

Białas Filip, Placzek Alicja, Machaj Dominik, Baciur Patrycja, Skowrońska Katarzyna. The relationship between magnesium deficiency and depression, and the effects of magnesium supplementation on depression symptoms – literature review. *Journal of Education, Health and Sport*. 2022;12(8):484-490. eISSN 2391-8306. DOI <http://dx.doi.org/10.12775/JEHS.2022.12.08.050>
<https://apcz.umk.pl/JEHS/article/view/JEHS.2022.12.08.050>
<https://zenodo.org/record/6991751>

The journal has had 40 points in Ministry of Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of December 21, 2021. No. 32343. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical Culture Sciences (Field of Medical sciences and health sciences); Health Sciences (Field of Medical Sciences and Health Sciences).

Punkty Ministerialne z 2019 - aktualny rok 40 punktów. Załącznik do komunikatu Ministra Edukacji i Nauki z dnia 21 grudnia 2021 r. Lp. 32343. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przepisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).

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The authors declare that there is no conflict of interests regarding the publication of this paper.

Received: 29.07.2022. Revised: 07.08.2022. Accepted: 15.08.2022.

The relationship between magnesium deficiency and depression, and the effects of magnesium supplementation on depression symptoms – literature review

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Summary:

Magnesium is a very important macronutrient in the human body. Its main storage is bones. The correct concentration of this macronutrient within the normal range is necessary for the proper functioning of the body. Deficiency of this element negatively affects the entire body. One of the symptoms of magnesium deficiency is depression and other psychiatric disorders. The factors explaining the mechanism of magnesium's antidepressant effect are not fully understood, however, a relationship between magnesium deficiency and the pathogenesis of depression has been demonstrated. Supplementation with preparations of this element improves the condition in ill people with depression. [3][6]

Key words: magnesium, depression, deficiency

INTRODUCTION AND PURPOSE

Magnesium is one of the key elements in the human organism. It is an element that affects many systems and organs. [2] The human body contains 24-35 g of this element. Most of its resources are in the bones (about 60%) and muscles (about 20%). The remainder occurs in soft tissues. [11][35]

Magnesium supports the proper operation of enzymes. It is an activator or a coenzyme for about 300 enzyme systems. [3][14] It is an important element in the metabolism of all nutrients. It also supports the synthesis of DNA, RNA and ATP. [2] As a result, the optimal degree of bone mineralization is possible and the proper functioning of the neuromuscular junction and synaptic connections in the CNS. [35]

The correct concentration of magnesium in plasma is 0.62-1.02 mmol / l. [4] Low levels of magnesium in the body may be a result of its low intake with food, impaired absorption and its increased loss by the kidneys. [18] Emotional stress may also be the cause of magnesium loss. Magnesium deficiency can lead to seizures, weakness, hallucinations, and depression, which are reversible when the magnesium levels in the brain are balanced. [12][13]

A human should consume 310-320 mg of magnesium daily [33]. Magnesium is found in foods like green vegetables, nuts, sunflower seeds and whole grains. Magnesium absorption is mainly in the jejunum. [2] Factors that intensify the absorption of magnesium include high-protein diet, lowering the pH of extracellular fluid, PTH, insulin, sodium ions, and vitamin D and vitamin B6. [30]

The main goal of our work is to summarize and draw conclusions on the impact of magnesium deficiency on the pathogenesis of depression. We tried to build on the current knowledge on the relationship between magnesium deficiency and depression, the incidence of which is constantly increasing worldwide. The literature review shows the relationship between magnesium deficiency and the genesis of depressive disorders, as well as the positive effect of its supplementation in patients with depression.

DESCRIPTION OF THE STATE OF KNOWLEDGE

Already in animal studies, behaviors resembling a depressive episode in the case of magnesium deficiency have been shown. [15][16][17] In rats with traumatic brain injury, the severity of depression was reduced as a result of administration of magnesium sulfate. [37] Behavioral changes suggestive of depression have been observed in mice that were fed a diet without magnesium. [9] Another animal study demonstrated the effect of magnesium on shortening the immobility time in a swimming test. [38][39]

The molecular mechanism of the antidepressant effect of magnesium is not fully understood. [1][36] Magnesium is an NMDA receptor antagonist for glutamate in the brain. [3] Studies in mice have shown that NMDA receptor agonists are anti-depressant. [3][8] Magnesium is antagonistic to calcium. This relationship explains in some way the antidepressant effect of magnesium ions. Lowering the level of magnesium ions in the hippocampus (at the same time lowering the calcium level in the hippocampus) causes disturbances in the functioning of nerve connections and leads to mood disorders and depression [2][24]. Magnesium also lowers ACTH levels and probably affects P-glycoprotein, which facilitates the access of glucocorticoids to the brain. [25] The studies also found the effect of reduced magnesium levels on sleep disturbances. [24] Sleep disturbances influence the genesis of depression.

Researchers have come to different conclusions regarding the correlation between depressive disorders and the level of magnesium in the serum. There are studies showing a reduction in the level of

magnesium in the blood serum in depression [26] and an increase in this element. [31] Therefore, it seems that the assessment of the level of depression severity on the basis of the measurement of the level of magnesium in the blood serum is not appropriate. A much better indicator of the severity of depression is the level of magnesium in the brain and in the cerebrospinal fluid (CSF). Nevertheless, there are similar discrepancies in the results of studies regarding the relationship of magnesium in the cerebrospinal fluid (CSF) and depression. Some researchers did not notice the difference between the concentration of magnesium in CSF in the group of people suffering from depression and healthy people. [21][28]. Other scientists have noted a correlation between the decreased magnesium concentration in CSF and depression. [27][31]

The correlation between the decrease in magnesium concentration in the brain and the severity of depression symptoms was also noticed in two other studies. [26][32] A reliable measure of magnesium in the body is the level of this element in erythrocytes, not blood serum. A decrease in the level of magnesium in the red blood cells of patients suffering from depression or severe depression has been shown. It has been shown that the lower the level of magnesium in the erythrocytes, the more severe the symptoms of depression determined on the Hamilton scale. Interestingly, Nechifor et al. Also noticed a decreased level of magnesium in erythrocytes in patients suffering from severe depression who had taken antidepressants before hospitalization. [1]

Increased magnesium intake does not protect against depression, but decreased magnesium intake may be its cause. [2][10]. Young adults are the most vulnerable group of people to developing depression caused by decreased levels of magnesium. [29] The level of magnesium in the brain tissue is low in people with depression and suicidal behavior. [20][21] The relationship between low magnesium levels and depression is not confirmed in depression resulting from Wilson's disease, hormonal disorders, or drug-induced depression. These conclusions were reached by Eby and Eby [1][22]

It absorbs about 30-40% of the consumed magnesium into the human body. [2] It has been shown that not all magnesium preparations are well absorbed into the circulatory system. The most bioavailable compounds are aspartate, lactate, taurate, malate and citrate. [40] On the opposite side is magnesium oxide, which is not actually absorbed into the blood. Vitamin B6 significantly improves magnesium absorption. Diarrhea may be rare side effects after supplementation with magnesium preparations [33][35] The use of magnesium preparations may reduce the absorption of other drugs, e.g. bisphosphonates, digoxin and nitrofurantoin. [2] It has also been shown to reduce the effect of penicillamine, quinolones, tetracyclines, NOAC and VKA when used with magnesium. [41] Certain antidepressants, as well as neuroleptics and lithium salts can alter the serum magnesium level. [1] Ingesting too much calcium can reduce magnesium absorption. [1] The most recommended ratio in magnesium and calcium supplementation in patients with cardiovascular diseases, osteoporosis or depression is the Mg: Ca 2: 1 ratio. [22]

Magnesium is an important element, the decreased level of which may contribute to the occurrence of many psychiatric disorders and emotional problems. The antidepressant effect of this element has been demonstrated in both acute and long-term treatment [34] it was found that taking 248 mg of magnesium per day for 42 days contributed to the reduction of depression symptoms by 6 points according to the Patient-9 Health Questionnaire. [3][6] In a study of 13,000 healthy Spaniards, it was found that taking magnesium supplements reduced the incidence of depression 6 years later. [3][10] An increased antidepressant effect has been demonstrated with the simultaneous use of magnesium preparations with antidepressant drugs of various classes. [36] A positive effect of magnesium supplementation in severe depression, postpartum depression, chronic fatigue syndrome and PMS has been shown. [22][41] Magnesium aspartate hydrochloride has been proven effective in 50% of patients with manic depression [23], magnesium sulfate in patients with chronic fatigue syndrome (patients experienced an

improvement in mood and a reduction in pain sensation). [41] and magnesium-pyrrolidone acid in PMS. [19]

CONCLUSIONS:

Depression is a chronic disease that is very troublesome for both the patient and his whole family. About 7% of US citizens experience a depressive episode in one year. [4][7]

Proper dietary magnesium intake is very important. This element is mainly responsible for the proper function of the nervous system, muscles and the enzyme system. Supplementation with magnesium preparations has been shown to be effective in mild and moderate depression [5][6] A positive effect on depressive symptoms has been proved by supplementation with magnesium preparations. Despite numerous studies, the detailed role of magnesium in the prevention of depression is still not fully understood, therefore additional research is needed on the mechanism of the impact of magnesium deficiency on depression and studies explaining the individual response of various people to magnesium supplementation.

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