

HEALTH EFFECTS OF BLACK AND GREEN TEAS



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Tea is the most popular drink in the world after water and offers a range of natural health benefits, largely due to its flavonoid content (30 percent dry weight). Of the tea produced worldwide, 78 percent is black (i.e. regular tea), 20 percent is green and two percent is oolong (traditional Chinese). Media attention often focuses on green tea, yet all teas are made from the same plant, *Camellia sinensis* and in theory should offer similar health benefits. This article examines the published literature to compare the evidence for green and black teas.



FLAVONOIDS

Tea leaves undergo different processes to make green and black teas and this impacts on the flavonoid content. Leaves destined for green tea are withered, steamed/pan fired and rolled before being dried. In contrast, the manufacturing process for black tea involves an additional step of aeration of the cut, withered leaves for several hours. This oxidises the flavonoids as well as darkening the colour of the leaves. While overall flavonoid levels remain similar, green teas contain more catechins (80 to 90 percent), while black teas contain less catechins (20 to 30 percent) and more theaflavins and thearubigins (50 to 60 percent) (1). Caffeine levels are also lower in green teas (approx 40mg/serving) compared with black teas (approx 50mg/serving), although both are lower than coffee (80-100mg/serving).

CARDIOVASCULAR HEALTH

Most of the high quality evidence on tea relates to cardiovascular (CV) health where heart health benefits are indicated by observational, intervention and mechanistic studies, as well as meta-analyses.

For green tea, epidemiological studies suggest a reduction in the risk of heart disease and stroke at intakes of five to six cups per day, while intervention studies using green tea extracts have reported a significant modification of CV risk factors (2). A large Japanese cohort study found a 30 percent reduction in CV mortality risk in women when green tea was consumed frequently (3). A review of randomised, controlled trials using green tea or extracts found CV benefits in more than half of the studies (3). Green tea catechins are believed to exert their effects on CV health by inhibiting oxidation, reducing blood lipids, regulating vascular tone, preventing inflammation and suppressing platelet adhesion (4).

Studies on black tea offer a similar picture, with a number of observational studies reporting significant associations between black tea consumption and a lower risk of CV disease (5). A meta-analysis (6) found that the risk of myocardial infarction (MI) was 11 percent lower, on average, when three cups of black tea were consumed daily. The longitudinal Rotterdam study found a 46 percent lower risk of severe aortic atherosclerosis (7) and a 43 percent lower risk of MI (8) at black tea intakes of one to two cups per day. These are supported by intervention and mechanistic

studies which suggest similar physiological effects to green tea (5).

A few studies have directly compared the effects of green and black tea. In a meta-analysis which pooled data on 194,965 individuals, Arab et al (9) concluded that three cups per day of green or black tea could prevent the onset of ischemic stroke and reduced stroke risk by 21 percent, while a meta-analysis of six cohorts, involving 111,067 individuals, found a 20 percent lower risk of stroke at higher intakes of the flavonoids found in both types of tea (10). Two acute intervention trials found improved vascular function following consumption of both types of tea (11,12).

DIABETES

Diabetes is an emerging area of interest in relation to tea. While studies on green tea are limited, several observational studies have reported significant associations between black tea consumption and a lower risk of Type 2 diabetes. In the Singapore Chinese Health Study, drinking ≥ 1 cup black tea per day was associated with a 14 percent lower risk of developing Type 2 diabetes (13), while the Dutch EPIC survey found a 37 percent lower risk when adults drank >5 cups per day (14). Regular tea drinking has also been associated with lower fasting blood glucose levels (15).

With regard to modes of action, it has been suggested that theaflavins in black tea could modulate plasminogen activator inhibitor function, which is believed to play a role in lowering diabetes risk (16). Evidence from animal studies suggests that tea flavonoids could help to regenerate the pancreas and protect beta cells against oxidative stress (17).

CANCER

It is notoriously difficult to find consistent relationships between dietary factors and cancer, probably because the aetiology is multifactorial and cancers take many years to develop. A Cochrane review of green tea and cancer prevention examined 51 studies, find-

ing that the only consistent evidence related to green tea consumption and reduced risk of prostate cancer (18). Other findings were insufficient and conflicting, although no adverse effects were noted. The authors suggested that intakes of three to five cups per day may be beneficial.

For black tea, a similar picture arises with studies finding either significant or null associations between tea consumption and cancer prevention, although many in vitro or animal studies provide mechanisms to explain why tea constituents may theoretically lower cancer risk (e.g. increased apoptosis, antioxidant effects) (5). The most consistent evidence appears to relate to black tea intake and a reduced risk of bowel cancer, perhaps due to the beneficial impact of flavonoids in the large intestine (19).

DENTAL HEALTH

Since the 1800s, when Mrs Beeton recommended bathing styes with it, tea has been recognised for its antibacterial properties. More recently, in vitro research has revealed that tea flavonoids inhibit *Strep. mutans*, the species of bacteria responsible for dental caries, reduce the adhesion of bacteria to teeth and inhibit the production of amylases, which break down starch in the oral cavity (20). Human research is limited and mainly focuses on green tea. The results show that regular tea consumption significantly lowers the risk of caries and tooth loss. However, thearubigins, which are found in black tea, appear to offer the best anti-caries effects in laboratory tests (21). Black tea is generally served with milk, which may enhance any dental effects due to its calcium and phosphorus content. While more controlled human trials are needed, tea does appear to offer dental health benefits and could be recommended as a suitable accompaniment to starchy snacks.

DISCUSSION

While there is more published research on green tea, at least in relation to heart disease, cancer and dental health, black tea appears to offer the same health benefits. This is not surprising given that both teas originate from the same plant and that the total polyphenol levels are similar (22). Additional research on dietary flavonoids supports the observational data associating regular tea consumption with a reduced risk of chronic conditions. The evidence for health benefits is strongest for heart disease and stroke, with emerging positive findings linking tea consumption with a reduced risk of Type 2 diabetes and dental caries. The evidence on cancer prevention is inconsistent, although no adverse effects were found by reviewers.

When weighing up the relative benefits of green versus black tea, it is important not just to consider the amount and quality of available evidence, but the cultural context and availability of these beverages in the UK population. The National Diet and Nutrition Survey reveals that 77 percent of adults drink black tea with an average intake of 2.3 mugs per day (23). In contrast, there are no reliable estimates of green tea consumption as it remains a niche beverage.

Bioavailability is another issue. Although the ab-

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sorption of tea flavonoids is generally low due to their molecular weight, the popularity of tea makes it one of the most important sources of flavonoids in the diet, providing up to 80 percent of total flavonoids in some countries (24). There has been some debate about whether the addition of milk to black tea adversely affects flavonoid absorption due to binding with milk proteins. However, studies in this area have tended to use a variety of analytical methods and provide conflicting findings suggesting that more evidence is needed (25). In the meantime, it is worth noting that adding milk to tea makes an important contribution to calcium intakes in women (5).

In conclusion, black and green teas appear to offer similar health benefits at intakes of around four cups per day for black tea and five to six cups per day for green tea (due to the smaller cup traditionally used). However, because of its relative popularity, lower cost and wider availability, it is more practical to recommend black tea consumption in the UK. According to a recent clinical trial (26), an intake of up to six cups of black tea per day can make a contribution to fluid consumption, while the caffeine levels fall within safe limits.

Dr Ruxton is a member of the Tea Advisory Panel which advises the UK Tea Council. For more information, see www.teaadvisorypanel.com

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