

# Cognitive Benefits of Magnesium L-Threonate

Some people's brains shrink with age more than others. It's now believed that increasing synapses and their density may prevent cognitive decline, and magnesium L-threonate may help.



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## STORY AT-A-GLANCE

- Developed by scientists in 2010, magnesium L-threonate (MgT) is a patented magnesium compound with the ability to enhance working memory, short- and long-term memory and learning
- In 2016, scientists found that not only did MgT enhance performance on individual cognitive tests in older adults with cognitive impairment, but reversed brain aging by more than nine years

- MgT has been found to make dramatic improvements for people suffering from anxiety, sleep disorders and cognitive dysfunction
- People with low magnesium levels are at risk for a number of serious disorders, including cardiovascular disease, high blood pressure, high blood sugar and other signs of metabolic syndrome, as well as osteoporosis
- The latest discoveries regarding MgT were deemed critical because of the connection between the loss of synaptic density, brain shrinkage and subsequent cognitive decline

Described as a patented compound with the ability to enhance working memory, short- and long-term memory and learning in animal studies, magnesium L-threonate (shortened to MgT and pronounced "Mag T") was developed by scientists at the Massachusetts Institute of Technology in 2010.

The animal study that first introduced MgT, published in *Neuron* in 2010, noted its ability to rapidly absorb into the brain, which structurally reversed specific aspects of brain aging by increasing the number of "functional presynaptic release sites while it reduced their release probability."

Magnesium is already recognized as a mineral required by your body for more than 300 crucial biological functions, such as contracting your muscles, maintaining your heartbeat, creating energy and activating nerves to send and receive messages.

However, with all its importance to your bodily functions, a large percentage of the U.S. population is deficient in magnesium, with about half not getting the recommended amounts: 310 to 320 milligrams (mg) for women and 400 to 420 mg for men. Presumed deficiencies vary depending on your health status and age; for example, having heart disease and being elderly increase the risk for being deficient in magnesium, one analysis found.

But still, no matter the age, it's apparent that magnesium deficiency is a genuine health concern worldwide. In fact, in 2006 a French study of 2,373 subjects aged 4 to 82 concluded that 71.7% of men and 82.5% of women weren't getting adequate amounts of magnesium.

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A study published in the *Journal of Alzheimer's Disease* in 2016 notes MgT's benefits in the areas of anxiety, sleep disorders and cognitive dysfunction in human adults. The randomized, double-blind, placebo-controlled, clinical trial took place in three separate institutions, and involved participants between the ages of 50 and 70 with reported episodes of memory problems, sleep disorders and anxiety.

In short, the study found brain atrophy is a natural part of aging, but supplementation with magnesium L-threonate, aka MMFS-01, for 12 weeks improved and even reversed symptoms in the study group:

*"With MMFS-01 treatment, overall cognitive ability improved significantly relative to placebo. Cognitive fluctuation was also reduced."*

*The study population had more severe executive function deficits than age-matched controls from normative data and MMFS-01 treatment nearly restored their impaired executive function, demonstrating that MMFS-01 may be clinically significant ... The current study demonstrates the potential of MMFS-01 for treating cognitive impairment in older adults."*

## Scientists Double Down on Reversing Brain Aging

To come to this conclusion, this study conducted baseline cognitive testing, with the first follow-up testing six weeks later. Then, for 12 weeks, study subjects were randomly dosed daily with either placebos or 1,500 to 2,000 mg of MgT, depending on body weight, as cognitive tests were repeated at six-week and 12-week intervals in the areas of:

- Executive function
- Working memory
- Attention
- Episodic memory (ability to recall fleeting events)

Significantly, the most "startling" finding is that not only does MgT enhance performance on individual cognitive tests in older adults with cognitive impairment, but it serves to reverse brain aging by more than nine years. The study's findings revealed four significant results from MgT use:

1. **Improved body magnesium status** — After 12 weeks, two things were noted in the treated group: They exhibited significantly increased red blood-cell magnesium concentration, indicating high circulating levels of magnesium in the body; and significant urinary output of magnesium, showing that large amounts of magnesium were absorbed.
2. **Improved cognitive abilities** — Visual attention and task switching revealed (in some cases as early as six weeks) increases in performance speed for executive function and cognitive processing. Notably, overall composite scores rose steeply compared with baseline scores and with placebo recipients at Weeks 6 and 12.
3. **Reduced fluctuation in cognitive ability** — Cognitive functions that are worse some days than others is one sign that mild [cognitive impairment](#) may be developing. Those on the placebo showed notable fluctuation in their cognitive scores, while the MgT group reflected mostly positive changes.
4. **Reversed clinical measures of brain aging** — Perhaps the most significant finding, which explains how MgT can "turn back time" in aging brains.

## MgT and the Blood-Brain Barrier

MgT boosts the magnesium levels in your brain when taken orally due to its ability to cross the blood-brain barrier. Once it's in your brain, it increases the density of synapses, the communication connections between brain cells. What's more, MgT increases this function in precisely the places needed.

The importance of getting it to your brain shows why it isn't as simple as adding magnesium to your diet, as MgT works differently than typical magnesium, which doesn't reach the brain to change the factors of brain aging.

Even raising blood magnesium levels by 300% (known as "induced hypermagnesemia") doesn't change cerebrospinal fluid levels by more than 19%. An all-encompassing study showing the complex regulatory functions of the [blood-brain barrier](#) notes:

*"The environment exerts profound effects on the brain. A large body of evidence shows that brain plasticity is strongly affected by exposure to stimulating environments, with beneficial consequences throughout the entire life span."*

One reason these discoveries were deemed critical is because there's a connection between a loss of synaptic density, brain shrinkage and subsequent cognitive decline, the study authors said.

## Understanding How MgT Rejuvenates Aging Brains

According to researchers, your brain doesn't age at the same rate as the rest of your body. For instance, a 60-year-old can have a brain that essentially functions like that of someone a decade older. How that varies is measurable via performance test scores as well as physiological parameters. It can also happen in cases of traumatic brain injury.

The MMFS-01 study shows an average chronological age of 57.8 years in their study participants. However, their cognitive function averaged 68.3 years of age — about a 10-year difference.

But supplementing with MgT made a dynamic difference: The subjects' collective brain age decreased from 69.6 at the start of the study to just 60.6 in just six weeks' time — a nine-year brain age drop. The improvements continued through all 12 weeks, with the brain age at the end averaging 9.4 years younger, which closely matched their peers with healthy brains.

The takeaway is the remarkable difference that magnesium, and more specifically, MgT, makes in regard to turning back time in people whose brain age is greater than that of their chronological age.

Studies also show how increasing concentrations of magnesium in cultured brain cells from the hippocampus (where memories are stored and retrieved) boosts both synaptic density and brain plasticity. The reasons this is important are twofold:

- **Synaptic density** isn't just the measure of the structural integrity of brain synapses, but evidence suggests that greater synaptic density results in more efficient cognitive processing.
- **Plasticity** is a measure of the speed at which synaptic connections can change with new stimuli — it's essentially learning at the cellular level.

## Sleep Factors and Anxiety Observed in Cognitive Decline

Researchers cited a number of earlier studies exploring factors contributing to cognitive decline. Sleep loss and anxiety disorders with perceived memory loss. Not surprisingly, people with this particular set of conditions are more likely to develop Alzheimer's, as the following studies can attest.

In a review published in 2013, researchers from several hospitals and research centers in St. Louis reported that symptoms of sleep disorders, anxiety and disrupted [circadian rhythms](#) are common in patients with Alzheimer's disease. In their study objective, the authors wrote:

*"Recent animal studies suggest a bidirectional relationship between sleep and amyloid- $\beta$  ( $A\beta$ ), a key molecule involved in AD (Alzheimer's) pathogenesis. This study tested whether  $A\beta$  deposition in preclinical AD, prior to the appearance of cognitive impairment, is associated with changes in quality or quantity of sleep."*

The upshot was that amyloid deposition was associated with an inferior quality of sleep, specifically worse sleep efficiency (the percentage of time in bed spent actually sleeping) in comparison with those without amyloid deposition, although sleep time was similar in both groups. Significantly, "Frequent napping was associated with amyloid deposition."

In 2007, scientists in Sweden followed 185 people for three years with no cognitive impairment along with another 47 people with depressive symptoms related to mood, motivation and anxiety. Interestingly, the scientists observed, "The predictive validity of mild cognitive impairment for identifying future Alzheimer disease cases is improved in the presence of anxiety symptoms."

Another 2013 study as a collaboration between researchers in California observed that aging is associated with regional brain atrophy, reduced slow wave activity during non-REM sleep and impaired long-term retention of episodic memories. The researchers found that age-related gray-matter atrophy was linked to [sleep disorders](#) and impaired long-term memory.

## What Does Calcium Have to Do With Magnesium?

There are a few little-known but important factors regarding [magnesium](#). One is that like other minerals, your body doesn't produce it, so it must be derived from an outside source. Second, magnesium works hand in hand with calcium, and the optimal ratio between magnesium and calcium is 1-to-1.

However, doctors have mistakenly pushed women in particular to concentrate on their calcium intake to avoid problems with osteoporosis. With insufficient amounts of magnesium, your heart can't function properly. When the balance between the two favors calcium, especially to the 2-to-1 ratio promoted by doctors over the past 30 years, it can result in a heart attack.

In one study, high incidences of hip fractures in Norway were thought to be a result of an imbalance between the concentration of calcium and magnesium in municipal drinking water. In fact, 5,472 men and 13,604 women aged 50 to 85 years suffered hip fractures, which, after an investigation, researchers concluded that increasing magnesium may protect against them.

In addition, keeping your vitamin K2 and vitamin D intake on par with magnesium and calcium is also important. The four work together. For instance, people whose magnesium intake was relatively high were shown in one study to be less likely to have a vitamin D deficiency, compared with people with an inadequate magnesium intake.

If you opt for a magnesium supplement, note that there are several different forms. Additionally, one way to get it is through taking regular Epsom salt baths or foot baths. This form of magnesium, magnesium sulfate, absorbs into your skin to raise your levels.

Essentially, since you get only one brain to last your entire life, scientists believe supplementing with MgT appears to be imperative for anyone wanting to preserve brain function, and even recover some function that was lost.

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