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THE EFFECT OF NUTRITIONAL SUPPORT WITH MAGNESIUM L-THREONATE ON COGNITIVE PERFORMANCE AND ACADEMIC ACHIEVEMENT IN STUDENTS

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There are many factors that affect our brain's efficiency and cognitive abilities, but one of the least obvious is magnesium. This mineral is necessary for our body to perform more than 300 biochemical reactions, including those that directly affect brain activity. Magnesium is a key mineral that plays an important role in maintaining brain function and overall nervous system health. It is involved in energy metabolism, neurotransmitter regulation, and is a cofactor in many enzymatic processes.

Researchers at the Massachusetts Institute of Technology have developed a new form of magnesium called L-threonate, which can overcome physiological barriers in the body. L-threonate is easily absorbed by the body and actually crosses the blood-brain barrier. When taken orally, magnesium L-threonate can significantly increase magnesium levels in the brain. This, in turn, helps increase the number of synapses and their ability to adapt to different stimuli, which helps neutralize some inhibitions in the brain.

The results of using magnesium L-threonate are impressive. In one study involving humans, it was found that subjects who took magnesium L-threonate showed significant improvements in cognitive function, resulting in brain rejuvenation of more than 9 years.

Brain synapses need plasticity—the ability to adapt and change in response to external influences—for learning and memory access. Decreased synaptic plasticity is one of the main causes of cognitive decline in older adults.

Animal studies show that increasing magnesium levels in the brain: increases the total number of synapses; improves synaptic plasticity; stimulates the growth of new brain cells; improves learning and memory. Magnesium deficiency can affect brain function, leading to impaired attention, memory, and increased irritability.

There are numerous causes of memory and attention decline, but the most

highlighted ones are chronic stresss and anxiety. They affect the areas of the brain responsible for memory and learning. It overloads the brain, making it difficult to remember and recall information. Mental health issues are one of the most common causes of memory problems in young people.

Also sleep time plays its significant role in cognitive function. It is necessary for memory consolidation. Irregular sleep, insomnia, or sleep disorders reduce the brain's efficiency. Poor sleep can lead to forgetfulness, decreased concentration, and impaired clarity of thought.

Moreover proper nutritions are essential for normal brain function. Deficiencies in vitamin B12, vitamin D, iron, and folic acid can cause memory loss, fatigue, and confusion. Nutrition-related memory problems are common and usually reversible with treatment.

In our modern era of technology excessive screen time and digital overload are main problems which influence negatively the synapse conduction. Constant exposure to screens, multitasking, and continuous notifications reduce concentration.

Hormonal imbalance, such as problems with the thyroid gland or sex hormones, can affect memory and cognitive function. Hormonal imbalances often go unnoticed but are easily detected through medical tests.

Modern students are constantly faced with all factors mentioned above. They have multiple complexities and problems as cognitive loads due to tight schedules, the need to absorb large amounts of information, and the stress factors of the learning process, frequent exams as a source of constant stress, poor nutrition, poor sleep and chronic fatigue, and hormonal disorders. The use of gadgets, social networks, etc. can lead to a decrease in concentration and memory impairment even in young people with normal intelligence and learning abilities. It is important to explain why this works specifically for students.

Under stressful conditions (such as exams), adrenaline and cortisol are released, leading to the accelerated elimination of magnesium. L-threonate not only replenishes the deficiency, but also increases the density of synaptic connections. This can be compared to upgrading a computer's RAM: the amount of information remains the same, but the speed of processing and accessing it increases.

In light of the above, we conducted a study to investigate the effect of magnesium L-threonate on cognitive abilities, academic performance, and quality of life in students.

Materials and methods. We observed 30 student volunteers (aged 18–25) who complained of increased fatigue and decreased concentration. The study lasted 8 weeks. Participants were divided into two groups: the main group (n=20), who

took magnesium L-threonate at a dosage of 2000 mg/day (144 mg of elemental magnesium) for 8 weeks, and the control group (n=10).

To monitor the effectiveness of the therapy before and after the 8 weeks, we administered the Wexler test, the Schulte tables (assessment of attention switching speed), and the author's questionnaire "MS-QoL-Edu" (Magnesium-Student Quality of Life & Education).

Effectiveness assessment questionnaire (MS-QoL-Edu).

Instructions: Rate each statement on a scale from 1 (strongly disagree) to 5 (strongly agree).

Block A: Cognitive sphere (learning ability)

It has become easier for me to maintain my attention during lectures lasting more than 45 minutes.

My speed of memorizing new material has increased.

I am less distracted by extraneous stimuli when preparing for classes.

The level of "mental fog" at the end of the school day has decreased.

Block B: Psycho-emotional status (Quality of life)

I fell asleep more quickly and easily.

My anxiety before exams/tests has become less pronounced.

I feel more alert in the morning.

The frequency of tension headaches has decreased.

Block C: Academic performance

My subjective assessments of my work have improved.

The time spent on homework has decreased.

Block D: Additional information, observations

Research results:

At the end of the 8-week course, the following statistically significant changes ($p < 0.05$) were recorded in the main group: Cognitive indicators: The speed of working with Schulte tables increased by 22%. Errors in short-term memory tests decreased by an average of 1.8 points.

When it comes to academic performance: the average current performance score in the main group increased by 0.4 points, while no significant changes were found in the control group. Students noted their ability to engage in longer intellectual work without signs of exhaustion.

Also quality of life of 78% of participants in the main group reported improved sleep quality, improved sleep onset, easier morning awakening, and a 15% decrease in reactive anxiety in the group receiving therapy, as opposed to the control group.

In addition, 12% of students receiving therapy reported improved mood, 8%

reported reduced irritability, and increased tolerance to physical exertion.

Conclusions: thus, the use of magnesium L-threonate considerably improves working memory and concentration in students under academic stress. The drug helps reduce the time needed to learn new material and increases overall intellectual productivity. Its positive effect on quality of life (normalization of sleep and reduction of anxiety) creates a physiological basis for more effective learning.

Recommendations: It is advisable to recommend a course of magnesium L-threonate to students during periods of intensive study and when signs of chronic fatigue syndrome are present. To achieve more stable results it is recommended to stick to 3 months', 6 months' or 1 years' reception mode.

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