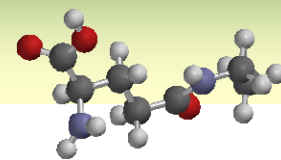


Tea and L-theanine



Drinking **tea** may:

- help maintain focus^{1,2,3}
- improve alertness throughout the day^{2,3}

L-theanine

- L-theanine is an amino acid found primarily in tea of the *Camellia sinensis* species and constitutes 0.3-1.5% of the dry weight of tea leaves.^{4,5}
- There are 2 isomeric forms and L-theanine is the predominant isomer found in tea (~98%).
- A single cup of brewed tea contains L-theanine in the range of 5-23 mg.

Caffeine

- Caffeine is a methylxanthine mainly found in coffee, tea, cocoa and chocolate products, mate and cola drinks.
- Typically, black tea contains 40-60 mg caffeine per cup.
- Caffeine is a stimulant; it has been reported to affect alertness, mood and cognitive performance.^{6,7}

L-theanine

L-theanine has been shown to modulate alpha brain wave activity in individuals at rest and during cognitive tasks.

- Numerous studies have shown that 50-200 mg of L-theanine alone can increase alpha wave activity.⁸⁻¹⁰

↳ Increased alpha wave activity at rest indicates a *more relaxed yet alert state of mind*.

- During performance of cognitive tasks, 250 mg of L-theanine alone was shown to decrease alpha wave activity.^{11,12} Another study found that 100 mg of L-theanine combined with 50 mg of caffeine decreased alpha wave activity, while 100 mg of L-theanine or 50 mg of caffeine alone did not have an effect.¹³

↳ Decreased alpha wave activity during cognitive tasks is associated with the *ability to focus*.

Alpha brain wave activity

- Neurons in the brain communicate through weak electrical pulses, known as brain waves, which can be measured on the surface of the subject's head by electroencephalography (EEG).

- There are different kinds of brain waves, according to their frequency. Each is associated with a different mental state.

Brain Waves	Frequency	State of Arousal
β -wave	14+ Hz	Awake Excitable
α -wave	8-13 Hz	
θ -wave	4-7 Hz	Doze Sleep
δ -wave	0.5-3 Hz	Sound Sleep

- Interpretation of alpha activity depends on the circumstances under which it is measured

- Increased alpha during rest
 - Associated with a relaxed yet alert mental state
- Decreased alpha during cognitive tasks
 - Associated with the ability to focus

Tea

- Recently, two double-blind, randomized, placebo-controlled human studies investigated the effects of black tea (2-3 cups) on short-term attention and alertness.¹⁴

- Participants performed more accurately on aspects related to selective attention and reported feeling more alert after consuming tea than after consuming placebo.



Conclusions

Research suggests that black tea can help maintain focus and improve alertness.

- Cumulative intake of 2-3 cups* of tea within 1-2 hr
- Measured with standardized cognitive tests
- Measured objectively but also as self-reported

L-theanine in combination with caffeine is likely responsible for these effects.

* Based on consumption of 2-3 cups of tea delivering 45 mg of L-theanine and 100 mg of caffeine

References

1. Durlach PJ. The effects of a low dose of caffeine on cognitive performance. *Psychopharmacol* 1998;140:116-119.
2. Hindmarch I, Quinlan PT, Moore KL, Parkin C. The effects of black tea and other beverages on aspects of cognition and psychomotor performance. *Psychopharmacol* 1998;139:230-238.
3. Hindmarch I, Rigney U, Stanley N, Quinlan P, Rycroft J, Lane J. A naturalistic investigation of the effects of day-long consumption of tea, coffee and water on alertness, sleep onset and sleep quality. *Psychopharmacol* 2000;149:203-216.
4. Cartwright RA, Roberts EAH, Wood DJ. Theanine an amino acid of N-ethyl amide present in tea. *J Sci Food Agric* 1954;5:597-599.
5. Finger A, Kuhr S, Engelhardt UH. Chromatography of tea constituents. *J Chromatogr* 1992;624(1-2):293-315.
6. Rogers PJ, DERNONCOURT C. Regular caffeine consumption: a balance of adverse and beneficial effects for mood and psychomotor performance. *Pharmacol Biochem Behav* 1998;59:1039-1045.
7. Smith A. Effects of caffeine on human behaviour. *Food Chem Toxicol* 2002;40:1234-1255.
8. Juneja LR, Chu DC, Okubo T, Nagato Y, Yokogoshi H. L-theanine: A unique amino acid of green tea and its relaxation effect in humans. *Trends in Food Sci Technol* 1999;10:199-204.
9. Song CH, Jung JH, Oh JS, Kim KS. Effects of theanine on the release of brain alpha waves in males. *Korean J Nutr* 2003;36:918-923.
10. Nobre AC, Rao AR, Owen GN. L-theanine, a natural constituent in tea, and its effect on mental state. *Asia Pac J Clin Nutr* 2008;17:167-168.
11. Gomez-Ramirez M, Higgins BA, Rycroft JA, Owen GN, Mahoney J, Shpaner M, Foxe JJ. The deployment of intersensory selective attention: a high-density electrical mapping study of the effects of theanine. *Clin Neuropharmacol* 2007;30:25-38.
12. Gomez-Ramirez M, Kelly SP, Montesi JL, Foxe JJ. The effects of L-theanine on alpha-band oscillatory brain activity during a visuo-spatial attention task. *Brain Topogr*. 2009 Jun;22(1):44-51. Epub 2008 Oct 9.
13. Kelly SP, Gomez-Ramirez M, Montesi JL, Foxe JJ. L-theanine and caffeine in combination affect human cognition as evidenced by oscillatory alpha-band activity and attention task performance. *J Nutr* 2008;138(8):1572S-1577S.
14. De Bruin EA et al. Submitted 2009.