



L-Theanine – A Therapeutic Amino Acid

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L-Theanine

L-Theanine is a relatively uncommon amino acid found almost exclusively in green tea leaves. Despite it being relatively uncommon in the human diet, this is a nutrient that is proving to exhibit much benefit for the human body. Green tea has always been a popular drink throughout Asian countries and its undisputed health properties have now made it popular in the western world. As well as containing powerful antioxidant properties, green tea may have a relaxing effect and it is the theanine content of green tea that is directly responsible for this. The theanine content of tea is also claimed to indicate quality of the tea.

Theanine (r-glutamylethylamide) is a water soluble compound, structurally similar to glutamic acid. It is absorbed in the small intestine and has been proven to cross the blood brain barrier via the large neutral amino acid (leucine preferring) transport system.¹

L-Theanine affects neurotransmission

Theanine may play a role in the brain as an agonist or antagonist of some receptors. Significant increases in brain dopamine and serotonin concentrations, especially in the striatum, hypothalamus and hippocampus have been seen following theanine administration.² Theanine perfusion into the brain has been shown to also cause dopamine release from dopaminergic neurons; prevent aspartic acid release and increase glycine release. These observations indicate an inhibitory modulation effect of theanine.³

Some literature indicates that theanine may also enhance GABAergic function and inhibit glutamate receptor binding (AMPA, kainate and NMDA).⁴

L-Theanine may relieve anxiety and promote relaxation

Due to its proposed effects on neurotransmission in the brain described above, theanine may be an appropriate therapy to support relaxation, stress and anxiety. Increasing previously low levels of brain serotonin and dopamine levels are associated with decreased symptoms of depression, stress and anxiety.

L-theanine can also directly affect brain wave patterns. There are four basic types of brain waves – delta, theta, alpha and beta. Alpha brain waves are associated with wakefulness and relaxation, beta waves are associated with highly stressful thinking and working situations, theta is seen in light sleep and drowsiness and delta is only seen in the deepest stage of sleep.

In a placebo controlled trial, 50 women, divided into low and high anxiety groups received either water, 50mg of theanine or 200mg of theanine once per week for two months. Theanine groups were found to experience an increase in alpha wave generation within 40 minutes of theanine administration.⁵

Theanine may counteract the stimulatory effect of Caffeine

Studies in rats show blunting of the stimulatory effects of caffeine by theanine administration. Results suggested that theanine has an antagonistic effect on caffeine's stimulatory action at an almost equivalent molar

concentration.⁶

A Neuroprotective Nutrient

Several animal studies have indicated that theanine may be a neuroprotective nutrient. In one such study glutamic acid was used to induce neuronal death in rat brains, and this neuronal death was suppressed with exposure to theanine.⁷ In another study, ischaemia induced neuronal death was significantly prevented in a dose-dependent manner in theanine pre-treated groups of gerbils, indicating theanine may be useful clinically for preventing ischaemic neuronal damage.⁸ And yet another study on mice found that theanine may directly provide neuroprotection against focal cerebral ischaemia and may be clinically useful in preventing cerebral infarction.⁹ Theanine can bind to the NMDA and AMPA/kainite receptors, blocking excitotoxicity of glutamate.

Theanine as an adjunct in Cancer support

Theanine has been found to enhance the antitumour activity of doxorubicin (chemotherapy drug) due to inhibition of doxorubicin efflux from tumour cells. The mechanism by which theanine inhibits doxorubicin efflux was suggested to be inhibition of glutamate transporters (inhibiting the uptake of glutamate into cancer cells).^{10, 11} By inhibiting the efflux of doxorubicin from the cancer cells, concentration of the chemotherapy drug and its activity is increased against the cancer cells. Theanine may also have an effect on glutathione, maintaining glutathione levels in normal tissues during chemotherapy treatment.¹²

¹ Yokogoshi, H., Kobayashi, M., Mochizuki, M., Terashima, T., Effect of theanine, r-glutamylethylamide, on brain monoamines and striatal dopamine release in conscious rats. *Neurochem Res.*, 1998. 23(5): p. 667-73.

² Yokogoshi, H., et al., Effect of theanine, r-glutamylethylamide, on brain monoamines and striatal dopamine release in conscious rats. *Neurochem Res*, 1998. 23(5): p. 667-73.

³ Yamada, T., et al., Effects of theanine, r-glutamylethylamide on neurotransmitter release and its relationship with glutamic acid neurotransmission. *Nutr Neurosci*, 2005. 8(4): p. 219-26.

⁴ Kakuda, T., et al., Inhibition by theanine of binding of AMPA, Kainate and (3H) MDL 105,519 to glutamate receptors. *Biosci Biotechnol Biochem*, 2002. 66(12): p. 2683-6.

⁵ Ito, K., et al., Effects of L-theanine on the release of alpha brain waves in human volunteers. *Nippon Nogeikagaku Kaishi*, 1998. 72: p. 153-157.

⁶ Kakuda, T., et al., Inhibiting effects of theanine on caffeine stimulation evaluated by EEG in the rat. *Biosci Biotechnol Biochem.*, 2000. 64(2): p. 287-93.

⁷ Kakuda, T., Neuroprotective effects of the green tea components theanine and catechins. *Biol Pharm Bull.*, 2002. 25(12): p. 1513-8.

⁸ Kakuda, T., et al., Protective effect of gamma-glutamylethylamide (theanine) on ischemic delayed neuronal death in gerbils. *Neurosci Lett.*, 2000. 289(3): p. 189-192.

⁹ Egashira, N., et al., Neuroprotective effect of gamma-glutamylethylamide (theanine) on cerebral infarction in mice. *Neurosci Lett.*, 2004. 363(1): p. 58-61.

¹⁰ Sugiyama, T., et al., Inhibition of glutamate transporter by theanine enhances the therapeutic efficacy of doxorubicin. *Toxicol Lett.*, 2001. 121(2): p. 89-96.

¹¹ Sugiyama, T., Sadzuka, Y., Theanine and glutamate transporter inhibitors enhance the antitumor efficacy of chemotherapeutic agents. *Biochim Biophys Acta.*, 2003. 1653(2): p. 47-59.

¹² Sugiyama, T., Sadzuka, Y., Theanine, a specific glutamate derivative in green tea, reduces the adverse reactions of doxorubicin by changing the glutathione levels. *Cancer Lett.*, 2004. 212(2): p. 177-84.