

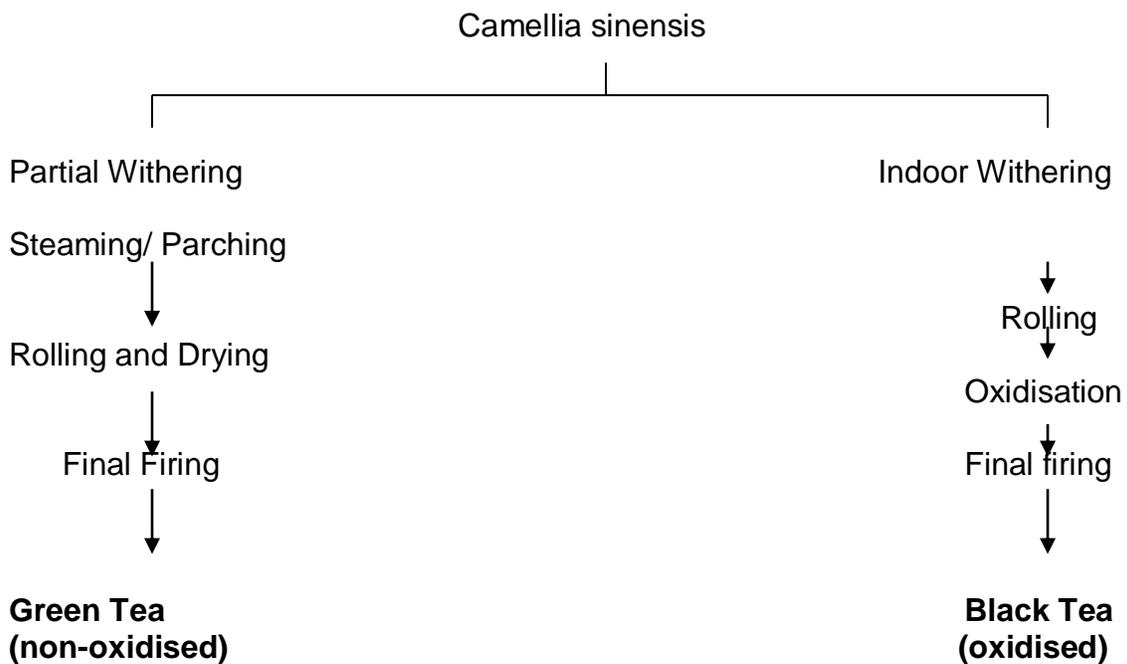
## Black and Green Tea: How do they differ?

### Introduction

Tea is a drink that is enjoyed by people across the globe. Black tea represents approximately 72% of total consumed tea in the world, whereas green tea accounts for approximately 26%.<sup>1</sup>

Both green tea and black tea come from the leaves of the plant *Camellia sinensis*, however the processing that the leaves undergo to make the final tea is different. The leaves for black tea are fully oxidised while those for green teas are lightly steamed before being dried. Figure 1 outlines the processing of green and black tea in more detail.

Figure 1 – Green and Black Tea Processing

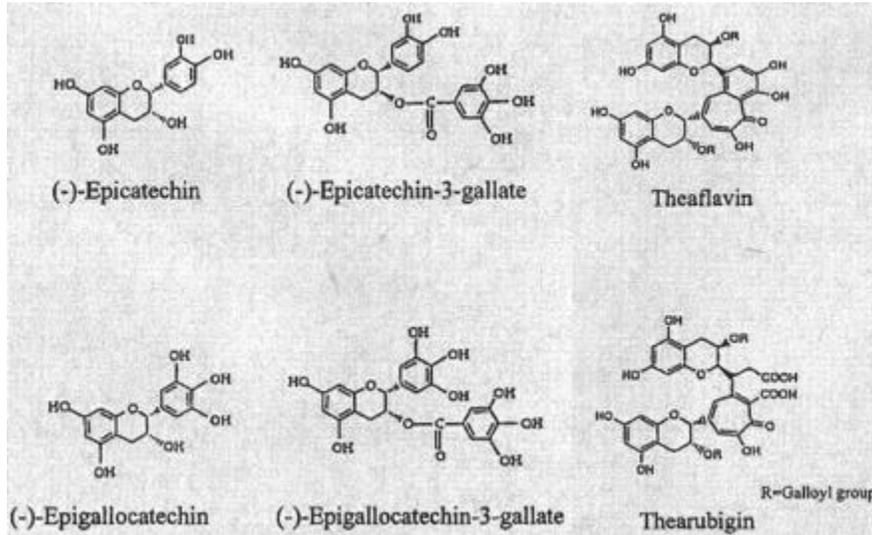


Black teas mostly come from plantations in Africa, India, Sri Lanka and Indonesia while green teas come from countries in the Far East such as China and Japan.

### Flavonoid content of black and green teas

Black and green teas both contain similar amount of flavonoids, however they differ in their chemical structure. Green teas contain more of the simple flavonoids called catechins, while the oxidisation that the leaves undergo to make black tea converts these simple flavonoids to the more complex varieties called theaflavins and thearubigins. Figure 2 provides the chemical structures of the major flavonoids found in both green and black tea.

Figure 2 – Major flavonoids founds in tea<sup>2</sup>



Tables 1 and 2 provides average values for the different constituents present in green and black tea although they will differ dependent on the variety of leaf, growing environment, manufacturing, particle size of ground tea leaves and infusion preparation.<sup>3,4</sup>

Table 1 – Principle components of black tea<sup>5</sup>

	<b>Black Tea</b> (% weight of extract solids)
Catechins	3-10
Theaflavins	3-6
Thearubigens	12-18
Flavonols	6-8
Phenolic acids and depsides	10-12
Amino Acids	13-15
Methylxanthines	8-11
Carbohydrates	15
Protein	1
Mineral water	10
Volatiles	<0.1

Table 1 – Principle components of green tea<sup>5</sup>

	<b>Green Tea</b> (% weight of extract solids)
Catechins	30-42
Flavonols	5-10

Other flavonoids	2-4
Theogallin	2-3
Other depsides	1
Ascorbic Acid	1-2
Gallic Acid	0.5
Quinic acid	2
Other organic acids	4-5
Theanine	4-6
Other amino acids	4-6
Methylxanthines	7-9
Carbohydrates	10-15
Minerals	6-8
Volatiles	0.02

Oolong tea, is a partially fermented leaf, with a flavonoid profile midway between green and black tea.

### **The health benefits of flavonoids**

Although the oxidation process modifies the type of flavonoids present, the total level and their overall antioxidant activity, is similar in both teas.<sup>6,7</sup> Research is now suggesting that antioxidants, such as those found in both green and black tea, may have a protective role to play in certain conditions such as heart disease, stroke and some cancers.

Further work is still required in understanding the protective antioxidant action of black and green teas. In one in vitro study, black tea was found to be more efficient than green tea as a chemopreventor against certain free radicals, oxygen and nitrogen species.<sup>8</sup> However, in another study both green tea and black tea were equally able to protect against Nitric Oxide toxicity.<sup>9</sup>

More detailed information about the health benefits of black tea, antioxidants and flavonoids can be found in the Fact Sheets 'Tea and Antioxidant Properties; Tea and Cancer; Tea and Cardiovascular Disease'.

### **The health benefits of green tea**

A number of epidemiological studies have suggested that green tea maybe protective against certain types of cancer<sup>10,11</sup> including lung<sup>12</sup>, ovarian<sup>13</sup>, breast<sup>14,15,16</sup>, prostate<sup>17</sup>, stomach cancer<sup>18,19,20,21,22,23,24,25,26,27</sup> and its precancerous condition, gastritis<sup>18,28</sup>. The possible protective action of green tea is unclear, although a number of in vitro and animal studies are attempting to explain this.<sup>29,30</sup> Mechanisms by which green tea may be protective are discussed in more detail in the fact sheet 'Tea and Cancer.'

In addition to its potential anticarcinogenic and antioxidant effects, other studies have shown green tea to have anti-inflammatory, antithrombotic<sup>31</sup>, cholesterol lowering<sup>32,33,34,35</sup>, antiviral and antibacterial properties<sup>36,37,38</sup>.

Although the scientific evidence demonstrating the health benefits of green tea is increasing it is not yet conclusive and provides an interesting area for future research.

### **Green tea and skin protection**

A number of animal studies have shown that topical treatment or oral consumption of green tea polyphenols prevent UVB-induced inflammatory responses, immunosuppression and oxidative stress, which are the biomarkers of several skin disease states<sup>39</sup>. Treatment of green tea polyphenols to skin has been shown to have a beneficial effect on the biochemical pathways involved in skin inflammation, cell proliferation and chemical tumour promoters. Antioxidant and anti-inflammatory effects of green tea have also been observed in human skin.<sup>39</sup> One human model found that topical application of green tea polyphenols protected against UV light induced DNA damage<sup>40</sup>. Based on results mainly from animal studies, many companies are now supplementing their skin care products with green tea extracts. However, the effects on human skin are still not well understood and further research in this field is required.

### **Green tea extract and weight loss**

Preliminary research published in the American Journal of Clinical Nutrition suggests that an extract from green tea may help with weight loss by speeding up fat oxidation.<sup>41</sup> In this study, researchers conducted a 6 week study of 10 healthy men in their 20's and found that those men who were given a green tea extract used more calories in a day than those who did not. However, due to the short term duration of the study, the impact of these results on body composition and body weight could not be determined.

Another study examined whether green tea had any affect on weight maintenance in subjects who had previously lost weight. A total of 104 overweight and moderately obese male and female subjects participated. The study consisted of a very-low-energy diet intervention of 4 weeks followed by a weight-maintenance period of 13 weeks in which the subjects received green tea or placebo. The green tea contained caffeine (104 mg/d) and catechins (573 mg/d, of which 323 mg was epigallocatechin gallate). Green tea appeared to have no effect on weight maintenance following weight loss on the low energy diet compared to the placebo.<sup>42</sup>

Further research using longer term studies is required before any firm conclusions about green tea and weight loss can be drawn.

## **Caffeine Content of Green Tea and Black Tea**

Black and Green teas are produced from the same plant *Camellia sinensis* so both green and black teas naturally contain caffeine. Further information about caffeine and tea can be found in the Fact Sheet, 'Tea and Caffeine.'

## **Which to drink?**

The health benefits gained from drinking black and green tea are comparable, both helping towards promoting health and well-being. The decision about which to drink is simply a matter of taste.

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