

L-Theanine: How a Unique Anxiety Reducer and Mood Enhancer Increases Alpha Waves and Alertness

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Hundreds of studies exist showing the many health benefits of green tea. But what makes it the most consumed beverage in the world after water is its pleasant taste and relaxation effect. Both of these qualities and more can be traced to a unique, neurologically-active amino acid in tea called L-theanine (gamma-ethylamino-L-glutamic acid).

L-theanine is a free (non-protein) amino acid found almost exclusively in tea plants (*Camellia sp.*), constituting between 1 and 2-percent of the dry weight of tea leaves. It is the predominant amino acid in green tea leaves, giving tea its characteristic umami or "5th taste" (besides the four traditional tastes: sweet, salty, acid, and bitter). Attempts to isolate the L-theanine, with its physical and neurological benefits, from the tea leaves were once difficult, expensive, and inefficient. Economically feasible methods of producing the identical L-theanine now exist and do not require a mountain of tea leaves.

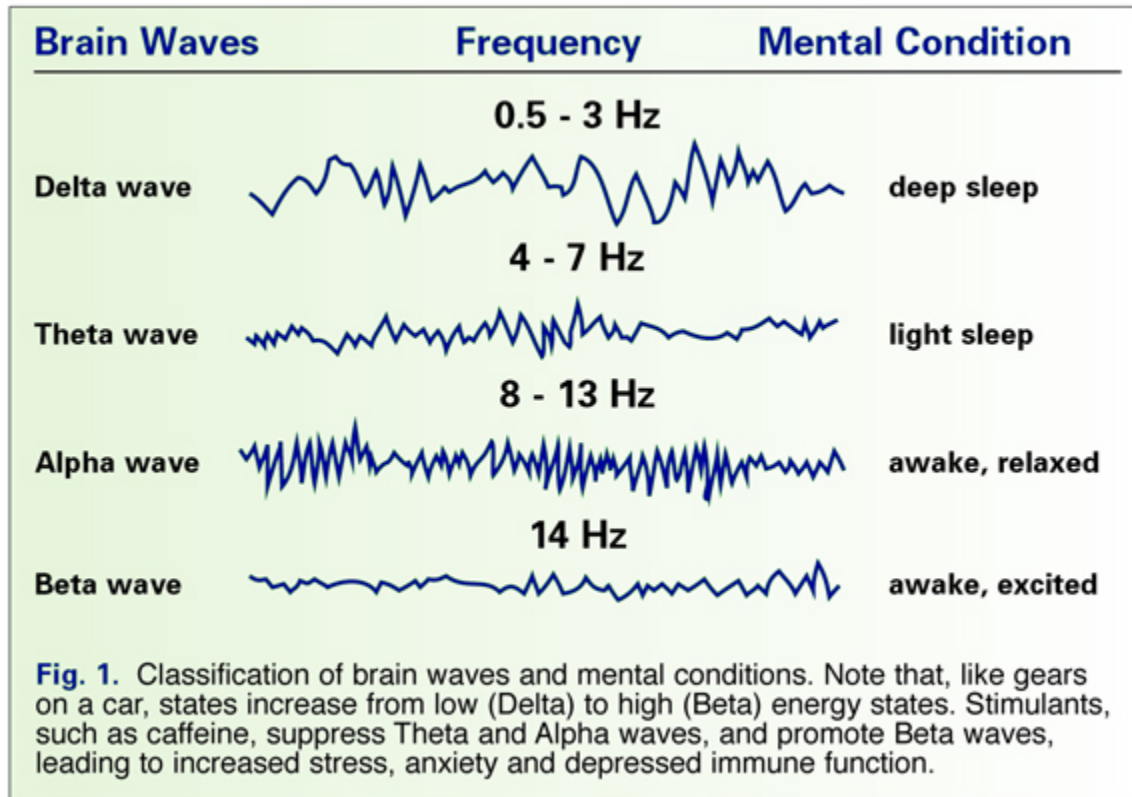
Physiological Effects

The calming effect of green tea may seem contradictory to the stimulatory property of tea's caffeine content but it can be explained by the action of L-theanine. This amino acid actually acts antagonistically against the stimulatory effects of caffeine on the nervous system. ⁽¹⁾ Research on human volunteers has demonstrated that L-theanine creates a sense of relaxation in approximately 30-40 minutes after ingestion via at least two different mechanisms. First, this amino acid directly stimulates the production of alpha brain waves, creating a state of deep relaxation and mental alertness similar to what is achieved through meditation. Second, L-theanine is involved in the formation of the inhibitory neurotransmitter, gamma amino butyric acid (GABA). GABA influences the levels of two other neurotransmitters, dopamine and serotonin, producing the key relaxation effect. ⁽²⁾

Alpha Brain Activity

The brain emits weak electrical impulses (brain waves) that can be measured on the surface of the head. The predominant frequency of electrical impulses correlates with different types of mental states and activities. Brain waves are classified into four categories (delta, theta, alpha, and beta) each with an associated mental state (Fig. 1). Delta is seen only in the deepest stages of sleep. Theta is seen in light sleep and drowsiness. Alpha is present in wakefulness where there is a relaxed and effortless alertness and Beta is seen in

highly stressful situations and where there is difficulty in mental concentration and focus. It is well known that alpha brain waves are generated during a relaxed state and therefore alpha waves are used as an index of relaxation.

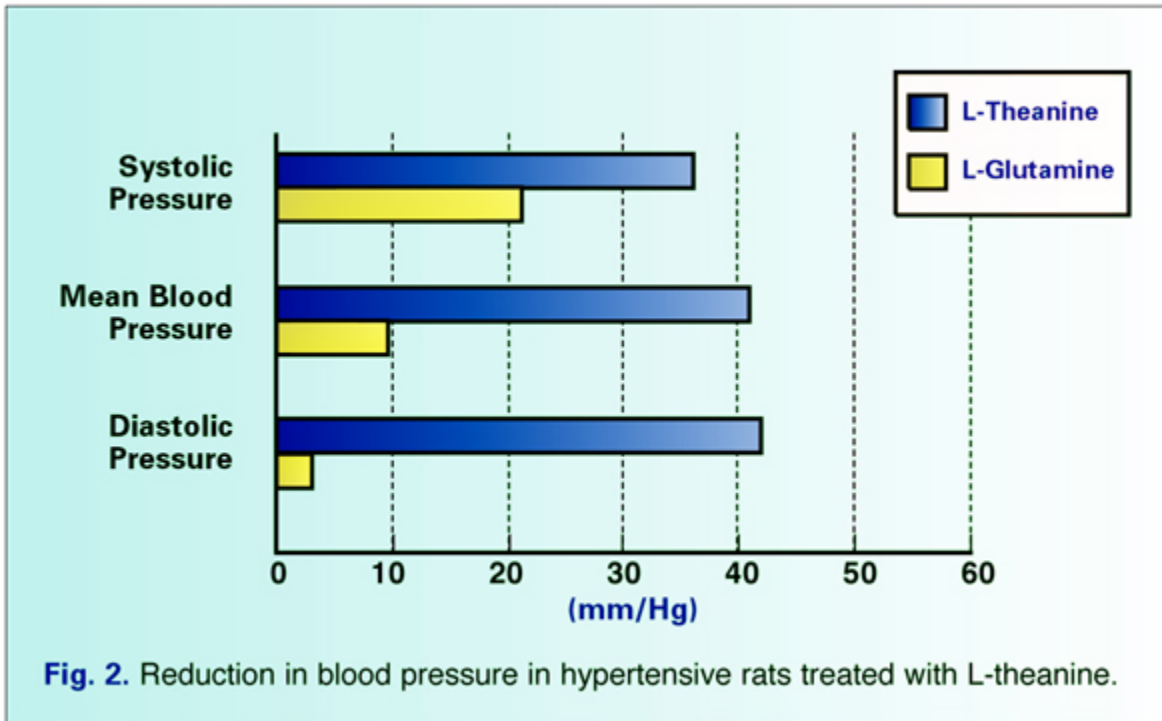


In one study of these mental responses to L-theanine, brain wave topography showed that alpha waves were observed from the back to the top of a person's head (occipital and parietal regions of the brain) within approximately 40 minutes after the subjects had taken either 50 or 200 mg of L-theanine. In a separate study, the intensity of alpha waves were determined to be dose dependent (with a 200 mg dose showing a significant increase over controls) and detectable after 30 minutes. (2,3)

Additional Benefits

L-theanine has a significant effect on the release or reduction of neurotransmitters like dopamine and serotonin, resulting in improved memory and learning ability. L-theanine may also influence emotions due to its effects on the increased release of dopamine. L-theanine reduces brain serotonin concentration by either curtailing serotonin synthesis or increasing degradation in the brain.

The regulation of blood pressure is partly dependent upon catecholaminergic and serotonergic neurons in both the brain and the peripheral nervous system. Studies on spontaneously hypertensive rats (SHR) showed an impressive blood pressure lowering effect with L-theanine. The lowered blood pressure effect was dose-dependent with the highest test dose creating the most significant drop. L-glutamine was used as one of the controls. Although L-glutamine is similar in chemical structure to L-theanine, it did not exhibit an anti-hypertensive effect (Fig. 2). (3)



Preliminary studies report that L-theanine has been found to increase the anti-tumor activity of some chemotherapeutic agents (doxorubicin and idarubicin) and to ameliorate some of the side effects of these drugs. It appears to increase the inhibitory concentration of these drugs in the tumor cells, although the mechanism is not known. At the same time, L-theanine decreased oxidative stress caused by these agents on the normal cells, possibly due to its mild antioxidant activity. In this regard, L-theanine has been shown to inhibit lipid peroxidation, catalyzed by copper, in low-density lipoprotein (LDL) in vitro. (4)

Stress Relief

Stress and anxiety are debilitating conditions that upset the balance of our hormones leading to a loss of our well-being, performance, and even lifespan. Stress impairs the immune system, leaving us vulnerable to opportunistic infections, and can cause depression. In 1998, pharmaceutical sales of anti-anxiety drugs totaled over 700 million dollars, while sales of antidepressants

totaled close to 5 billion dollars! People under stress can mitigate many of the harmful effects of stress with L-theanine without becoming sedated in the process. L-theanine doesn't make one drowsy, nor does it promote sleep because this amino acid does not produce theta waves in the brain. It should be noted that if an individual were already relaxed, taking L-theanine would not produce further relaxation.

Status and Usage

L-theanine has just recently been introduced to the U.S. market. Japan is credited with most of the clinical studies and information we possess thus far on L-theanine but research is ongoing. We do know that it is absorbed from the small intestine via a sodium-coupled active transport process. It crosses the blood-brain barrier, as evidenced by the mental effects. L-theanine competes for absorption in the intestinal tract and the brain with the amino acids found in the methionine group (leucine, isoleucine, and valine), however the concentrations of amino acids are unchanged by simultaneous ingestion of L-theanine.

L-theanine is extremely safe. There are no dietary limits on L-theanine intake by the Japan Food Additive Association. In 1964, the Japanese Ministry of Health and Welfare approved L-theanine for unlimited use in all foods, with the exception of infant foods.

The intended use of L-theanine is that of a mental and physical relaxant that does not induce drowsiness. Although there is no set schedule for taking L-theanine, it may generally be taken at the first signs of stress. Based on the results of the clinical studies, L-theanine is most effective in the range of 50-200 mg, with the effect being felt within 30 minutes and lasting for 8-10 hours. Individuals with high stress levels may increase their dosage of L-theanine to at least 100 mg, with no more than 600 mg being taken in a six hour period. FDA recommends a maximum dose of 1200 mg daily, although the reason for this limit is not clear, due to its demonstrated safety. There are no known adverse reactions to L-theanine and no drug interactions have been reported. L-theanine is not affected by food and may be taken anytime, as needed. Because it has a mild taste, capsules may be opened and dissolved in water. Although it is probably safe for pregnant women and nursing mothers, we discourage its use by them pending conclusive research.

Conclusion

Research into L-theanine derived from the contradictory observation that green tea, with its high caffeine content, produces a very calming effect. The seemingly multi-dimensional reasons for this relaxation effect will continue to be studied. Current areas of ongoing research include using L-theanine as an alternative to Ritalin in children and adults, as a treatment for PMS, in controlling certain conditions of high blood pressure, in sharpening mental acuity and concentration, and as an anti-cancer agent alone and in synergy with other cancer-fighting agents. L-theanine may find another area of application for its use as a

supplement in reducing the negative side effects of caffeine brought on by the over-consumption of coffee, soft drinks, or other caffeine-containing substances.

References

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