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Magnesium: Important Role in Medicine & Oncology

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Abstract

Magnesium is an important mineral of our body involved in many human proteins and enzymes of our body. Its deficiency has significant consequences of the health and has been related to many diseases. In this paper I describe the role in medicine and cancer. We should do more studies regarding the use of magnesium as anti-cancer.

Open Access Short Communication

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Short Communication

Benefits of magnesium

About 80 percent of Americans have a deficiency of this essential mineral, and the health consequences of deficiency are significant. One reason could be because of magnesium, like vitamin D, serves so many functions it's hard to corral.

Over 3,751 magnesium binding sites on human proteins have been reported, suggesting that the role is underestimated. Magnesium is found 300 different enzymes responsible for:

1. Creation of ATP (Adenosine Triphosphate)
2. Proper formation of bones and teeth
3. Relaxation of blood vessels
4. Action of your heart muscle
5. Promotion of proper bowel function
6. Regulation of glycemia

Underestimated health benefits of magnesium

Some studies have previously shown magnesium can lower the blood pressure and help prevent sudden cardiac arrest, heart attack, and stroke. One meta-analysis published in the American Journal of Clinical Nutrition looked at a total of seven studies collectively covering more than 240,000 participants. The results showed that dietary magnesium intake is inversely associated with risk of ischemic stroke.

But its role in human health appears to be far more complex than previously thought, and-like vitamin D-its benefits may be more far-reaching than we've imagined. GreenMedInfo.com's database project has indexed over 100 health benefits of magnesium so far, including therapeutic benefits for:

1. Fibromyalgia
2. Atrial fibrillation
3. Type 2 diabetes
4. Premenstrual syndrome
5. Cardiovascular disease
6. Migraine
7. Aging
8. Mortality

The discovery of the "magneseome" indicates that the presence or absence of adequate levels of ma may epigenetically alter the expression and behavior of the proteins in our body, thereby modify the course of both health and disease.

Magnesium also plays a role in body's detoxification processes and therefore is essential to prevent damage from environmental chemicals, heavy metals, and other toxins. Even glutathione requires magnesium for its synthesis.

Signs of hypomagnesemia

No lab test will give a truly accurate reading of the magnesium status in our tissues. Only one percent of magnesium in our body is distributed in the blood, making a simple sample of magnesium from a blood test highly inaccurate. Other tests to evaluate the magnesium status include a 24-hour urine test or a sublingual epithelial test. Still, these can only give you an estimation of the levels, and doctors typically need to evaluate them in conjunction with the symptoms the patient exhibit.

An ongoing magnesium deficiency can lead to more serious symptoms, including: Numbness and Tingling, Muscle contractions and cramps, Seizures, Personality changes, Abnormal heart rhythms, Coronary spasms.

Some early signs of magnesium deficiency include loss of appetite, headache, nausea, and vomiting, fatigue, and weakness.

Best ways to optimize magnesium levels

The best way to consume this mineral is through organically bound magnesium, found in whole foods. We have to eat a variety of whole-food.

We have to be aware of conditions that can cause deficiency such as a weak digestive system (which impairs the body's ability to

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absorb magnesium), alcoholism (up to 60 percent of alcoholics have low blood levels of magnesium). kidney disease, (which contribute to excessive loss of magnesium in urine), age (older adults are more likely to be magnesium deficient because absorption decreases with age and the elderly are more likely to take medications that can interfere with absorption), Diabetes (especially if it's poorly controlled, leading increased magnesium loss in urine), certain drugs (diuretics, antibiotics, and medications used to treat cancer can all result in magnesium deficiency).

Treatment with Intravenous Magnesium

Magnesium may be administered intravenously and is safe. Diluted in 0.9% saline to 250 ml 100 to lower in 1 to 2 hours and can be repeated depending on the need that the patient has. Side effects are rare or none. Diarrhea occurs when administered orally.

Magnesium in Alzheimer's Disease (AD)

Magnesium depletion, particularly in the hippocampus, appears to represent an important pathogenic factor in AD. A decreased magnesium level is found in various tissues of AD patients in clinical and laboratory studies. A sustained reduction in dietary magnesium impairs memory, and the treatment of dementia patients with nutritional magnesium improves memory. A causal relationship between low magnesium in hippocampal neurons and impairments in learning ability has been demonstrated in aged rats. In a Chinese study, intraperitoneal administration of magnesium sulfate increased the brain magnesium levels and protected learning and memory capacities in streptozotocin-induced sporadic AD model mice. They also found that magnesium sulfate reversed impairments in Long-Term Potentiation (LTP), dendritic abnormalities, and the impaired recruitment of synaptic proteins. Magnesium sulfate treatment also decreased tau hyperphosphorylation by increasing the inhibitory phosphorylation of GSK-3b at serine 9, thereby increasing the activity of Akt at Ser473 and PI3K at Tyr458/199, and improving insulin sensitivity. We conclude that magnesium treatment protects cognitive function and synaptic plasticity by inhibiting GSK-3b in sporadic AD model rats, which suggests a potential role for magnesium in AD therapy [1,2].

Magnesium and cancer

Use of magnesium in side effects of chemotherapy: Hypomagnesaemia is a relatively common side effect of some Systemic Anti-Cancer Therapies (SACT). Oral and intravenous magnesium have problems arising from their poor tolerability and a need for frequent administrations, respectively. Objective Assessing the effectiveness and safety of weekly Continuous Magnesium Infusions (CMI) in the management of SACT-related hypomagnesemia. Methods CMIs (initiated at ten mmol/day and up-titrated subject to response) were prescribed to patients with ≥ 3 magnesium readings < 0.5 mmol/L despite intravenous replacement with bolus-or-short-infusions (BSI). Efficacy (compared to BSI): (a) reduction in the number of moderate/severe hypomagnesemia episodes, and (b) increase in mean magnesium serum levels. Safety: non-occurrence of grade ≥ 3 toxicities (according to the common terminology criteria for adverse events v4). Results Three patients were treated (mean age: 62-years), pre-SACT levels were 0.629 ± 0.121 mmol/L. Efficacy: (a) 1 *versus* 18 episodes; (b) 0.639 ± 0.093 mmol/L *versus* 0.533 ± 0.191 mmol/L. All comparisons were statistically significant for CMI ($p < 0.001$). No magnesium-related grade ≥ 2 side effect was observed. Conclusion CMIs resulted in a marked reduction in the number of episodes of hypomagnesemia and higher magnesium levels, with no significant side effects. CMIs represent a potential option for the management of SACT-related hypomagnesemia, although further research in an expanded cohort is required [3].

Another study confirmed that magnesium supplementation (8-16 milliequivalents) might limit cisplatin-induced nephrotoxicity, and mannitol may be considered for high-dose cisplatin and patients with preexisting hypertension [4]. These findings have broad implications for clinical practice and represent best practice principles for the prevention of cisplatin-induced nephrotoxicity.

Use of magnesium as anti-cancer: Basic science study aimed to attempt for fabricating elastomeric Poly (l-lactic acid-co-ε-caprolactone) (PLACL) with Aloe Vera (AV), Magnesium Oxide (MgO) nanoparticles, Curcumin (CUR) and β-Cyclodextrin (β-CD) composite nanofibers to control the growth of MCF-7 cells for breast cancer therapy. The study focused on the interaction of MgO nanoparticle with CUR and β-CD inhibiting the proliferation of Michigan Cancer Foundation-7 (MCF-7) breast cancer cells. The proliferation of MCF-7 cells was decreased by 65.92% in PLACL/AV/MgO/CUR on PLACL/AV/MgO nanofibrous scaffolds on day 9. The obtained results proved that 1% CUR interacting with MgO nanoparticles showed higher inhibition of MCF-7 cells among all other nanofibrous scaffolds thus serving as a promising biocomposite material system for the breast cancer therapy [5].

T Hirano et al. from Japan demonstrated that both calcium and magnesium ions enhanced the growth-inhibition effects of tangeretin [6]. The flavonoid was less efficient on the growth of human T-lymphocytic leukemia MOLT-4 cells or blastogenesis of peripheral blood mononuclear cells. These results suggest that tangeretin inhibits the growth of HL-60 cells in vitro, partially through induction of apoptosis, without causing serious side-effects on immune cells. So, this is another evidence of the anti-cancer effect of magnesium.

Conclusion

Magnesium is a key essential nutrient. It is necessary for every major process in our bodies such as digestion, protein synthesis, cellular energy production and glucose metabolism. Epidemiological studies identify magnesium deficiency as a risk factor for some types of human cancers. Also, impaired magnesium homeostasis has been reported in cancer patients, and frequently complicates therapy with some anti-cancer drugs. Studies *in vitro* and animals have proven the anti-cancer effect, but more studies should be undertaken to disclose whether a straightforward and inexpensive intervention to optimize magnesium intake might be helpful in the prevention and treatment of cancer.

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