L-theanine

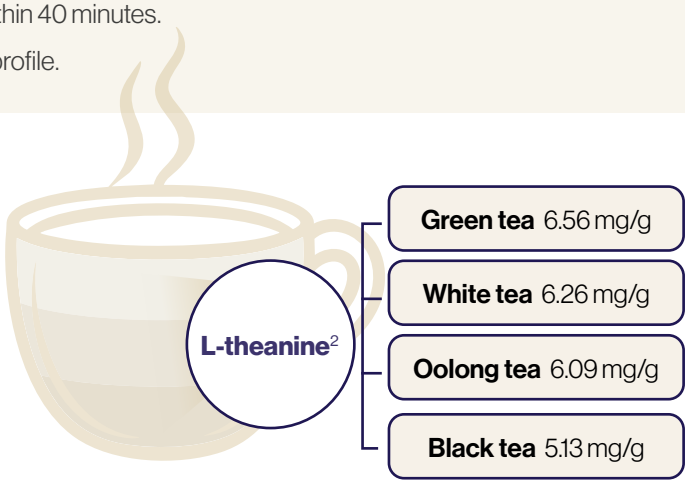
PRACTICE POINTS

- L-theanine is a calming amino acid that promotes relaxing alpha waves in the brain.
- Primary clinical applications include stress, anxiety, insomnia, and cognitive function.
- Dosage range of 200-400 mg/day induces relaxation and relieves nervous tension.
- Oral administration results in an increased secretion of neurotransmitters, such as dopamine and serotonin, after 30 minutes and the generation of alpha waves in the brain within 40 minutes.
- Supplemental L-theanine is well-tolerated and has a good safety profile.

OVERVIEW

L-theanine is a non-protein forming and water-soluble amino acid.[1,2] In nature, L-theanine is found almost exclusively in the tea plant (*Camellia sinensis*).[1,2] It makes up 1-2.5% of the dry weight of fresh tea leaves and is the major compound providing the umami taste of tea.[1]

Yellow tea and green tea contain the highest amount of L-theanine, however, L-theanine is also found in considerable quantities in white, oolong, and black tea.[2]



Non-protein amino acids

Amino acids can be proteinogenic (used to form proteins) or non-proteinogenic (perform a range of other important biological roles in the body).[3]

Why supplement?

Due to the degree of variation of L-theanine content in tea, **supplementation is often required for consistent therapeutic outcomes**.[2]

ACTIONS & BENEFITS

L-theanine induces relaxation and relieves nervous tension via the following mechanisms:

Stimulates the production of alpha brain waves, which:
- Support the transition to sleep
- Are associated with light meditative states[4]

Modulates neurotransmitter activity to:
- Reduce glutamate release
- Increase the release of gamma-aminobutyric acid (GABA), glycine, serotonin, and dopamine[1]

Enhances neurogenesis[1]

Inhibits the excitatory effects of caffeine[1]

Evidence also indicates that L-theanine has many other health benefits, exerting antioxidant, anti-inflammatory, neuroprotective, metabolic regulatory, cardiovascular protective, and immunomodulatory effects.

ALPHA BRAIN WAVES FOR A RELAXED MIND

Brain waves are oscillating electrical voltages in the brain that result from groups of neurons firing in a synchonised pattern.[5] They are measured by frequency, cycles per second, or hertz (Hz), and are correlated with very fast to slow brain activity. The human brain has five types of brain waves: gamma, beta, alpha, theta and delta (See Figure 1).[4]

- **Gamma and beta waves** are produced when alert and focused.
- **Alpha waves** fall in the middle of the brain wave spectrum and are associated with feelings of calm and relaxation.
- **Theta and delta waves** are produced during sleep and deep relaxation.[4]

By enhancing the production of alpha waves, L-theanine has a significant effect on the nervous system. Increases in alpha power reduces cortisol levels, relaxing the mind and decreasing stress.[6] Alpha brain waves also stimulate parasympathetic nervous system activity and decrease sympathetic nervous system responses, reducing anxiety.[1] This can help to promote sleep onset by calming the body and facilitating the transition to a theta-dominant state. Alpha brain waves are also found to be the optimal state for learning and can boost creativity.[4]

BRAIN WAVE AND FREQUENCY		ACTIONS
Gamma waves 30 Hz - 100 Hz		Motor functions, high level information processing and cognitive thinking.
Beta waves 13 Hz - 30 Hz		Normal waking state, concentration, focus.
Alpha waves 8 Hz - 13 Hz		Relaxed mind, meditation, creative thinking, super learning, conscious thought.
Theta waves 4 Hz - 8 Hz		Light sleep, deep meditation, dream state.
Delta waves Less than 4 Hz		Deep dreamless and restorative sleep. Non-REM sleep.

Figure 1. Alpha brain waves are associated with a relaxed mind and are typically present during light meditation.[4]

Alpha brain waves dominate when the mind is in a wakeful state, however with increased inhibition of sensory inputs, as seen when in a state of relaxation. They hold the middle ground of the brain wave spectrum, **representing a bridge between relaxed conscious awareness and the transition to sleep.**[4]

The effect of L-theanine on neurotransmitters

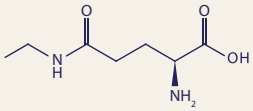
A delicate balance between neurotransmitters is essential for a healthy stress response, quality sleep, and optimal neurological function. The main neurotransmitters in the brain responsible for maintaining this balance between inhibition and excitation of the nervous system are glutamate and GABA.[7,8]

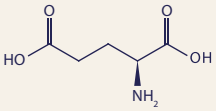
Glutamate is the major excitatory neurotransmitter of the central nervous system and is responsible for promoting neural activity.[7] **GABA** is the major inhibitory neurotransmitter and is responsible for preventing over-excitation.[1,8]

When glutamate overactivity is suppressed and the inhibitory effects of GABA are enhanced, nervous system excitation is reduced, resulting in a more relaxed mental state.[1,7,8]

L-theanine is structurally similar to L-glutamate and L-glutamine and can cross the blood brain barrier (BBB) to compete for glutamate receptor sites. By inhibiting glutamate activity, L-theanine induces relaxation and relieves nervous tension (See Figure 2).[1]

Due to these actions, L-theanine is commonly used to support sleep, stress, anxiety, and cognitive function.[1]

L-theanine 

L-glutamate 

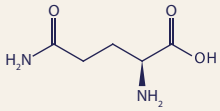
L-glutamine 

Figure 2. Chemical structure of L-theanine, L-glutamate and L-glutamine.[1]

L-theanine increases the release of GABA . It also suppresses glutamine (a precursor to glutamate) transporters to inhibit the incorporation of extracellular glutamine into the neuron. L-theanine also competes for glutamate receptors, such as N-methyl-D-aspartate (NMDA) and amino-3-hydroxy-5-methyl-4-isoxazole propionic acid (AMPA), thereby reducing glutamine's excitatory actions (See Figure 3).[1]

Additionally, L-theanine increases the release of glycine, serotonin and dopamine, further supporting its relaxing effects.[1]

Glycine is a neurotransmitter that has a balancing neurological effect on the brain. Research has found it may help with sleep latency (the time it takes to fall asleep) and sleep quality by lowering core body temperature and modulating circadian rhythms.[9,10]

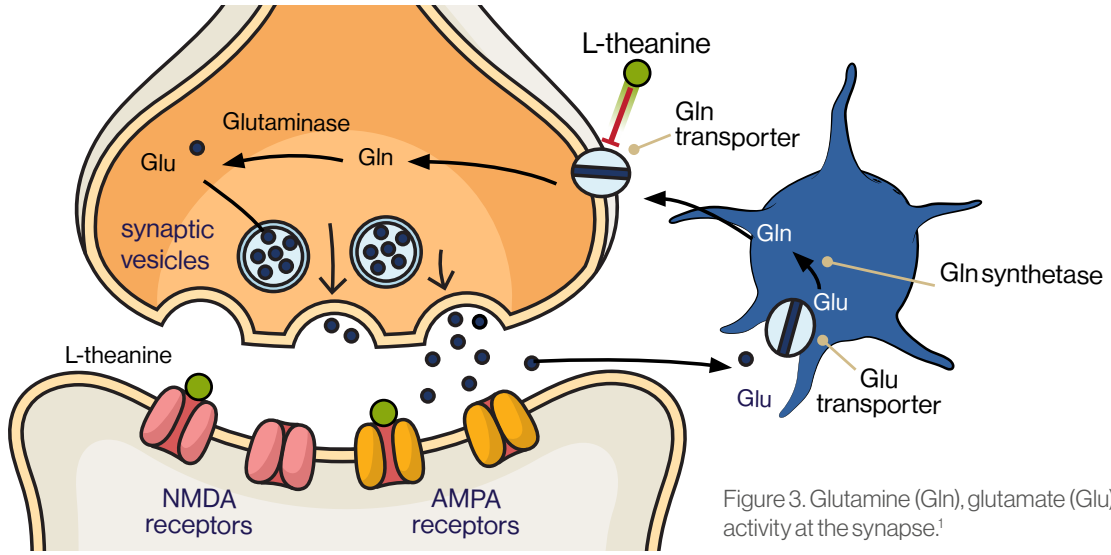


Figure 3. Glutamine (Gln), glutamate (Glu), and L-theanine activity at the synapse.[1]

ABSORPTION & BIOAVAILABILITY

L-theanine is absorbed by sodium-coupled cotransporters in the intestinal brush-border membrane and distributed to various organs.[1,11] **It can cross the BBB, with an increase in brain-theanine levels seen after 30 minutes of ingestion.**[1]

Why L-theanine?

With the exception of glycine, natural amino acids are found in two forms, L (left) and D (right) enantiomers (mirror-image versions of molecules).[12] **L-theanine is more commonly found in natural foods and is much more bioavailable than D-theanine.**[13]

Oral administration

30 minutes later — L-theanine increases the secretion of neurotransmitters such as dopamine and serotonin 30 minutes after oral administration.[7]

40 minutes later — L-theanine generates alpha waves in the occipital and parietal regions of the brain within 40 minutes.[7]

50 minutes later — Plasma concentrations of L-theanine reach their highest level approximately 50 minutes after ingestion,[13] and start to decrease in concentration after 5 hours.[7]

AlphaWave® L-theanine[7,14,15]
Highly purified and caffeine-free

- Clinically trialled
- Premium grade L-theanine
- Standardised to 98% L-theanine
- Enhanced absorption
- Acute benefits

INTERACTIONS & SAFETY

Safety

L-theanine supplementation is generally well tolerated in humans.[7]

AlphaWave® L-theanine at 400 mg/day is considered safe and well tolerated.[14]

Pregnancy and breastfeeding

The safety of L-theanine has not been examined in pregnant or lactating women; hence, it is not recommended for use in these populations.[16]

Anti-hypertensive medications

As L-theanine may decrease blood pressure, a theoretical concern exists.

Sedatives

As L-theanine may compete with glutamate and increase GABA levels, a theoretical concern exists.

There is no evidence from human studies to support clinical recommendations, however, patient monitoring is recommended.

PRESCRIBING GUIDE

Clinical evidence-based dosage guide for the prescribing of L-theanine supplements

CONDITION	LEVEL OF EVIDENCE	DOSAGE AND DURATION
Alpha brain wave enhancements	B	200 mg AlphaWave® prior to acute stressful mental challenge[7]
Anxiety	A/B	200-400 mg/day acutely and up to 8 weeks[17] 200 mg/day before bed each night for four weeks[18]
Cognitive function	B	100 mg prior to mental task, and after taking for 12 weeks[19] 200 mg/day before bed each night for four weeks[18] 200 mg AlphaWave® twice daily for 28 days[14]
Major depressive disorder (depression symptoms, anxiety, sleep disturbance and cognitive impairments)	C	250 mg/day for eight weeks, alongside regular medication[20]
Immunity and inflammation	C	150 mg/day for six weeks[21]
Sleep quality, latency and depth	B	200 mg/day before bed each night for four weeks[18] 200 mg AlphaWave® twice daily for 28 days[14]
Stress (including salivary cortisol decreases)	A/B	200 mg/day before bed each night for four weeks[18] 200-400 mg/day acutely and up to 8 weeks[17] 200 mg AlphaWave® prior to acute stressful mental challenge[7] 200 mg AlphaWave® twice daily for 28 days[14]
Working memory	B	100 mg prior to mental task, and after taking for 12 weeks[19]

Evidence levels:
A: Meta-analysis and/or systematic review B: High quality clinical trial C: Good quality clinical trial

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