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Magnesium Deficiency in the Human Body

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Abstract

This article analyzes the medical-biological significance of magnesium deficiency in the human body, its prevalence rate, main causes, and clinical signs. Magnesium (Mg) is considered an important microelement that participates in more than 300 enzymatic processes in the human body. The article comprehensively covers the impact of magnesium deficiency on the neurological, cardiovascular, and musculoskeletal systems, as well as laboratory diagnostic methods and preventive measures. Recommendations are provided on magnesium-rich food products, norms for their consumption, and the use of magnesium preparations.

Keywords: magnesium deficiency, hypomagnesemia, microelements, mineral imbalance, magnesium metabolism, magnesium sources, prophylaxis, magnesium preparations, neurological symptoms, cardiac arrhythmia.

Introduction

In recent years, the issue of healthy nutrition and micronutrient balance has been attracting increasing attention from both the medical community and the general public. In particular, magnesium deficiency is gradually turning into the "silent crisis" of modern humanity. According to statistical data, approximately 50–75% of the population in developed countries consumes magnesium below the recommended daily allowance. This problem remains relevant in Uzbekistan as well. Magnesium is one of the essential minerals in the body. It is directly involved in DNA and RNA synthesis, energy production in cells (ATP metabolism), bone formation, the transmission of nerve impulses, and muscle contraction. Deficiency of this mineral negatively

affects the functioning of the entire body and can lead to the development of various pathological conditions.

The physiological importance of magnesium in the body:

Energy production: Essential for glycolysis, oxidative phosphorylation, and ATP synthesis. ATP is biologically active only when bound to magnesium (Mg-ATP).Nerve and muscle function: Regulates calcium and potassium transport across cell membranes, controls nerve impulse transmission, muscle contraction and relaxation, and helps maintain normal heart rhythm.Bone health: Supports bone structure, activates osteoblasts, works with vitamin D and parathyroid hormone to regulate bone mineralization and density.Metabolism: Participates in DNA, RNA, and protein synthesis; helps produce the antioxidant glutathione; improves insulin sensitivity and blood glucose control.Cardiovascular system: Promotes blood vessel relaxation, helps regulate blood pressure, and supports heart health.Other roles: Aids immune function and protects cells from oxidative stress.

The main causes of magnesium deficiency

Magnesium deficiency (hypomagnesemia) is uncommon in otherwise healthy people with a balanced diet, but it becomes more likely due to inadequate intake, poor absorption, excessive losses, or certain medical conditions and medications.The causes generally fall into three main categories:

1. Inadequate Dietary Intake or Reduced Absorption:Poor diet or low intake of magnesium-rich foods — Common in diets high in processed, refined, or ultra-processed foods (which strip away magnesium). Also seen in starvation, anorexia, fasting, or malnutrition. Soil depletion from modern farming and food processing can further reduce magnesium content in foods.Gastrointestinal disorders causing malabsorption — Includes celiac disease, Crohn's disease, inflammatory bowel disease (IBD), short bowel syndrome, or conditions after bariatric/weight-loss surgery. Chronic diarrhea, frequent vomiting, or steatorrhea (fatty stools) impair intestinal absorption of magnesium.Older age — Magnesium absorption in the gut naturally decreases with aging.

2. Excessive Losses (Renal or Gastrointestinal):Chronic alcohol use disorder — Alcohol increases urinary excretion of magnesium and often pairs with poor nutrition. It is one of the most common causes, affecting 30–80% of people with alcohol dependence.Kidney-related issues — Uncontrolled diabetes (causing polyuria/excessive urination), kidney tubule disorders, hyperaldosteronism, or recovery from acute kidney injury lead to increased magnesium loss in urine.Chronic diarrhea or gastrointestinal losses — From conditions like pancreatitis, laxative overuse, or fistulas. Large-area burns can also cause significant losses.

3. Medications and Other Factors: Many common drugs increase renal magnesium wasting or reduce absorption: Diuretics (especially loop diuretics

like furosemide and thiazides) — Promote urinary loss.Proton pump inhibitors (PPIs) — Used for acid reflux; long-term use is a well-documented cause.Other medications — Including certain antibiotics (aminoglycosides), chemotherapy drugs (e.g., cisplatin), amphotericin B, digoxin, metformin and some immunosuppressants.Uncontrolled type 2 diabetes — Often combines poor control with increased urinary loss.Other contributors — High stress (increases urinary excretion), certain endocrine disorders, refeeding syndrome in critically ill patients, or redistribution of magnesium into cells (e.g., during insulin therapy).

Clinical signs of magnesium deficiency

Clinical signs of magnesium deficiency, also known as hypomagnesemia, often start subtly and become more noticeable as levels drop further. Many people with mild deficiency have no obvious symptoms, while moderate to severe cases can affect multiple body systems due to magnesium's important role in nerve, muscle, and heart function.

Early or mild signs usually include fatigue, generalized weakness, loss of appetite, nausea, vomiting, and lethargy. As the deficiency worsens, neuromuscular symptoms become prominent because of increased nerve and muscle excitability. These include muscle cramps, spasms, twitching, tremors, numbness or tingling in the hands, feet, or around the mouth, tetany with painful sustained contractions, hyperactive reflexes, and positive diagnostic signs such as Chvostek sign (facial twitching when the cheek is tapped) or Trousseau sign (hand spasm when a blood pressure cuff is inflated).

Neurological signs may involve irritability, agitation, personality changes, apathy, depression, confusion, delirium, abnormal eye movements like nystagmus, ataxia, seizures, and in rare severe cases, psychosis, hallucinations, or coma. Cardiovascular manifestations are particularly important and can include heart palpitations, irregular rhythms or arrhythmias such as atrial fibrillation or torsades de pointes, and changes on ECG like a prolonged QT interval.

Magnesium deficiency frequently occurs together with low potassium and low calcium levels that are difficult to correct until magnesium is restored. Chronic low magnesium, even without acute symptoms, has been linked to higher risks of high blood pressure, insulin resistance, migraines, anxiety, and bone problems, though these are not direct clinical signs of acute deficiency.

Diagnosis

Diagnosis relies on blood tests measuring serum magnesium, sometimes with additional urine or red blood cell tests. If you notice several of these signs, especially muscle cramps with fatigue and palpitations, it is important to consult a doctor for proper evaluation rather than self-diagnosing, as symptoms can overlap with many other conditions. Treatment involves

addressing the underlying cause and replenishing magnesium through diet, oral supplements, or intravenous administration in hospital settings when needed.

women. Geneva.

Treatment and prevention

Treatment and prevention of magnesium deficiency (hypomagnesemia) focus on correcting the low levels, addressing the underlying cause, and maintaining adequate magnesium through diet and supplements when needed. The approach depends on the severity — mild cases are often managed at home, while severe or symptomatic cases require medical care. Treatment begins by identifying and managing the root cause, such as stopping or adjusting medications that cause magnesium loss (like certain diuretics or proton pump inhibitors), treating gastrointestinal disorders (e.g., celiac disease or chronic diarrhea), controlling diabetes or alcohol use, or improving nutrition. For mild or asymptomatic deficiency, oral magnesium supplements are usually sufficient and continued for several days to weeks until levels normalize, with common forms including magnesium oxide, citrate, glycinate, or glycerophosphate taken in divided doses with meals to improve absorption and reduce side effects like diarrhea. Doses typically provide 200–600 mg of elemental magnesium per day, but the exact amount is guided by a doctor based on blood tests.

In moderate to severe cases, especially with symptoms like seizures, tetany, arrhythmias, or very low blood levels, intravenous (IV) magnesium sulfate is given in a hospital setting, often starting with 1–4 grams infused slowly over hours, followed by maintenance doses over 24–72 hours or longer to fully replenish body stores. IV treatment is preferred when oral intake is not possible or when rapid correction is needed for heart or neurological stability. After initial IV repletion, oral supplements are often used for ongoing maintenance.

Prevention is primarily achieved through a balanced diet rich in magnesium-containing foods, including leafy green vegetables (spinach, kale), nuts and seeds (almonds, pumpkin seeds), whole grains, legumes (beans, lentils), bananas, avocados, and dark chocolate. The recommended daily allowance for adults is generally 310–420 mg of magnesium, depending on age and sex, and most people can meet this with varied, unprocessed foods. Additional steps include limiting processed and refined foods that are low in magnesium, moderating alcohol intake, staying hydrated during intense physical activity or illness, and managing chronic conditions like diabetes or gastrointestinal diseases that increase risk. For people with ongoing risk factors (such as long-term medication use, older age, or malabsorption issues), a doctor may recommend regular low-dose oral magnesium supplements or periodic blood monitoring to prevent recurrence.

Note that self-treatment with high-dose supplements is not advised without medical guidance, as excessive magnesium can cause side effects or toxicity, especially in those with kidney problems. Always consult a healthcare provider for blood testing, personalized dosing, and to rule out other causes of symptoms. With proper management, magnesium deficiency is usually correctable and preventable.

Conclusion

In conclusion, magnesium deficiency is a serious but preventable condition. Maintaining magnesium balance through a healthy diet and lifestyle helps to strengthen the health of the entire body. If any suspicious symptoms appear, it is recommended to consult a doctor in a timely manner and undergo appropriate examinations. Because early diagnosis and proper treatment are the main guarantee of preventing any disease.

List of used literature:

1. Gayton, A. C., & Hall, J. E. (2021). Textbook of Medical Physiology (14th ed.). Elsevier.
2. Ibn Sino, Abu Ali. Medical Canons (Vol. II). Tashkent: "U‘zbekiston" Publishing House.
3. Qurbonov Sh. Q., & Qurbonov A. Sh. (2018). Bioenergetics and Metabolism. Tashkent: "New Generation of the Century".
4. Gromova, O. A. (2020). Magnesium and Pyridoxine: Fundamentals of Therapy. Moscow: "Medicina".
5. Ahmedov A. G. (2019). Pathological Physiology. Textbook. Tashkent: "Ibn Sino".
6. Jahongirov, B. B. (2022). "Microelements and their prevention". Uzbekistan Medical Journal, No. 4, pp. 45-50.
7. Nelson, D. L., & Cox, M. M. (2017). Lehninger Principles of Biochemistry. W. H. Freeman.
8. World Health Organization (WHO). (2023). Guideline: Magnesium supplementation in pregnant women. Geneva.
9. Абдурахмонов, С. А., Эсанов, Ш. Ш., Улугбердыев, А. Ш., ЭСАНОВ, Я., & АБДУРАЗАКОВ, Х. (2024). Автоматизация процесса управления системой здравоохранения. Оптимизация управленческих решений в автоматизированных системах управления с использованием стилей линейного программирования. *МОЛОДОЙ УЧЕНЫЙ Учредители: ООО" Издательство Молодой ученый"*, (45), 16-18.
10. Shaxzod, E. (2025, November). Коррозиябардош қопламаларни металлургик бойитиш жараёнларида қўлланилиши. International scientific and scientific-technical conference on.
11. Shaxzod, E. (2025). *ULTRA YUQORI CHASTOTALI ELEKTROMAGNIT MAYDON BILAN DAVOLASH*

TEXNIKALARI (Doctoral dissertation, DIGITIZATION IS THE FUTURE OF MEDICINE).
12. Shaxzod, E. (2025). *YUQORI CHASTOTALI ELEKTR TOKI BILAN TA ‘SIR E ‘TUVCHI TIBBIY QURILMALAR* (Doctoral dissertation, DIGITIZATION IS THE FUTURE OF MEDICINE).
13. Shaxzod, E. (2025). *ELEKTR QURILMALAR VA ELEKTR XAVFSIZLIGINI TA ‘MINLOVCHI BINOLARNING TASNIFI* (Doctoral dissertation, DIGITIZATION IS THE FUTURE OF MEDICINE).
14. ABDURAKHMONOV, S., ESANOV, S., ULUGBERDIYEV, A., & ABDURAZZOKOV, J. (2025). MODERN GENERATION DEVICES IN COMPUTER TOMOGRAPHY. DENTOPR APPARATUS CAPABLE OF SIMULTANEOUSLY VISUALIZING BOTH SOFT AND HARD TISSUES. *SCIENCE*, *4*(2-4), 9-11.
15. Kzar, H. H., Jasim, S. A., Kurbanova, S. Y., Al-Ghamdi, H. S., Al-Khafaji, F. A. H., Al-Gazally, M. E., ... & Alghamdi, M. A. (2023). The biomedical potential of polycaprolactone nanofibrous scaffold containing titanium oxide for wound healing applications. *International Journal of Microstructure and Materials Properties*, *16*(4), 278-291.
16. Нуралиев, Н. А., Сагдуллаева, Б. О., & Курбанова, С. Ю. (2016). Теоретические и практические основы санитарной микробиологии. *В журнале представлены материалы*, 101.
17. Nıshanova, Y., Juravlov, I., Kurbanova, S., & Salokhıddınov, M. (2020). Imaging of breast cancer associated with pregnancy.
18. Bakhtiyarova, S. U., & Kurbanova, S. Y. (2026, March). PCR, ANAEROBIC BACTERIA, MAXILLOFACIAL INFLAMMATION, MICROBIOCENOSIS, REAL-TIME PCR, MOLECULAR DIAGNOSTICS. In *International Conference on Social Sciences & Humanities* (Vol. 2, No. 2, pp. 141-142).
19. Saidkasimova, N. S., Mirtazaev, O. M., Matnazarova, G. S., Toshbaev, B. Y., & Khatamov, A. H. (2021). Epidemiological and Epizootological Characteristics of Salmonellosis and Improvement of Their Epidemiological Control. *JournalNX*, 610-618.
20. Хамзаева, Н. Т., Матназарова, Г. С., & Расулов, Ш. М. Тошкент Шаҳрида Covid-19 Инфекцияси Билан Касалланганларнинг Эпидемиологик Таҳлили. *Ўзбекистон Республикаси Соғлиқни Сақлаш Вазирлиги Тошкент Тиббиёт Академияси*, *71*.
21. Тиркашев, О. С., Мустаева, Г. Б., Брянцева, Е. В., & Матназарова, Г. С. (2023). Изучение клинических и

эпидемиологических особенностей кори. *Science and education*, *4*(2), 420-428.
22. Матназарова, Г. С., & Неъматова, Н. У. (2018). Эпидемиолоическая ситуация по ВИЧ-инфекции в Республике Узбекистан. In *Материалы XXXIX Международной научно-практической интернет-конференции.-Переяслав-Хмельницкий* (pp. 516-519).
23. Мустафакулов, А. А. (2020). Рост кристаллов кварца на нейтронно-облученных затравках. *Инженерные решения*, (11), 4-6.
24. Saidkasimova, N. S., Matnazarova, G. S., & Mirtazayev, O. M. (2018). Some epidemiological patterns of salmonellosis in Uzbekistan. *Biology and Medical problems*, *4*, 95-96.
25. Миртазаев, О. М., Матназарова, Г. С., & Магзумов, Х. Б. (2023). Зоонозный сальмонеллёз-болезнь цивилизации. *микробиологиянинг долзарб муаммолари» мавзусидаги республика илмий-амалий анжумани*, 132.
26. Uktamov, K., Akhmedov, S., Khashimova, D., Fayziyeva, K., Narmanov, U., & Sobirova, D. & Komilov, A.(2024). RETRACTED: Improving the country's food security in the conditions of developing a circular economy. In *BIO Web of Conferences* (Vol. 116, p. 07010).
27. Azizova, F. K., Madaminova, G. I., Azizova, P. K., Tursunmetov, I. R., & Sobirova, D. R. (2022). Morphofunctional Features of the Formation of the Testicular Generative Function in the Female Rats' Offspring with Experimental Hypothyroidism. *NeuroQuantology*, *20*(6), 3471-3476.
28. Азизова, Ф. Х., Миртолипова, М. А., Махмудова, Ш. И., Ишанджанова, С. Х., & Сабирова, Д. Р. (2022). Структурные механизмы нарушений постнатального морфогенеза органов иммунной системы потомства, рожденного в условиях тироидной гипофункции у матери. *Oriental Journal of Medicine and Pharmacology*, *2*(1), 116-123.
29. Sobirova, D. R., Nuraliev, N. A., Nosirova, A. R., & Ginatullina, E. N. (2017). Study of the effect of a genetically modified product on mammalian reproduction in experiments on laboratory animals. *Infection, immunity and pharmacology.–Tashkent,(2)*, 195-200.
30. Abdullaevich, N. N., Ravshanovna, S. D., & Klara, B. (2017). Effect of genetically modified product on reproduction function, biochemical and hematology indexes in experimantal study. *European science review*, (1-2), 94-95.

31. Uktamov, K., Akhmedov, S., Khashimova, D., Fayziyeva, K., Narmanov, U., Sobirova, D., ... & Komilov, A. (2024). RETRACTED: Improving the country's food security in the conditions of developing a circular economy. In *BIO Web of Conferences* (Vol. 116, p. 07010). EDP Sciences.
32. Собирова, Д. Р., Нуралиев, Н. А., Носирова, А. Р., & Гинатуллина, Е. Н. (2017). Изучение влияния генномодифицированного продукта на репродукцию млекопитающих в экспериментах на лабораторных животных. *Инфекция, иммунитет и фармакология*, (2-С), 195-200.