

Caspar ([00:00](#)):

If you're looking to optimize your health, which I really hope you are, there's an essential nutrient that's involved in almost every major metabolic and biochemical process within our cells that you may want to focus on. The problem is you might be lacking it and not even know. This often overlooked deficiency can impact your sleep, mood, heart, brain, kidneys, and so much more. This is the Story of Magnesium the Missing Mineral, with Dr. James DiNicolantonio, Dr. DiNic, nice to have you back.

Dr. James DiNicolantonio ([00:30](#)):

Thanks for having me back. Yeah, appreciate it. So

Caspar ([00:32](#)):

This is your seventh time, meaning each time was for a different book, which you just knock out. I love it. But I do remember you being on, you already wrote a book called The Mineral Fix, and that talked a little bit about magnesium. What made you then focus on just magnesium for this book?

Dr. James DiNicolantonio ([00:49](#)):

I think it was a lot of feedback from my followers, kind of wanting a deeper dive on what supplements should I take, how do I take it, what do I need to avoid when I take it, et cetera. So I thought, I thought, let me just focus on this topic since I've, you know, been researching it for almost 10 years, and let's actually just put out a book right, about magnesium. And I think that's, you know, that that was why I did it.

Caspar ([01:09](#)):

Yeah, no, it's a wonderful book I just showed you with all the marks and everything. You got a ton of information within it. Let's start with just the problem really here. How prevalent is this issue of magnesium deficiency in societies today?

Dr. James DiNicolantonio ([01:24](#)):

Well, part of the problem is, most doctors don't even test for it, which is, yeah, you might be asking why, like, why are we not actually testing for magnesium deficiency? So that's one, one problem. I mean, the short answer is on average, if you actually do like a good gold standard test for magnesium deficiency, whether you give an oral load and see how much comes out in the urine, or you do an IV load test, which are, is the gold standard, half the population is gonna be magnesium deficient based on the true, you know, gold standard tests. And you, and, and the reason, there's so many reasons. One, we don't, we're not eating as much as we used to. Yeah. We used to consume somewhere between 500 and 600 milligrams of magnesium a hundred years ago. We're consuming half that now. And part of the reason why is because our nutrition, the foods that we eat have been processed, but also the actual food that we eat that is natural healthy food, we grow it differently. So it's 30 to 40% less in magnesium itself. So we have to eat 30 to 40% more food than 50 to 80 years ago just to get the same amount of magnesium. And then of course, you know, the book goes in like 60 different factors that contribute to magnesium deficiency, which most people are gonna have at least one of those factors is an issue contributing to magnesium deficiency.

Caspar ([02:36](#)):

You talked about testing, and I read it's, it's often overlooking, you wrote only 7% of physicians request magnesium testing in certain patients where it probably should be done, but there's no one test to definitively diagnose magnesium deficiency. Talk about the current tests that are out there. You sort of mentioned that a little bit before that one can take to see where their magnesium levels are.

Dr. James DiNicolantonio ([02:59](#)):

Yeah, well, I think the, the most available test is a blood test, and all you actually have to do is improve the typical quote unquote normal range. And if you put it into an optimal range, you can actually have a decent snapshot if you are deficient in magnesium or not. So magnesium is typically measured in the blood either as milligrams per deciliter or millimoles per liter. So typically your doctor won't diagnose you as deficient in magnesium unless your blood level is less than 1.7 milligrams per deciliter. If you simply just bump that up to 1.9 to two, if you're less than that, that's a good indication that you may be deficient in magnesium. So we have a blood test that's not perfect, but if you improve just the level and you bump up how much going from 1.7 to 1.9, let's say that that right, right there is gonna really give you a good snapshot.

Dr. James DiNicolantonio ([03:55](#)):

The only thing, the only thing that I like to tell people is that there are certain things that will actually keep magnesium normal or even high, which would be if you're on a thiazide diuretic or blood pressure can actually increase magnesium levels. So blood won't, won't be perfect there. Vigorous exercise can also increase magnesium levels acutely and so can smoking. So it's not perfect. And that's why you typically want at least two tests. And some of the other tests would be a hair mineral analysis for magnesium, a muscle biopsy, which most people aren't gonna do. Yeah, we talked about a little bit about the oral load where you give, basically you absorb a third of the magnesium you eat. So if you're basically urinating less than a third of what you consumed, that means your body's holding onto it. And so that's a decent test where you look at 24 hour urine after you've either given an oral load or you've given an IV load of magnesium. Those are some tests. The best blood test is mononuclear blood cell magnesium, which is like a combination of lymphocytes and monocytes because the immune cells, they actually match whole body status of magnesiums. But no, it, it, nobody orders this test. But that is, if I had to say that if there's one good blood test to get that one is the best.

Caspar ([05:07](#)):

Yeah. Because as, as we know, so much of the magnesium where it matters is intracellularly, it's inside the cell that matters. Yeah. So we're doing a blood test, you know, you're, you're kind of seeing what's in the system, but not in the cells unless you do that one where you're looking at specific cells within the blood and what they have within them. Correct?

Dr. James DiNicolantonio ([05:26](#)):

Correct. Yes. And basically, so you're right, 99% of all magnesium is found within the cell. It gets even more interesting when you take into account that there's bound magnesium, which is the unactive form or the inactive form, and ionized magnesium, which is the active form. So you can actually have good blood levels, which your ionized magnesium, which is the, which is the unbound, is, which is the active form, could actually be low. So things like high levels of free fatty acids in the blood, which happens when you're insulin resistant, can actually, they're negatively charged. They will bind positively charged magnesium ions and inactivate them. So if you're someone who's insulin resistant and you consume a lot of, let's say, heavy cream or, or you know, a lot of fat in just one sitting, it'll release a lot of free fatty acids in the blood, bind the magnesium and, and inactivate it. And so that can actually induce like arrhythmias, et cetera, because all of a sudden you're acutely deficient in, you know, circulating ionized free magnesium.

Caspar ([06:25](#)):

Yeah. When I speak to some integrated practitioners to try and get that picture of what's going on at magnesium levels, I hear the blood you know, testing, but as well there, there are other ones, there's something called like oligo scan that could test within the kind of cellular and try to pick up and it's kind of matching, but you're right, there's no one definitive way that you get it. And that's kind of you know,

throwing people off. But if someone were, were sitting here and said, okay, my blood test came up, but I still have a inkling that I might be deficient, what, what would be your advice or what would be the symptoms you'd say, Hey, look out for these things 'cause It might be true that you are magnesium deficient.

Dr. James DiNicolantonio ([07:02](#)):

Right. I think that's the, the most important thing too, is the fact that, you know, regardless of what any of tests says, no test is perfect. And so if you're having symptoms of magnesium deficiency and then all of a sudden you, you empirically start taking some and they go away, that's a pretty good indicator that you were deficient. But yeah, some of the main symptoms of magnesium deficiency would be muscle cramps, muscle spasms, your muscles just locking up. So basically this technique can happen. Twitching of like the eyelids, twitching of muscles too can happen. Sleep disturbances, photosensitivity, tinnitus, which is ringing in the ears can be caused by magnesium deficiency. Even mitral prolapse has been shown to be due to magnesium deficiency. And giving magnesium in people with mitral prolapse has been shown to improve that. But vitamin B1 deficiency can contribute to that as well.

Dr. James DiNicolantonio ([07:54](#)):

Osteoporosis, heart conditions, high blood pressure, you know, kidney issues cognitive decline. I mean, there really isn't anything that magnesium doesn't touch or affect because we now know that it affects over 800 enzymes is a co-factor for these enzymes to function. So 20 years ago when I, when, you know, when I first started researching magnesium about 10 years ago, but 20 years ago, all the scientific literature said 300 enzymes magnesium was dependent on. Then 10 years ago it went up to 600. Now we have, we have do documentation of over 800 enzymes that it's a co-factor for. So that's kind of why so many things, so many symptoms can happen when you're deficient in magnesium.

Caspar ([08:30](#)):

Yeah. And, and I know people that are, you know, eat very healthy, you know, do workout, maybe even supplement magnesium, but some of the ways that you become deficient as well. One of the things you said is this chronic stress. We live in a very stressful environment. Everything around us is a stress. And that depletes. Can you go into how that works? Almost the, the mechanism to how we're depleting ourselves just through the stress we live with?

Dr. James DiNicolantonio ([08:54](#)):

Yeah. So the stress hormones, particularly noradrenaline, will actually kick out magnesium in the cell from that stressful type of response, and then you lose it in the urine. So that's actually the mechanistic piece of how it happens is noradrenaline kicking magnesium out of the cell and then we lose it through the urine. And so it's this vicious cycle of more noradrenaline release, more magnesium is pushed out of the cell, and then more is lost in the urine. And so many things are causing us to be deficient in magnesium, over consuming caffeine or coffee. Mm-Hmm. Be having elevated blood glucose levels. Elevated insulin will increase magnesium loss out the urine, be the cell being insulin resistant. You can't even push magnesium into the cell well when it's insulin resistant, which, you know, 88% of Americans are metabolically unhealthy. Mm-Hmm. <Affirmative>. So they're, that means basically nine outta 10 people are struggling probably to get magnesium into the cell where they need to get it into.

Dr. James DiNicolantonio ([09:50](#)):

And then you have many different things, many medications, diuretics, proton pump inhibitors, ant acids that can cause magnesium deficiency and many nutrient deficiencies. You don't get enough B6, you're not gonna absorb magnesium well or get it into the cell. You don't get enough selenium, you don't get enough salt. A lot of people don't realize this. Basically if you don't consume at least a teaspoon of salt a day and

you're working out about an hour a day, you're gonna go on a negative salt balance. And also negative magnesium and calcium balance, because the body's gonna pull sodium from the bone to try to maintain a normal sodium level in the blood, but it pulls magnesium and calcium from the bone at the same time, spikes magnesium in the blood, tricks the body into thinking you're overloaded, and then your body downregulates the absorption of magnesium and kicks it out. So actually not getting enough salt leads to magnesium pulled from the bone, and it also causes more magnesium to be lost in the sweat to conserve sodium. So there's a, there's a whole plethora of reasons of why someone could be deficient in magnesium.

Caspar ([10:48](#)):

Yeah. It, it really is this, you gotta kind of look at everything you're doing. Like you mentioned, those PPIs like Nexium, you know Prilosec, they're depleting you and you don't even know it. Right. You're, you think you're taking a medicine to improve where you are, whether it's GERD or antacid, you know, and, and you're actually being depleted and just to like really nail it home. I saw this like reach researcher that you wrote about, wrote, eliminating a magnesium deficiency may produce a higher return on investment and a higher reduction of disease and pain in a shorter time than any miracle drug or high tech development. Do you, do you share in that sentiment?

Dr. James DiNicolantonio ([11:25](#)):

Oh yeah, of course. Because that's a root cause to a lot of issues. So, you know, nobody has a medication deficiency. I'm not saying medications can't have benefits. Of course they can. But when it comes to chronic health conditions, many of them are either contributed by, or literally caused by a deficiency in, in either one nutrient or multiple nutrients, and you simply fix the deficiency and you fix the disease. Chronic, chronic diseases I'm referring to.

Caspar ([11:55](#)):

Yeah, no, it really is this, this master mineral of sorts. And one, one of the things I loved about the book is that even early on, you talked about water, right? And, and you dedicated a chapter to it and you broke down this difference that many people don't know about between, you know, people know water is water, it's just H₂O, right? But you talk about soft water and hard water, and I was hoping you could break that down a little bit again, because people don't really consider water as these different things. And what's the difference between soft and hard water as it relates to magnesium?

Dr. James DiNicolantonio ([12:26](#)):

So basically all the water that we consume in the United States is soft water, whereas most of the water consumed in Europe is hard water. So that would be your natural mineral waters, your spring waters that are coming either from, you know, mountains or underground sources of water. It would always have had magnesium in it. But we, we basically filter that all out with tap water, and now we don't get any. And typically, you know, a typical European can get a hundred to 150 milligrams of magnesium per day just from the water they drink. And so in the United States, we're only consuming maybe 250, so they're getting half of the magnesium we eat just from the water they consume.

Caspar ([13:04](#)):

Yeah. You, you make that really good point that, you know, everyone looks at food for their magnesiums or supplementation, whatever it may be, but water is this, this, you know, magnificent thing that we're consumed that we are so much made up of that we do improperly in many ways because of that you know, depletion of it in what we drink in soft water. And I found it really interesting also that the out cause of making it sought made it acidic. And therefore, as it goes through the pipes, you may leach out that, you know, the heavy metals that were in their academy and, and others, you know, do you feel like

we've, why did we do that? Number one? I know you wrote a little bit about we don't like scaling on things. We don't like washing things and getting a little bit of mineralization on it. Is, is that like the main reason that we move to a soft water system?

Dr. James DiNicolantonio ([13:53](#)):

Yes. Yeah. Basically when you have a hard water with that has good amounts of calcium and magnesium, well, it'll calcify the cooking materials, right? You run that through a coffee machine, it can mess it up a little bit. So it was to avoid that, basically scaling on, on our, on our basically cooking utensils. But at the same time, then we removed all the minerals that we would typically have gotten from that. And there's this good correlation between countries that have harder water with less heart disease, but also even within the United States. Ty as you move east to west and, and the water becomes more hard, you know, the, the risk of heart cardiovascular disease and other diseases goes down. So it is interesting that if you live in an area that has naturally higher magnesium content in the water, there is lower rates of cardiovascular disease in those areas.

Caspar ([14:41](#)):

And you even bring up this idea of what you cook with the water, whether it's soft or hard, is also going to then go into the foods, right? Your pastas, your, your rice, everything that sucks in a lot of those nutrients. So even that is a benefit in you utilizing hard water with magnesium. Correct?

Dr. James DiNicolantonio ([14:59](#)):

Right. And, and, and so minerals are different than vitamins where whereby if you cook rice in water, you're gonna lose basically all the B1, the B2, the B vitamins get destroyed by heat, but minerals do not. So the magnesium will stay and the cooking water, all the minerals in there will stay. And so in Europe, they're cooking with hard water too. So they're getting water not just through, you know, consuming it in a glass, let's say, or, or a naturally bottled mineral water, but they're also getting it exactly through the foods, absorbing the water and cooking in that type of kind of harder water.

Caspar ([15:34](#)):

If someone were listening and they're like, well, I I don't drink tap water, right? I have a filter, but that filter doesn't have any remineralization portion, would you say seek that out if you're doing a whole filtration system?

Dr. James DiNicolantonio ([15:48](#)):

I would say like, it's probably just easier to, to take a magnesium supplement. Yeah. I mean, you can, if you want to try to remineralize the water there are certain products too that you can add to the water, but typically it tastes a little bit bitter. Magnesium is just a molecule and water. So just a, just a capsule that you don't have to kind of deal with. The taste, the metallic taste of magnesium is probably an easier way to do, to go about it.

Caspar ([16:09](#)):

And you said the Europeans, you know, they drink a lot of the bottled water that has magnesium and is is a harder water. What are some of your favorite ones that you drink?

Dr. James DiNicolantonio ([16:19](#)):

Yeah, well, the, the highest magnesium waters one would be Magnesia. Mm. The other would be Gerolsteiner. Gerolsteiner's. Very, yeah, it's great. It's, it's very carbonated though, so people Mm-Hmm, <affirmative> just gotta be a little careful how much you consume at once or if you're doing it with food,

but it's still a great one. I mean, even Mountain Valley spring water, it's not a ton of magnesium, but you know, there's, there's some in there, there's some calcium. It's, it's, I think consuming water from a glass container too is very important to decrease your plastics as well. So,

Caspar ([16:50](#)):

Yeah, no, I, I think between like Gerolsteiner you know, San Pellegrino, you could say Mountain Valley, those are in the, you know, heavy glass bottles and everything that some people don't like, but there's a huge benefit to that. And then you do have that ascent, you know, the addition of those minerals that are already in there. Now, if we shift over to like, all right, how's magnesium impact certain systems, the cardiovascular system, you know, that's a really big one. What's, what's the main effect of magnesium within the heart and complete a cardiovascular system?

Dr. James DiNicolantonio ([17:21](#)):

Y you don't get enough magnesium, you'll start having cardiac arrhythmias. Hmm. Super ventricular arrhythmias. You'll have something called Torsades de Pointes, which is like basically prolongation of the QT interval. You can drop dead of sudden cardiac death if you, if you don't have enough magnesium basically because the heart will just start kind of spasming. And so it'll, you'll lose the good function of the heart. Part of the reason why is because magnesium controls the electrolytes going in and out of the cell, sodium and calcium will actually start building up in the cell in the heart. If you don't have enough magnesium, calcifying the coronary arteries as well, and you will lose potassium from the cell if you don't have enough magnesium as well. And you obviously need potassium for a good heart, you know, rate, rhythm, et cetera. And so when it comes to the heart that arrhythmias are probably the biggest you know, issue. And, and there was one study where they put women on about 110 milligrams of magnesium per day, and about 25% of them within like a month developed AFib. And be just, just from that. And so we know that you have to have a minimal amount of magnesium to prevent arrhythmias from kind of kicking in.

Caspar ([18:32](#)):

Oh, another heart condition that impacts a lot of people is hypertension and a lot go on hypertensive drugs as the number one thing to do. You know, you just go on, but you wrote that could actually lead to magnesium depletion in the body. Are we just creating by placing people on these drugs that deplete a kind of vicious cycle. It's like you go on it to treat the cause, but then you deplete magnesium, which exacerbates it. Are we just doing this rotating kind of thing? Go on the drug, you need more magnesium. It depletes more magnesium. Is, is that kind of what you're seeing when, when a lot of these drugs interact with the body?

Dr. James DiNicolantonio ([19:06](#)):

Yeah, I think for one, if you are being put on a thiazide diuretic, like either hydrochlorothiazide, which is HCTZ, chlorthalidone or indapamide, those have been shown, if you are on those for six months or longer, 80% of people tested have magnesium deficiency. And so that definitely is a big one inducing. And, and what's crazy is, is it causes elevated magnesium in the blood. So you might think you're overloaded even though you're depleted when you're on a thiazide diuretic, which is very weird. So it's one of those things that you don't even realize that Dr my tests you know and be like, oh my gosh, your magnesium's great on the size of diuretic, I don't need to give you magnesium. And in fact it's the exact opposite. And so magnesium helps lower blood pressure, it helps basically relax the smooth muscle on the basically surrounding the arteries and helps to be, it's basically your natural vasodilator. We used to treat hypertension and preeclampsia, et cetera, high blood pressure in pregnant women with magnesium. That was our blood pressure medication back 50, 60 years ago.

Caspar ([20:08](#)):

Yeah, it almost seems we should go back to those times and start there before we move into the more, you know, kind of powerful drugs that we place ourselves on. And now another big system in the body that that's right up there with the heart is the brain. Let's talk about how magnesium impacts the brain. And let's actually start somewhere that people know a lot about magnesium, which is sleep. I know a lot of people that take magnesium before they go to sleep, they say it improves their sleep. How does that work?

Dr. James DiNicolantonio ([20:36](#)):

So magnesium helps to form the feel-good neurotransmitters, serotonin, dopamine, and noradrenaline. So depression, mood, et cetera is very important. But serotonin ends up forming melatonin in the brain. Mm-Hmm. <affirmative>. And so you need magnesium in actually order to make melatonin, which we we're supposed to release a couple hours before we get sleepy. And so when you are deficient in magnesium, you're not going to release as much melatonin, and thus you will have difficulty falling asleep.

Caspar ([21:05](#)):

Do do you ever recommend people take melatonin with magnesium? Or should you start with just magnesium? You know, because again, people like taking things to help them sleep, right. And it's probably much better than your Ambien's and other sleeping pills. But what, what would be a recommendation for someone having some trouble with sleep? Start with magnesium, don't worry about? Mix the two. What is it?

Dr. James DiNicolantonio ([21:27](#)):

The, actually the number one supplement that has helped my patients out the most with sleep is inositol by far and away, but, but secondarily would be magnesium glycinate. And then after that glycine three grams of glycine an hour before bed, and then also l-theanine 200 to 400 mil milligrams I think about an hour before bed. Most people get benefits with that too.

Caspar ([21:50](#)):

It's a nice stack because of course the l-theanine anxiety levels, things like that, especially if you're doing caffeine, they say take l-theanine. But you wrote about that the big impact that magnesium has on mood, anxiety and depression, which basically everyone seems to be dealing with some form of. What's that correlation if you're gonna go to like depression and how magnesium works with that?

Dr. James DiNicolantonio ([22:14](#)):

Well, you know, we have these SSRIs that we typically treat depression with, basically there, they're serotonin reuptake inhibitors. They try to keep serotonin elevated to improve your mood. But as I had just mentioned, in order to form serotonin, the enzymes required to do that require magnesium as a co-factor. So the natural way to boost serotonin is magnesium supplementation. And a lot of people's serotonin levels are low because of magnesium deficiency. So why give a drug when it's potentially a deficiency in an essential mineral?

Caspar ([22:47](#)):

Right? And it, and it leads into another one. And, and let's talk a little bit about children, because you wrote about ADHD, you know, this inability to pay attention, hyperactivity. Where's, where is magnesium fall in line with that?

Dr. James DiNicolantonio ([23:04](#)):

That's the neurotransmitter noradrenaline. We need that neurotransmitter to focus. And so, and also dopamine is for mood too, right? So those two neurotransmitters to be formed in the brain require magnesium. And so that's why, you know, you see signs of ADHD with magnesium deficiency due to, due to the low noradrenaline. Well, and we have medications too that try to boost that noradrenaline as well along with the serotonin and then the, the dopamine too for mood. So poor mood can definitely be caused by not getting enough magnesium.

Caspar ([23:33](#)):

Yeah. And if we switch over to an aging population, we hear a lot about Alzheimer's, we hear about Parkinsonism, dementia. Even now you not eat aging population. A lot of people are dealing with MS, these are all these neurological conditions, autoimmune some cases. But how can magnesium benefit people there in both prevention and as something to utilize if you are dealing with these conditions?

Dr. James DiNicolantonio ([23:59](#)):

So the synapses that connected the neurons basically magnesium is like the miracle grow for those mm-
Hmm. <Affirmative>. So those connections between our neurons. And so there's been certain studies, there's been at least two clinical studies looking at magnesium l-threonate, which is a mm-hmm
<affirmative> brain bioavailable magnesium, but also magnesium acetyl-taurate or taurinate sometimes called also can cross the blood brain barrier very well. And, and there's been two studies showing improvements in cognition as well as MMSE score in patients with moderate Alzheimer's disease or cognitive impairment. So giving a brain bioavailable magnesium may definitely help with cognition.

Caspar ([24:39](#)):

Another one that you touched on condition that seems to demystify a lot of doctors out there as fibromyalgia. What's, what's the relation of magnesium in, in helping with fibromyalgia,

Dr. James DiNicolantonio ([24:51](#)):

Particularly magnesium malate is, is the best one to actually boost magnesium levels in the skeletal muscle. And again, we need magnesium to make sure that calcium isn't basically overloaded in the skeletal muscle. And when you start overloading calcium, you can start getting muscle pain and that can lead to things like, quote unquote, we're thinking it's fibromyalgia, but actually studies have shown that 90% of patients with fibromyalgia may either be cell deficient or magnesium deficient, and typically getting one or the other can dramatically improve fibrile myalgic pain.

Caspar ([25:24](#)):

Yeah, it's interesting when you talk about, you know, the skeletal system, you usually focus on the calcium there, right? When you're looking at things like osteoporosis and perimenopause, menopausal women, you know, that's a big one to focus on. We've really taken that, hey, it's calcium deficiency, but 60% of all magnesium is in the bones, right? Yeah. And it's so essential. Can you talk about why magnesium and not just calcium is so important? When we look at our skeletal system,

Dr. James DiNicolantonio ([25:52](#)):

Like you said, the majority of magnesium is stored in our bones. We use it as our last resort when we need it. So if our blood levels are going down, we'll start breaking down bone. Our osteoclast, our cells will break down bone to get that magnesium to try to keep it at a normal level so we don't have an cardiac arrhythmia and die. So it is that reservoir and, and throughout our life we are trying to store it, but by the time we're 50, half of the magnesium in our skeletal system has been depleted on average. So we have less and less and less magnesium to draw from when we're deficient now. And so magnesium is required

to activate vitamin D and it's the active form of vitamin D that absorbs calcium in the diet. So if you wanna be able to absorb the calcium, you gotta have good magnesium to activate vitamin D. And then the magnesium plus the vitamin K2, helps to drive calcium where it needs to go away from the arteries and into the bones. And so the, like you said, we've been focusing on calcium and a little bit of vitamin D, but you can't even activate vitamin D without magnesium. Yeah. And so it's a very key mineral when it comes to bone health.

Caspar ([27:00](#)):

Yeah, I saw your post on that in vitamin D, if you don't have the magnesium, the vitamin D's worthless. Right. And that, that, that would go also if, if you are outdoors producing vitamin D in the sunshine and everything, you have to still look at your magnesium levels K2 levels and understand that relation. Right. So if, would it be your recommendation if you're taking vitamin D, let's say we're getting into these you know, this time of the year in the northern hemisphere where you're not gonna be as much outside and producing that within the sunlight. So you may switch to a vitamin D supplement, but would you say absolutely, take that with a magnesium supplement? K2 has to be with the vitamin D? Is, is that something you're pushing for there?

Dr. James DiNicolantonio ([27:41](#)):

100% because it's well known that magnesium deficiency leads to vitamin D resistant rickets. In other words, vitamin D will not work if you are deficient in magnesium because of that. And so it's, I like to take vitamin D and K with fat typically during the day, and then magnesium can be taken either during the day or at night, depending. Some people get energy from it, I get energy from it. Some people actually get sleepy. So you gotta kind of test that out. But magnesium is funny. You wanna make sure to avoid fiber and a lot of fat around the time you take it because both fat and fiber can bind magnesium and decrease its absorption. And here's, here's the real interesting part that when I was researching for the book that came to light is that all the high magnesium foods, nuts, seeds, dark chocolate, greens, beans, all these high fiber foods, yes they are high in magnesium, but their bioavailability is so low that when we look at individuals on high fiber diets, they can actually be a negative magnesium balance, even consuming 500 milligrams of magnesium per day. And so you have to be really careful consuming these quote unquote high magnesium foods because the fi, the fiber and the phytic acid dramatically reduces the magnesium that's absorbed. So really the best sources of magnesium from food would be shellfish.

Caspar ([29:00](#)):

Mm-Hmm. <affirmative>

Dr. James DiNicolantonio ([29:01](#)):

Seafood, meat, and avocados. Those are really good bioavailable sources of magnesium.

Caspar ([29:09](#)):

And you, you, you brought this up also, it's like those plant-based you know sources of magnesium, they're, they're not what they used to be because the soil is so depleted. Right? So even though they, they are the magne, they're not as bioavailable, they're losing magnesium. And a lot of that is due to how we're farming, regenerative farm, you know, depleting our soil. Right? So

Dr. James DiNicolantonio ([29:32](#)):

You

Caspar ([29:33](#)):

Is is the best diet here, a balanced one that's going to have that still, but has that source of animal, source of magnesium within also?

Dr. James DiNicolantonio ([29:42](#)):

Yeah, I think that's a, that's a great way to put it. Basically, yes, animal foods have been depleted by about 20% in magnesium, but the plant foods have been depleted by about 40%. Yeah. So you've, you've lost twice as much in the plants as compared to the animal. 'Cause the animal's still gonna saturate it. It might take more food, more plants for it to saturate the magnesium in its flesh, but it's still gonna do that. Whereas the plant, we grow it so quick for high yield, it has less time to take up the magnesium in the crop itself. And then the fertilize, the chemical fertilizers that we use prevent the magnesium from being taken up from the crop. And so yeah, you're right, plants, they're not what they used to be either.

Caspar ([30:19](#)):

Yeah. And unfortunately the standard American diet doesn't really put a focus on that as well. We eat so much processed food. You talk about refined sugars, you know, when when you have that standard American diet that's gonna be processed food, refined sugars in it, how, how is that impacting our magnesium levels?

Dr. James DiNicolantonio ([30:37](#)):

So when you refine molasses into pure white sugar, you've lost all of the magnesium. So like the thick brown molasses actually does have a decent amount of magnesium in it, but by the time it gets to the table, or by the time it's put into a processed food, it's that pure white crystal in sugar, or it's high fructose corn syrup. It has literally no magnesium in it. And then it is taxing your magnesium status from the perspective of spiking your blood glucose, increasing insulin kicking out magnesium in the urine. So it's a magnesium depleter. When you overeat sugar, it will deplete your magnesium levels. And, you know, refinement of rice, refinement of grains typically causes us to lose, you know, 80 to 90% of the magnesium in that food.

Caspar ([31:18](#)):

Now if, if people are looking at the specific diets, we're talking about balanced diets, but people like their specifics. They like their keto, they like their paleo, they like their vegan. Is there a certain diet within those more niche ones that is more prevalent to increasing magnesium levels rather than depleting?

Dr. James DiNicolantonio ([31:37](#)):

Yes. So I would say basically you don't necessarily wanna be on a strict carnivore diet. Mm-Hmm. <Affirmative>. Because when we metabolize sulfur containing amino acids, cystine and methionine, which are very high in animal foods, when the liver oxidizes that it forms sulfuric acid and then it basically releases hydrogen ions or that, that's what makes our body acidic. And that low grade acidosis which I, I published two review papers on, can actually lead to magnesium deficiency. So you wanna somehow offset the acid load of animal foods. I still, I consume an animal-based diet, so I get most of my nutrition from animal foods, probably 80% of my calories. You wanna still offset that acid load. That doesn't mean you have to consume plants. You can, you can consume low oxalate fruits or vegetables to offset it, or you can consume bicarbonate supplements or citrate supplements or bicarbonate mineral waters. So however you wanna offset that acid load, you do wanna do that though, from the perspective of not increasing the acid in the body, breaking down the bone and losing magnesium.

Caspar ([32:42](#)):

One of the things I read in the book as well was this relation of aluminum, whether found in foods or just in everyday products and how that depletes magnesium. Can you talk about that?

Dr. James DiNicolantonio ([32:53](#)):

Yep. So heavy metals will also basically reduce the absorption of magnesium in the diet. And so you have aluminum as a heavy metal and that's probably the most prevalent when we do hair analysis. Aluminum comes up as one of the most prevalent heavy metals. But mercury too is a problem. Cadmium is actually a very big problem as well, particularly for the kidneys. And all three of those can kind of inhibit magnesium. They also increase your need for it because they're gonna increase inflammation. And of course when that happens, you know, you need more magnesium as well. So what's interesting is minerals are one of your kind of, you know, best ways to reduce the absorption of heavy metals. 'cause They, they compete with each other. And so having a high mineral diet sort of helps reduce how much heavy metals you actually absorb.

Caspar ([33:40](#)):

Yeah. Now for many people, you know, there, there's this issue of obesity, of course, right? World Health Organization, more than 1.9 billion or overweight, 650 million obese. That's probably under reported there. But, you know, while big pharma searches for solutions in ozempic and other drugs, you know, should we be looking within the obesity factor at the levels of magnesium we're consuming?

Dr. James DiNicolantonio ([34:04](#)):

100. Yeah, 100%. Because most people who are obese, the cell is insulin resistant. It doesn't wanna take, it doesn't want to take up more fat. It's already overloaded in fat. So it's, most obese people are releasing a ton of free fatty acids in the blood because the cell can't take up any more fat. And all those free fatty acids that we, I had mentioned in the beginning of our podcast here was are negatively charged and will bind the magnesium and it activates the blood, the blood magnesium, which is really, I mean, that was probably one of the most eye-opening things that I've learned is that when you are insulin resistant or overweight, the release of those free fatty acids in the bloodstream is just depleting you of active ionized magnesium. And that's a big problem.

Caspar ([34:44](#)):

Yeah. So if, if you are on a diet trying to reduce your weight, magnesium should be up there as something you're supplementing.

Dr. James DiNicolantonio ([34:53](#)):

Yes, for sure.

Caspar ([34:55](#)):

Yeah. So let's talk about the different forms. 'Cause this is where I, I get the most questions, right? Like what's the best one? And, and you know, you wrote not all magnesium supplements are created equal, the market's flooded with different types of magnesium, each with distinct strengths, weaknesses, specific uses. So let's get into 'em a little bit. I'm just gonna go through the list and maybe you could just tell me, all right, here's what they do. Yeah. Magnesium hydroxide.

Dr. James DiNicolantonio ([35:21](#)):

Yep. Magnesium hydroxide kind of, we like to use that as, you know, an anac acid too. So it's, it, you know, helps with magnesium status, but it's, it also can be used as an antacid. It, it doesn't have a lot of clinical studies to it, but it's a decent magnesium form.

Caspar ([35:36](#)):

Okay. Now, magnesium chloride, that's like things you find in seawater right from the Dead Sea and everything. How does that work?

Dr. James DiNicolantonio ([35:42](#)):

Yep, yep. So magnesium chloride is gonna help with stomach acid production. We need the chloride to actually secrete hydrochloric acid. And some people do, especially as we age, our stomach acid decreases how much we secrete and thus we can't break down the food very well. So, you know, magnesium chloride's probably a better one for someone who has low stomach acid,

Caspar ([36:02](#)):

Magnesium citrate

Dr. James DiNicolantonio ([36:04](#)):

Citrate is good. A very bioavailable at lower doses. As you increase the dose, when you start getting to the 300, 400 milligram or higher dose, you're gonna start getting that laxative effect. So if you do suffer constipation, citrate is kind of like a go-to at those higher doses.

Caspar ([36:21](#)):

Isn't that similar also for magnesium malate, that that that can also produce a kind of laxative effect?

Dr. James DiNicolantonio ([36:28](#)):

Malate is actually very bioavailable doesn't typically have a, a big laxative effect. It's, it's, what's interesting about malate is it's the most bioavailable magnesium when we look at the animal studies into the muscle, into the skeletal muscle. So good for things like, you know, muscular pains. And what's interesting about malate is that the brain bioavailable magnesiums, which there's two of them, the magnesium threonate, l-threonate mm- Hmm <affirmative> and acetyl-taurinate, those are the only two that really have good brain bio availabilities. They seem to deplete though, even though they boost the brain, they deplete the muscle magnesium a little bit. 'Cause they start kind of pulling the magnesium away from the muscle and into the brain. So taking malate with a, a cognitive one, like threonate or acetyl-taurinate is probably a good idea.

Caspar ([37:16](#)):

Yeah. I know that it's in a number of supplements as like an additional one. Usually like a malate version. Another one you see is, is a glycinate. What would that be more used for?

Dr. James DiNicolantonio ([37:27](#)):

Yeah, GA lot of people like the, either the bisglycinate or glycinate for sleep and, and calming effect. Because there is some glycine in there, it's not a whole lot. You might get somewhere between 300 and 600 milligrams of glycine, but for some people that's enough to have that calming effect. So typically that is the one that's used for sleep.

Caspar ([37:47](#)):

Now magnesium taurate.

Dr. James DiNicolantonio ([37:49](#)):

Yep. Taurate so you, I had mentioned magnesium, acetyl-taurate or acetyl-taurinate, you know, they're used interchangeably. It's the acetylation of the taurate that allows it to be bioavailable in the brain when you don't acetylate and it's just magnesium taurate, then that one is good for the heart, blood pressure, et cetera.

Caspar ([38:11](#)):

What about orotate?

Dr. James DiNicolantonio ([38:14](#)):

Orotate's really interesting. It has a very, very low elemental magnesium content, but you're getting this benefit of orate acid which it acts as a basically long sustained version of beta alanine. Because how the liver converts orotate it's basically a way to avoid the pins and needles of taking beta alanine to improve athletic performance. You can take magnesium orotate very good for athletic performance. High doses have been used in heart failure patients showing improvements in overall survival. Typically they used 3,000, they used I think 6,000 milligrams for the first like one to three months, and then they dropped it to 3,000 milligrams of magnesium orotate, which may sound like a lot, but it's not a whole lot of elemental magnesium in that 3,000 milligrams because I think 80% of it or so is actually orotic acid.

Caspar ([39:04](#)):

Mm-Hmm. And this one's probably like the, the newer sexier one, even though it's not newer, but l-threonate, like a lot of, you know, supplement companies that are out kind of gearing in on that. Why is that?

Dr. James DiNicolantonio ([39:15](#)):

Yeah, so basically it has the most research in regards to cognitive benefits in people with cognitive impairment or actually moderate Alzheimer's patients. So it has the most studies. I've taken both, I've taken both threonate and acetyl-taurinate. And I actually get better sleep with the acetyl-taurinate. The threonate gave me some pretty wicked nightmares in in Oh yeah, <laugh>. So I, I remember waking up one night kind of like screaming, you know, 'cause it like <laugh> like you feel like it's real. So you kind of gotta test these things out and kind of see how they affect you.

Caspar ([39:48](#)):

Yeah, it's interesting. I, I remember being sent a supplement from a company that was a GABA, like it was topical and just put a bunch like on, you know, and just had like the worst dream like nightmares, right? <Laugh> just was like, nope. Like, and they tell you like, you will dream vividly. And it's like, somehow it just took me to the nightmare stuff where I'm just waking up like not doing that. Again, not knocking GABA or this company at all, it's just you gotta test these products on yourself like Right. They, they're all gonna interact differently with different people. There is no one size fits all. This is the best for that. Correct?

Dr. James DiNicolantonio ([40:22](#)):

Exactly. Yep.

Caspar ([40:24](#)):

Now if we go into the a, a different form that a lot of people use, you know, Epsom salts right there, there's, there's different ones. And I remember speaking with Max Casa who does a lot of float tanks and he talked about the different magnesiums you use aside from Epson salt. But if you're looking just for

that, let's say relaxation and muscular benefit of soreness and everything, what's the best type is, is Epsom salt the go-to, are there other magnesiums you'd look at?

Dr. James DiNicolantonio ([40:50](#)):

Yeah, no, the magnesium sulfate, which you're referring to as Epsom salts is the most studied. It basically you just dump those salts in a hot bath. And because there's local topical effects when you put either magnesium directly on the skin or you dissolve it in water, so it can help with the muscles, it can help with the, basically the look of the skin, the, you know, basically, you know, how, how you know how firm your skin looks, et cetera. But it cannot boost magnesium levels in the body. So this is a common misconception. People think, oh, you know, I'll just take a topical. And a lot of companies are promoting topical magnesium as a way to boost your magnesium levels in the blood. And unfortunately we don't absorb minerals through the skin. If we did every time we went into the ocean, we would die from salt overload and magnesium overload just doesn't happen that way. So you can get local muscular benefits from topical magnesium, but you will not boost your magnesium status by doing that.

Caspar ([41:48](#)):

That's interesting. You know, there are a lot of companies that, that go that direction of topically, right. With magnesium. And so it's more for just generalized topical relief and localized relief. Correct?

Dr. James DiNicolantonio ([41:59](#)):

Exactly. Yeah.

Caspar ([42:00](#)):

Yeah. Now when we get into different forms, also, I, I know there's ionic forms of magnesium. Sometimes you take drops of it, it's very like low form trace minerals. They do this with, I've seen. What are your thoughts on the ionic magnesium supplements?

Dr. James DiNicolantonio ([42:15](#)):

I've taken some of those and I, for some reason I ha it just pulls the water right out of my, like I instantly have a laxative effect from that type of magnesium. So I tend to to avoid that. So it is like we had just talked about, kind of like test these things out and see what works for you.

Caspar ([42:33](#)):

Now, if there was like a default form that you're just gonna say, okay, like if you just wanna raise your magnesium levels, you, you're not that defined in let's say athletic perform anything else, would there be a form you'd recommend just to start with and try?

Dr. James DiNicolantonio ([42:46](#)):

Yeah, the two most common forms in, in the forms that I take is, is a combo blend of glycinate and malate. I think those two are very bioavailable. They don't really have a laxative effect. They're not gonna give you crazy vivid dreams and nightmares typically. And so, and you're gonna you know, avoid some of the side effects that you can see with some of the other ones. So those two I think are really good to start with.

Caspar ([43:08](#)):

Now if, if people are listening and, and they're like, okay, there's, there's a lot here, right? That, that magnesium impacts a ton and I could take my supplements. But if we were just to recap, like what are the

three or four steps that you would do to improve that ma the magnesium levels in your body, what would you say to them?

Dr. James DiNicolantonio ([43:26](#)):

Number one, make sure you're getting a good amount of animal foods in the diet. Don't eat too much high fiber because then your magnesium requirement could go over 500 milligrams per day just to stay in balance. If you can try to drink some water that contains magnesium, whether it's, you know, a natural spring water or a mineralized water, that's a good non calorie way to get magnesium in the body. And most people are lacking anywhere between 150 to 300 milligrams of magnesium. So taking about a hundred to 150 milligrams of magnesium twice a day is probably a good way to just hedge your bets to ensure that you're at least not in negative, you know, magnesium balance.

Caspar ([44:08](#)):

You mentioned fiber there and trying to minimize it. I feel like so much of what's out there in information about diets is like high fiber, it's good for you, it's good for gut microbiome, it's good for this, but there's, there's that other side of it, right? That you're speaking too much isn't, and I've, I've seen this with people that, that, you know, too much fiber is not necessarily good. We're told that, but it's not true. What, what is your feelings on, on that push for like a high fiber diet?

Dr. James DiNicolantonio ([44:35](#)):

Yeah, I mean, there is some data that having some fiber might help to offset a little bit of, you know, some of the harms, potential harms of animal foods. You know, speeding up the GI tracked transit times, so decreasing the time that some, some toxins may sit in the intestine, but the reality is, is you gotta try it out yourself. A lot of people that start eating high fiber foods, particularly grains, they're, they're more bloated. They're having worse diverticulitis, they're having worse cramping, et cetera. So I think it it, from the literature, it kind of looks better than what it kind of plays out in the real world.

Caspar ([45:12](#)):

Yeah. And, and it comes back a lot, I guess Dr. DiNic to the quality, right? Yeah. You're taking poor quality types of fiber sources that that's not just not gonna translate well. Right? So, you know, I know you, you espouse this as well, it's like quality matters. Don't just look at any meat as meat, right? Any animal sources that look into those things of how they are create, how they are raised and, and everything. You know, if someone's looking at animal sources again for, for increasing their magnesium, are there certain things you look for certain, you know companies or, or places that you're looking at pasture raised versus, you know, grain fed, all these things? What do you look for?

Dr. James DiNicolantonio ([45:53](#)):

I mean, the, the, the top tier is always going to be pasture raised because that means they are set to pasture and so they're grazing on fresh grass. They're getting, you know, the worms, the bugs, et cetera. Your next best spot would be 100% grass fed. So they may be just sitting inside in a barn, but they're only consuming grass, which is obviously better than consuming grains. So one of the two, ideally top tier pasture raised for eggs too. You want pasture raised? I don't, I don't ever eat non pasture raised eggs. I think that's the worst idea because it's high and omega six. And so when you start veering from that, I don't think that's a good idea. But, you know, animal foods, most of the time I try to consume pasture raised or a hundred percent grass fed. Will I consume a regular burger out every now and then? Of course. You know, so just do the best you can.

Caspar ([46:43](#)):

Yeah, yeah. No, that, that's always the best advice. It's like the most sensible, like put quality first, you know, eat, moderation, all these things. Try it out too. You know, understand that magnesium is so essential to so much and it could be part of the problem of what you're dealing with if you have health issues, but put quality first. Now you, you've touched on a number of different topics in your books, and I always ask you at the end, like, what's next? Do you have any idea of where you wanna focus to next as, as a subject for a next book?

Dr. James DiNicolantonio ([47:16](#)):

Yeah, so I mean, I I, I have a cookbook slotted that'll be coming out in six months and then after that, you know, there's probably, maybe a supplement book would be good is on my mind. Mm-Hmm. <Affirmative>, but also thiamine because thiamine and Vitamin B1 and magnesium have this very good interconnection where basically if magnesium is required to, you know, activate B1 and there's this really good kind of interconnection between the two, I would love to do it. It's just, I don't know if anyone would be that interested. So do I really sit down again and just write a book on one nutrient? It's a, it's a, it's a pretty big task to do.

Caspar ([47:53](#)):

It is people don't know, like I would be super interested, so you at least got one person with their hand up voting for that. It was something we looked at a lot when we were like creating something, looking at, you know, combining things together. And it was, you know, looking at glycine, thiamine you know magnesium as well. Like, there's the interaction and synergies of it all that people need to know about and it's, it's often overlooked. And I think a big portion of it too is people wanna find the one thing, right, that that's going to be the best. Like that one magnesium source that just does it all and that's never the case. So I would love to see a book like that, but I'd also love to see a supplement book and everything else. So thank you so much for coming on again. Seventh time on here. I mean, you, you just knock out these books and they are so informative. Where can people pick up this one? Magnesium, the Missing Minerals, as well as just connect with you?

Dr. James DiNicolantonio ([48:45](#)):

Yeah, most active on Instagram at drjamesdinic and also my website, drjamesdinic.com. And then the book is available on Amazon for magazine.

Caspar ([48:54](#)):

Yeah. Awesome job. Keep it up. Looking forward to the next one having you on. I feel like we'll be doing this. You'll be on your like 50th like time on the show very soon. We might be a little older, but hopefully still just as healthy, just a little bit wiser. But thank you again, Dr. DiNic for coming on. All the best you. Thanks for coming. And if you're listening, be sure to visit Dr. DiNicolantonio's website. That's drjamesdinic.com and go check out the book on Amazon. We'll be including links and ins to his Instagram. I'll receive social media channels in the show notes. Until next time, continue writing your own healing story.