

# Research Project Takes Aim at Magnesium Deficiency

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✓ Fact Checked

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## STORY AT-A-GLANCE

- › Magnesium is required for the functioning of more than 300 enzyme systems driving a diverse array of biological reactions in your body
- › Magnesium is important for healthy mitochondrial function, energy production, heart health and cognition. It's also important for the metabolism and activation of other nutrients, including vitamin D
- › An estimated 48% of Americans do not get sufficient magnesium from their diet. Among postmenopausal women with osteoporosis, the rate of magnesium deficiency is 84%, and up to 75% of diabetics are magnesium depleted
- › While severe deficiency can be identified through a careful analysis of physical symptoms, mild or subclinical deficiency is far more difficult to spot, so testing is advisable
- › GrassrootsHealth's Magnesium\*PLUS Focus Project aims to help identify the ideal dosage with a given compound and level, the specific health outcomes associated with magnesium deficiency and sufficiency, the dose-response relationships and much more

**This article was previously published September 23, 2019, and has been updated with new information.**

Many of the nutrients your body needs for optimal health must be derived from your diet, as your body cannot produce them. One crucial one that many are deficient in is magnesium. It's the fourth most common cation (positively charged ion) in your body<sup>1</sup>

and is required for the functioning of more than 300 enzyme systems driving a diverse array of biological reactions.<sup>2,3</sup>

As noted in a 2018 scientific review,<sup>4,5</sup> "because of chronic diseases, medications, decreases in food crop magnesium contents, and the availability of refined and processed foods, the vast majority of people in modern societies are at risk for magnesium deficiency."

According to this review, most fail to meet the recommended daily allowance (RDA) for magnesium; 48% of Americans do not get sufficient magnesium from their diet. Among postmenopausal women with osteoporosis, the rate of magnesium deficiency is 84%.<sup>6</sup>

Type 2 diabetics also tend to be more prone to magnesium deficiency, and magnesium depletion has been found in 75% of patients with poorly controlled Type 2 diabetes based on serum magnesium status.<sup>7</sup>

During the COVID-19 pandemic, studies showed that "the average county-level COVID-19 cumulative incidence in low-magnesium areas was significantly higher than in the control areas," according to the medical journal *Nutrients*.<sup>8</sup>

While severe deficiency can be identified through a careful analysis of physical symptoms<sup>9,10</sup> (some of the most common of which are muscle spasms, heart arrhythmias or spasms, fatigue and frequent headaches), mild or subclinical deficiency is far more difficult to spot.

Absence of symptoms doesn't mean you're in the clear, however. Again, magnesium is required for the optimal function of many bodily systems, so a mild deficiency will still take its toll.

## **Magnesium Testing Is a Valuable Health Screen**

Considering the importance of this mineral for good health — including cognition and heart health — it's a good idea to measure your level. [GrassrootsHealth](#) Nutrient

Research Institute, which has spearheaded research into vitamin D and omega-3, has now added magnesium, offering low-cost testing for all three.

Like its vitamin D and omega-3 projects, the Magnesium\*PLUS Focus Project<sup>11</sup> aims to identify the ideal dosage and level, the specific health outcomes associated with magnesium deficiency and sufficiency, the dose-response relationships and much more. As noted by GrassrootsHealth:<sup>12</sup>

*"Measuring your nutrient status, adjusting intake as needed, and re-testing is the only way to tell if your nutrient intake is helping you achieve sufficient or desired nutrient status which is tied to particular health outcomes.*

*We will analyze the collected data and give participants feedback on how the magnesium could be working for them; we will publish scientific papers on key results, the first after meeting an enrollment target of 1,000 participants. There will be preliminary analyses and interim newsletters available for all during the enrollment phase."*

Choosing to add the "Plus Elements" test to this magnesium test will also measure other important trace elements – selenium, zinc and copper – that interact with magnesium, and three toxic heavy metals – lead, cadmium and mercury – that can interfere with and block availability of these essential elements.

Coincidentally, a study in the journal *Nutrients* done during the COVID-19 pandemic also noted that "Micronutrient supplementation among specific populations may become an effective public health strategy for dealing with seasonal COVID-19 epidemics that comes with a low social cost."<sup>13</sup>

## **Why Do You Need Magnesium?**

Enzymes are proteins composed of individual amino acids. They are necessary to speed up many cellular functions and biological processes, and each has a different function.

Due to it being required for the functioning of hundreds of enzyme systems, magnesium can therefore play a role in a very long list of ailments.<sup>14</sup> In the video above, Dr. Carolyn Dean discusses magnesium deficiency and some of the effect it has on your health.

She also indicates that the serum magnesium test is not the right one – it's highly regulated by the body so that's why this project will be using the RBC (red blood cell) test to see how much magnesium is in the red blood cells.

For starters, magnesium plays a role in the creation of adenosine triphosphate (ATP), the energy currency of your body.<sup>15,16</sup> Needless to say, without sufficient energy, cellular functions throughout your body will suffer, creating a cascade of dysfunction.

Magnesium also affects your mitochondrial function and health, as it's required both for increasing the number of mitochondria in your cells and for increasing mitochondrial efficiency.

It's also important for the metabolism of other nutrients, including calcium, potassium, zinc, phosphorous, iron, sodium, hydrochloric acid, acetylcholine and nitric oxide.<sup>17</sup> Importantly, magnesium is required for the activation of both thiamine<sup>18</sup> and vitamin D.<sup>19,20,21</sup>

In fact, magnesium deficiency has been shown to impede your ability to convert vitamin D from sun exposure and/or oral supplementation. As noted by Mohammed Razzaque, professor of pathology at Lake Erie College of Osteopathic Medicine in Pennsylvania, coauthor of a study published in The Journal of the American Osteopathic Association in March 2018:<sup>22</sup>

*"By consuming an optimal amount of magnesium, one may be able to lower the risks of vitamin D deficiency, and reduce the dependency on vitamin D supplements."*

Another study<sup>23</sup> published in The American Journal of Clinical Nutrition in December 2018 also concluded that your magnesium status plays an important role in your vitamin D status.

Overall, people with high magnesium intake were less likely to have low vitamin D. As explained by Dr. Qi Dai, professor of medicine at Vanderbilt University Medical Center and the lead author of this study, "Magnesium deficiency shuts down the vitamin D synthesis and metabolism pathway."

## **Magnesium Is Important for Heart Health**

Magnesium is involved in the regulation of blood sugar and insulin sensitivity, which is important for the prevention of many chronic diseases, including Type 2 diabetes<sup>24,25,26,27</sup> and heart disease and dementia. It also supports your brain and heart health via other mechanisms.

It supports healthy heart function by relaxing your blood vessels and normalizing blood pressure, for example. Magnesium also has anti-inflammatory activity, support your endothelial function,<sup>28</sup> and the function of your muscles and nerves, including the action of your heart muscle. Besides increasing your risk for COVID-19 infection, low magnesium has been linked to a higher risk for hypertension,<sup>29</sup> cardiovascular disease, arrhythmias, stroke<sup>30</sup> and sudden cardiac death.<sup>31</sup>

According to one scientific review,<sup>32</sup> which included studies dating as far back as 1937, low magnesium actually appears to be the greatest predictor of heart disease, and other recent research shows even subclinical magnesium deficiency can compromise your cardiovascular health.<sup>33</sup>

## **Magnesium and Your Brain**

Brain related benefits of magnesium include lowering mental and physical stress, catalyzing mood-regulating neurotransmitters like serotonin, which helps prevent anxiety and depression.<sup>34</sup>

Research<sup>35</sup> published in 2015 found a significant association between very low magnesium intake and depression, especially in younger adults. A study<sup>36</sup> published in

PLOS ONE demonstrated magnesium supplementation improved mild-to-moderate depression in adults, with beneficial effects occurring within two weeks of treatment.

In fact, the effects of magnesium were comparable to prescription SSRIs in terms of effectiveness, but without any of the side effects associated with these drugs.

Participants in the treatment group received a daily dose of 248 milligrams (mg) of elemental magnesium for six weeks, while controls received no treatment. According to the authors, "It works quickly and is well tolerated without the need for close monitoring for toxicity."

Importantly, magnesium acts as a buffer between neuron synapses, particularly those involved with cognitive functions (learning and memory). Magnesium "sits" on the receptor without activating it, protecting the receptor from overactivation by other neurochemicals, especially glutamate, an excitotoxin that can harm your brain if it accumulates. Magnesium also activates nerve channels involved in synaptic plasticity.<sup>37</sup>

Magnesium threonate, which has the ability to cross your blood-brain barrier, appears to be the most effective in this case. An animal study<sup>38</sup> published in the journal *Neuron* in 2010 found this form of magnesium enhanced "learning abilities, working memory and short- and long-term memory."

Magnesium also helps prevent headaches, including migraines,<sup>39</sup> by relaxing blood vessels in your brain and acting as a calcium channel blocker.<sup>40</sup> In fact, researchers have noted that empiric treatment with a magnesium supplement is justified for all migraine sufferers.<sup>41</sup>

As a prophylactic, be prepared to boost your magnesium intake for at least three months to experience results, ideally in combination with CoQ10. In many cases, receiving a high dose of magnesium can also abort an attack in progress. The most effective way would be to get an intravenous (IV) infusion. Barring that option, magnesium threonate may be your best option for an oral supplement.

## **Magnesium Deficiency May Increase Your Vulnerability to EMFs**

In theory, magnesium may also help prevent or ameliorate health problems associated with electromagnetic field (EMF) exposure by blocking voltage gated calcium channels, which are activated by EMFs.<sup>42,43,44,45</sup>

Since magnesium is a natural calcium channel blocker, it's possible that having an optimal level of cellular magnesium could help limit the damage from exposure to EMF, which includes heart arrhythmias, infertility, anxiety and depression – all of which are indeed associated with magnesium deficiency. Conversely, being magnesium deficient could potentially increase your sensitivity to EMFs.

## Are You Getting Enough Magnesium?

The RDA for magnesium is around 310 to 420 milligrams (mg) per day depending on your age and sex,<sup>46</sup> although some researchers believe we may need as much as 600 to 900 mg/day for optimal health. I believe many may benefit from amounts as high as 1 to 2 grams (1,000 to 2,000 mg) per day.

As mentioned, many fail to meet this RDA, and one of the primary reasons for this shortage is eating a primarily processed food diet. Magnesium resides at the center of the chlorophyll molecule, so fresh leafy greens are an important food source.

A number of things can also affect your magnesium absorption and excretion. For proper absorption of magnesium, you need selenium and vitamins B6 and D, as well as sufficient levels of parathyroid hormone, while factors that raise your risk for insufficiency by boosting magnesium excretion include:<sup>47</sup>

|  |   |
|--|---|
| Carbonated beverages   | Soft drinks, as the phosphates bind to magnesium, preventing absorption |
| Alcohol consumption  | Lack of sleep   |
| Prescription drug use (especially diuretics, statins, fluoride and fluoride- | Elevated insulin levels <sup>48</sup>                                   |

containing drugs such as  
fluoroquinolone antibiotics)

Heavy sweating

Stress

Excess coffee consumption

Excess salt intake

Parasite infestation

Heavy menstruation

Many experts agree that magnesium supplementation is advisable,<sup>49</sup> but to have a better idea of whether you need additional magnesium, and how much, testing is highly recommended.

As a general rule, I recommend starting out on a dose of 200 mg of oral magnesium citrate per day, gradually increasing your dose until you develop slightly loose stools. To use this method, you need to use magnesium citrate, as it's known for having a laxative effect.

Once you know your cutoff, you can switch to other forms if you like. Other effective ways to boost your magnesium level include taking Epsom salt (magnesium sulfate) baths, as the magnesium will effectively absorb through your skin, or using a homemade topical solution made from 7 tablespoons of Epsom salt mixed with 6 ounces of water.

Heat the mixture until all the salt has dissolved. Pour into a dropper bottle and apply to your skin. I rub a fresh aloe leaf over it to help it dissolve better. This is an easy and inexpensive way to increase your magnesium and will allow you to get higher dosages into your body without risking diarrhea.

## **Magnesium Needs To Be Balanced With Other Nutrients**

Magnesium works synergistically with calcium and vitamins K2, D and B6 (pyridoxine). The ideal ratio of magnesium to calcium is thought to be 1-to-1. Keep in mind that, if like

most people, you get more calcium than magnesium from your diet, your need for supplemental magnesium may be two to three times greater than calcium.

Vitamin B6 is important as it actually escorts magnesium to the cells that need it most. When you get insufficient amounts of magnesium from your diet, your body will leach magnesium from your bones, muscles and internal organs, which can lead to osteoporosis, kidney problems and liver damage.

Getting enough vitamin B6 can help ameliorate this chain of events by ensuring the magnesium in your body is being used as efficiently as possible.

## Sources and References

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- <sup>1, 2</sup> [Open Heart 2018;5:e000668, Magnesium in human biology](#)
- <sup>3</sup> [NIH.gov Magnesium Fact Sheet for Professionals](#)
- <sup>4, 10, 33, 49</sup> [Open Heart 2018;5:e000668](#)
- <sup>5</sup> [Open Heart 2018:e000668 \(PDF\)](#)
- <sup>6, 7</sup> [Open Heart 2018;5:e000668, Magnesium deficiency](#)
- <sup>8, 13</sup> [Nutrients. 2022 Feb; 14\(4\): 909. February 21, 2022](#)
- <sup>9</sup> [Carolyn Dean, Gauging Magnesium Deficiency Symptoms](#)
- <sup>11, 12</sup> [GrassrootsHealth Nutrient Research Institute, Magnesium\\*PLUS Focus Project](#)
- <sup>14</sup> [Selfhacked.com 21 Amazing Magnesium Benefits](#)
- <sup>15</sup> [Journal of Biological Chemistry 1999 Oct 8;274\(41\):28853-6](#)
- <sup>16</sup> [Magnesium 1987;6\(1\):28-33](#)
- <sup>17, 18, 47</sup> [Medical Hypotheses 2001 Feb;56\(2\):163-70](#)
- <sup>19</sup> [Live Science February 26, 2018](#)
- <sup>20</sup> [Medicalxpress.com February 27, 2018](#)
- <sup>21</sup> [News-Medical.net February 26, 2018](#)
- <sup>22</sup> [Eurekalert February 27, 2018](#)
- <sup>23</sup> [American Journal of Clinical Nutrition December 1, 2018; 108\(6\): 1249-1258](#)
- <sup>24</sup> [Nutrients 2013; 5\(10\): 3910-3919](#)
- <sup>25</sup> [Diabetes Care 2013 Oct; DC\\_131397](#)
- <sup>26</sup> [Diabetic Medicine December 2013; 30\(12\)](#)
- <sup>27, 48</sup> [J Am Coll Nutr December 2006 ;25\(6\):486-92](#)
- <sup>28</sup> [Biomedicine 2016 Dec; 6\(4\): 20](#)
- <sup>29</sup> [Medical News Today July 12, 2016](#)
- <sup>30</sup> [BMC Medicine, December 8, 2016; 14: 210](#)
- <sup>31</sup> [BMC Medicine, December 8, 2016](#)
- <sup>32</sup> [New Hope Network January 31, 2013](#)

- <sup>34</sup> Journal of the American Board of Family Medicine 2015; 28(2):249-256
- <sup>35</sup> Journal of the American Board of Family Medicine 2015 Mar-Apr;28(2):249-56
- <sup>36</sup> PLOS ONE June 27, 2017
- <sup>37</sup> drperlmutter.com, Magnesium and Your Brain
- <sup>38</sup> Neuron January 27, 2010; 65(2): 165-177
- <sup>39</sup> Huffington Post December 17, 2015
- <sup>40</sup> Nutrition Reviews 2012 Mar;70(3):153-64
- <sup>41</sup> J Neural Transm (Vienna). 2012 May;119(5):575-9
- <sup>42</sup> Rev Environ Health. 2015;30(2):99-116
- <sup>43</sup> International Journal of Innovative Research in Engineering and Management, September 2015; 2(5)
- <sup>44</sup> J Cell Mol Med. 2013 Aug;17(8):958-65
- <sup>45</sup> Current Chemical Biology 2016; 10(1): 74-82
- <sup>46</sup> National Institutes of Health, Magnesium