Cardiovascular Benefits of Tea Consumption

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Abstract

Tea, a popular beverage worldwide, is classified into green, oolong and black tea based on the degree of fermentation. Increasing evidence from animal experiments and epidemiologic studies support the properties of tea and its constituent’s for protecting against atherosclerosis, coronary heart disease, stroke, and hypertension. This study demonstrates that potential cardiovascular benefits of consuming tea or tea polyphenols regularly (dose-dependent effect for drinking ≥1 cup of tea daily or weekly).

Keywords: Tea; Polyphenol; Cardiovascular Disease

Introduction

Tea is commonly classified into three forms based on the degree of fermentation involving unfermented green tea, partially fermented oolong tea and fully fermented black tea. Tea leaves contain polyphenols in high quantity (~30% of dried tea leaves), mainly flavonoids. For green tea, polyphenols are maintained in monomeric forms and catechins are present in higher quantities than in oolong or black tea. Black tea contains polymeric compounds thearubigins and theaflavins due to extended fermentation. Black tea has 2-3 times more caffeine as compared to green tea. Oolong tea is a mixture of monomeric polyphenols and theaflavins. Of the tea produced worldwide, 78% is black tea mainly consumed in Western countries; 20% is green tea commonly consumed in Asian countries; whilst 2% is oolong tea usually consumed in southern China. Compelling evidence shows the cardiovascular benefits of consuming tea or the major ingredient polyphenols during pathological conditions like diabetes, obesity, hypertension and atherosclerosis [1-3]. Tea or tea polyphenols have been shown to possess anti-inflammatory, antioxidative, antithrombogenic, hypocholesterolemic and hypotensive effects [4]. This short communication highlights the protective effects of consuming tea or tea polyphenols for the prevention of cardiovascular complications.

Regular Tea Consumption Promotes Cardiovascular Health

Epidemiologic studies support the potential role of tea consumption to reduce the risk of cardiovascular diseases. Increased tea intake (>375 ml/day, or <14 cups/week) contributes to the protection against myocardial infarction and reduces infarct-related ventricular arrhythmia and mortality [5-7]. Similarly, the inverse association of tea consumption (≥1 cup/day, or 1-6 cups/week) with mortality due to all causes and due to cardiovascular disease was reported in Japanese adults [8,9]. A dose-response meta-analysis indicated that regular green tea consumption (1 cup/day) reduced the...
risk of cardiovascular disease mortality and all-cause mortality [10]. A recent meta-analysis also provides evidence that green tea consumption (≥1 cup/day) reduced the risk of myocardial infarction and stroke [11]. Of note, black tea promotes cardiovascular health as potently as green tea with the predominant theaflavins and thearubigins counterbalancing the lack of catechins [12].

Atherosclerosis

Studies using animal models like apo E deficient mice demonstrate that flavonoids present in tea can attenuate atherosclerotic lesion development [1,13]. Green tea consumption (≥2 cups/day) was found to be negatively associated with the occurrence of coronary atherosclerosis in men [14]. Similarly, lower prevalence of carotid plaques was shown in women with increasing daily tea consumption (≥1 cup/day) [15]. Consumption of green tea (8 g/day) for two weeks improves flow-mediated vasodilatation in chronic smokers [16]. Furthermore, long-term ingestion of black tea (5 cups/day) for 4 weeks improves vasodilation of the brachial artery in mildly dyslipidemic subjects [17]. Chronic inclusion of black tea extract (15 mg/kg/day for 4 weeks) favorably modifies lipid profile and attenuates endothelial dysfunction in rat model of estrogen deficiency [18].

Coronary heart disease

Tea drinking (≥2 cups/day) appears to be inversely correlated with coronary heart disease [19]. Regular consumption of black tea (5 cups/day) is demonstrated to link with diminished total and LDL cholesterol in mildly hypercholesterolemic adults; and thereby reduce the risk of coronary heart disease [20]. Black tea intake enhances flow-mediated vasodilation in patients with coronary artery disease (900 ml/day) [21] as well as in healthy individuals (1-8 cups/day) [22]. On the other hand, a meta-analysis supports the protective role of green tea (1 cup/day) against coronary artery disease but not for black tea [23].

Stroke

Green tea intake (≥2 cups/day) reduces the stroke incidence in Japanese population [24]. Another study in China also suggests a lowered risk of ischemic stroke among frequent tea drinkers (1-2 cups/day) [25]. A meta-analysis reveals that daily consumption of black tea can prevent the onset of ischemic stroke [26]. Lower risk of total stroke was observed among Swedish individuals with daily consumption of black tea (≥4 cups/day) [27].

Hypertension

Consumption of green or black tea was shown to lower both systolic and diastolic pressure in hypertensive rats [28,29]. Cardiovascular benefits of black tea consumption are attributed to scavenge of reactive oxygen species (ROS) level [30] and the increase of nitric oxide (NO) bioavailability through PI3/Akt pathway [31] in endothelial cells. In addition, oral administration of black tea extraction (15 mg/kg/day for 2 weeks) can improve endothelium-dependent relaxations and normalize blood pressure through alleviation of endoplasmic reticulum stress in hypertensive rats [32]. In agreement with animal studies, black tea consumption decreased both systolic and diastolic blood pressure in hypertensive patients [33]. Habitual drinks of green or oolong tea (≥120 ml/day for at least 1 year) have decreased risk of hypertension in Chinese population [34]. The protective association between green tea consumption (100 ml/day) and blood pressure was observed in another study [35].

Detrimental effects on human health

Tea is “generally recognized as safe” by US Food and Drug Administration (FDA). There are no reports of clinical toxicity from daily tea consumption as a beverage. However, adverse effects following the consumption of large amounts of tea have been reported. Overconsumption of tea may be considered harmful primarily due to its caffeine content, presence of aluminum and the effect of tea polyphenols on iron bioavailability. The reported deleterious effects of caffeine include nervousness, restlessness, tremor, palpitation, tachycardia, insomnia, nausea, vomiting, diarrhea, diuresis, headache, and abdominal pain [36]. FDA advises pregnant women or those may become pregnant to avoid caffeine. Not specific to tea, caffeine content needs attention. Some people are more sensitive to it and pregnant women should use it with constrains. Caffeine should be limited to less than 400 mg a day (or less than 200 mg for pregnant or nursing women). Hepatotoxicity is considered from excessive levels of epigallocatechin gallate or its metabolites [37]. Multi-dose pharmacokinetic studies suggest a daily dosage of 800 mg/day of epigallocatechin gallate capsules for up to 4 weeks to be safe and well tolerated. It is a natural ability of the tea plant to absorb fluoride from surrounding soil which mostly accumulated in leaves. Excess tea drinking (consuming a pitcher of tea made from 100 to 150 tea
batches daily for 17 years which approximately equivalents to 20 mg fluoride intake per day) may lead to skeletal fluorosis [38]. Tea consumption may limit the absorption of non-heme iron from diet and thereby individuals at risk of iron deficiency are advised to wait at least one hour after meal before drinking tea [39].

**Conclusion**

The positive evidence for the cardioprotective effects of tea or tea polyphenols in human and murine models provides insights into taking tea as dietary supplements to prevent or retard the development of cardiovascular diseases. Many studies indicate the dose-dependent effect: the more cups of tea you drink, the more obvious the health effects; nevertheless, an overdose can lead to unpleasant side effects. To gain its health benefits, drinking a few cups of green tea each day (approximately 3 cups) is recommended by Harvard Health Publications and the University of Maryland Medical Center. Notably, the bioavailability of polyphenols varies in different types of tea and different studies supporting the cardioprotective potentials have used a mixture of several polyphenols, so further detailed investigation is required to correlate the amount of tea polyphenols to vascular benefits. To conclude, tea consumption can reduce the risk of cardiovascular diseases like other well-established ways such as healthy eating and physical activity. It is not necessary to have strict regulation on the amount of tea to be consumed as drinking 1 cup of tea daily has already been shown to be beneficial; whilst drinking more cups of tea daily or weekly can obtain greater cardioprotective effects.

**References**


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