


TEA AND HEALTH



Apart from water, tea is the most consumed beverage in the world. Various health benefits have been associated with regular tea drinking, including a lower risk of cardiovascular disease and cancer, and protection against cognitive decline, dental caries and bone loss. Most of these benefits are attributed to tea flavonoids, which are plant polyphenols. This brochure will look in detail at the health benefits associated with leaf teas.



Introduction

Apart from water, tea is the most consumed beverage in the world. Black (regular), oolong, green and white teas are all made from the leaves of *Camellia sinensis*, a plant cultivated in tropical and subtropical regions. The differences in colour and taste relate to processing, with green and white tea leaves undergoing less or no oxidation.

Various health benefits have been associated with regular tea drinking, including a lower risk of cardiovascular disease and cancer, and protection against cognitive decline, dental caries and bone loss. Most of these benefits are attributed to tea flavonoids, which are plant polyphenols. Flavonoids are found in citrus fruits, berries, onions and soya, although 61% of dietary flavonoids in Western populations come from black (i.e. regular) tea (Hertog et al, 1993). This brochure will look in detail at the health benefits associated with leaf teas.

Cardiovascular health

The largest body of evidence on tea and health relates to cardiovascular disease (CVD). One review (Gardner et al. 2007) looked at 20 observational studies, finding that the majority reported associations between regular tea drinking and a reduced risk of myocardial infarction (MI) or heart disease prevalence/mortality. A meta-analysis of 17 studies calculated an 11% lower risk of MI when three cups of tea were consumed daily (Peters et al., 2001).

Evidence on stroke is also strong. One meta-analysis reported a 21% reduced risk of developing, or dying from, a stroke when three or more cups of tea per day were consumed (Arab et al, 2009). Another meta-analysis found a 20% reduction in stroke when higher intakes of dietary flavonoids were consumed (i.e. 16-47mg per day; Hollman et al. 2010).

Mental performance

As most developed countries now have an ageing population, there is increased interest in how to maintain optimal physical and mental function throughout life. Tea is relevant to this debate as it contains biologically-active substances, such as flavonoids, caffeine, and theanine.

Two surveys observed a lower rate of cognitive decline in older adults with higher flavonoid intakes and/or regular black tea consumption (Ng et al. 2008; Nurk et al. 2009). Intervention studies are few in number but suggest benefits of tea on mental performance. Earlier studies found that having a few cups of tea during the day helped to sustain alertness (Durlach 1998, Hindmarch 1998, Hindmarch 2000). More recent studies have linked regular tea drinking, at around 4 servings daily, with reduced stress and increased relaxation (Steptoe et al, 2007), or an enhanced ability to focus attention (de Bruin et al, 2011).

This is supported by a number of short-term clinical studies showing that consumption of leaf tea, or tea extracts, has a positive impact on CVD risk factors. In particular, tea and tea flavonoids appear to improve the ability of blood vessels to dilate (Hodgson & Croft, 2010).

There are also emerging data linking tea and flavonoids with beneficial effects on blood pressure, blood cholesterol, inflammation, platelet activation and reduced oxidative damage, although more studies are needed.

Most effects on mental performance have been attributed to theanine and caffeine. Theanine is an amino acid almost unique to tea. Studies show that it affects alpha brain activity, a pattern associated with a relaxed yet alert mental state (Nobre et al, 2008). Through its effects on alpha brain activity, theanine may also improve the ability to focus attention when people perform a cognitive task (Gomez-Ramirez et al, 2007).

Caffeinated drinks are sometimes criticised by the media. However, a recent review (Ruxton, 2008) found that moderate caffeine intakes, as found in a few cups of tea, actually improve mood and mental performance. The review concluded that caffeine intakes of 38 to 400 mg/day, equivalent to one to eight cups of tea, appeared to deliver benefits without adversely affecting sleep quality.

Weight management

In addition to the calorie-free properties of tea (when consumed without sugar and milk), there is evidence that green tea may be beneficial as part of a weight management programme. This is possibly because caffeine, and catechins (the particular flavonoids found in green tea), work synergistically to promote body fat loss and increase energy expenditure (Westerterp-Plantenga, 2010).

In Asian populations, research shows that a regular intake of catechin-enriched green tea reduces total body fat, in particular the fat around the waist, especially when combined with exercise (Hursel et al, 2009). Evidence is still building in Western populations but could have important implications since excess body fat around the waist relates more strongly to health risks, e.g. type 2 diabetes, than body weight alone.



Emerging areas of health

Dental health

Tea is thought to help lower the risk of dental decay in two ways. Firstly, tea can be a source of fluoride, depending on cultivation and preparation factors. It has been estimated that 1 litre of tea prepared with fluoridated water could provide around 2.2mg fluoride per day (Gardner et al, 2007). Secondly, tea flavonoids possess anti-bacterial properties. A review found that regular tea drinking reduced the incidence and severity of dental disease in humans, although the number of trials was limited (Hamilton-Miller, 2001). In laboratory studies, tea flavonoids have been shown to inhibit the growth of oral bacteria species associated with caries development.

Diabetes

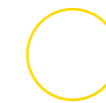
Although still a new area of research, some studies have linked tea consumption with a reduced risk of type 2 diabetes. In a large Chinese survey, drinking one or more cups of tea per day was associated with a 14% reduction in diabetes risk (Odegaard et al, 2008). This was confirmed by two meta-analyses (Huxley et al, 2009; Jing et al, 2009). It is thought that tea flavonoids could support normal glucose metabolism by lowering inflammation and by promoting insulin activity but further human studies are needed before drawing any conclusions.

Cancer prevention

Laboratory tests generally show that tea flavonoids stimulate normal cell turnover and inhibit tumour development (Shukla, 2007). While these actions would be expected to help cancer prevention or management in the long-term, evidence from human trials is lacking. Some surveys have reported a lower risk of colon cancer in regular tea drinkers, but the results are inconsistent (Gardner et al. 2007). Until further research is done, no firm conclusions can be drawn about cancer prevention properties of tea.

Bone health

Tea might have a role in helping to support bone health. A review found that tea had a modest beneficial effect on bone mineral density (BMD), particularly in older women where significant increases were seen when four or more cups of tea were consumed daily (Gardner et al, 2007). A survey of 1500 elderly women reported that BMD was higher in regular tea drinkers, and declined more slowly over time, compared with BMD in non-consumers of tea (Devine et al. 2007). These data now need to be confirmed by controlled trials. It is not clear why tea may affect bone health but there is speculation, based on animal and cell studies, that the flavonoids in tea, particularly green tea, act by enhancing bone creation and inhibiting bone breakdown (Shen et al, 2009).



Dispelling the Myths

Tea loses its benefits after adding milk and sugar

Flavonoids are believed to bind to milk proteins and therefore be less available to the body when tea is drunk with milk. Overall, a majority of human studies show that the addition of milk (up to 25% volume) does not affect flavonoid bioavailability but may delay uptake. Further research is needed to assess whether or not milk affects the benefits of tea and flavonoids on cardiovascular health. In contrast, adding sugar to tea does not influence absorption of flavonoids, but it would increase the calorie content and present a risk for dental health.

Drinking tea will affect my digestion

There are no studies showing an impact of tea on digestion. However, some trials show that tea flavonoids could inhibit the growth of *H. pylori* – a bacteria linked with gastric ulcers (Friedman, 2007). This interesting work needs to be verified by larger human trials.

Is it safe for my children to drink tea?

Unsweetened tea is a healthy drink and there is no reason why it shouldn't be offered to children. Caffeine guidelines for children are lacking in most countries. However, Canadian experts advise limits of 45 mg/day for 4-6 year olds, 62.5 mg/day for 7-9 year olds, and 85 mg/day for 10-12 year olds (Health and Welfare Canada, 2003). This means that most children can enjoy at least one cup of tea a day.

Caffeine in tea is bad for me

Tea contains around half the caffeine found in coffee. i.e. about 50 mg / 200 ml for black tea, less for green tea (Astill et al, 2003). At intakes of one to eight cups of day, caffeine intakes in tea are well within safe limits (Ruxton, 2009). There is good evidence that moderate caffeine intakes, of 38-400mg per day, are beneficial for mood, mental performance and physical endurance.

I am pregnant... Can I drink tea?

New guidelines advise pregnant women to limit daily caffeine intakes to 200mg. This equates to 3-4 cups of tea (Ruxton, 2009).



Tea doesn't count towards my daily fluid requirements

Tea does indeed count towards daily fluid requirements. A recent clinical study showed that four cups of tea a day are equally hydrating to an equivalent amount of tap water (Ruxton & Hart, 2011). This level of tea intake provides only around 200mg of caffeine. Concerns about the dehydrating effects of caffeine are overstated. While large amounts of caffeine taken in one sitting (i.e. 250-500mg) can increase urine output and increase the risk of dehydration, this has not been seen when caffeinated drinks are consumed. In addition, tea and coffee drinkers develop a tolerance for caffeine over time (Maughan and Griffin 2003).

Does tea affect mood?

Anecdotal claims that drinking tea boosts mood have turned out to be true. Studies show that theanine, an amino acid found in tea, produces a calming feeling. Combined with the modest amount of caffeine in tea (only 50mg per cup), this can help to reduce fatigue and create a feeling of wellbeing.

Drinking tea blocks iron absorption

For most people, drinking tea with meals will have no impact on iron status. However, those at risk from iron deficiency, e.g. young children and vegetarians, should drink tea away from mealtimes as it can have a modest impact on the absorption of iron from cereal and vegetable foods. The more bioavailable iron from animal products is not affected. There is no evidence of increased iron deficiency amongst regular tea drinkers (Gardner et al, 2007).

Drinking tea is bad for my teeth

Studies show that tea flavonoids inhibit the growth of bacteria which cause dental decay. Tea is also a source of fluoride, containing 0.3-0.5mg per average cup. This means that drinking tea could be beneficial for teeth, although more research is needed to prove this. It is a myth that black tea contains tannins – the colour is, in fact, due to the beneficial flavonoids. While these can stain the teeth over time, good oral hygiene helps to minimise this.

Drinking green tea is better than black tea

Both types of tea come from the same plant and have been associated with health benefits. The overall flavonoid level in each type of tea is similar, but the types of flavonoids differ. Research on green tea has focused on weight management benefits and cancer prevention, while research on black tea has focused on cardiovascular health and mental performance.

Drinking more than 5 cups of tea isn't safe

A meta-analysis found heart health benefits when three or more cups of tea were consumed daily (Peters et al., 2001). However, intakes of up to 8 cups per day are still within safe caffeine limits. A recent clinical study showed that four cups of tea per day was as hydrating as water (Ruxton & Hart, 2011).

Do herbal teas have the same benefits as green/black teas?

No, herbal teas are not true teas in that they are not made from *Camellia sinensis*. So, apart from the same hydrating properties, the benefits attributed to black and green teas don't apply to herbal teas.

Drinking tea causes kidney stones

Tea and coffee are rich in oxalate which could theoretically present a risk for kidney stones. However, studies show no consistent link between tea consumption and kidney stone formation. Indeed, two large US surveys showed that tea consumption reduced the risk of kidney stones by 8-14%. This is probably because tea drinking boosts fluid intake. Doctors recommend that a high intake of fluids is the best way to prevent kidney stones.





Advising patients

People of all ages can benefit from drinking tea. Here are some examples of how health research could translate into patient advice:

Tea is an excellent and pleasurable source of hydration. According to a recent clinical study, consuming four cups of tea a day did not cause excessive urine output or dehydration and was as hydrating as drinking water

Research shows that regular tea consumption is linked to a reduced risk of heart disease, stroke and myocardial infarction. This may be due to the favourable impact of tea flavonoids on blood vessel function. Optimal effects are seen at 3 or more cups of tea per day

Unsweetened tea is a healthy drink for people trying to reduce calories or limit their sugar intake. Emerging research suggests that catechin-enriched green tea may help to reduce body fat, particularly around the waist

Tea is a moderate source of caffeine, containing around 50mg of caffeine per serving. Caffeine intakes of 38-400mg per day appear to deliver health benefits without adversely affecting sleep. This equates to one to eight cups of tea a day

Studies show that a few cups of tea daily improve mood and help to sustain alertness and concentration

It is advised that pregnant women limit their daily caffeine consumption to 200mg. This equates to 3-4 cups of tea per day

New evidence suggests that drinking tea might be beneficial for bone health and dental health. This means that tea is a healthy choice of drink for young people. One to two cups a day is within suggested caffeine limits, depending upon the age of the child.



References

- Astill C, Birch MR, Dacombe C, Humphrey PG, Martin PT (2001). Factors Affecting the Caffeine and Polyphenol Contents of Black and Green Tea Infusions. *J. Agric. Food Chem.* 2001, 49, 5340-53474.
- Hertog MG et al (1993) Dietary antioxidant flavonoids and risk of coronary heart disease: the Zutphen Elderly Study. *Lancet* 342, 1007-11.
- Gardner EJ et al (2007) Black tea - helpful or harmful? A review of the evidence. *European Journal of Clinical Nutrition* 61, 3-18.
- Peters U et al (2001). Does tea affect cardiovascular disease? A meta-analysis. *American Journal of Epidemiology* 154, 495-503.
- Arab L et al (2009) Green and black tea consumption and risk of stroke. A meta-analysis. *Stroke* 40, 1786-92.
- Hollman PC et al (2010) Dietary flavonol intake may lower stroke risk in men and women. *Journal of Nutrition* 140, 600-4.
- Hodgson JM & Croft KD (2010) Tea flavonoids and cardiovascular health. *Molecular Aspects of Medicine* 31, 495-502.
- Ng TP et al (2008) Tea consumption and cognitive impairment and decline in older Chinese adults. *American Journal of Clinical Nutrition* 88, 224-31.
- Nurk E et al (2009) Intake of flavonoid-rich wine, tea, and chocolate by elderly men and women is associated with better cognitive test performance. *Journal of Nutrition* 139, 120-7.
- Durlach PJ (1998). The effects of a low dose of caffeine on cognitive performance. *Psychopharmacol* 140, 116-119.
- Hindmarch I, Quinlan PT, Moore KL, Parkin C (1998) The effects of black tea and other beverages on aspects of cognition and psychomotor performance. *Psychopharmacol* 139, 230-238.
- Hindmarch I, Rigney U, Stanley N, Quinlan P, Rycroft J, Lane J (2000) A naturalistic investigation of the effects of day-long consumption of tea, coffee and water on alertness, sleep onset and sleep quality. *Psychopharmacol* 149, 203-216
- Steptoe A et al (2007) The effects of tea on psychophysiological stress responsivity and post-stress recovery: a randomised double-blind trial. *Psychopharmacology* 190, 81-9.
- De Bruin EA et al (2011) Black tea improves attention and self-reported alertness. *Appetite* Dec 17. [Epub ahead of print]
- Nobre A et al (2008) L-theanine, a natural constituent in tea, and its effect on mental state. *Asia Pacific Journal of Clinical Nutrition* 17, 167-8.
- Gomez-Ramirez M et al (2007) The deployment of intersensory selective attention: a high-density electrical mapping study of the effects of theanine. *Clinical Neuropharmacology* 30, 25-38.
- Ruxton CHS (2008) The impact of caffeine on mood, cognitive function, performance and hydration: a review of benefits and risks. *Nutrition Bulletin* 33, 15-25.
- Westerterp-Plantenga MS (2010) Green tea catechins, caffeine and body-weight regulation. *Physiology & Behaviour* 100, 42-6.
- Hursel R et al (2009) The effects of green tea on weight loss and weight maintenance: a meta-analysis. *International Journal of Obesity* 33, 956-61.
- Hamilton-Miller JMT (2001) Anti-cariogenic properties of tea (*Camellia sinensis*). *Journal of Medical Microbiology* 50, 299-302.
- Odegaard AO et al (2008) Coffee, tea and incident type 2 diabetes: the Singapore Chinese Health Study. *American Journal of Clinical Nutrition* 88, 979-85.
- Huxley R et al (2009) Coffee, decaffeinated coffee, and tea consumption in relation to incident type 2 diabetes mellitus: A systematic review with meta-analysis. *Archives of Internal Medicine* 169, 2053-2063
- Jing Y et al (2009) Tea consumption and risk of type 2 diabetes: a meta-analysis of cohort studies. *Journal General and Internal Medicine* 24, 557-62
- Shukla Y (2007) Tea and cancer chemoprevention: a comprehensive review. *Asia Pacific Journal of Cancer Prevention* 8, 155-66.
- Devine A et al (2007) Tea drinking is associated with benefits on bone density in older women. *American Journal of Clinical Nutrition* 86, 1243-7.
- Shen CL et al (2009) Green tea and bone metabolism. *Nutrition Research* 29, 437-56.
- Friedman M (2007) Overview of antibacterial, antitoxin, antiviral, and antifungal activities of tea flavonoids and teas. *Molecular Nutrition and Food Research* 51, 116-134.
- Health and Welfare Canada (2003) Caffeine and your health. www.hc-sc.gc.ca/fn-an/securit/facts-faits/caffeine-eng.php
- Ruxton C (2009) Health aspects of caffeine: benefits and risks. *Nursing Standard* 24, 41-48.
- Ruxton CHS, Hart VA (2011) A randomised cross-over trial to evaluate the impact of tea on measures of hydration. *Proceedings of the Nutrition Society* (in press).
- Maughan RJ, Griffin J (2003) Caffeine ingestion and fluid balance: a review. *Journal of Human Nutrition and Dietetics* 16, 411-420.
- Curhan GC et al (1996) Prospective study of beverage use and the risk of kidney stones. *American Journal of Epidemiology* 143, 240-7.
- Curhan GC et al (1998) Beverage use and risk for kidney stones in women. *Annals of Internal Medicine* 128, 534-40.



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Published April 2011
All information correct at time
of going to press

Information for
healthcare professionals



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