-dependent vasodilation. The benefit of tea polyphenols in promoting nitric oxide bioavailability (12) is consistent with the meta-analysis of Peters et al. (13) showing that higher tea consumption is associated with a significant, but modest, 11% reduction in risk of heart disease. Kuriyama (14) updates this work with contributions from recent observational studies on tea and cardiovascular disease. He notes the challenge of conducting long-term randomized clinical trials on the effects of diet and lifestyle and suggests the need for continued refinement of prospective cohort studies to improve the precision of the exposure assessment. Grassi et al. (15) revisit the epidemiologic evidence and provide an in-depth examination of the mechanisms of action explored in human and animal experiments, particularly the effects of tea on nitric oxide-mediated pathways. They note the recent recommendation by the American College of Cardiology Foundation Task Force (16) for including moderate tea intake as part of nutritional advice for risk reduction of cardiovascular disease.

There is a substantial body of evidence from animal models demonstrating an inhibition of cancer initiation and progres-
sion. Nonetheless, in their recent report, the World Cancer Research Fund (17) found that evidence from human studies for a benefit of tea in chemoprevention was too limited to draw any conclusions. However, their report is not comprehensive with regard to flavonoids and is inconsistent in its classification of polyphenols. Arts (18) presents a more comprehensive review of 20 observational studies on tea consumption, flavonoid intake, and lung cancer. She identifies 4 studies that found a significantly lower risk associated with a high intake of black or green tea, specifically among never smokers. Hakim et al. (19) suggest that some of the confounding in studies of tea intake and cancer risk might be better understood through new investigations of susceptibility and repair genotypes in these cohorts.

New frontiers in tea research are reflected by investigations of tea and its constituents in weight management, diabetes mellitus, and neurophysiological and cognitive functions. Tea flavonoids and caffeine may affect energy and fat metabolism through a variety of mechanisms. The increasing prevalence of diabetes mellitus presents a growing challenge to public health, and some evidence suggests that tea may reduce the risk of this disease. Stote and Baer (20) review the effect of tea on glucose regulatory control and detail clinical trials that have evaluated tea and its constituents on biomarkers such as fasting insulin and glucose, fructosamine, hemoglobin Alc, and homeostasis model assessment of insulin resistance. With observational evidence that tea consumption is inversely associated with the incidence of age-related dementia, Alzheimer’s and Parkinson’s diseases, Mandel et al. (21) report on their effort, together with work from other laboratories, showing that tea polyphenols, particularly (−)-epigallocatechin-3-gallate, are bioavailable to the brain and can act via antioxidant, iron-chelation, signal transduction modulation, and other mechanisms to effect neuroprotective and/or neurorescue action. Extending this experimental work to human studies, Foxe and his colleagues (22) have matched electroencephalographic recordings with cognitive task performance to demonstrate that the unique tea amino acid l-theanine (γ-glutamylethylamide) plays a role in attentional processing in synergy with caffeine.

As the functional benefit of any food is evaluated, so must its potential adverse effects be considered. Certainly, the extensive history of daily, long-term intake of tea indicates a high level of safety, although that usage does not adequately address the issue scientifically. Areas that have been of some concern are the potential of tea to inhibit nonheme iron absorption and the impact of its caffeine content. The former issue was addressed in a systematic review by Nelson and Poulter (23) of 35 studies on iron absorption and black tea. Although none of these reports included clinical trials, based on the 12 highest-quality studies, there was a measurable inhibition of iron bioavailability, but one that presents no threat to healthy adults with normal iron status. However, for those at risk of iron deficiency, restricting tea consumption to times 1 or more hours before or after meals was advised. Although the caffeine content of dry tea exceeds that of coffee, the amount in a brewed cup of tea is approximately one-half that of a cup of coffee. Along with the known benefits of modest amounts of caffeine in performance enhancement and its potential anticarcinogenic effects (24–26), concerns have been expressed about higher caffeine consumption and pregnancy outcomes (27,28). Although recent studies have failed to support this concern (29,30), prudent advice remains to limit daily consumption by pregnant women to fewer than 5 cups per day.

Utilizing the USDA Flavonoid Database, Song and Chun (31) are the first to examine the most recent release of dietary intake data from NHANES and report that differences in total flavonoid intake among subgroups are principally associated with the percentage of tea consumers and their prevalence of tea consumption. Further, Henning et al. (32) and Auger et al. (33) add valuable new information regarding the bioavailability and metabolism of tea flavonoids using novel approaches with in vitro digestion models as well as in human studies with the recruitment of ileostomy and prostatecmy patients. These categories of data are important as we consider what foods to recommend when promoting greater consumption of bioavailable and bioactive phytochemicals. However, it is useful to note as well that tea also contributes to hydration. As Popkin et al. (34) emphasize in their ranking of beverages from the lowest to the highest value based on energy and nutrient contents and related health benefits and risks, after water, unsweetened tea and coffee were rated more than 500 times higher than all other drinks because of their precedence over the consumption of beverages with more energy. Finally, it is worth noting the special role of tea in providing a sense of social well-being as illustrated by rich cultural practices as diverse as the Japanese tea ceremony, the British afternoon tea, the communal use of the Russian samovar, and the American invention of iced tea. The recent data presented in these proceedings of the Fourth International Scientific Symposium on Tea and Human Health establish an encouraging foundation for new and broader research efforts to understand the contributions of tea in promoting health and reducing the risk for chronic disease.

**Literature Cited**


19. Hakim IA, Chow HHS, Harris RB. Green tea consumption is associated with decreased DNA damage among GSTM1 positive smokers regardless of their hOGG1 genotype. J Nutr. 2008;138:1567S–71S.


