Magnesium Deficiency Is Linked to Sudden Cardiac Death

Heart disease is the leading cause of death in the U.S. While coronary heart disease rates have fallen by around half in the decades from the early 1970s to today, the incidence of sudden cardiac death remains a significant fraction, nearly three quarters, of all heart disease deaths. That fraction increases when considering men under the age of 45. Magnesium deficiency is linked to sudden cardiac death.

Sudden Cardiac Death

Sudden cardiac death (SCD) is said to occur when someone has an unexpected heart attack or arrhythmia or other heart problem and dies within one hour of the event. The truly scary thing about SCD is that the majority of victims have no prior symptoms of heart disease. While they do often have risk factors, notably obesity, hypertension, and a history of smoking cigarettes, the onset of SCD is truly sudden. Essentially what happens is that one fine day the SCD victim just collapses and dies without having any inkling of what might be wrong. By the time they get to the hospital it’s usually too late.

In 1998, there were over 450,000 cases of SCD in the U.S. SCD is a major public health problem; despite all of the advances in cardiac medicine, as well as vastly increased knowledge of how to prevent heart disease, hundreds
of thousands of people die from SCD annually, and this problem is particularly acute among men.

**Risk Factors**

As mentioned, risk factors for SCD include obesity, hypertension, diabetes, and smoking. If you're reading a health and fitness blog like this one, you likely either don’t have these risk factors or are working to bring them under control. Frankly, most people who do have these risk factors don’t care enough about their health to do anything about them.

But there is another risk factor that many, even the most health-conscious, are unaware of, and that is their magnesium level.

**Magnesium**

Magnesium is an essential element that is required for over 300 enzymatic reactions in the body, and is particularly important in energy production. Muscles function poorly when magnesium levels are low, and it will not escape notice that the heart is a muscle. Low magnesium levels can lead to arrhythmias.

Importantly, magnesium deficiency is widespread in the U.S., with up to 70% of people failing to consume the RDA. The high level of deficiency centers around two causes: one, the use of processed food, which is low in magnesium; and the abandonment of drinking hard water, which is abundant in magnesium. Locations in which people drink hard water are associated with lower rates of sudden cardiac death.

**Magnesium deficiency is linked to sudden death.**

(1) Sudden death is common in areas where community water supplies are Mg-deficient. (2) Myocardial Mg content is low in people who die of sudden death. (3) Cardiac arrhythmias and coronary artery vasospasm can be caused by Mg deficiency and (4) Intravenous Mg reduces the risk of arrhythmia and death immediately after acute myocardial infarction.

**Magnesium levels are strongly and negatively correlated with rates of SCD,** even after adjusting for other risk factors. In a prospective study, those who were in the highest quartile of magnesium level had a nearly 40% reduced risk of SCD. What is more, the paper that found this specifically recommends looking at magnesium supplementation in order to prevent SCD.

Even if you eat a diet consisting mainly of whole foods, you’re likely not drinking hard water and could very well be magnesium deficient. A serum magnesium level will tell you something about your magnesium levels, but it’s not the whole story, since most magnesium is stored inside cells, little of it is in the serum, and the body strives to hold serum magnesium levels within a fairly narrow range. So a blood test for magnesium can be
misleading, although low levels probably do show an overall deficiency.

Personally, I take a supplement consisting of 200 mg magnesium daily, and I’ve done this for the past six or seven years. I take it right before bed, since magnesium promotes relaxation and may improve sleep because of this.

Deficiency can take some time, perhaps months, to completely overcome when supplementing with magnesium, since the cells will remove it from the blood to use for their own purposes. If you’re interested in the complete story on magnesium and how it affects health, I recommend the book by Carolyn Dean, M.D., The Magnesium Miracle, which tackles the subject in great detail. (And of course you might try my own book on supplements for men, which covers magnesium.) I credit magnesium with a large role in my return to health. Some of my readers have told me about their experiences with magnesium in terms that validate Dr. Dean’s use of the word “miracle”.

The common form of magnesium seen in drugstores and the like, magnesium oxide, is very poorly absorbed from the gut, with some reports showing zero change in magnesium levels after a course of it. Magnesium citrate is available at Amazon (that’s an affiliate link, no extra cost), is nearly 100% absorbed, and is the kind I use.

So, don’t become a victim of sudden cardiac death. Ensure that your magnesium levels are up to snuff, and that your other risk factors are under control, and you won’t. If you do have these other risk factors, and are unable to get them under control, magnesium could mean the difference between life and death.

PS: Those with kidney disease should consult a doctor before supplementing with magnesium, as this could cause a potentially toxic accumulation of magnesium. For everyone else, magnesium generally has very low toxicity and no side effects. The RDA is ~400 mg for an adult man, so supplementing with 200 mg is a moderate dose.

PPS: Check out my Supplements Buying Guide for Men
Good health is not just about physical health, but about mental health. Usually, good mental health accompanies good physical health; the Romans used to have an expression for this: *mens sana in corpore sano*, or a sound mind in a healthy body. Nevertheless, sometimes the brain and the mind can go awry even in a healthy body, one of the ways being when anxiety manifests itself. If you have anxiety to the point that it bothers you, there are several things that one can do, like the following.

1. Watch your caffeine intake.
   This seems elementary, yet even most doctors won’t ask about caffeine intake when a patient comes to him with a complaint of anxiety. Yet it appears that *people with an anxiety disorder have increased sensitivity to caffeine*. If too much caffeine is ingested, *caffeine intoxication* may result. There are *case reports* of increase suicidal tendencies with excessive caffeine consumption.

   Excessive caffeine consumption is also linked with *depression, anxiety, and psychosis*. (The subject in this paper was drinking a hell of a lot of coffee.)

   This would be the first thing I’d look at if I were suffering from anxiety. Those Starbucks coffees can have a huge amount of caffeine, and if you add energy drinks or even soda to that, you could be consuming way more caffeine than you think. Cut back on it. Consider drinking tea instead of coffee; that way you can still get a mild caffeine boost without overdoing it.

2. Exercise.
   Anxiety is closely associated with depression, and exercise has been found to be a good way of dealing with both. In a cross-sectional study, those who exercised were found to be *less prone to anxiety and depression*. Exercise can also be used to *treat anxiety*, since exercise is *a profound anxiolytic*. 
So it appears that exercise over a longer time period results in less anxiety, and that an acute bout of exercise relieves anxiety. Furthermore, being sedentary is associated with more anxiety and depression.

3. Magnesium.

Low magnesium intake is associated with anxiety and depression. In animals, magnesium deficiency reliably induces anxiety-like behavior. Magnesium also appears to have a role in the etiology of major depression.

If you suffer from anxiety, a trial of magnesium citrate wouldn’t be a bad idea at around 400 mg magnesium a day. (Anyone with impaired kidney function should see a doctor before supplementing with magnesium.)

4. N-acetylcysteine

I’ve covered this cheap, safe, and over-the-counter supplement in a number of blog posts. Suffice it here to say that is has efficacy in depression, and it appears that it may be useful for anxiety as well.

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**How magnesium deficiency and depression are linked**

A recent issue of *Nutritional Neuroscience* featured a review study of possible links between magnesium intake and depression: Magnesium and depression: a systematic review.

The incidence of depression is increasing worldwide. Much is still unknown about the possible role of magnesium in depression prevention and treatment. Magnesium has an effect on biological and transduction pathways implicated in the pathophysiology of depression. The possible role of magnesium in depression prevention and treatment remains unclear....

Magnesium seems to be effective in the treatment of depression but data are scarce and incongruous. Disturbance in magnesium metabolism might be related to depression. Oral magnesium supplementation may prevent depression and might be used as an adjunctive therapy. However, more interventional and prospective studies are needed in order to further evaluate the benefits of magnesium intake and supplementation for depression.

So, there’s at least some evidence for the link between low magnesium and depression, which I discussed at more length in my new book. Also, for a bit more speculative take that’s highly favorable to magnesium treatment of...
depression, see Magnesium and major depression (pdf).

How might magnesium work in depression? A group of scientists recently discovered that, in mice, **low magnesium intake was associated with changes in the levels of four key proteins in the brain.**

There is evidence to suggest that low levels of magnesium (Mg) are associated with affective disorders, however, causality and central neurobiological mechanisms of this link are largely unproven. We have recently shown that mice fed a low Mg-containing diet (10% of daily requirement) display enhanced depression-like behavior sensitive to chronic antidepressant treatment. ... Collectively, these findings provide first evidence of low magnesium-induced alteration in brain protein levels and biochemical pathways, contributing to central dysregulation in affective disorders.

It’s been estimated that up to 60% of Americans do not get the recommended amount of magnesium in the diet, which could go some way toward explaining rising levels of depression.

I’ve noted before that **magnesium citrate** is the best absorbed form of magnesium, so if you want to supplement, that form is the one to go with – not the common drugstore form, magnesium oxide, which is barely absorbed at all.

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**Magnesium citrate is the most bioavailable form of magnesium**

Bioavailability of Magnesium Salts – A Review

Background: Magnesium supplementation is of value in several different medical disorders. Several kinds of Mg-salts are commercially available.

Purpose: This review evaluates their bioavailability criteria such as solubility, urinary excretion, and plasma levels of magnesium from studies of different Mg-salts.

Conclusion: Although methodology differences were large, the results consistently demonstrate a **better bioavailability for Mg-citrate**.

I’m posting this mainly because I’ve stated in a number of places that
magnesium citrate is what you want to take for mag supplementation, since it’s better absorbed. This review article reinforces previous research.

Magnesium is of course of great benefit to health and probably most people should be supplementing with it. I do so myself with a daily tablet of magnesium citrate, containing 200 mg magnesium. If you recall from chemistry class, mineral salts may be more or less prone to dissolving and to absorption from the gut. Milk of magnesia, for example, is magnesium hydroxide, and is used to treat constipation. Magnesium hydroxide just isn’t absorbed well at all, which from one aspect is good, since that makes it non-toxic, as almost all of it remains in the gut. But for supplementation of magnesium, it doesn’t work at all.

Magnesium oxide is another form of magnesium that’s commonly found in drug stores and similar places, but unfortunately magnesium oxide is also hardly absorbed at all from the intestinal tract. Some studies have shown virtually zero absorption of magnesium oxide. Of course, most people, including most doctors and other health practitioners, don’t know this.

Yet other forms of magnesium supplements exist, such as epsom salts (magnesium sulfate), which has a bit better absorption. Epsom salts can also be used to soak in, and some magnesium does get absorbed through the skin. However, you never know what dose you’re getting and so don’t know whether the supplementation is effective or not.

In these types of studies, magnesium citrate always comes out as the most bioavailable form of magnesium. There’s really no reason to take any other kind, other than the fact that you may have to order from Amazon or similar place, as local stores may not have it. The citrate itself also has some health benefits.

You can find magnesium citrate on my recommended supplements page. The recommended dose is one 200 mg tablet daily, but if you are just starting magnesium supplementation and know or suspect that you are deficient, then two doses of 200 mg daily may be appropriate. Those with kidney disease should consult a doctor before beginning; for everyone else, magnesium has low toxicity and virtually no side effects.

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**Magnesium improves athletic performance**

*Magnesium status and the physical performance of volleyball players: effects of magnesium supplementation*

The aim of this study was to test the hypothesis that magnesium
supplementation influences the physical performance of volleyball players, as the efficacy of this approach remains questionable. Twenty-five professional male volleyball players were assigned randomly to experimental (350 mg Mg · d⁻¹, 4 weeks) and control groups (500 mg maltodextrin · d⁻¹, 4 weeks) maintaining inter-group homogeneity of urinary magnesium. Erythrocyte, plasma and urinary magnesium levels, plasma creatine kinase activity, lactate production, maximal oxygen uptake (VO₂ max) and plyometric (squat jump, countermovement jump, countermovement jump with arm swing) and isokinetic (peak torque, potency and total work) performances were evaluated before (T₀) and after (T₁) supplementation. Levels of erythrocyte and urinary magnesium and creatine kinase activity and VO₂ max remained within normal ranges in both groups. Plasma magnesium decreased significantly only within the experimental group. Significant decreases in lactate production and significant increases (of up to 3 cm) in countermovement jump and countermovement jump with arm swing values were detected in the experimental group following magnesium supplementation, but not in the control group at T₁. It is concluded that magnesium supplementation improved alactic anaerobic metabolism, even though the players were not magnesium-deficient.

Sounds as if the researchers started out with doubts, but ended up convinced. They state that the players were not deficient at the start, but if they used a simple blood test for that determination, it’s not reliable, as blood tests are a poor determinant of overall magnesium status. In any case, performance improved with magnesium.

How can you know whether you truly need magnesium? It’s tough, since more than a simple blood test is required. Usually, doctors will order a red cell magnesium level, which is better than a simple serum magnesium test, but it’s a test that most labs do not do in-house and hence is more expensive.

However, magnesium consumption in this country is relatively low, and it’s been estimated at up to 60% of Americans don’t get enough. It used to be that most people consumed magnesium through drinking hard water, but that doesn’t happen much any longer.

A simple way to determine whether magnesium will improve your athletic performance may be simply to try supplementation with magnesium citrate and see.

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**Magnesium increases T levels**

*Effects of Magnesium Supplementation on Testosterone Levels of Athletes and Sedentary Subjects at Rest and after Exhaustion*
This study was performed to assess how 4 weeks of magnesium supplementation and exercise affect the free and total plasma testosterone levels of sportsmen practicing tae kwon do and sedentary controls at rest and after exhaustion. The testosterone levels were determined at four different periods: resting before supplementation, exhaustion before supplementation, resting after supplementation, and exhaustion after supplementation in three study groups, which are as follows: Group 1—sedentary controls supplemented with 10 mg magnesium per kilogram body weight. Group 2—tae kwon do athletes practicing 90–120 min/day supplemented with 10 mg magnesium per kilogram body weight. Group 3—tae kwon do athletes practicing 90–120 min/day receiving no magnesium supplements. The free plasma testosterone levels increased at exhaustion before and after supplementation compared to resting levels. Exercise also increased testosterone levels relative to sedentary subjects. Similar increases were observed for total testosterone. Our results show that supplementation with magnesium increases free and total testosterone values in sedentary and in athletes. The increases are higher in those who exercise than in sedentary individuals.

Magnesium is the nutritional factor most people are likely to be deficient in. Some studies have indicated that as many as 60% of Americans are deficient. One reason is that people used to get much of their magnesium through drinking hard water, but hardly anyone does that anymore. Supplementing with magnesium is also crucial for treating chronic fatigue. (As discussed in my book.) Many forms of magnesium are poorly absorbed. Magnesium oxide is the form found most commonly such as in drugstores, and it has nearly zero absorption from the gut. So if you want to supplement, get a form that’s readily absorbed; magnesium citrate is best for this.