

# **WIN: Using Hydration Strategically to Boost Performance A Special Interview With James DiNicolantonio, PharmD, and Siim Land**

**By Dr. Joseph Mercola**

**Dr. Joseph Mercola:**

Welcome, everyone. Dr. Mercola, helping you take control of your health, and today we're going to take a little tangent and go back into health, rather than the COVID-19. Although, of course, there's going to be a connection, because if you are healthy, you're going to be more resistant to COVID-19. Our guests today are previous guests, Dr. James DiNicolantonio, who I actually wrote a book with. I think I did, didn't we?

**James DiNicolantonio:**

Yep, "Superfuel."

**Dr. Joseph Mercola:**

"Superfuel," that was it, yeah. So after 17 books, it becomes a little murky. And they've written a new book called "WIN: Achieve Peak Athletic Performance, Optimize Recovery and Become a Champion," and Siim Land, who has been a guest multiple episodes previously. They've written three books together. This is their third book together. The first book we interviewed them on was "The Immunity Fix," and then followed up with "The Mineral Fix," although we didn't interview that one because I thought it was too much of a reference textbook, like almost like an encyclopedia. But this new book, "WIN," is the practical how-to guide of "The Mineral Fix," in my view. Lots of good, powerful, simple strategies for exercise.

**Dr. Joseph Mercola:**

Let me just give my little perspective on exercise and then we'll dive in, because you've got a lot to share, especially you, James, about hydration. This is probably the best book ever written on hydration, more than likely, so you've done a phenomenal job. But before we dive into hydration, I just want to give the reason why I think this book is also so important, because it focuses on – a big part of it is on exercise and movement. You've got, in my view, and I'm biased and prejudiced, I think once – especially after you hit 40, 50 and certainly 60, if you're not engaging in a regular exercise program, you are heading for catastrophe. You're heading for frailty and sarcopenia and a miserable, and I mean miserable-on-steroids existence. To not be able to engage in anything you could do when you were younger, is beyond – not disappointing. It's just indescribable. You do not want to be there.

**Dr. Joseph Mercola:**

So the only solution, there is no magic pill for it. You've got to engage in regular movement and exercise. If you are committed to that program of exercise to impact your health positively, then I would strongly encourage you to put this as one of your key books in your reference library, because it's a really great tool to have the knowledge in here so that you can apply it for your exercise, and succeed and prevent some of the complications, so strongly, strongly recommend

it. So congratulations, guys. I mean, I loved the book the first time I read it. I don't endorse – I mean, you've been on previously, but the last book you wrote I didn't think was so great, so I didn't have you on for it because, but this one is. This one is good.

**Dr. Joseph Mercola:**

So oh gosh, I've got one big question for both of you before we engage in the hydration, which I think is going to consist of the majority of this interview. But the book – and either of you can answer, but both of you should, relates – because I don't think it was addressed well in the book. It's the issue of ingesting calories before exercise. It's clear that if you – I admit, there's a lot of controversy on this, and many experts believe that you should have carbs and protein before you work out because you'll be able to work out stronger. But so that's one point. The other side, and this is what I'd like you to respond to, is that – and Siim has, his first book, “Metabolic Autophagy,” was beyond brilliant. It was really one of the best books I ever read.

**Dr. Joseph Mercola:**

He dives really – and if you don't have that book, you need to pick that up. But “Metabolic Autophagy” goes deep into the biochemistry of why autophagy is so important. In my view, if you're going to engage in a regular exercise program, you're going to want to exercise fasting, to maximize those autophagy benefits. So can both of you respond to that primary question of, “When should we exercise? What time?” I mean, obviously you can exercise better if it's in the afternoon, but if you're going to exercise fasting in the morning, I think you're going to maximize autophagy benefits. So, why don't you give us your opinion on that?

**James DiNicolantonio:**

I think it's important to train both in a fasted state, as well as loading with complex carbs about an hour before at least vigorous exercise. The reason is, is you want metabolic adaptations for both systems, one utilizing fat for fuel in a fasted state, and also the ability to utilize glucose. Essentially, if you're exercising in a fasted state your body's going to be better at utilizing fat for fuel, and it's going to help spare glycogen, which is important for anaerobic performance. So basically, training in a fasted state actually not only helps you from the perspective of basically moderate-intensity exercise, but it will actually help more vigorous exercise performance as well through sparing of glycogen, because you're able to utilize the fat for fuel better, and you're probably going to burn fat better in a fasted state as well.

**James DiNicolantonio:**

But the data is very clear that if you are performing at a vigorous pace, essentially 70% VO2 max or higher, preloading with about 50 grams of complex carbs is absolutely going to help preserve muscle glycogen levels and improve performance, both from an endurance but as well as like a peak power output standpoint.

**Siim Land:**

Yeah, and I think it also depends on the goal. Because like you said, there's different ways to train and lots of different reasons to do that as well. Like let's say for an athlete, it does make a lot more sense to have some carbs and food in their system because arguably their performance will be just better. If they are competing in something, then they need to also train at least near

peak performance all the time, to a certain extent, to be able to also perform at competition. So it wouldn't make sense to let's say go to the Olympics in a fasting state or something like that.

**Dr. Joseph Mercola:**

Sure, sure, sure.

**Siim Land:**

So yeah, say an average person, I know of course there are some merit also to training periodically in a fasting state or a low-glycogen state to build up this metabolic flexibility and adaptation. But from a progressive overload perspective, which means that you actually get better over time, and get stronger or faster, whatever the sport is, then you will need to at least have some food or some calories, at least, in some shape or form to help you to push yourself further. There are some cases, let's say easier exercise sessions like if you're doing mobility exercises or just regular cardio, hiking, those kind of things, very low-intensity cardiovascular exercise, then in that case even high-level athletes could train in a fasting state. But let's say yeah, more like glycolytic sports, bodybuilding, strength training, weightlifting, CrossFit, whatever, it would be better for just the performance side to have some calories beforehand.

**Dr. Joseph Mercola:**

Okay, so I disagree a bit because, but I think the answers are brilliant, because it does really target it to the individual. So if you're young like you, Siim, and you're competing and you're active, and especially if you're in a competition, you're going to need to pump up the glycogen reserves in your muscle. Otherwise, you're not going to be performing as well. But if you're beyond those years, and you're not interested in competing in any way, shape or form except for the Centenarian Olympics, to be able to compete and do all the things you were doing at 20 when you're 100 years old, then I think you're really going to want to pay a lot more close attention to autophagy, the repair and regeneration of everything that goes on. There's nothing that depletes glycogen from your muscles more effectively than exercising in a fasting state. I mean, you're going to just maximally upregulate autophagy when you do that, which is why I almost exclusively – because you know, I'm approaching 70.

**Siim Land:**

Yeah, but well the thing is also we don't know what – we do know that exercise and fasting, both of them increase autophagy. We didn't know whether or not exercising – well, I would imagine that exercising in a fed state also increases autophagy. Maybe you get a bit less, but there is still some upregulation of autophagy that occurs in that state, especially because of exercise. So exercise is still a very powerful stimulant. And if you were, let's say, if you were able to train harder, for example, then your maybe also intensity is higher, then you're able to reach autophagy faster in that sense as well.

**Dr. Joseph Mercola:**

Yes, a mixed bag.

**Siim Land:**

But there are also benefits. What I do is I do have some workouts fasted, but I do have a lot of times when I have some calories in my system. I personally do like a protein shake, which is easier to digest, I think. But like I say, exercising always in a fasting state can also lead to a muscle catabolism, and that can also be harmful for let's say the elderly. So even for the elderly, it can be somewhat good to periodically at least have some calories in their system, especially like amino acids in their bloodstream, during the exercise to help to prevent this muscle catabolism.

**Dr. Joseph Mercola:**

So along those lines, one of the things you want to do when you're exercising is to activate mTOR. A precursor and the best way to do that is – well, not the best but one way to do that is branched-chain aminos, specifically leucine, isoleucine and valine. One of the metabolic byproducts of leucine as I understand it is hydroxymethylbutyrate, also known as HMB. So what are your views on taking HMB pre- or post-workout?

**James DiNicolantonio:**

There's some evidence, particularly in catabolic states, that HMB may be beneficial. I think the jury's still out. I mean, some of the studies show dramatic improvements in muscle gains utilizing it, but I think the evidence is pretty controversial. So I think personally, I can't necessarily recommend it outside of really low-caloric intake states to help preserve muscle mass.

**Dr. Joseph Mercola:**

Yeah.

**Siim Land:**

Yeah, I agree and I think the use case would be, yeah, like in more sarcopenic conditions like the elderly, or in low-calorie states or low-protein diets, they may have more particular benefits. But if you're getting enough protein in your diet, then you probably don't need it.

**Dr. Joseph Mercola:**

Yeah, I definitely want to talk about protein levels, because you do a really good job of describing those, too. I think a lot of people are confused about this, so we want to talk about that after the hydration. So let's skip back to what I believe is the highlight and really the premiere content in the book, is the exploration of using hydration as a very powerful tool to optimize your health and workout. So James, why don't you lead it off since you did most of the work on that part?

**James DiNicolantonio:**

Sure. So basically hydration and how you want to hydrate is similar to what we were just talking about in regards to what you want to do with different ways. One, in regards to boosting performance acutely is going to be different. Your hydration strategy is going to be different, versus getting gains later on. And so really if you're in a training camp, you always want to make sure you're coming in [[crosstalk 00:11:36](#)]-

**Dr. Joseph Mercola:**

Well, what do you mean by training camp [crosstalk 00:11:38]?

**James DiNicolantonio:**

Like if you're a high-competitive athlete and you are essentially basically training three months out before competition, so you have a while. You have a while to train to actually get better gains later on, then you want to practice something called dehydration acclimation. Because it's multiple sessions of dehydration that will lead to adaptations where you will get expansion of baseline blood volume and all these other adaptations, where you're actually performing better later on. Your training may suffer a little bit performing dehydration acclimation, and I can talk about the strategies on how to do that. And then you simply rehydrate after the workout, and you get those metabolic adaptations.

**James DiNicolantonio:**

And then before a performance or competition, you do basically salt-loading with high doses of salt and fluids about 90 minutes prior. That's going to dramatically boost blood volume and increase performance. But you don't always want to use high doses of salt because you want adaptations to be in a, let's say, dehydrated state. So there's really three ways to hydrate. If you don't feel like you have a lot of energy before a training camp, you probably want to take 1,000 to 2,000 milligrams of sodium and about 10 to 20 ounces of fluid respectively, just to get basically a blood volume expansion of about 3% so you can train fairly well. The goal then is to actually lose about 1.5% to 2.5% of your body weight through sweat, which will induce mild dehydration. And then you do that multiple times and you get dehydration acclimation-

**Dr. Joseph Mercola:**

Well, so excuse me. When you're making the recommendations of milligrams of sodium, it would help I think if you translated that into teaspoons or quarter teaspoons of salt.

**James DiNicolantonio:**

Sure. So basically 1,000 milligrams of sodium is just under a half a teaspoon of salt. So we're talking about a half a teaspoon to maybe a full teaspoon of salt, with 10 to 20 ounces of fluid. If you have low energy that will definitely help to make sure you at least have a good training session, but you still will be able to induce likely mild dehydration and then get all the acclimation benefits after that. Now, that's going to expand between 1,000 and 2,000 milligrams of sodium in 10 to 20 ounces of fluid, that's only going to expand blood volume maybe three to 4%. You really, if you want to acutely boost performance dramatically, you want to get 8% to 10% increases in blood volume. Because the blood volume drops within five minutes of vigorous exercise, by about 8% to 10%, because blood flows away from the heart towards working skeletal muscle.

**James DiNicolantonio:**

So there's a relative drop of blood volume feeding the heart by 8% to 10%, which is really the main linchpin decreasing athletic performance. So if you can get ahead of the problem and you can take appropriate salt solutions prior to performance, you can prevent the 8% to 10% drop in blood volume and dramatically improve performance. When I say dramatically improve performance, there's nothing better. Nothing even comes close to preloading with salt and fluids.

So, I'll give you an example. Beta-alanine can increase the time of vigorous exercise performance by a minute. Taking salt solutions can increase exercise time by anywhere from typically 10 to over 20 minutes, so it's 10 to 20 times more effective than basically your best pre-workout that's out on the market.

**Dr. Joseph Mercola:**

Yeah, I'm a huge fan of beta-alanine because it's the rate-limiting amino acid for the formation of carnosine, especially if you're a vegetarian or not eating any animal products. Because carnosine may have far other, I think more significant clinical benefits than attenuating dehydration, or athletic performance and improving athletic performance, because its major primary benefit is to serve as a sacrificial sink for these [advanced] lipoxidation endproducts (ALEs) that people get from having too many seed oils. So, I think it should be in everyone's regimen, beta-alanine.

**James DiNicolantonio:**

Yeah, I mean and advanced glycation end products (AGEs).

**Dr. Joseph Mercola:**

Yeah, AGEs too, but the ALEs I think are more significant. But yeah, especially if you're pre-diabetic like so many people are.

**James DiNicolantonio:**

Right. And one other way to actually boost carnosine levels that actually might be tolerated even better, unless you can get a delayed release or long-acting beta-alanine, is actually magnesium orotate. Orotate is actually a long-acting-

**Dr. Joseph Mercola:**

Oh? What's the mechanism?

**James DiNicolantonio:**

Orotate converts into beta-alanine, and then into carnosine in the liver.

**Dr. Joseph Mercola:**

Wow.

**James DiNicolantonio:**

So it acts like a delayed-release beta-alanine.

**Dr. Joseph Mercola:**

[inaudible 00:16:05]

**James DiNicolantonio:**

Magnesium orotate is terribly expensive, but still it's another way, if you're getting those pins and needles from beta-alanine. If you can't find a delayed release or long-acting supplement, that's one potential way around it.

**Dr. Joseph Mercola:**

Nice. Nice pearl. Very good. All right, so yeah, so you've confirmed that beta-alanine or magnesium orotate would be good, or carnosine. I mean, you could buy carnosine but it's not as cost-effective and winds up being broken down to beta-alanine anyway.

**James DiNicolantonio:**

Right. So basically taking beta-alanine to boost carnosine is sort of like taking N-acetyl cysteine, right, to boost cysteine?

**Dr. Joseph Mercola:**

Mm-hmm (affirmative).

**James DiNicolantonio:**

You're taking something that helps, that's like the precursor to it, which is better than taking the actual substance that you're trying to boost.

**Dr. Joseph Mercola:**

Yeah. Well, I would say increased glutathione might be more accurate. It's just one of the precursors of it, right?

**James DiNicolantonio:**

Well, it may increase glutathione. What it's doing is it's boosting cysteine, and then there's three amino acids to form glutathione. Whether it will go to forming glutathione or not will depend on the need of the body and how well it is able to convert it. But we're sort of kind of sidetracking, but essentially-

**Dr. Joseph Mercola:**

Yeah, I know. Sorry about that, but I mean you-

**James DiNicolantonio:**

No, no. That's fine.

**Dr. Joseph Mercola:**

You're just such a wealth of knowledge. So let's go back to the hydration, because it's so important.

**James DiNicolantonio:**

So what's really key here is that most people think plain hydration is water intake. This is sort of like what we turn basically on its head in the book, is that actually just hydrating with plain water

can actually have numerous, basically, negatives towards both types of performance, both vigorous and endurance exercise. So to give you an example, when you consume just 5 ounces of water in 15 minutes, that exceeds gastric emptying. So when you're vigorous exercising, gastric emptying dramatically goes down. So if you drink too much water, you're going to bloat the system. Water is just going to sit in the stomach, and you can actually decrease vigorous exercise performance by 2.5% just drinking water, which is what most people think is going to help them.

**James DiNicolantonio:**

And so that's the problem in vigorous exercise. In endurance exercise, drinking plain water dramatically increases hyponatremia or low sodium levels in the blood, which can kill you. So having salt in a solution is not just important for vigorous exercise, but also endurance exercise. We can sort of go into some of the details of the studies and how you should be basically formulating these solutions. But that was one key thing that when I was doing research for the book is that, "Wow. Actually drinking water can have numerous harms on the body, including increasing the risk of muscle cramps." Drinking plain water has been shown to increase the susceptibility of skeletal muscle to electrically induced muscle cramps. So again, salt and electrolytes are playing key roles here at reducing muscle cramps, especially in performance in the heat.

**Dr. Joseph Mercola:**

Yeah, I would imagine it's even exacerbated further when you're fasting.

**James DiNicolantonio:**

One hundred percent it is, because essentially what we think causes a muscle cramp is you get a basically contraction of the interstitial fluid, and you get mechanical deformation of the nerve endings, and that can induce muscle cramps. So really, you want to expand interstitial fluid, expand blood volume to reduce the risk of muscle cramps. If you get the salt solution dosing correct, it can decrease heart rate by 9 to 10 beats per minute. It can increase exercise duration by 20 to 21 minutes, which is essentially anywhere from 25% to 50% increase in how long you can exercise vigorously, which is crazy when you think about it. And, it can decrease core body temperature by three-quarters of a degree Fahrenheit because we lose water from our blood volume to dissipate heat through sweat. And so if you have more fluid, you can cool off better. You'll have better sweat rates, and that can evaporate obviously and cool you down quicker, so it keeps core body temperature lower simply by drinking salt solutions before exercise.

**Dr. Joseph Mercola:**

If we have time, we'll go into some other strategies that you address in the book that are relatively new, how to lower core body temperature and the benefits of that.

**James DiNicolantonio:**

Yeah, lowering core body temperature is super important because at a certain point, you start inhibiting enzymes that produce ATP (adenosine triphosphate), like phosphofructokinase and pyruvic kinase. They're very temperature – not just pH-sensitive, which they are too, and the acidosis inhibits those enzymes as well during vigorous exercise performance. But that also – heat will inhibit ATP-producing enzymes in the mitochondria.

**Dr. Joseph Mercola:**

So there's so many elements to the hydration. One is getting the electrolyte distribution in the water with the salt concentration, or other additives you can use to improve that. So why don't you discuss some of those, things like glycine amino acid and the importance of that, and some of these alkalizing salts, like sodium bicarb or sodium citrate, that can even further enhance the benefits of this hydration protocol.

**James DiNicolantonio:**

Sure. So you can get some benefits if you get about 2,000 milligrams of sodium per liter of fluid. That seems to be sort of the minimum threshold to get at least about a 3% to 4% increase in blood volume. But really, the top benefits are when you start hitting 3,000 to 4,300 milligrams of sodium, which is essentially like one-and-a-half to 2 teaspoons of salt basically around per liter of fluid. But when you hit those higher amounts, you can get 8% to 10% increases in blood volume and get dramatic improvements in performance. Essentially how you do this, you'll be almost matching the saltiness of your blood. This is why it works, is because your blood is 3,200 milligrams of sodium per liter. So if you get close to that, or actually slightly hypertonic, slightly saltier than that, you're going to boost blood volume the best, and you're going to absorb salt and fluids the best when you have that type of concentration.

**James DiNicolantonio:**

We actually learned this through astronauts in NASA (National Aeronautics and Space Administration). So what ended up happening decades ago was we were sending astronauts in outer space for days, and cardiac deconditioning would happen where their blood volume would dramatically drop because there's no longer gravity pulling upon that. And then upon reentry, upon entering earth's gravity, astronauts were passing out. So if you want to learn about hydration, you go to NASA because they had to figure out how to actually prevent blood volume drops upon reentry, and that's where some of the data comes from. But essentially, these astronauts basically pre-hydrate two hours prior to upon reentry into the earth's atmosphere to prevent passing out.

**James DiNicolantonio:**

And so basically, that's almost what you do during exercise. You start drinking these salt solutions 90 minutes prior, and you slowly drink them over about 30 minutes. One of the key here is you don't want glucose in the solution. Glucose will actually increase diuresis and dehydrate you compared to just plain salt and fluids. And then adding glycine, which is an amino acid, is much better than adding glucose because glycine can actually help drive and increase sodium's absorption into the intestine, and it decreases core body temperature. That's how it helps you fall asleep better. So, and the third benefit of glycine is that it's an inhibitory neurotransmitter and probably helps reduce muscle cramps. So you're kind of killing three birds with one stone when you take glycine with these salt solutions, and again it's going to help in both regular, ambient temperature and in the heat.

**Dr. Joseph Mercola:**

I did not realize that glycine inhibited muscle cramps. Did you mention that in the book? If you did, I missed it.

**James DiNicolantonio:**

So actually, I did mention that in the book how we think pickle juice works so quickly, right?

**Dr. Joseph Mercola:**

Oh, that's right, yes.

**James DiNicolantonio:**

There's been two studies showing that pickle juice, at about 2 and a half ounces, can abort a muscle cramp within 30 to 90 seconds. It can't be due to volume expansion and interstitial fluid expansion. It would never happen that quick. It's the acetic acid in the pickle juice we think that releases glycine, and that basically aborts a muscle cramp. Now, we would still need confirmatory studies to prove this. You really want to basically – you'd have to use animal models to do that. But essentially, that's theoretically how we think pickle juice works so quickly.

**Dr. Joseph Mercola:**

Yeah, well, that is a definite pearl from watching this video for sure, because muscle cramps are the worst. Most all of us have had them, and we don't want to get them again. So if you have a tendency to get those, either use glycine and/or pickle juice.

**James DiNicolantonio:**

Absolutely. I mean the reason is, is we lose salt in our sweat at a tremendous rate. The average sodium loss per liter of sweat is 1,200 milligrams, and that can dramatically go up depending on the person and depending how hot it is. And so if you're constantly sweating out salts, and you're taking caffeine, which is a huge salt-waster. Four cups of coffee causes you to lose a half a teaspoon of salt, then you can quickly become salt-depleted and that can induce muscle cramps and lead to over-training syndrome.

**Dr. Joseph Mercola:**

Yeah, I think I neglected to mention on the intro that you're most famously noted for your first book, which is “The Salt Fix,” so you clearly are expert on the literature with salt and sodium.

**James DiNicolantonio:**

Yeah, I think I try to translate – a lot of “The Salt Fix” was more focused on diets and cardiovascular effects, and then basically took a lot of that research and then translated it to athletic performance. But like you said, if we should be exercising to grow new mitochondria and to improve mitophagy, then automatically we're going to need more salt. In fact, if you exercise one hour a day, balance studies show you need 5,000 milligrams of sodium just to remain not only in salt balance, but salt controls magnesium and calcium. Because if you don't have enough salt, the body will pull sodium from bone to maintain a normal blood level, but it also pulls magnesium and calcium. So if you don't get enough salt, it can actually lead to negative magnesium and calcium balance, so all these electrolytes are highly interconnected.

**Dr. Joseph Mercola:**

So I'm particularly curious, as I opened up with the question about, should you exercise fasting or with food? I'm wondering if the benefits of the proper hydration protocol that you just described would favorably boost the exercise enough for a person – or if it's even been looked at. I don't know, but I'm curious as to what your guess is – the difference between someone who's fasting and with a hydration protocol, versus who's repleted with food and no hydration protocol.

**Siim Land:**

That's an interesting question.

**James DiNicolantonio:**

Yeah, I'm not sure if I'm 100% following. But essentially, the more, basically – or the less you have on board regarding electrolytes, regarding calories, regarding carbs, you're going to get more metabolic adaptations later on. Your training will suffer at that point, but as long as you rehydrate afterwards appropriately, then you're actually going to get better gains later on. So how you want to rehydrate, and there's a simple calculation to do this, is if you lose on average 1,200 milligrams of sodium, which is a half a teaspoon of salt per liter of fluid, you simply weigh yourself before and after training sessions. One liter of fluid is 1 kilogram. If you lose a full kilogram through sweat, you want to make sure you're replacing that 1,200 milligrams of sodium back that you lost, which is the average loss of sodium per liter of fluid loss.

**Dr. Joseph Mercola:**

Okay, so actually the question was a little bit different, though. That's good to know about the rehydration protocol. That's useful information. But the question – Siim, you got it, did you? You understood it, right?

**Siim Land:**

I think, yeah, like the – personally, I do think that hydration and electrolytes are more let's say paramount to just overall muscle function and performance. So that if you're, let's say you're getting a muscle cramp, then it doesn't matter how many calories you have on board, or how many carbohydrates. So I think that the electrolytes are more important, and being in a fasted state isn't going to be that big of a detriment to your performance, especially if you're used to it, or if you're fat-adapted and you're used to training fasted, then it will have a slightly less of a negative effect compared to someone who hasn't done that at all.

**Siim Land:**

It also depends on, how long have you been fasting for. If you've been fasting for only like less than 16 hours, then it probably doesn't have any serious or negative effect. The hydration protocol could be at least equally as good as just eating the food beforehand and not hydrating properly. So at least I would imagine they would be equal, but if we're talking about let's say a longer fast, maybe 24 hours or 48 hours, then probably the food will be still better in that scenario.

**Dr. Joseph Mercola:**

Okay. Yeah, that's the point is that it seems like it's the perfect addition if you want to persist in exercising fasted, which I still think is a good strategy if you're elderly. But to enhance your

performance and allow your body to do more work to get the exercise gains, you integrate this hydration protocol which is – so, why don't you go over the hydration protocol again? Because it's so, so important. And talk about the sodium bicarb and sodium citrate, too.

**James DiNicolantonio:**

Sure. So if the protocol is to improve performance later on, it's essentially just drinking when you're thirsty. Because that will leave you mildly dehydrated, and the goal would be to drop body weight through sweat loss of about 1.5% to 2.5% after you're training. And then you do that multiple times, and you become dehydrated acclimated, and you get all the benefits of that, like a better baseline blood volume, better sweat rates, better ability to cool off. You lose less electrolytes through sweat, as well, when you become dehydrated acclimated. Basically when you have a more dilute sweat, it evaporates faster and you literally become a better cooling machine. This is how heat acclimation through sauna sessions works as well. There's numerous metabolic adaptations, and then you simply rehydrate using that formula of 1,200 milligrams of sodium per liter of fluid lost during your training.

**James DiNicolantonio:**

If you're looking to acutely boost performance, then you want to drink about 3,000 to 4,300 milligrams of sodium in anywhere from 26 ounces to a full liter, respectively. You start drinking those solutions 90 minutes before competition or before exercise, and you slowly drink those fluids over 30 to 60 minutes. You can add about 4 to 6 grams of glycine to improve the absorption of the sodium and to decrease core body temperature.

**Dr. Joseph Mercola:**

So how long have you been doing this for increasing performance?

**James DiNicolantonio:**

I've probably been doing this for about a year.

**Dr. Joseph Mercola:**

What have you noticed? What have you noticed?

**James DiNicolantonio:**

Oh, my gosh. I mean, this doesn't just translate to endurance performance. Power output is dramatically increased. If you lift heavy weights, preload with salt and fluids and see how much more you can lift and how much longer you can go [[crosstalk 00:31:29](#)].

**Dr. Joseph Mercola:**

What have you noticed? What have you noticed? What have you noticed?

**James DiNicolantonio:**

Yeah, I've noticed very similarly to what occurs in the studies, anywhere from a 25% to 50% increase in how long I can vigorously exercise, but also increases in dramatic reductions in feeling dizzy, and being able to do more reps, and increases in power output as well. So I'll

actually cite a good study that showed that salt solutions increase power output, and just show you how dramatic it is. This study only boosted blood volume by 4%, so it wasn't even an optimal salt solution per boost. But, it was a 15-minute timed trial of cyclists. They were able to cycle a full kilometer longer in 15 minutes by preloading with salt and fluids.

**James DiNicolantonio:**

That's a lot, to be able to cycle 1 kilometer more in the same time frame? That's a huge power output increase. It's about 10%.

**Dr. Joseph Mercola:**

Wow, that's amazing. So Siim, have you applied this protocol? Because you work out pretty vigorously. I mean, are you a competitive bodybuilder now, too? I thought I saw that in one of your blogs.

**Siim Land:**

No, I'm not. No, I'm not.

**Dr. Joseph Mercola:**

You should be.

**Siim Land:**

I have done a few competitions maybe like, I don't know, six years ago, but yeah, not at the moment. But I do, yeah, I do notice a huge difference as well when you are properly hydrated, and especially with electrolytes. Because, and actually on my own case I can notice a bit more, because I am fasting as well a lot. I do work out semi-fasted, so I haven't really eaten actual solid food before my workout. If I don't let's say have the sodium and the electrolytes, then I do notice that my, let's say, at least the risk of cramps is much higher and just, yeah, not able to push that hard. The kind of injury risk is also higher because of that, because I think I'm stronger. But because I'm not properly hydrated then I'm actually weaker and may get some difficult situations in that sense. So I do note, yeah, because I'm fasting, then I do notice a bigger effect being hydrated with salt and fluids versus not.

**Dr. Joseph Mercola:**

That's interesting.

**James DiNicolantonio:**

Yeah, I mean you probably notice that too because glycogen holds water. So if you're in a fasted state and you're depleting yourself of glycogen, right? One molecule of glycogen is – the literature varies, but three to four molecules of water. If you're in a fasting state, your muscles are already severely dehydrated versus being preloaded with carbs. So hydration is going to have a more dramatic improvement in your performance if you're in a fasted state anyway, so that's interesting. Now, what was really my – this is mind-boggling is, how much minerals and electrolytes you lose through sweat. Not just salt but copper, particularly in the sauna. I mean, you can lose upwards of 1.5 milligrams of copper per liter of fluid loss.

**Dr. Joseph Mercola:**

Oh, God.

**James DiNicolantonio:**

And most people are only consuming maybe 1 milligram per day. So you can lose more than your daily intake in just an hour of a sauna session, and this includes things like selenium and chromium, calcium, magnesium. All these electrolytes get lost a tremendous amount, basically through the heat push. The higher you go to in temperature, which is why I'm kind of targeting sauna, is increasing the loss of those electrolytes.

**Dr. Joseph Mercola:**

Well, I'm a big fan of sauna, huge. I'm going to be doing a lot more interviews on it later this year, but I've put together [inaudible 00:34:59] basically a near-infrared sauna with heat lamps, and it's about 160 degrees. 160 in heat lamps is hot. Only 20 minutes of that, I will lose a half gallon of water, 20 minutes.

**James DiNicolantonio:**

Right.

**Dr. Joseph Mercola:**

I'm sweating like a river, for the most part. So I didn't know you lost that much copper. Are there other minerals that we need to be concerned about?

**James DiNicolantonio:**

Yeah, here's the key, too. The bioavailability of copper in the diet is only 30% to 50%. So if you lose let's say, right, one and a half milligrams, you've got to eat two and a half to replace that. That's the key with chromium. Chromium's bioavailability is only 1%. So if you lose 7 micrograms of chromium, you've got to consume 700 to get that back. That's the average loss, at least based on the two metabolic studies that we cite, that you lose about 7 micrograms of chromium. You also lose about 1,500 micrograms of iodine per hour of exercise, so getting iodine back too is important for thyroid hormone function and things like that. We have a table that lays out the average losses for minerals per hour of sweat, per liter of sweat loss.

**James DiNicolantonio:**

But like you said, there's huge benefits of sauna. Going into the sauna post-exercise basically every day for two weeks dramatically increases how long you can vigorously exercise for, by about 20%. So athletes did this. They averaged four and a half sauna sessions a week for three weeks, with a total of 13 sessions at about 190 Fahrenheit in a traditional sauna. They went in about 20 to 30 minutes each day. They were able to increase how long they could vigorously exercise from 14 minutes to 18, so they gained four minutes of how long they could vigorously exercise for. Part of the reason is because of the acclimations, the increase in blood volume at baseline, the dilution of the sweat so you can cool yourself off faster.

**James DiNicolantonio:**

As you become more heat-acclimated though, you have to use more heat and longer duration to maintain the adaptation. So you have to hit about an internal core temp of about 101.3 to become heat-acclimated, and so that becomes harder and harder to do as you become more heat-acclimated. But, you can actually maintain those gains after you do a sauna session for two to three weeks, as long as you exercise for up to two weeks. And then you want to probably do sauna at least every other day to maintain the heat acclimation benefits.

**Dr. Joseph Mercola:**

Yeah. The other benefits, actually, Siim did a podcast on, not a podcast, but, well, I guess a podcast on melatonin. I just read some really interesting results on the benefit of near infrared to increase mitochondrial melatonin, which is virtually not known by anyone. Siim didn't seem to be aware of that, but I think that's of the hidden benefits of sauna exposure, if you're doing a near-infrared sauna. Far-infrared will not produce melatonin, or a traditional sauna, so that is huge from my perspective. But yeah, it's great, so let me get back to the hydration formula. I notice that personally when I'm doing heavy lifts, especially the legs, when I'm doing leg presses, really where I push to the limit of almost failure and going up heavy, that after I finish that I get really dizzy. I didn't really understand until you explained it, it was probably the inadequate hydration.

**James DiNicolantonio:**

Right, because the blood flow to the skeletal muscles, especially to the legs, is now dramatically increasing, dropping blood flow to the brain. That's why you're getting a huge increase in dizziness, and fainting and collapse in those type of exercises. So maintaining good blood volume and good blood circulation with salt solutions is going to help prevent that.

**Dr. Joseph Mercola:**

So I'm wondering how many athletes or professional trainers, or I guess trainers, more specifically, know this information and are recommending it, because it seems like it's relatively new and not widely adopted.

**James DiNicolantonio:**

I don't know a single person who hasn't discussed this with me and me giving that information, besides perhaps maybe Tim Noakes, who actually knows this. Because it's not in any athletic performance guidelines, and the reason probably is, is because number one, some of the studies didn't show as much benefits. But I covered the reasons why because they inappropriately used lower doses of sodium and the concentration wasn't correct, and they didn't boost blood volume good. You have to look at it from the perspective of the population too, of who's being tested. It's not going to really benefit too much a moderately-exercising person. But someone who's vigorously exercising, it's going to show dramatic benefits, too. So I think I've never seen anything laid out – we have 50 pages on hydration alone in the book, and I don't really know anyone that's really talking about this.

**Dr. Joseph Mercola:**

Well, the other component of your book that I neglected to mention, that half of the book references, is like I was listening to the book for a big portion of it and it was being spoken, and reading the words. It got to be really annoying, because it's like every other line it was reading a number, for the reference, because there's thousands of references in your book so it's very well-referenced. No one could really throw a criticism that you didn't research this material well enough. So, but let's get back to the – you talk about alkalizing and the benefits of that. We haven't covered that yet, so why don't you review that, and then the protocols and using the bicarb in addition to the salt, sodium and the glycine.

**James DiNicolantonio:**

Yeah, so there's a common misconception that delayed-onset muscle soreness is due to lactic acid, or lactate. Lactate is actually the beneficial molecule pulling the acid, which is actually hydrogen ions, out of the cell. So lactate is actually a good molecule. We actually use it as fuel during exercise. It just correlates with high acid in the cell, and that's why there's this myth that lactate is bad for you, and it's not. Nothing further could be from the truth.

**Dr. Joseph Mercola:**

It reverts back to glucose, doesn't it, metabolically?

**James DiNicolantonio:**

Yeah, exactly. It gets recycled back to glucose. Yeah, the liver does that. It's just one of those important molecules to buffer acid. When you vigorously exercise, when you go anaerobic, you produce a lot of hydrogen ions because ATP demand exceeds supply. When that happens, you just automatically basically retain acid. Now if you can get ahead of the problem, just like salt solutions, and you can hit peak alkalosis, which is essentially boosting your bicarbonate levels and decreasing the pH or decreasing the acidity in the blood, you can dramatically improve performance. That's because many enzymes in the mitochondria are pH-sensitive, and as the cell becomes more acidic, it will shut down those enzymes and reduce ATP production, and muscle will eventually cease to work.

**James DiNicolantonio:**

So a lot of people don't believe that you can make the body more alkaline. Well, it's clear you can, because you can boost bicarbonate levels using things like sodium bicarbonate or sodium citrate. A lot of people also don't believe that diet has anything to do with the acid/base balance in the body, and it does. Because from a physiological perspective, the kidneys can only get rid of anywhere from 40 to 70 milliequivalents of acid before it starts retaining 1 milliequivalent of acid for every 2 and a half milliequivalents above that threshold. And then in order to get rid of that retained acid, you have to breathe it out. But in order to breathe out acid, you have to deplete one molecule of bicarbonate.

**James DiNicolantonio:**

So yes, you can breathe out acid, but it's not a free lunch. You will deplete your bicarbonate levels. So this is why you do need a balance if you're on an animal-based diet or a carnivore diet. You need to be consuming some type of bicarbonate-forming substance, whether it be sodium citrate or sodium bicarbonate, to offset the acid load of the diet.

**Dr. Joseph Mercola:**

It is crucial, and I think anyone who is engaging in a high-meat diet is being negligent if they don't address this, because you're going to get way too acidic. I don't know if you discuss it in this book, but I know that you can easily measure the pH of your body fluids with just doing a first morning urine with litmus paper, just checking it with litmus paper. You want to get to – it has different colors, but you go to the color about 7.4 or so, and most people are in the sixes or even lower.

**James DiNicolantonio:**

Yeah, the best way to actually test, if you're using a urinary pH, is actually about four hours after you eat because there's something called an alkaline tide. And you actually don't want to do first morning. It'll artificially say you're a little too acidic than what actually is going on. So four hours after you eat, you do want to be in a "fasted" state, but you don't want to be first morning, actually. So basically, four hours after breakfast is probably the best way to take a urinary pH. If your urine pH is less than 6.8, you're very highly likely retaining acid. Probably half the population probably has a urinary pH of 6.8 or less.

**James DiNicolantonio:**

Here's the key, too. A lot of people, you'll get your blood pH tested and you'll be in a normal range. But we start off at about 7.43, and we slowly go down to 7.36, and we're still considered normal. Well, you've just dramatically increased the acidity even of your blood, and yet you're still considered normal. Your bicarbonate levels, by the time your blood pH hits 7.36, is probably in the tank. You really want bicarb levels of 28 to 30 milliequivalents. And before performance, you really want those bicarb levels to about 35 milliequivalents per liter.

**Dr. Joseph Mercola:**

So you mentioned you could also use citrates, and I don't think this was discussed in the book but the citrates have another benefit in that they bind to oxalates. Oxalate consumption is really a pretty massively overlooked area of diet, something that Sally Norton has discussed quite – and I've actually done an interview with her in the past, but it's a hidden source of a lot of diseases. So you need to be careful about foods that are ostensibly healthy, like Swiss chard or kale, that are really loaded with oxalates and can really cause a load of problems. But if you're taking citrates, it actually binds it and helps your body excrete them so they don't damage you.

**Dr. Joseph Mercola:**

So you talk about sodium citrate, and just mentioned it as another way to alkalize your body. But what about the other citrate salts, like magnesium or potassium would be the big ones, or even calcium citrate? And have you come up with a sort of an ideal combination formula to alkalize your body? Because almost everyone watching this would likely need – well, first everyone watching I sincerely believe needs to measure their urine pH. Thank you for that modification. I thought first morning urine was a standard, but four hours after your big meal would be a better way to do this. Just measure it. The litmus paper, wherever you get it, it's pretty cheap. It's only a few dollars. It's not going to cost you an arm and a leg, and you can measure it yourself and see if you need to be supplementing. So, let us know what your view on the citrates, the citrate salts and the bicarb, and an ideal formulation to compensate for this acidosis.

**James DiNicolantonio:**

The reason why I like sodium citrate is you can get a lot more citrate per volume versus potassium citrate which is – and it's tougher on the stomach too, potassium citrate, where sodium citrate is tolerated better. But you make a good point. The reason why I like sodium citrate versus sodium bicarbonate is you're not increasing the pH of the stomach with citrate, whereas sodium bicarbonate, that is going to alkalinize the stomach as well. You can then have some issues with that. The key here is that most studies, dosing studies-

**Dr. Joseph Mercola:**

Excuse me. Excuse me for interrupting, but just explain why, because there's a metabolic transformation that occurs, why that happens.

**James DiNicolantonio:**

Right, so essentially when you are consuming bicarbonate, it's making the stomach pH increase and you're diluting the acid of your stomach. You need acid in order to digest food and absorb nutrients. It's super important. So if you start messing with the pH of your stomach, that's not good because you might not be able to digest food well. That's how we kill pathogens, too. Foodborne illness will go up as well if you – and chloride is important, which is part of salt, to actually form hydrochloric acid in the stomach acid. The reason why I like sodium citrate is because you're not dumping bicarbonate into the gut, and you're not decreasing the acidity of the stomach.

**James DiNicolantonio:**

The key here though is that most studies have inappropriately dosed sodium citrate much too close to exercise to show benefits. It takes longer to form bicarbonate in the body when you take citrate versus taking bicarbonate. So you actually should be dosing sodium citrate about four hours before performance to get to a peak alkalosis state. And what's great about citrate too is, if it doesn't get converted to bicarbonate, citrate is actually better than bicarbonate in regards to improving alkalinity. Because one molecule of citrate can bind three hydrogen ions, whereas it's a one-to-one binding of bicarbonate to hydrogen.

**Dr. Joseph Mercola:**

Wow.

**James DiNicolantonio:**

So citrate really is just an amazing way to alkalinize the body.

**Dr. Joseph Mercola:**

Now, does citrate do that directly, binding the hydrogen ions? Or does the citrate-

**James DiNicolantonio:**

It will.

**Dr. Joseph Mercola:**

Cells get metabolically transformed into bicarb.

**James DiNicolantonio:**

Both. So if it's there to pick up a hydrogen ion, it will directly bind three per citrate molecule. If it transforms to bicarbonate, it will be a one-to-one binding.

**Dr. Joseph Mercola:**

Okay, all right. One molecule of citrate for every molecule of bicarb. It's one-to-one conversion from citrate to bicarb?

**James DiNicolantonio:**

It's a one-to-one conversion, but the molecule itself, citrate can bind three hydrogen ions.

**Dr. Joseph Mercola:**

Okay, yeah. Yeah, I got that. Okay, so it's good. Is it the same for the other forms? I mean, you like sodium citrate better than the others because you can get more in, and it's more easily tolerated, but is it the same benefit of binding hydrogen ions? I would imagine it's the citrate molecule-

**James DiNicolantonio:**

Yeah.

**Dr. Joseph Mercola:**

Whether it's potassium, magnesium or calcium.

**James DiNicolantonio:**

Correct. It's just that you won't – it's difficult to get decent amounts of citrate when you're utilizing anything but sodium. But here's what's really important. You don't want to drink it in solution, because it will just – it's tough on the gut. So it's really something you want to take with food, especially with at least 20, 25 grams of carbs. You take it four hours before performance, which is really when you should be having your protein meal, is about four hours before your performance. You don't want to have steak two hours before a performance. That's just too close. So it's nice that you can dose the citrate with food, so you can tolerate it better.

**Dr. Joseph Mercola:**

Mm-hmm (affirmative), yeah. And since it peaks out about four hours, that'd be a perfect time to do the urinary pH measurement too, since you're probably going to be pretty high on the urinary pH.

**James DiNicolantonio:**

Yeah, and that's a really good point too, is that it's a tool you can actually use to measure the alkalinity of the body. Because you're not going to be able to really test your blood to see if you're hitting peak alkalosis unless you're [[crosstalk 00:50:15](#)]-

**Dr. Joseph Mercola:**

Well, most of us. Some people would have access to a blood gas, but it's not easy or convenient.

**James DiNicolantonio:**

Right, so in regards to the regular person, they might be able to just test their urinary pH to make sure their alkalosis is actually working, their regimen.

**Dr. Joseph Mercola:**

Yeah, it's so great. That's such a practical, practical, useful tool, and we just need to emphasize that because optimizing your pH is really important. There's a lot of – many, many books written about the alkaline diets and such, and that you can, as you mention, modify it with your diet but it's so – of we're having a high-meat diet, you really need to neutralize that some way with these alkaline salts. So, that's a great recommendation. So what type of doses are you looking at for performance, and maybe just for diet optimization even if you're not using exercise therapeutically, like you should?

**James DiNicolantonio:**

Right. Five grams of sodium citrate inhibits 60 milliequivalents of acid. An average carnivore is going to produce 150 to 200 milliequivalents of acid. So in order to neutralize that, you would need anywhere from like five grams of sodium citrate probably about three times a day, is going to help neutralize all that acid, which is great. You really want to be at a net acid excretion of zero, because even if your body is able to excrete acid, which it is, it's still damaging on the kidneys to do that so you want to try to get it to a neutral acid excretion.

**Dr. Joseph Mercola:**

Yeah, and I would assume radically increases your risk of osteoporosis, because your body's going to neutralize it one way or the other. You don't want it to neutralize it from the minerals in your bones.

**James DiNicolantonio:**

Right, yeah. So how this works is that the negatively-charged sulfite, the sulfate ions that are released when you consume animal foods, have to be matched with a positively-charged potassium, magnesium, calcium, sodium. It will pull that from bone if you don't have enough alkaline minerals on board. The balance studies in the 1960s, Jack Lennon and his group confirmed that dietary acid leads to a tremendous loss of calcium from bone. It's just astronomical how much comes out. And so we know that basically dietary acid does contribute to bone loss through those balance studies.

**Dr. Joseph Mercola:**

Well, that's good. So I think we've discussed most of the items that I recall from the book, but is there anything that we missed or that you'd like to mention now, about the hydration?

**James DiNicolantonio:**

I think we covered hydration pretty well. I mean, then we go into things like blood flow restriction and stuff like that, like the biohacks.

**Dr. Joseph Mercola:**

Well, we could. I mean, I'm a big fan of blood flow restriction, huge, but there's just not enough time to go into it. I think there's other points I'd like to emphasize that you discuss really, really well in the book, which is the protein intake. I can share a personal story, in that I was seriously confused in this because I had a mentor, Ron Rosedale, who was overly concerned, and I think Siim has done some really good videos on this, about protein activating mTOR and increasing cancer and a whole variety of other metabolic diseases. So I went to a relatively low-protein diet, probably either 0.6 or 0.8 grams per kilogram, and suffered the consequences.

**Dr. Joseph Mercola:**

Since I understood the higher doses it required, I put on 20, 25 pounds of muscle mass, so it is essential. You've got to have protein. So why don't you review this? Because people need to know, and it's easy. I recommend an app called Cronometer, where you can easily and freely input your data measuring your food and measuring it with a kitchen digital scale. And then you can find out within a tenth of a gram how much protein you're eating, so you don't have to guess. So then you can figure out the numbers that you're going to tell us about in a moment.

**James DiNicolantonio:**

Sure, Siim. Why don't you take this one, and I can come in later on too, if needed?

**Siim Land:**

Yeah, sure. Maybe I'll just briefly mention about the idea of mTOR and longevity. So yeah, I mean in animal studies it is associated that mTOR activation or excess mTOR can be linked to some accelerated aging and some cancers. But there's no human studies, and at least when it comes to exercise performance, mTOR is still quite central to things like muscle protein synthesis and muscle growth. We also know that muscle use is very important for longevity and anti-aging, so I think the kind of worries about that can be a bit overblown. I mean, protein isn't the only thing that activates mTOR. It's also carbs and insulin, so yeah, you're screwed either way if you're wanting to restrict mTOR.

**Siim Land:**

But from an exercise perspective specifically, then yeah, protein is quite important, at least, for these rotation strength sports and the muscle-building sports. Obviously, athletes have generally more muscle mass than they need, the muscle mass to perform as well. If you talk about how much protein, especially to-

**Dr. Joseph Mercola:**

Well, before we talk about how much, you didn't mention what you said so eloquently in your video. Describe how it's the time of activation of mTOR that's so crucial. If you're eating over 16 hours a day, you're going to activate it all day long except when you're sleeping. Where if you do engage in time-restricted eating, it's minimized and it's not the issue that people think it is.

**Siim Land:**

Yeah, so basically there's a limit of how much mTOR you're going to basically activate in one sitting. Because the amount of protein synthesis is also limited, and that threshold is around 20 to 40 grams of protein in one sitting. So you're not going to activate more muscle protein synthesis by consuming more protein, so it doesn't matter if you eat 100 grams of protein or 20 grams of protein in one sitting. You're still going to activate the same amount of mTOR, because there's no direct way to look at whether or not you activate mTOR. You look at it through like, "I jumped one level, so protein synthesis levels," so yeah, that's the only way to know. There is a limit, basically. If you eat six times a day, then you're still going to turn on mTOR even if you eat very few calories. Even if you eat like 100 calories or 10 grams of protein. You're on a low-protein diet, you're eating 10 grams of protein, but you're eating six times a day then it's still spiking your mTOR several times, let's say compared to eating two times a day or once a day.

**Siim Land:**

But even if you are eating 200 grams of protein for example in one sitting, then you're not going to activate more mTOR because it's going to be capped off. That's why athletes and bodybuilders are eating six times a day, to basically have their protein synthesis elevated frequently so that they will build more muscle and basically recover faster. So, that's why, let's say, the athlete would be eating more frequently whereas the average person and it doesn't matter how much protein they're eating. If you're eating in a confined eating window, then the eating frequency basically matters in terms of how much mTOR you're going to activate over the course of 24 hours, not the actual amount of protein in grams.

**Dr. Joseph Mercola:**

So the athlete eating six times a day for increased muscle mass is probably not serving himself well for the long term, because he's overactivating mTOR.

**Siim Land:**

Yeah, I mean, maybe. We don't have an actual human study to yeah, say that it definitely will be a shorter lifespan because of that. I mean, maybe it wouldn't be the best. It would be still beneficial to practice some aspects of time-restricted eating for other reasons, for metabolic flexibility, for example, it would be still better to have some periods where you don't eat. But let's say, I mean like the bodybuilding, the professional bodybuilding, the mass monsters, they're not doing it for the health anyway, so it doesn't matter.

**Dr. Joseph Mercola:**

Yeah, that's for sure. All right, so why don't you go into the actual protein levels that we need to have to build up muscles?

**Siim Land:**

Yeah, yeah. Well, the RDA is quite low. It's like 0.4 grams per pound of body weight. You said you consume 0.7 grams per kilogram, which I think would be around the same amount of the RDA, or even less. But the research, at least for elderly people, it also finds that the higher protein you take is better for maintaining muscle mass and bone density and reducing frailty, those kind of things. So the RDA itself is already considered inadequate for even regular people.

When it comes to just fitness or sports or your training, then the demands would increase exponentially as well.

**Siim Land:**

In the book, we outline this kind of meta-analysis or reviews where they look at, "How much protein do you actually need?" Then they find that the kind of optimal peak or the kind of threshold again is around 1.6 grams per kilogram of body weight, which translates into like 0.8 to 1.0 grams per pound of body weight. That's kind of, you're not going to be building more muscle if you eat more protein and that, so that's going to be maximal effective threshold. But they do find in studies that if you eat more than that, like 3 grams per pound or something like that, then you're not going to build more muscle but you do burn more fat especially, or you put on less fat if you're in a calorie surplus. You tend to also burn more fat, or you're able to lose weight faster. These proteins, they're not only important for the protein synthesis and recovery and muscle adaptations, but also the kind of satiety and thermic effect, they are also very powerful in terms of weight management and weight loss.

**Siim Land:**

So, high-protein diets are better, at least, for all resistance sports, resistance-training sports. Maybe the endurance athlete may need a little bit less protein than the resistance training athlete, but for the weight loss, the high-protein diet is always better in research. The people who are on high-protein diets, at least the calories are equal, they always lose more weight because you burn more calories for digesting the protein. It's 30% of protein gets converted or burned off as energy, the calories from protein, whereas for carbohydrates it's only 7%, that fat is one or even like 2% or something like that.

**Dr. Joseph Mercola:**

And what about those who are older, say over 60, 65? I believe the protein needs increase, or recommendations increase.

**Siim Land:**

For the elderly, it also appears that the higher protein intake is better for reducing risk of frailty and osteoporosis and hip fractures. The actual amount is hard to tell, although a higher protein intake, I mean, anything between let's say 0.7 up to 1.0 grams per pound of body weight is good, I think even for the elderly, if they're not exercising hard or they're not doing regular resistance training. Even for them, I think 0.7 is kind of the bare minimum. 0.8 is pretty good as well, and 1.0 grams per pound of body weight is kind of the upper threshold where you don't see any additional benefits for muscle growth.

**Dr. Joseph Mercola:**

So if you're taking these higher protein intakes, that is likely going to increase the acidity of your blood. So I'm wondering if you personally have incorporated an alkalinizing mineral supplementation regimen to compensate for that?

**Siim Land:**

I do eat a lot of vegetables. I'm not eating a full-meat diet. I also consume some baking soda, not all the time, but yeah. I have these bicarbonate waters, as well, that I consume, yeah, but not a specific supplement.

**Dr. Joseph Mercola:**

The chains are so bonded, like [inaudible 01:02:27], right?

**Siim Land:**

Yeah, yeah.

**James DiNicolantonio:**

Yeah, that one's definitely good. I mean, that's one of the reasons why I eat potatoes with steak, because the potatoes offset the acid from the steak. So if you have a decent balance in your diet, you can offset the acid through things like bananas, potatoes, beans, if you tolerate those types of foods.

**Dr. Joseph Mercola:**

Yeah, there may be some reasons for many not to consider those foods, but if you do, but they do have their benefits, there's no question. So can you give us your take on the protein recommendation?

**James DiNicolantonio:**

Well, to address your question of do the elderly need more protein? I think from the perspective of, they're glutathione-deficient, typically.

**Dr. Joseph Mercola:**

Really?

**James DiNicolantonio:**

And so they need more cysteine to form the glutathione, so that's why we see that higher protein intakes in the elderly is beneficial. That's one reason. In regards to, for like an athlete, the evidence is pretty clear that you want about 30 grams of protein four times a day as a minimum. If you do a whole-body workout, you actually want to increase that to about 40 grams of protein in regards to maximizing muscle protein synthesis. And then the data is pretty clear too, that taking 30 to 40 grams of casein, which is a long-acting protein, about 30 minutes before bedtime, will also help maximize muscle protein synthesis.

**Dr. Joseph Mercola:**

But a four-times-a-day eating regimen seriously conflicts with a time-restricted eating protocol. It's hard to fit in four meals in like six to eight hours.

**James DiNicolantonio:**

Well, here's the thing though, right? You're almost, when you do, let's say, a heavy lifting session, that's almost like fasting for four hours, right, in a way?

**Dr. Joseph Mercola:**

Yeah.

**James DiNicolantonio:**

You're sort of activating, or you're putting yourself in a catabolic state. You're accelerating sort of how quickly you get into a fasted state. So yes, technically eating four times a day versus eating twice a day is ... You're less activating autophagy. But from a just strictly muscle protein synthesis perspective, the four times a day seems to be the best to maximize muscle protein synthesis.

**Dr. Joseph Mercola:**

I'm curious, what is your eating window?

**James DiNicolantonio:**

I typically eat, on a day that I work out, I eat three times a day. If I don't work out that day, I typically only eat twice a day.

**Dr. Joseph Mercola:**

But what's the window? How many hours are you eating?

**James DiNicolantonio:**

Usually I actually just eat an early dinner. So what I'll do is I'll have breakfast, and I actually target protein. I have a high-protein meal during breakfast, like steak and eggs with potatoes or bananas. That will actually help keep me satiated. And then if I'm not working out that day, I might only have dinner at like 3:00 pm. If I am working out that day, I will have lunch at probably noon, and then I'll have an early dinner, maybe like four o'clock. And then I'm not eating from 4:00 all the way to 9:00 am, so I don't know how many hours that turns out to be fasted, but it's basically having an early dinner is what's important because-

**Dr. Joseph Mercola:**

Yeah, yeah. That's definitely the key, eating at least three hours before you go to bed, for sure.

**James DiNicolantonio:**

Yeah, not just from an autophagy, time-restricted eating standpoint. A lot of people have hidden acid reflux, and causing themselves Barrett's esophagus. They don't realize it, because they're laying down within an hour of eating every night. So eating an early dinner is actually really important, not just from an autophagy perspective but also from that perspective of refluxing at night.

**Dr. Joseph Mercola:**

Yeah, yeah, for sure. So a really important principle, and I'm pretty sure you address this in the book, is that you can't exercise every day. You're going to dig a deep hole that you'll never get out of. You need repair and recovery. So, what is your strategy for implementing recovery into the exercise regimen?

**James DiNicolantonio:**

Yeah, so recovery, if you're talking about in a training camp, and you need to train hard the next day-

**Dr. Joseph Mercola:**

Well, let's not go training camp. I mean, most people are not going to go in training camps. I mean, I know the book is designed for people in it, but we're looking at people who are just living normal lives, and most of them elderly.

**James DiNicolantonio:**

Yeah, so to improve recovery in regards to – there's definitely certain strategies to reduce delayed-onset muscle soreness. High-dose omega-3s, like 3 to 4 grams of EPA and DHA will help reduce delayed-onset muscle soreness, increase muscle protein synthesis, increase fat burning as well with higher doses of omega-3s, like wild salmon. Beet root juice prior to exercise is a great way to reduce delayed-onset muscle soreness as well, and improve recovery.

**Dr. Joseph Mercola:**

But it's high in oxalate [[crosstalk 01:07:05](#)].

**James DiNicolantonio:**

Yes.

**Dr. Joseph Mercola:**

But it also makes great nitric oxide. It's a great precursor for it.

**James DiNicolantonio:**

Right, and so L-citrulline or citrulline malate can also help with recovery as well, same with the alkalinity. It's going to help with recovery, and the salt solutions will too, because of blood volume expansion and that increases the removal of waste and build-up as well. But actually submerging the body in water, and preferably cool water which is typically 64 to 84 degrees Fahrenheit, will also help to improve recovery. Usually, you want to be head-out water immersion, and it's the opposite of exercise. You're eliminating gravity, so there's less neuronal activity. There's increased ATP synthesis. You can recover better, simply basically going into a bath. If it's cool, we talk about pre-cooling strategies in the book, and how to cool the body to dramatically improve performance as well using glabrous skin cooling, which is essentially cooling the face, the palms of the hands and the bottoms of the feet. That can help to improve performance and recovery as well.

**Dr. Joseph Mercola:**

Well those are – I mean, what I was looking for is like how do you figure out when you're not going to – when do you need to take a day off, a complete day off, when you're not doing it? I mean, I guess you could increase the likelihood that you'll need to take that day off with these strategies, but you're still going to need to take a day off. So how do you – what's your recommendations?

**James DiNicolantonio:**

Yeah, if you're training to near-fatigue or fatigue, then yes, you will need to take days off. But if you're just doing reps to do reps, and you're not actually even going until you're fatigued, you might not actually need to take a day off, and then-

**Dr. Joseph Mercola:**

Really? Huh.

**James DiNicolantonio:**

Because you're not – that's really the key to growth, to muscle protein synthesis. It's not necessarily how much you're doing. It's getting near fatigue or to fatigue every time you do a set, that's the key. You can be lifting at 20% of your one rep max, but if you lift that weight to near failure or failure, you will absolutely increase muscle protein synthesis and strength.

**Dr. Joseph Mercola:**

So Siim, do you have any feedback on it, recovery?

**Siim Land:**

Yeah. Well I think, yeah, it depends on – there's different variables. You manipulate the intensity and the frequency and the volume, and I think especially if you're a natural athlete, then you can only choose two. So you could train every day, but in that case you have to either keep the intensity low or the volume low. So gymnasts, they train every day but they train at low – they're not going max out all the time. They're training with high volume and many hours a day, but with high frequency, but they're not reaching complete failure. Or like the Bulgarian method which is used in weightlifters, where they basically train near maximum intensity or near maximum weights with their lifts, basically every day, even sometimes several times a day. But they keep the volume very low, so they literally do only one set or one rep of their max intensity lift.

**Siim Land:**

So yeah, I mean you could get away with training every day. I've done it many times, like I've trained calisthenics every day for a long time. But if I'm doing higher intensity and higher volume, like in the gym, yeah, literally reaching near failure with many different exercises, then in that case I do feel that a rest day is very kind of needed, or is actually better for the performance, because the body can only adapt to a certain point. If it's always forced to recover from the exercise, then it never has the opportunity to adapt. So it adapts, which means getting to a higher baseline, gets stronger and faster. For that to happen, it needs some time off whereas if you constantly keep hammering, the body again then is always stuck in this recovery trap of being able to just recover. You can train every day and recover, but if you're not making progress, you're not getting stronger or faster or whatever, then you probably have to kind of dial down some of the frequency.

**Dr. Joseph Mercola:**

Do you find the biometrics from apps like Oura Ring helpful? Because one of the metrics that seems to be correlated with the need for having an easy day is the lowest heart rate of your night – of the night, that the time that it occurs. If it goes very close to when you wake up, that probably means you should take a day off or consider working out at a lower capacity. Whereas if it occurs very early, you're ready to kill it.

**Siim Land:**

I do think, yeah, HRV or like in regular body temperature and heart rate, those things, yeah, can just indicate how recovered your body could be. But even then just regular things like, “Are you sore? Do you have brain fog? Do you have depression or depressive symptoms and lack of motivation?” Those kind of things are also very clear signs that can be telling you whether or not you should train hard or take a rest.

**Dr. Joseph Mercola:**

Okay, that's good. Yeah, I mean this is so important. It's one of the keys that you have to understand, that you cannot really exercise every day unless you manipulate the variables like you suggested, and you don't really train to failure, you don't have a lot of high volume, and then you can get away with it, for sure.

**James DiNicolantonio:**

Right.

**Dr. Joseph Mercola:**

But, you're not going to get a lot of benefits if you do that. You'll get some for sure, but you're not going-

**Siim Land:**

[inaudible 01:12:17]

**Dr. Joseph Mercola:**

[inaudible 01:12:17]

**James DiNicolantonio:**

Essentially, if you're training to failure then you probably shouldn't lift that muscle group more than four times a week. I would not go above that.

**Dr. Joseph Mercola:**

Yeah, I would agree. Maybe three times, because four [crosstalk 01:12:29].

**James DiNicolantonio:**

Exactly, yeah. Four is pushing it. That's the upper, I would say, upper limit.

**Dr. Joseph Mercola:**

Yeah, for sure. Yeah, so that's what I like to do is I like to isolate body parts, and then you have two days a week where it's more comprehensive. I'll do biceps on one day, just biceps, like crush it with six or seven different workouts, then a triceps and then a shoulders day, then an upper body and a lower body. So I think that helps too, is if you focus it on body parts rather than do the whole body. I mean, it's hard. You could legitimately probably spend four hours working on your whole body, just so many different things you can do.

**James DiNicolantonio:**

Sure.

**Dr. Joseph Mercola:**

So all right, so any other points you'd like to make?

**James DiNicolantonio:**

Just I would say the cooling strategies.

**Dr. Joseph Mercola:**

Oh yeah, yeah, huge.

**James DiNicolantonio:**

You can pre-cool the body. Pre-cooling the body is [crosstalk 01:13:20]-

**Dr. Joseph Mercola:**

Oh, wait. Before you go into the cooling strategies, you had mentioned that you could cool down as part of the recovery. But I just wanted you to – I forgot to ask you about that cooling down versus abolishing some of the benefits of the exercise you just did, because it aborts that processing of information that contributes to the activation of the hormone, of the exercise benefits. So, how do you balance that out?

**James DiNicolantonio:**

Right, yeah. So going into a cold shower isn't enough to inhibit hypertrophy or strength, but going into a cold ice bath will reduce hypertrophy and strength. But, it will dramatically improve how quick you recover out to 96 hours. And so one way around this, where you get benefits for recovery but you don't get such a reduction in hypertrophy or strength, is to go into a cool bath. So instead of going into a bath that's 59 Fahrenheit or less, you go into a cool bath between 64 and 84 Fahrenheit. That way, you can inhibit some of the information but you're not completely shutting it down.

**Dr. Joseph Mercola:**

Okay, 64 is still a bit uncomfortable, but high 60s would be better.

**James DiNicolantonio:**

Right, yeah.

**Dr. Joseph Mercola:**

Okay, that's a good answer. So why don't you review some of the cooling strategies? Because you do that very well in the book, and really highlight some things like the cool mitts that are being used now, and cooling the glabrous skin in the palms to allow you to exercise more efficiently. So I mean, this is like brand new stuff.

**James DiNicolantonio:**

Yeah, I mean most athletes get it wrong. They will cool the back of their neck or their chest when they get hot. Especially UFC fighters, you see this all the time, their coaches are cooling off their chest or their back with ice packs. But, that's not where the glabrous skin is, and the glabrous skin is enervated with special blood vessels that can dilate and bring in cold directly from the venous supply right into the arterial supply, so they bypass the capillaries. So you can cool the body very quickly when you cool the glabrous skin, and the glabrous skin is contained in the palms of the hands, your ears, the face, particularly the forehead and the cheeks, and the bottoms of the feet. So this is why on a hot day, if you just put the bottom of your feet in a pool, you cool off your whole body so quickly despite only cooling off maybe 1% of your surface area. It's because of the AVAs that are highly dense in those areas, where that's how you cool the body off. It's twice as effective.

**Dr. Joseph Mercola:**

The AVAs are arterial venous anastomosis.

**James DiNicolantonio:**

Anastomoses.

**Dr. Joseph Mercola:**

Why don't you describe what those are?

**James DiNicolantonio:**

Yeah, so the arterial venous anastomoses are blood vessels that have a much larger diameter, and they bypass the capillaries. So they can basically dump heat or bring in cold directly from the venous supply right to the arterial supply, and basically that cools you off much faster. The studies show that cooling the glabrous skin is twice as effective than cooling let's say the chest or the back. In really hot situations, the glabrous skin can dump five times as much heat as compared to non-glabrous skin. The best way to cool those skin surfaces down is using water, because water conducts heat/cold two to four times better. So simply putting your palms in in cold water, and the bottoms of your feet in cold water, you do that for 30 minutes and you're going to drop. The goal for pre-cooling the body is to drop core body temperature by 0.5 degrees Fahrenheit, which is about 0.3 degrees Celsius. You see the dramatic improvements in performance because you have a larger tank to soak up all the heat before you hit a critical core body temperature.

**Dr. Joseph Mercola:**

And have to sweat and lose your electrolytes.

**James DiNicolantonio:**

Exactly, true.

**Dr. Joseph Mercola:**

Yeah, that's good. Yeah, so I think you reviewed in your book where they have this cool mitt now. I don't even know if it's available, or basically you've got a pump, and pumping ice-cold water into this vacuum?

**James DiNicolantonio:**

Yeah, it's a sub-atmospheric temperature, or a sub-atmospheric chamber essentially, which pulls more blood to the palms, and then you cool the palms on like a metal plate. But, you don't need anything that high-tech. The key here is to add as many glabrous skin locations and cool them down simultaneously as you can. Actually, they've compared cooling the bottoms of the feet simultaneously, versus cooling the palms of the hands simultaneously. Actually the feet are better, but when you start adding them together you get additive benefits.

**Dr. Joseph Mercola:**

And what's the best? If you're going to just use the low-tech approach and submerge your hands and feet in the water, ice-cold water would be counterproductive because it's going to cause the vessels to constrict and it actually may potentially increase your body temperature. So, what's the sweet spot for the temperature, and how much time do you need to do it?

**James DiNicolantonio:**

Yeah, for sure. If you're pre-cooling the body, you want to avoid temperatures of water of 59 Fahrenheit or less, because that can actually inhibit performance. Ideally, you want to be between that 64 and 84 degrees Fahrenheit, which is considered a cool-water bath, or cool water. You can start at 84, and you can slowly notch your way down. Now what the studies show is that if you're using 84 Fahrenheit water, it's probably going to take you an hour to drop half a degree Fahrenheit. But if you're using 64, it'll probably only take you 20 to 30 minutes, depending on how much surface area you're cooling to.

**Dr. Joseph Mercola:**

Yeah. It occurs to me, this is one of the reasons why I can walk very comfortably in the summer at noon on the beach, because I'm always walking in the ocean with my feet submerged typically to my ankles. But it's cooling me down, when you've got the sun on you. It's anticipating the heat.

**James DiNicolantonio:**

Right, and I mean you don't even have to do pre-cooling. You can do this during training. It's been shown if you cool glabrous skin, like cooling both of the palms, you can increase the reps on a bench and how much you do pull-ups by like 40%, just cooling the palms during the rest periods. So you get really good benefits with cooling the body.

**Dr. Joseph Mercola:**

Well, you definitely hit the target. You gave us a lot of great information orally in this interview, but certainly it's in the book. So this is just a taste, because there's a lot of other good pieces of information. And as I said, I'm a strong believer in exercise and I really believe this book should be in your library. So, you can head over to your favorite sources of acquiring books and pick it up, in all the different formats. So, congratulations on putting that together.

**James DiNicolantonio:**

Appreciate that, Joe.

**Siim Land:**

Yeah, thanks.

**Dr. Joseph Mercola:**

Yeah, do you have a website for the book? I neglected to ask. Or is it just-

**James DiNicolantonio:**

Yeah, I mean they could go on [DrJamesDiNic.com](http://DrJamesDiNic.com), but the best way is just Amazon.

**Dr. Joseph Mercola:**

Okay. All right, sound good. All right, well, you keep up the good work. You guys are always surprising me.

**James DiNicolantonio:**

Appreciate it. Thank you.