

# Tea and L-theanine



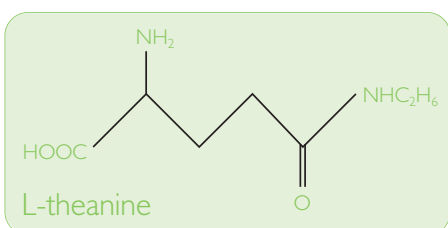
Tea has long been known for its rejuvenating effects – to revive, relax and refresh at the same time. Researchers have now started to investigate how tea might produce these effects. L-theanine, a natural component of tea, has only recently begun to be understood and is thought to be fundamental for the positive effects of tea on mood.

## Tea and alertness

Drinking 1-2 cups of tea has been shown to have a positive effect on maintaining alertness throughout the day.<sup>4</sup> Tea is naturally lower in caffeine than coffee.<sup>5</sup> However, when tea and coffee are matched for caffeine dose, tea appears to have differential effects on measures of alertness and potentially produces better effects at the same caffeine dose.<sup>6</sup>

## What is L-theanine?

L-theanine is an amino acid found in tea<sup>7</sup> but is otherwise rare in nature. It is the main amino acid in tea and constitutes between 1%–2% of the dry weight of tea.<sup>7,8,9</sup> There are two isomers of theanine in tea. The predominant form in tea is the L isomer (~98%). The L-theanine content of green, oolong and black tea is similar (Table 1). Animal research indicates that L-theanine is readily absorbed from the gut with blood L-theanine levels peaking about one hour after ingestion and returning to baseline levels within 24 hours.<sup>10</sup>



**Table 1. The L-theanine and flavonoid antioxidant content of tea - all values per cup (200ml)**

Tea type	L-theanine <sup>11</sup>	Flavonoid antioxidants <sup>12</sup>
Black (regular) tea	14-18mg	117mg
Green tea	8-14mg	132 mg

## How is L-theanine thought to exert its action in the brain?

Animal research indicates peak concentrations of L-theanine in the brain occur within 5 hours of ingestion.<sup>10</sup> L-theanine is thought to cross the blood-brain barrier via the L-leucine transporter and once in the brain may increase levels of neurotransmitters serotonin and dopamine.<sup>13</sup>

All true teas - black, green, oolong and white — are the only beverages that naturally contain L-theanine

## L-theanine and brain activity

Once L-theanine reaches the brain, it has clear effects on electrical brain activity. The human brain generates weak electrical pulses on its surface, known as brain waves, which can be recorded by EEG. There are four kinds of brain waves, named  $\alpha$  (alpha),  $\beta$  (beta),  $\delta$  (delta) and  $\theta$  (theta) waves, according to their frequencies. Each is associated with a different mental state (see Figure 1).

In 1999, Japanese researchers were the first to show that L-theanine increases alpha brain wave activity<sup>14</sup> which is associated with being relaxed but alert. Two recent studies at Oxford University in the UK have replicated this research and show that 50mg of L-theanine (as would be found naturally in 3 cups of tea) stimulates alpha brain wave activity.<sup>15,16</sup> One study investigated the effect of L-theanine on brainwave activity in individuals at rest,<sup>15</sup> while the second study used a naturalistic setting.<sup>16</sup> The latter study showed that in 20 individuals watching television, 50 mg of L-theanine increases alpha activity gradually over time with maximum effects seen 80 minutes after ingestion.<sup>16</sup>

L-theanine stimulates alpha brain waves which are associated with a relaxed yet alert mental state. Yoga and meditation are other examples of states where alpha brain waves may increase.<sup>17,18</sup>

## What are alpha waves?

Different mental states are associated with specific brain wave frequency bands. Brain waves change in a characteristic way from wakefulness to sleep. Sound sleep is associated with the low frequency  $\delta$  waves, whilst doze sleep is associated with

slightly higher frequency  $\theta$  waves. When an individual is awake and excited, the brain generates very high frequency  $\beta$  waves. Alpha brain waves are lower in frequency than  $\beta$  waves and are associated with a relaxed yet alert mental state.



## L-theanine and attention

Emerging research is also suggesting that higher levels of L-theanine may improve the ability to focus attention.<sup>19</sup> Alpha brain waves are now widely believed to be a key component in selective attention – enabling an individual to suppress irrelevant information during a demanding task.<sup>20,21,22</sup> While research is still emerging, it does suggest that L-theanine may increase the ability to concentrate and focus on tasks. Research is now underway to see if this effect is also seen when lower intakes of L-theanine are consumed.

The effect of L-theanine on alpha brain waves may be the mechanism by which tea exerts its unique effect on mood and mental performance.

## L-theanine and caffeine

The consensus of opinion is that moderate consumption of caffeine (up to 300 mg/day, equivalent to 5-8 cups of tea, 3 cups of coffee) has no adverse effects on health and has beneficial effects on mood and mental performance.<sup>5,23</sup> However, preliminary research has shown that when the level of caffeine in tea and coffee is identical, alertness across the day may be more consistent in the tea drinkers.<sup>4</sup> Scientists now believe that L-theanine in combination with caffeine, may well be responsible for the positive effect of tea on alertness.

## L-theanine and sleep

Anecdotally, people often avoid drinking tea in the evening as they are concerned that caffeine may adversely affect their sleep. Emerging evidence around L-theanine's possible effect on sleep quality suggests that this may be unwarranted. The small study has shown that L-theanine may have positive effects on sleep quality.<sup>24</sup> The L-theanine treatment group reported a significantly better ability to initiate and maintain sleep when compared to the placebo group. Further studies are underway to confirm this finding.

## L-theanine and immunity

L-theanine may enhance immune function by stimulating gamma delta T cells.<sup>25</sup> This effect has been replicated with regular (5-6 cups/day) tea consumption in humans.<sup>26</sup> This is a very exciting area, however, the research is still in its early stages and larger clinical studies are required before conclusions can be drawn.



Investigation into the effects of L-theanine on mood, alertness and attentiveness in humans has brought psychology and nutrition together in an exciting new field of study which will unfold rapidly in the next few years

## In summary

Emerging research on L-theanine, is beginning to explain the unique effects felt by tea drinkers that are so different to other hot beverages. L-theanine is a natural component found almost exclusively in tea and early research suggests that just 50 mg of L-theanine (found in 2-3 cups of tea) naturally stimulates specific brain activity, known as alpha brain waves. The alpha brain wave frequency is associated with a relaxed yet alert state of mind.

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