Episode 638: Dr. Chris Masterjohn on Understanding Key Nutrients: Biotin, Sodium, Potassium, and Omega-3s

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Katie: Hello and welcome to the Wellness Mama Podcast. I'm Katie from wellnessmama.com and this episode is with a guest who is a repeat guest, and I always love having him on. I'm here with Dr. Chris Masterjohn who has a PhD in nutritional sciences and has done a lot of work and research in this area. And he has an incredible ability to take in a large amount of information and then translate it into really practical principles that each of us can use to support better health. And I'm really excited that he has been putting some of this toward really diving into and understanding the intricacies and the nuance of different vitamins and minerals and supplements that we may or may not be getting enough of. And he talks about food sources and really gets into the details of this. He's my go to for a lot of these things, and I will link to his resources he has available about more of this.

I also recommend following him on Instagram because he has constantly great content around a lot of these different topics. But today we go into biotin, sodium, potassium, even things like Omega-3s, and he breaks down so much of this information and makes it very practical and usable. Like I said, he's my source for a lot of this and it's always a pleasure to get to chat with him. So I want to maximize our time. Let's join Dr. Masterjohn. Chris, welcome back. Thanks for being here.

Chris: Thanks for having me, Katie. It's great to be back.

Katie: Well, you are one of my favorite people to follow on Instagram because all of your posts are actually so packed with relevant information. And I love following your vitamin and mineral series that you've been doing for a long time. So I would love to kind of go through just sort of a few of the key ones that you've talked about recently and understand them more personally and also for the sake of the audience.

So to start with, you're currently doing one. I'll link to it in the show Notes on Biotin, and I feel like biotin is not a very well discussed supplement. It's not one I hear a lot about, and it's not like the latest trendy biohacking supplement. But you make a very compelling case for why it can be important and some really interesting uses that I've never heard talked about. So to start broad, can you maybe just walk us through what biotin is and some of the high level points related to how the body uses it?

Chris: Sure. Biotin is a B vitamin. It's also known as vitamin B-7, and that is one of the water soluble vitamins. The most well established, abundant sources of it are liver and egg yolks. There's a lot of controversy in the data over how much biotin is in each particular food, but liver and egg yolks are the most kind of solid sources that we know of. Some newer data suggests that some fermented foods, like nato, are also very high in biotin.

And in the world of supplements, you'll find that people are usually using it for skin health, hair health, and nail health. Usually when doctors prescribe it to people, it's for mainly hair and nail health, and it's usually dermatologists prescribing. Interestingly though, if you look at high dose biotin supplements, so we typically in our diets, the average person is getting around 50 micrograms. If you look at supplements, you will find some supplements at 300 micrograms or 600 micrograms, and you will find smaller amounts in multivitamins.

But generally speaking, most biotin supplements are in the milligram range, which is wildly high if you think about it. So 1 milligram, is 1000 micrograms. Even at 1mg, you are massively higher than what people are getting in their diet. And yet the percentage of people who are taking high dose biotin supplements in the one, five or ten milligram range has exploded over the last couple of decades. And so it's still only a few percent, but it's basically gone depending on which dose you look at it's somewhere around 20 fold more people are using high dose biotin supplements than they were 20 years ago. And most of those people are using it for things like hair, skin and nail health.

But if you go back and look at the classical deficiency signs, what's typically described in a textbook, and there's a lot of variation on this because whenever you see something in a textbook, it's a summary of something that was in a bunch of reviews that was summarized 20 years ago from case reports. But the so-called sort of classical deficiency signs are terrible candida infected rashes that are usually scaly, red and itchy. But if you go and look into the case reports, the rashes can be almost any type of skin rash. They're not always red, they're not always scaly, etc. But usually if you swab the rash you can culture candida from it. So these are cutaneous fungal infections that are most common in all the folds of the body, the orifices and the folds.

So the nostrils, the mouth, the perineum between the anus and genitals, inside the elbows, inside maybe inside the finger folds, even inside the knee folds, inside the armpits, etc. Conjunctivitis, hair loss and neurological signs that can range from simple depression to severe depression. Lethargy appetite, peripheral neuropathy, so, tingling or numbness in the extremities or feeling like something's crawling on your skin, or even like hallucinations and seizures in the worst cases, and problems with muscle tone. So, in babies, a very severe biotin deficiency can cause floppy baby syndrome, which basically means they have no muscle tone, like they're just rubber.

And in other cases it can cause both loss of muscle tone, but also something called cogwheel rigidity, which is traditionally associated with Parkinson's. And that's when you have someone stretch, but over the course of stretching into the position, their muscles become very rigid, even though they're not usually. Now, if you just look at that and you kind of extrapolate down what if I had a mild biotin deficiency? The number of people who are out there having hallucinations and seizures because a biotin deficiency is extremely exceedingly vanishingly small, but the number of people who are depressed and have rashes is really high. And in my calculations, based on the literature, I think most people need more biotin.

I think generally speaking, the average person is getting 50 micrograms of biotin and probably needs between 150 and 300 micrograms depending on how much protein is in their diet. So especially, I think, biotin certainly in the fitness community where you have people eating really high protein diets in a catabolic state when they're cutting and their skin starts falling apart. Biotin is not the only thing that I would think of, but it's certainly one of them. And, genetic disorders and medications and stuff that can mess with biotin. But pregnant women at a rate of 30% to 50% become spontaneously biotin deficient during pregnancy.

So I think there's very widespread potential for people who have skin rashes and even mild psychiatric problems to maybe need a little bit more biotin in their diet in the form of liver, egg yolks and then the high doses traditionally are used for high doses like 10 to 300 milligrams, or really 5 to 300 milligrams. Traditionally, those are used for genetic disorders and biotin metabolism that in their classical clinical condition are exceedingly rare. So they're are really seven or eight, but a few of them are extremely rare, and there's about five of them that have probably an average prevalence each of like, one in 100,000 people.

However, if you look at the carrier status, so the so you get this disorder. If you know two people who have the who have one copy of the gene, mate together, and they have a child who has two copies of the gene, and it is not severe enough to cause a miscarriage, but it is severe enough to cause a clinically diagnosed disorder. Those parents still have poor biotin status because they carry one copy of the gene. And I estimate that the genetic disorders, the carrier status is one in 30 people have a carrier status for one of the biotin responsive genetic disorders. And the health of carriers is very not widely considered by anyone.

But there's this very interesting case report of a 38 year old woman who had gone through a couple of pregnancies and then in her 38th year of life, all of a sudden started getting vaginal yeast infections that were treatment resistant. Or the treatment would help a little bit, but it would just come back with a vengeance for a year. And she only knew that remember, this is one in 30 people I think, have carrier status for one of these genetic disorders. The only reason she knew she was a carrier is because her husband was also a carrier and their kid had the clinical disorder.

So she had an on-call genetic counselor, and she called the genetic counselor and said, I know I'm a carrier for this. I know my son has to have this supplement or he'll go back to a terrible disease state. Is it possible that my chronic yeast infections might be helped by biotin? And the genetic counselor said, yeah, I don't know, try it. And so she goes on, ten milligrams of biotin problem disappears. Right? So I do think that there's one in 30 people who need high dose biotin supplements, and then I'll just throw in there. There are some convincing trials in diabetes for blood sugar with them and some very unconvincing trials with multiple sclerosis. But that's it in a nutshell.

Katie: This is fascinating. There's so much to unpack. So liver and egg or egg yolks are the most abundant food sources. Is it possible for the average person who doesn't have one of those genetic disorders to be able to get enough from food sources?

Chris: Oh, for sure. But I think that we all underestimate how much we need and how widely prevalent it is to need a little bit more. So I totally think the average person, not even the average person, I mean, I totally think that 29 out of 30 people can get enough from food. It's just that depending on what dietary trend you're in, you may be kind of pushing the limits in terms of what you want to eat. So, for example, on a high protein diet, I think someone, if you look in the fitness community, there's a lot of people that are like, well, we did a two year study, 300 grams of protein a day doesn't cause any kidney toxicity. It's all BS, blah, blah, blah, blah. And so for performance, people are eating three times more protein than anyone ever would have gotten before. And they're kind of having to go out of their way to do it.

That's going to make it really hard to get enough biotin from food, especially if you're in the fitness community and you believe in avoiding fat because you're going to have to eat like one egg yolk for each serving of whole food protein in order to make that happen. And it's not only egg yolks, but you get the point, right? If you're pushing your protein higher than what you would get if you were just kind of hanging out, eating whatever you want, you're also pushing your biotin to where you are going to have to put equal effort into getting your biotin as you do your protein. And no one in the fitness community is doing that.

Katie: And is this maybe some of the reason that we're seeing like people in the fitness community have more skin problems at times? And I'm actually really curious. So it sounds like protein increases our need for biotin. I've been eating higher protein than I used to try to put on muscle because that's part of my current journey. But I've only really ever heard biotin talked about mostly in the hair, skin and nails conversation, not in the like these are the things that increase our need for biotin. I feel like this is a very important point and I'm not hearing these people who are recommending a lot of protein also recommending biotin. So I feel like this is really important.

Chris: Yeah, and also it's not just hair, skin and nails. Depression is how many people are depressed, right? And I'm not saying everyone who's depressed needs biotin, but if the average person needs more biotin and there's a high rate of depression, there's probably a lot of people whose depression would get at least a little bit, if not a lot better with biotin.

Katie: I've given my advice before that is probably my second most unpopular advice, which is I consume a little bit of raw liver in the morning a few times a week. It's sort of a nutritional insurance policy that's second only to my recommendation about eating sardines. People seem to not love those recommendations, but it seems like biotin does at least have sort of an understanding about it being good for hair, skin and nails. But that part is spot on, right? Biotin can be supportive for those things as well.

Chris: Well, I wouldn't call it spot on. A, there's a lot of people taking it for hair, skin and nails who are probably not being helped at all by it. And B, the dosing doesn't make any sense, right? So the people who are taking by, like I said before, it's hard to find something that's like 600 micrograms or 300 micrograms that's not a multivitamin. And it's standard to find something one, five or ten milligrams. There's no way. The only way you can possibly need one to ten milligrams of biotin to optimize your hair, skin and nails is if my estimate of one in 30 people who have carrier status for a biotin responsive genetic disorder. Granted, that's one in 30 people, that's a lot of people, or you have a long standing, decades long marginal, marginal deficit in biotin that you are fixing more quickly.

So biotin is extremely well absorbed and is extremely well incorporated into body stores at high doses. And so it's very possible that if you spent the first five decades of your life eating 50 micrograms of biotin less than you need to, then you might well benefit from a loading dose of ten milligrams for two weeks, a month, two

months, and then you go back to a maintenance dose. But no one's doing that. I'll tell you. I believe that I have some of these genetics and that my mom does.

I should make it very clear anyone who's taking biotin supplements needs to stop taking them four days before any lab work. And if you're doing thyroid antibodies, you should stop biotin supplementation seven days before any lab work. And that has nothing to do with the biotin being bad for the thyroid, but it can mess with the tests. But my mom has been taking five milligrams of biotin because it was the one thing that stopped her lifelong elevated rate of hair loss. She stopped taking it for four days to do lab work, and her rate of hair loss increased during those four days and then decreased again when she started taking it again. So there are some people who don't know that they're doing that, who are doing that with those supplements, but probably 80 or 90 or more percent of the people who are taking those supplements should probably take a loading dose and then go to something smaller. But the supplement industry has not made it very easy to do that.

Katie: That was going to be my next question, is people hear this, they probably are thinking, oh, I probably need more biotin. This sounds great. How can the average person some people probably do have their own genetic test, but how can the average person figure out how much is an appropriate dose for them?

Chris: Well, there are good ways and there are okay ways to do it. So the ideal way, if resources are not limiting, is to do serum biotin testing and functional marker testing, usually in the urinary organic acids. It's where you'll find functional markers. The Great Plains Organic acid test has methyl citrate as a marker. The Genova ion panel has beta hydroxy isovaleric acid as a marker, and the nutrival has beta hydroxyisovaleric acid and three hydroxypropionic acid as markers. I think the nutrival is probably the best because 90% of people have elevated beta hydroxy isoville in their urine, but 10% don't, and the other 10% are probably going to be caught by the second marker that they have.

So the neutral valve with serum biotin from Labcorp or Quest would be the best way to dial up the dose that you need to optimize those things. But for people who are not doing data intensive health journeys, then I would say if you believe that the symptoms line up with your experience and that it makes sense with your diet or you think it's just plausible, that you have a higher need, given your symptoms, then you could take a ten milligram loading dose for two to four weeks and then cut it down to either just an increased amount of egg yolks or liver in your diet or something a little higher than that. I 300 microgram or a 600 microgram supplement and see A) did the high dose get rid of the symptoms? And then B) did the symptoms stay away on the maintenance dose and then use that data as feedback to try to titrate yourself up or down.

The issue is a lot of people may need very high dose biotin, but even though there's no toxicity of it, that doesn't mean that there's no adverse consequences to it. I mean, one case is that it can mess with all kinds of lab work and you have to be mindful of taking it out. But there are also issues where it might cause imbalances with other B vitamins, especially thiamin, riboflavin, niacin, pantothenic acid and lipoic acid. And then I just published an article last night where I think anecdotally and in my reading of the biochemical literature, I think it's possible that biotin promotes the detoxification of oxalate. And I think that although generally the low

oxalate community reports that biotin supplements are helpful for mitigating so called dumping symptoms, which are symptoms of removing oxalate from the body, where basically the oxalate comes back with a vengeance, sort of a detox reaction.

But there are some anecdotes of people who seem to have oxalate dumping symptoms in response to high dose biotin supplementation, either two milligrams or in one case, one commenter on my website had two kids who were taking five milligrams. They did fine, but when they increased it to ten milligrams, they got a terrible skin rash that took months to go away. So I don't think you want to be carelessly using doses that most people don't need. You should use high milligram doses if you have shown in yourself that it helps you.

But even then, you should think about what imbalances that might be creating with the other B vitamins. But I don't like how the supplement industry has encouraged people to almost only have the option of taking 1, 5, 10 milligrams because you want your diet and supplements together to mostly look like what a really good diet could provide. With the targeted exceptions that you have data, whether it's lab data or your own personal experience, to back up that, you need a deviation from that.

Katie: Yeah, and that's an important point because I feel like some people might hear that it helps stop hair loss in your mom and then want to take it as an insurance policy and high dose. And I feel like this is an important caveat that extends across a lot of supplementation, which is that if some is good, that definitely does not mean more is better. So even to your point, even though biotin would be considered pretty nontoxic, even at high doses, that doesn't mean it doesn't have potential effects.

Would it be safe to say that if someone's paying attention to their symptoms and their own data, that somewhere in that 300 microgram range could be a safe maintenance dose if they're noticing some of those symptoms and noticing a change from that?

Chris: Yeah, I think very few people outside of the genetic disorders we were talking about, so the 29 out of 30, I think very few people will need a maintenance dose above 300 micrograms.

Katie: And if it's possible, can someone get that in, for instance, a Be complex? Or do you not recommend a B complex for other reasons?

Chris: I don't like B complex’s that much, and part of it is that they all have some sort of problem with them. But the other part of it is ultimately you need to tailor the B complex to individuals in the same way that you need to tailor individual supplements to individuals. And it doesn't really simplify things, but yeah, I mean, if you are taking a B complex otherwise and it has that amount of biotin in it, then that covers your bases. But 300 micrograms at the high end of the requirement, that would typically be required by someone who's eating a lot of protein in the 200, 300 grams of protein range.

Katie: Okay, good to know. And I know we got to get into some of the other B vitamins in the past episode, so I'll make sure I link those in the show notes. They're really good for you guys who haven't already listened to them.

Another one I would love to go deep on is sodium. Because I feel like this one has been the target of a lot of misinformation over the course of the last couple of decades, and I still hear from so many people who are very carefully avoiding sodium in all forms. And I feel like there's so much interesting data about this. And I know you've also done a series on sodium, so let's kind of do the same thing, starting broad and then getting more specific as we go. But what do we need to know about sodium?

Chris: Yeah, well, real broadly, sodium. So for people who have heard of ATP, which is the universal cellular energy currency, sodium is just as common or almost as common as a secondary source of energy. So one of the main things that you do with ATP is you pump sodium across membranes so that when it flows back, you can use the kinetic energy to power things much in the way that a water mill, back in the old days would use the kinetic energy of water that's flowing down and use a turbine to harness it, and so on. And as a result of that, if you think about it in money terms, you could think of like ATP as your primary checking account. Sodium is the cash in your wallet or something like that.

And as it turns out, sodium is needed to absorb many nutrients, ranging from glucose to B vitamins to iodine to just a huge list, not only in the intestines, but also in cellular transport in the body. So transport of different things into different tissues. So that's one gigantic thing that covers sort of like everything could go wrong if you don't have enough sodium. And neural impulses would be kind of an example of that. In that case, you're not transporting a thing, you're transporting information. And the way you transport that information from whatever initiated a neural impulse is that sodium and potassium flip sides on the neuron's membrane all the way down, traveling down the axon, and that's how the information travels.

So if you don't have sodium neurologically, you're not going to work correctly. And then on top of that, sodium is how water gets around. In fact, if you have diarrhea like salted, rice is probably going to be, more often than not, a very helpful way to fix that, because the sodium and the glucose will get absorbed together, and they will hold on to the water in your blood. The main thing that keeps water in your blood is sodium and glucose. Those are the two major osmolytes that hold onto water.

Now, potassium is generally going to fall into your cells and hydrate your cells, but water has to come from your mouth, through your gut, into your blood, outside of the cell before it ever gets into a cell. So you can think of sodium hydrating the outside of your cells, and potassium hydrating the inside of your cells, but you can't hydrate the insides of your cells if you can't get water into the outside of your cells first. Right.

Sodium and potassium are playing non interchangeable roles in hydration. And if you don't have enough salt incoming, you cannot hydrate yourself with water because there's nothing to hold onto it. And generally, symptom wise, I think that on top of that, there's a million other things that happen where just certain enzymes only work with a certain concentration of sodium and things like that. So, like dopamine synthesis, for example, is very dependent on sodium because the enzymes don't work if there's not a high enough concentration of sodium.

And I've actually seen in people, it seems that there's a certain type of candidate for supplementing with salt. It's like LMNT or some kind of like salted water or whatever. But some palatable way to get more salt than you would otherwise want to eat are people with low dopamine symptoms, low motivation, low ability to target a task and keep your attention on it, low energy that has a mental component.

But then of course, the whole category of low blood pressure people. So even if it's positional low blood pressure, it's still probably the case that more sodium would help. And that's simply because your blood pressure is driven by how much water is in your blood, right? So hydrating your blood plasma is what provides blood volume. And if you have too much blood volume and get high blood pressure for it, that's the concern about sodium is that it would generate too much blood volume, putting too much pressure on the walls of the blood vessels. But correspondingly, not enough blood pressure is generally a not enough sodium problem.

And if you look at the trials of sodium restriction, then what you see is some 15% of people have all kinds of problems like fatigue and brain fog or just sort of general cognitive dysfunction and gut problems as a result of restricting salt down to the recommended for healthy cardiovascular function level. And conversely, if you look at high doses of salt in trials, one of the most common symptoms is a headache. So I think generally speaking, most people should just salt their food to taste. But if you have high blood pressure or headache and it responds to lowering salt or to increasing potassium, then you probably needed to alter your salt to potassium ratio.

And conversely, if you have malabsorption, gut problems, fatigue, brain fog, general cognitive dysfunction, or really any kind of secondary nutrient deficiency that you can't explain otherwise might be a sodium problem because sodium is used to transport so many nutrients from the gut that if you have malabsorption, you should see if it goes away with more salt. Because it might not be some kind of hard to fix gut issue. It might just be that you don't have any salt in your food.

And last thing on this is I think the real part where people go wrong is when they eat whole food diets, they do not realize they have no clue how much salt they cut out of their food supply. Because only 6% of the average person's salt comes from salt that was added on the table and some, like 20% comes from salt that was added during cooking. But almost all the salt people eat comes from processed foods. And in processed foods, they don't taste salty because the salt is used for many food science reasons that hide the salt from your taste buds.

So when you cut out processed foods, you're cutting grams of salt out of your diet that you will not ever be able to make up with whole foods unless you're eating from extremely obscure types of fish. As a blanket statement, your sodium intake will drop by grams if you move from a high processed food diet to a whole food diet. And you don't liberally salt your food. And so most people on a whole food diet, if they are purposefully restricting salt, are plunging themselves into a deficiency range where they're almost certain to need more salt.

But even many people who are not deliberately restricting salt, if you're going by taste alone, you don't realize how much salt was hidden from your taste in the processed food you used to eat. And so your perception of how much you need to salt your food might be off. And in general, I'm a believer that salting your food to taste is the right strategy, but it might not be the right strategy for someone whose taste has been artificially reprogrammed from a low salt diet or a processed food diet. You may need some time to recalibrate your taste.

Katie: That's so interesting. And so it's likely, especially if someone has cut out processed food, which I would of course recommend to at least reduce or cut out processed food.

Chris: Yeah, oh yeah, cut it out. But realize that you need more salt.

Katie: But be aware of this. So it's actually more likely that someone in that scenario could be deficient in salt or need more salt rather than less salt. Even though there's still kind of this prevailing idea that we should eat less salt in general, which I don't personally agree with, just purely anecdotally I've noticed I feel better and more energetic if I drink LMNT, for instance, before coffee, in the morning, before breakfast and really focus on actually getting enough of that.

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I also love their Red Light Mask, which boosts mood, stimulates collagen, activates glowing skin, reduces fine lines, and regenerates cells. Light therapy is a gentle, non-invasive treatment that mimics low-level wavelengths found in natural sunlight. Oh, and this mask is cordless and comes with a secure top strap so I can do other things while am getting my glow on! I most often use the mask while sitting on the PEMF mat and listening to a podcast or audiobook. They also have a whole line of supplements to maximize hydration

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Is it true that also if someone is sauna'ing daily or exercising heavily, that would be another reason to increase sodium intake?

Chris: Well, very interestingly. In the recent publication in the revisions of the sodium DRIs by what's now the National Academy of Medicine used to be the Institute of Medicine, the DRIs are the RDA and all the related variables. There is no RDA for salt, but there's an AI, which is a less evidence based recommendation, and there's a chronic disease reduction CDR or whatever it's called is a new metric.

But anyway, they state that their recommended amount for salt does not apply to people who engage in intense exercise or exposed to high ambient heat. And they never define anywhere where what constitutes hot or what constitutes too much exercise. Generally speaking, what happens is that if you are new to the exercise or you're new to the sauna, you're probably going to lose a ton of salt in the sweat. But if you do it all the time, you're going to adapt to it and you're going to lose less salt, but you're still going to lose some salt. So I think it's something where you just need to listen to your body and you may experience that the salt tastes less salty when you need a lot of salt. So pay attention to how different methods of getting salt, how they taste, how you feel afterwards, and how it correlates with your exercise regime and heat exposure.

Katie: I'm glad you said that. I've been curious if that was a reliable metric because I've noticed, for instance, after a heavy workout or a long sauna session, I can drink LMNT and I don't taste the salt at all. Whereas if I've

already had food with sodium throughout the day or I've already had a couple of LMNT, it tastes a lot more salty to me. So that's actually a reliable feedback mechanism that people can pay attention to.

Chris: Largely. But like I was saying before, if you've overridden it for a tremendous amount of time, it might not be as perfectly calibrated. But generally speaking, that the demand for water and salt is regulated by the hypothalamus. And you don't need to be good at it. It's sort of like you don't need to be good at breathing in order to get oxygen.

And if you just look at like a textbook explanation of how this stuff is regulated, the base case is that someone just drinks when they're thirsty and that's how they get enough water, and they eat more salt when they have a taste for it, and that's how they get enough salt. There are primary hypothalamic defects and psychiatric disorders that can override that. And then there's also conditions of, like, someone can get hyponatremia, which is low blood salt if they are running a marathon and they are drinking water faster than they can make urine from it. And so they may have a very intense thirst because of the exercise that they're doing, but the stress is just there's too much stress there for the system to work properly. And so you feel like you need a lot of water and you drink too much, and that can cause some serious problems. But 99% of the time, that's a good metric.

Katie: Is there any kind of general upper limit for someone to think of when they are on a more whole food diet? They've eliminated processed food and maybe they're exercising regularly. Is there like sort of a safe range you can pay attention to and then obviously pay attention to your own body as well? But is there any kind of general guideline you would get there?

Chris: I think it would be insanely hard to salt your food and hit any kind of upper limit. So probably five to six grams of sodium is a reasonable upper limit. But I forget the percentage. Salt is let's see, salt is somewhere around 70% sodium. So let me just take two figures here by 58. So yes, salt is like 40% sodium. So if you take 5 grams and divide it by that, that's like 13 grams of salt. I don't know, even LMNT, you need a box of it. So people are way more likely to hit their individual tolerance before they are to hit, like a general cap on how much sodium is safe, unless they have some belong to some weird cult that believes that the more grams of salt you eat a day, the closer you get to heaven or something like that. But no one's going to salt by taste their way to 13 grams of salt a day.

Katie: Okay. So the average individual wondering like, am I getting too much salt or not enough salt? They're much more likely to be on the not enough end of….

Chris: Well, you're getting too much salt if you get headaches, edema, swelling, or high blood pressure that responds to reducing your salt. Even in those cases, it might be more of a matter of balance of potassium than it is the salt. But your salt to potassium ratio is too high if you have those symptoms, and lowering gets rid of it.

Katie: Okay, and you've mentioned potassium a few times, so let's talk about that one too. Are there ranges, things to be aware of, forms of potassium, sources of potassium, amounts of potassium? What do we need to know about that in light of the sodium conversation as well?

Chris: Yeah, so very briefly, we could kind of borrow from that conversation for the sake of time and say that potassium is a nearly universal partner to sodium, generally participating in most of the things that sodium does. Potassium is also needed to handle sodium, and sodium is needed to handle potassium, and generally they're needed for water balance. Like I was saying before, sodium helps bring water in. Potassium helps bring it from outside to inside your cells, and then there but there are, there are things in particular that potassium does.

There are certain enzymes that are activated by potassium that are involved in energy metabolism. So I think potassium has a very unique way that it can promote feeling energetic and having good glucose tolerance. But that said, generally, when you look at adverse effects of sodium, it's really an adverse effect of the sodium to potassium ratio becoming too high. And generally speaking, people are a lot more likely to run too low in potassium for the simple reason that in our ancient past, we had to seek out salt deliberately, and potassium was in foods that were all around us because generally low calorie foods are pretty high in potassium.

But when you start, like with the advent of agriculture, we started producing foods that were very high in calories relative to their potassium. So the grains, for example, are much lower in potassium per calorie than pretty much any other plant food, and then we start refining them. And so nowadays it's very easy to get high calorie, low potassium food, but also we don't need to go to the ocean. Like, different ways to get salt in the past would be find like a wild salt lick in mine salt, or go to the ocean, take ocean water and use it in your cooking water. That's what they did in Katava, for example. Nowadays we have it on the table, right?

So we have an evolutionarily programmed desire to seek out salt and no such desire to seek out potassium because we never needed it. And now that the tables are flipped, it's hard to get potassium and it's easy to get low potassium foods, it's easy to get salt. So I think it's very common to need more potassium. And generally speaking, there's a few dietary rules of thumb. So first of all, animal foods are generally a good source of potassium, but there is no potassium in fat. So when you're looking, I'm not a fan of eating egg whites, and they're terrible for biotin status, but if you look at potassium in an egg, it's one of the few things where you're obviously getting more potassium if you were to eat egg whites alone and cut out the yolks.

I'm also not a fan of skim milk, but there's way more potassium in skim milk than there is in whole milk, simply because fat has no potassium. So there's no potassium in butter. If you eat meat, the leaner cut has more potassium. But another rule with animal foods is that potassium is lost in the cooking water. So if you cook steak, you will lose like half the potassium in the pan if you throw out the juices. So if you find a way to reincorporate the juices, whether it's cooking it into a stew or just drizzling it back over your meat and soaking

it up with rice or potato or bread or vegetable, whatever you want, then you'll get a lot more potassium from your animal foods.

And then in plant foods, there's a couple of principles. One is grains are low in potassium, refined grains are extremely low in potassium. And then a very wide spectrum of plant foods is basically the best way to get more potassium outside your animal foods. And most rules that people think of are bad ones. So, for example, like bananas are good in potassium. You have to eat 1200 calories of bananas to get enough potassium in a day. So you don't want the simple foods. Like, this food is high in potassium for the most part if you're not eating an extremely high fat diet.

So people on keto really need to select vegetables that are high in potassium. And in fact, I have on Chrismasterjohnphd.com, I have on tools, you can click open getting Potassium on Keto or Carnivore, I think it's called, and it's a database that ranks foods by their potassium to net carb ratio. So I do think that's, like, when you're, when your fat is really high is when you have to think a lot about your potassium, but otherwise it's sort of like don't eat a grain heavy diet and don't eat refined grains. Diversify your plant foods across legumes, tubers, fruits and vegetables and try to preserve the juices and your meat. And those are probably the top things you can do to get good potassium in your diet.

Katie: And I know you cover these in depth also on your website and your Instagram, so I will link to both of those. Definitely recommend following you because I always learn from you on those. I know we could do entire episodes on each of these topics for sure. Briefly, I would also just love to touch on Omega-3 Omega-6 balance only because this has been more prominent in the news lately and I feel like there's also a lot of misinformation circulating around that.

Chris: What happened in the news?

Katie: Well, just there was the whole, like, Omega-3s are good, Omega-3s are bad, they're going rancid. Omega-6 are actually good for you. We need vegetable oil.

Chris: There's been a lot of this is like the last ten to 20 years news cycle, I think. Okay, what you need in your body is an omega-6 fatty acid called arachidonic acid, which, like biotin, is most abundant in liver and egg yolks, and an Omega-3 fatty acid called DHA or Docosahexaenoic acid, which is mainly abundant in fish. But smaller amounts can be found in the egg yolks of pastured chickens, especially if they're free ranging and eating bugs and stuff like that.

And there are tiny amounts of these in other animal fats. Now there are plant oils that can provide precursors to these, but we need to make those conversions. And there's a lot of variation in the conversion. Humans generally aren't great at it, but some humans are terrible at it. And it's hard to know which one you are without measuring your red blood cell phospholipid fatty acid content. So for most people, I think as long as

you don't have ideological choices or ethical choices that exclude this, I think it's just generally people should try to incorporate egg yolks, liver and fatty fish into their diet on at least a weekly basis.

As I was saying before with the biotin that I think most people need really one egg yolk per serving of whole food protein is really like a good rule of thumb. So most people need more than that of egg yolks. But for the fatty acid content, if you just eat four to eight ounces of liver a week, a few egg yolks a week, and one serving of fatty fish a week, I think you're doing yourself a world of favor in terms of getting these fatty acids and not relying on the plant oils.

The Omega-6 Omega-3 balance issue is something that's gone on for ages. But it really doesn't matter if you do what I just said. So if you're getting the preformed fatty acids and you're not completely overdosing on one side versus the other, so you have one or two servings of fish, one or two servings of liver, handful of egg yolks in a week, you don't have to worry about the ratios. But when people are vegans, or when they are overwhelmingly getting these fatty acids from plant oils, that's when the plant oils become very relevant. And the specific problem that I think is the real problem, as opposed to what a lot of other people are talking a lot of other people are talking about inflammation and this and that, I think most of that is kind of bogus.

But the real problem is that if you do not have DHA in your diet and you are eating something that has an omega-6 to Omega-3 ratio of 150, such as you would find in some types of vegetable oil, corn, Safflower, etc, that is the singular way that you can reduce your brain DHA content. Because what happens is in order to convert the Omega-3 plant oils into DHA, you need to use the same enzymes that you use to convert the omega-6 oils into our academic acid. And if you overwhelm that one enzyme system with one side or the other, then you wash out the ability to do the conversion with the one that is in low supply.

So 150 to one ratio of omega-6 to Omega-3 is going to make all omega-6 feed into that enzyme system. And none of the Omega-3 is going to make it into make DHA in the brain. And instead, you're going to get this imposter Omega-6 fatty acid that looks like DHA, it smells like DHA, but it doesn't give you good psychiatric health. It doesn't make your eyes work. So you wind up with a bunch of problems. The, the way this was discovered was in the 70’s and a year old girl who had an abdominal gunshot wound. And she was fed for six months exclusively on total parental nutrition, which is intravenous nutrition. And they had two formulas. One was soybean oil, which has a reasonably balanced ratio. The other was safflower oil, which has a crazily unbalanced ratio. And they didn't know that they mattered. But when they fed her the safflower oil, she started getting double vision and all kinds of gait abnormalities, peripheral neuropathy. It was just neurological catastrophe. And they switched her back to the soybean oil and then she was fine.

But no one out there, there's not that many people who are eating safflower oil who are getting double vision, peripheral neuropathy, and gait abnormalities from it. So what that highlights is that when you're on total perennial nutrition, the only thing going in your body is whatever the oil was that they put in your veins. And so when it's your only source, that's when the ratio becomes extremely relevant. But I think just if people just follow the general rule of thumb I gave before, and eat a little bit of liver, a little bit of fish, and a little bit of

egg yolks, and don't load up on the plant oils, I think they're in a very good situation. Don't need to worry about it.

Katie: Okay, so would you say supplementing can still be beneficial or not really, like, not really needed for most people?

Chris: I think for people who don't eat fish and shellfish, I think some supplementation is a good idea, probably to the tune of 300 milligrams per day of DHA max. However, there are some pharmacological uses of fish oil containing a mix of EPA and DHA, which may possibly be more influenced by the EPA for certain psychiatric conditions, mainly depression. And it's definitely the case that high dose EPA is a pharmacological way that you can lower triglycerides. But I don't really consider either of those supplements because I think what they're doing is kind of hijacking the biochemistry and using it more like a drug, which is fine. I don't have, like, an ideology against drugs, but I think that's a very separate thing from what's the nutritional requirement for DHA.

Katie: Great point. Okay. And I know there's a thousand more topics that we could cover and they could each be their own episode, so hopefully I can talk you into another round in the future. But lastly, for today, can you just talk a little bit about the resources you have available on your website? Because I know you have so much more there for people who are interested in springboarding into learning more about these things.

Chris: Yeah, so, chrismasterjohnphd.substack.com is the main way to find my work. I've migrated my main content production into my Substack newsletter. And actually, if you go there now, not sure when the recording will be out, but this is probably still true. There's some recent stuff on Biotin that links to several articles that cover all the stuff that we were talking about.

And then on there you'll find in the menu there's links to my ebooks and to my courses. And one of my courses is a free course, which is Vitamins and Minerals 101, and that is a 30 day email course that gives you one lesson on each nutrient. That's basically what you'll also find on my Instagram. So on my Instagram, what I have is slides that are coming from those lessons. And so, yeah, I mean, you can find me all over social, but chrismasterjohnphd.substack.com just go to the menu and look at the different offerings available. There is where you'll find all my stuff.

Katie: And I'll make sure that link is in the show notes as well. Chris, it's always so much fun. I always learned so much from you. Thank you for the time today.

Chris: You're welcome. Thank you for having me on, Katie. It was fun.

Katie: And thanks as always to all of you guys for listening and sharing your most valuable resources, your time, your energy and your attention with us today. We're both so grateful that you did, and I hope that you will join me again on the next episode of The Wellness Mama Podcast.

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