



Episode 256: Decoding What Your Body Really Needs with Chris Masterjohn PhD

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Katie: Hello, and welcome to the "Wellness Mama Podcast." I'm Katie from wellnessmama.com. And I knew I wanted to have today's guest on this show when I sat at the same table with him at an event and we geeked out about pantothenic acid, and kinase, and genes, and a lot of other fun topics. And I'm here with Chris Masterjohn, who is a Ph.D. in Nutritional Sciences from the University of Connecticut. He has served as a Postdoctoral Research Associate in the Comparative Biosciences Department of the College of Veterinary Medicine at the University of Illinois, and as Assistant Professor of Health and Nutrition Sciences at Brooklyn College, part of the City University of New York, which is all really amazing because he's still very young, and he's already accomplished all of that. He now spends his time researching and producing some of the highest quality nutritional information out there, all in a way that's easy to understand and absolutely fascinating. And I'll link to it in the show notes, but definitely check out his Nutrition 101 course on his Facebook page, and his testing nutritional status, "The Ultimate Cheat Sheet," which helps you decode your own body. But we're gonna jump into all of that today. So Chris, welcome, and thanks for being here.

Chris: Thank you so much for having me. It's great to be here.

Katie: I can't wait to jump into so many topics with you. But just for a little bit of background, can you just tell us how you got into this area of nutritional research?

Chris: Sure. Well, I guess there's two aspects to the background, one is, why I kind of cared about it at all. And then, the other is like, how did I get into exactly where I am now? In terms of how I got interested in nutrition, it was largely a result of initially growing up around my mom who had her own health struggles. So when I was

a teenager, my mom had fibromyalgia and she was often in so much pain at night, that not only she didn't sleep, but I didn't sleep because I was, you know, across the apartment from her, the house depending on where we're living, and she was just in so much pain that she was, you know, moaning through the night. And I watched her go through a journey where she experimented with many things, and it's hard to really put a finger on exactly what worked. But macrobiotics was part of it, yoga was part of it, tai chi was part of it, herbs were part of it, lots of different things. And whatever it was, she no longer is moaning in pain every night. I mean, the chronic pain is largely a thing of the past. And so, for me to see the power of nutrition and diet and lifestyle so early on, made me just quite fascinated in what it could do for me and other people. And that curiosity got me into trouble. So, I experimented with a number of different diets, the zone diet was an early one. But then I read a book called "Diet for a New America" that convinced me that veganism was the ultimate solution to my problems and the problems of the world, especially on the fronts of making the environment better, helping animals, and helping my own health.

And on the vegan diet, my teeth fell apart, my mental health fell apart, my digestion fell apart to the biggest events. Well, one was an event. So the biggest event, single event, was when I went to the dentist and I found out that I had over a dozen cavities and that I needed two root canals in a single session. And the biggest sort of long term development, over that course, was that the anxiety problems that originally crept up when I was a teenager became so aggravated that...they were a nuisance before, at this point, they were really just tearing at the roots of my well-being and my being able to hold myself together as a human being. The other development that wasn't really a specific event, but was just a development over time, was that the anxiety problems that had originally crept up when I was a teenager became so extreme that they really started tearing at the fabrics of my life and at my ability to hold myself together as a human being. So, as an example of what I would go through, I would be so afraid to eat the food in my house, afraid that it was tampered with in some way, that it was drugged or poisoned, that I would examine everything that I ate for some evidence of that. And if I didn't find it, I would just continue examining it until I had, I don't know, say, rip the hole in the packaging or something like that, that convinced me that maybe that hole was there before. And it was just completely paralyzing and debilitating. And I would, you know, be angry at myself for not being able to eat anything, just throw the food across the room in anger.

And there were times where... And the crazy thing is that I don't really have much memory of this, but I was talking to my mom recently about it. And during that time, she told me that she had brought me to the emergency room numerous times during the peaks of panic attacks that I was having. And it took me a lot of effort to even start to remember a little bit of that. So, my memory of some of the worst things that happened to me, in that time, is actually really, really bad. And all of this changed one day when I was an undergraduate majoring in history, and I was working in the undergraduate dining hall, and my boss, at that time, was into drinking raw milk. And he had a pamphlet that came from the farm that he got his milk from that talked about the work of Weston Price. Weston Price was an early dental researcher and he inadvertently became a pioneer of nutritional anthropology. He had studied all across the world traditional diets that groups of healthy people were eating before modern foods came in the picture. And he documented the nutritional transition all across the globe from these traditional diets to what he called the displacing foods of modern commerce, the white flour, white sugar, canned goods, syrups, and sugary things. And of course, sort of, like, that book in a sentence is that, all these traditional diets, despite their great diversity, were all strongly protective of not only tooth decay, but mental and physical health in every way.

And the transition to these modern foods, as we might expect today if we have any sense of health, was associated with degeneration and onset of all these degenerative diseases that we take for granted today. And I think what really struck me and what was really transformative to me, was actually, what the traditional diets contained that Price had identified as so protective. So, he especially emphasized that these diets had foods that were rich in fat-soluble vitamins and that these groups went out of their way to procure. And these foods were things that I wasn't eating when I was an omnivore, and my friends who are omnivores weren't eating, and they were animal food. So it was like, I was at a disadvantage because I was vegan. But I had been at a disadvantage before because I wasn't emphasizing these foods. These were foods like organ meats, bones, small animals, like small insects and small frogs, where they were so small that you would eat them with all the organs, eggs, shellfish, dairy products with the fat. So, you know, I had some dairy products and I had some eggs, but I wasn't eating organ meats and bones, and shellfish on a regular basis or any basis, and in some cases, like with organ meats. And so, I started incorporating the principles that I had learned from Price's writings. And I underwent this dramatic transformation that is still mind-boggling to me to this day.

So, first of all, the tooth decay stopped, so that's great. But you know, I was actually trying to heal my teeth. I was not trying or expecting to heal my mental health. And the point at which I realized that everything had changed, was one day when I was working in the dining hall, and I watched this guy pick up a stack of plates, and take a plate from underneath that stack. And I look at the guy like he's kind of weird, I think to myself, "What's wrong with that guy? Why didn't he just take the plate off the top?" And then I take a few steps, maybe five or six seconds pass, and all of a sudden, it comes back to me that a few months before, I had always done that every time I took a plate. And when I would take a glass to drink water, I would spend 20 minutes looking at all the clean glasses, looking for a glass that was clean enough for me to drink out of. And so, somehow, not only did my mental health completely undergo a revolution, but it happened in such a way that I didn't even notice it. So, to this day, I really don't know whether everything was fixed in one minute and I forgot what I had been like before one minute ago, at that point, or if it was gradual over the course of three months, and I just gradually lost the memory of how bad my mental health had been, in proportion to the healing that took place over those three months. I really don't know because I have no memory of the actual transition. I just remember being borderline crazy and being completely mentally healthy, like a completely new person.

So, that was a really extraordinarily powerful experience for me to go through. And I wanted to pay it forward, that led me initially to pursue a medical degree. But graduating with a history degree, I needed a lot of science courses to make that happen. And as I was taking the science courses, a few things kind of collided. One was that my co-workers in... Well, I had started writing about nutrition. So the people that I was working with when I was writing about nutrition, and also my professors, were really telling me that I had the brain for research. The second thing was that I really fell in love with the molecules and the biochemical pathways, and all those tiny things that we can't see behind the curtain. And I really fell in love with playing around with theories and ideas about how those things worked. And in my writing, at that time, I was reading hundreds of scientific papers and coming up with new scientific hypotheses that I knew no one would research unless I went into research. And that's what led me down the research path. So I got my Ph.D. in Nutritional Sciences instead of going to medical school.

As you mentioned in the intro, I have graduated with that and then went to do a postdoc, and then I went through the full-time tenure track faculty course. And after spending five or six years in academia, I realized a couple of things about myself and about what I was really passionate about. And even though I really do have

a research-oriented brain, I'm far more interested in being able to work creatively with whatever I feel are the biggest problems to solve, and really connecting dots with what's needed in ways that I can't really do in academia. Academia really pushes you to specialize in one very narrow focus, and I really want more freedom than I would get with that kind of narrow focus. And personally, I have a very, very visceral need to be in control of the big picture of how I'm conducting my life. And although in academia, you get probably tremendously more freedom than the average person would ever want because of the associated responsibility, it's not enough for me. So, that brings me to where I am now, just operating independently, and trying to find new ways to immerse myself in the science, and come up with new ways to translate that science into practical things that people can use to help them on their journey towards vibrant health.

Katie: I love that. And that's when I knew I had to interview you on the podcast because, just in talking to you, I realized, I would agree with your professors, you have an amazing, brilliant mind for research, but it's that creativity key that is so important. I think together, those are your superpower because you can take these really complex topics and really delve into them, but then, make them digestible for anybody to learn from. And even more so, I could see your passion for doing that. I didn't realize, it's interesting, I had a similar story with learning about fat-soluble vitamins, thanks to a couple of cavities. And since I got that fixed and, like, worked out of my diet, I've never had a cavity since and neither have any of my kids. So, that's been a little bit of our story as well. I'm curious. part of what's so amazing about what you talk about is that it's about figuring out your own personalized nutrition and health plan. Because I think there's so much great information out there, but the real test is learning what actually works for our own bodies and our own lifestyles. And so, I have some questions in a little while about some specifics that I wanna go deep on. But before we do, I'm curious if there are any things that you think have widespread application that are almost somewhat close to universally applicable?

Chris: So, I think that, you know, the principles of individualization are incredibly powerful and incredibly important and very central, but they operate within this very, very big box. So, we kind of have a playground, it's such a big playground, that we can go in many different directions and spend our time in many different places, but there are boundaries around that playground. And so, you know, one of the principles that we could say is that, virtually anyone would greatly benefit by cutting out refined foods from their diets. So, white flour and white sugar, and things like that. Virtually anyone would benefit from cutting out highly heated oils, especially the industrial oils. Like, if you go to a restaurant, you're eating fried foods, you have a dual problem there, where the simple fact that the food is deep fried in oil, and that that oil has probably been reheated a number of times, means that there's gonna be a lot of toxic junk in that food no matter what the oil was. But there's a double whammy because, unless you go to a very specialized restaurant that is very interested in marketing at a specific type of health consumer, then it's almost guaranteed that the oils are gonna be as low quality as you could possibly get. And so, cutting out those fried foods is almost universally gonna be beneficial. You could probably extend that to say that, unless you're an extraordinarily avid label reader, you should probably just avoid packaged foods that have oils in them because even in a health food store, I would say that like 90...

I was just in a health food store and I was looking at seaweed snacks, and I was like, "Man, I could really go for some seaweed snacks right now." And I'm looking at all the seaweed snacks and, like, they all have cottonseed oil or canola oil in them. This is an organic health food store in my local neighborhood. I'm like, "Okay. I'll look for the olive oil one." So, I'm looking at the whole shelf, I find the olive oil one, then I look at it, and it turns out that there's more canola oil than olive oil in it. And so, I mean, unless you're really doing your homework to

select highly specific products based on the types of oils that they have, you'd be better off just avoiding any packaged foods that have oils in them at all. And in fact, if you're gonna go buy packaged foods, if you could just, you know, avoid ones that have refined sugar, refined flour, things you can't pronounce and any oils, then that'll probably help you narrow down the bunch quite a bit. So, there are some rules like this. I guess those are obvious ones. There's probably a lot of people who would maybe disagree with me on a tremendous amount of what I say and would still agree with that stuff, just because that's so, so, so obvious to anyone who spends much time in the health sphere. I think there are a few other principles that are... Well, I think, you know, you asked about universal, so I think the universal more or less ends there. But I think we could take once, before we get to individualizing, we could say, okay, maybe not universal, but what is a good baseline for everyone to start from before they start individualizing.

And I think that's where we could make a few additional rules. So, examples of some of these rules would be, try to get enough protein but diversify your proteins among the different possible protein sources. So, like, include some red meat, include some poultry, include some fish, include some dairy, include some eggs, include some shellfish. And you start to individualize that principle when you say, "Well, some people are allergic to shellfish and they can't have them. Some people can't consume dairy for various reasons," etc., etc. But diversifying across that branch, it's a very good starting place because even though you might think of these as protein sources, and they are, each of these different protein sources has a different profile of vitamins and minerals. And so, if you don't diversify, the more you restrict, the more you have to micromanage your vitamin and mineral intake. But if you do diversify, and you say, "I'm just gonna eat from the whole spectrum of this menu," then I have more liberty to not micromanage and not spend a lot of effort figuring out where I'm missing things. And then, you could take that same diversification principle and you could say, from your carbohydrate sources, diversify across whole grains, starchy tubers, legumes, fruits, and then you can start taking some of those out. So, like, you know, paleo people won't eat the whole grains. Often, paleo people won't eat legumes either.

I think you're better off taking grains out than you are legumes just because of their nutritional profile. But the more carbohydrate sources you take out of those categories or the more you just restrict carbohydrate intake, then the more you need to start micromanaging and making sure that you're getting your vitamins and minerals in. Another pretty good rule would be, eat several cups of vegetables a day, try to diversify across the color spectrum of reds, oranges, yellows, and greens especially, and put a special emphasis on making sure at least a cup of those are coming from dark green vegetables. And so, again, you can modify that rule, but it's a very good starting place to make sure that you're getting your vitamins and minerals in. And I think that one of the nutrients that is most narrowly distributed in the food supply would be calcium. And so, I think that a good rule of thumb for calcium is to try to shoot for about 1,000 milligrams a day. And you can get that from three servings of dairy products, three servings of edible bones, or some other foods. And I would kind of look at it like if you're not combining three servings of dairy or edible bones, then you should start looking at the specific foods that you're taking in. Because although you can get adequate calcium from other foods, within the context of a modern diet and the foods that are available in the grocery store, you have a pretty narrow scope of what you would be picking from to get those other things.

So, we can talk about those details later if you want. And then I would say, try to use the bones and skin of the animal products that you consume and try to use the organs of the animal products you consume. So, our ancestors, if they killed an animal, they would consume mostly the whole thing. They're not gonna throw away wasteful parts. But they also knew that there were valuable nutrients that were in the bones that weren't in

the muscle meat and knew that there were valuable nutrients that were in the organs and not the muscle meat. And I think most of us aren't slaughtering our own animals, so it's very difficult to get the sense of what is proportional. But as a rule of thumb, where most people who are coming from a standard diet aren't consuming any of these foods. And so, if you wanna get your feet wet, I would say consuming liver once a week would be the most important way to start consuming organ meats, working some heart and kidney into your diet would be the next best step. And in fact, heart is probably the easiest organ, even though it doesn't have the same value that liver does, it does have value to get heart and I think heart is fairly easy to consume just based on the taste and texture, it's much closer to regular meat.

And then bones to use bone broth or make soups and gravies out of bones, or to consume edible bones in the context of canned fish, are all great ways to start getting into using bones. And then finally, I would say we should all put some emphasis on getting digestive support at probably all of our meals. So, to eat something, even if it's a little bit, just something fermented or something like ginger or bitter tastes and other types of pro-digestive properties to make sure that all those other nutrients were actually digesting and assimilating because, you know, doing all that work to make sure there's a lot of nutrients in your diet doesn't really do you any good if they're not being digested and absorbed properly. So, I think maintaining a healthy digestion is very key. So, those aren't universal, but they are... I guess we could say they're universal in the sense that that's a universal starting place, and then we could move on from that foundation to start individualizing for people.

Katie: Got it. And I wanna circle back to calcium in just a minute because I think it's a really important one. But before we do, just a clarifying question. So, when it comes to organ meats, I get asked a lot if supplements like dehydrated organ meats work the same way because a lot of people seem to have trouble stomaching the taste or the texture of organ meats. So, what's your take on that?

Chris: My take on that is I hope so. And unfortunately, you know, I think it would be amazing to crowdfund some research into this. I think one of the most desperate needs for research in this community is actually getting a handle on that. What I do know is that, generally across the board, dehydrating something, as long as it's done in a gentle way, is the best way to preserve the nutrients in something. And that's largely because most chemical reactions are greatly enhanced in the presence of water. And that's true, like, if you're cooking something, cooking something in wet heat is generally far more destructive than cooking something in dry heat. And it's also true when something's just sitting on the shelf. Dehydrating something is a great way to prevent chemical reactions from taking place. Even if it's in the freezer, dehydrating something is a great way to... You know, certain things aren't as stable in the freezer as other things are, and dehydrating just across the board is... Actually, what I should say is, dehydrating and keeping it on the shelf is often better than freezing for certain things. In the case of liver, I think freezing is great because, probably the nutrient that is most unstable in the freezer is folate. And because the liver is so high...

Actually, I don't know why the reason is, and I'm assuming it's just because of the protective substances in the liver, for some reason, if you put liver in the freezer and you put vegetables in the freezer, within six months, all the folate is gone from most of the vegetables and all the folate is still there with the liver. So, my take is, I think so and I hope so, but I don't know. And I think what you wanna do is you wanna consume the organ meats in the ways that are as natural as you can stomach. So, I think it's better to freeze the liver... What some people do is they cut up the liver into little bite-sized pieces and freeze those, and then take them out, and

swallow them whole or maybe some people chew them up, I don't know. I think that's better than using the dehydrated liver capsules. But I think a lot more people are going to use the dehydrated liver capsules than are gonna do that. And so, you know, if it's not appealing to you to do that, then I would use the capsules. The best thing is probably the least practical thing, which is to consume the organ freshly after the animal was slaughtered. And none of us can do that. So I think just get it as fresh and as natural as you can.

Katie: Got it, that makes sense. And it would seem like taking the supplement is better than nothing.

Chris: Well, yeah, exactly. Exactly. So, yeah, taking the liver supplement is tremendously better than not getting any liver, for sure.

Katie: Got it. Okay. And one more clarifying question related to protein. You mentioned varying it, and I feel like the amount of protein that we should consume is a subject of pretty hot debate in the nutritional world with everything from the extreme saying like, you know, 2 grams per pound of lean body mass per day, all the way down to people saying, "We hardly need any protein at all." So, I'm curious what you're seeing in the research of how much...? Like, how do we even figure out how much protein we need?

Chris: Well, I would say that half a gram to a gram of protein per pound of body weight is what most people should be targeting. And basically, double that if you count your weight in kilograms. So, a gram to 2 grams per kilogram of body weight, a half a gram to a gram per pound of body weight. There are a variety of ways of looking at how much protein that we need. I would say there's far more data on body composition than there is on anything else. And those numbers are mainly from body composition. And body composition is not just about physique and aesthetics. Body composition is also about metabolic health and even longevity. So, some of the anti-protein stuff comes out of longevity circles, where the primary evidence is really on things like any animal experiments or, you know, a lot of longevity research actually comes from worms. But they're looking at longevity in the context of a highly controlled environment, where the animal just sort of, like, doesn't do anything and then just dies for some reason, at the end of the life. And that's not how longevity plays out in humans. So, I don't remember the stats off the top of my head, but in elderly people, one of the key things that happens before someone dies is they fracture their hip. And you know, heart disease and cancer are leading causes of death.

But hip fracture is up there, if you just assume that many of the deaths that happened in the year after someone fractures their hip are somehow causally related to the hip fracture. And if you look at how perching effects those things, well, you're looking at bone loss, you're looking at muscle mass loss, and you're looking at neurological coordination issues. I don't know about the neurological coordination, but certainly the bone mass and the muscle mass are tremendously better on higher protein intakes. And if you were to assume that protein was anti-longevity but pro performance in youth, you know, so it makes you stronger, it makes you look better, all things that you care about when you're very young but then it makes you die earlier, that would kind of seem to suggest that you should eat more protein when you're young and you should eat less and less protein as you get older. But all of the data on that indicate that the older you get, the more protein you need in terms of preventing muscle mass loss and probably preventing bone loss as well. And muscle mass isn't just about strength, and joint health, and movement, it's also about metabolic health. So the less muscle mass you have, the more likely you are to become insulin resistant and develop blood sugar problems, for

example. So, I think that optimizing body composition, according to what we know is healthy, is not just vanity, it's not just aesthetics, it's a real health-related endpoint. And I think, you know, in the absence of data on many other things we would wanna see, I do think that we should use that data.

I would also say that protein is very important for other things that we do have some data on, for example, glutathione is the master antioxidant of the cell and it's a very important detoxification agent in the liver. And glutathione levels require probably the lower end of what I had cited for protein amounts. So, you make glutathione from the protein in your diet. And it takes about a half a gram per pound of body weight to maximize glutathione synthesis. So, I think that range of a half a gram to a gram per pound of body weight is pretty good for available metrics of health. And if your focus is body composition, you wanna focus on the higher end of that range. If your focus is not body composition, then you can get away with going toward the lower end of that range. But when I say your focus is body composition, I don't just mean, do you wanna look like a bodybuilder? I mean, things like, do you need to lose weight? So, for example, overweight and obesity are significant factors in disease processes. When you lose weight, you need more protein to keep your lean muscle mass. And one of the things that you're trying to do when you lose weight is not just lose the fat but lose the fat and retain the lean mass. And then it's not just your muscle protein, it's also your internal organs in your bones. So, the healthy way to lose weight is to retain all your lean mass. And one of the most important ways to retain all your lean mass is to eat enough protein when you're losing weight. So, I think that, for any kind of body composition goal, whether it's athletic, or it's aesthetic, or it's health-related, such as losing weight healthfully, you wanna aim towards the higher end of what I had cited, being around 1 gram per pound of body weight.

Katie: That makes perfect sense. And it seems also really important for those of us with kids, who are in those growing phases or going to go through puberty when there's an increased demand. Like, it's great that, I think, to learn these things when your kids are still in those early ages so that you can help them optimize for the future by knowing these factors. And I also find it interesting, so I'm a doula and when I've worked with midwives and doctors, they talk about women especially needing more protein when they're pregnant, which even prevents things like preeclampsia if it's done correctly. And so, there definitely seems to be an important connection there. I think you explained it really, really well. Another area that's especially applicable, I think, to moms is the calcium issue. Especially because that's one area that mainstream lobbying does a pretty good job of letting us know that we need. But you know, from TV, it looks like you only get it from calcium. And I love that you mentioned fish in a can, which is one of my favorite sources. But I would love if you could talk us through calcium and how to know how much we need. And also, are there some things that need to be synergistic with it, like vitamin K and magnesium from what I'm remembering?

Chris: Okay. So, if you look at the RDAs for calcium, they are equivalent to 3 glasses of milk for most adults, they're equivalent to 4 glasses of milk for teenagers who are going through the puberty associated growth spurt, and they're equivalent to 4 glasses of milk for men over the age of 70, women over the age of 50, and not women who are pregnant or lactating. I was thinking it was increased for pregnant and lactating women, and it's not. But I'll lead into why I think we should strongly think about calcium differently in pregnancy and lactation after we lay down a few principles. So, there's a few things that make this a little hard to tease out. A lot of people look at this and they say, "Well, if we look at... If we're looking at the RDAs, we're looking at this powerful dairy lobby that wants to make sure we're drinking a lot of milk." And there have been plenty of human societies where people were not drinking a lot of milk and they still were thriving. And so, no one can get this amount of calcium without drinking milk. And therefore, you see like in the vegan crowd, you see in

the paleo crowd, and just the sort of anti-corporate lobby crowd, idea is circulating that we need a lot less calcium than what's there in the RDA. I think, one of the things that is interesting about this is, I think we actually have a lot more data on our calcium requirements than almost any other foods. So, like, in the case of growing children, there's actually a lot of data in children about how much calcium that we need. There's a lot of data for the age adjustments both in puberty and in older people to see how calcium needs increase over time.

One of the problems though is... Let me back up and address that first point. So, even though calcium in our society is mostly found in milk, calcium, generally, if you look at any other society, you're gonna find that, whatever society it is, in terms of traditional diets, they found unique ways of the filling their calcium requirements. So, in dairying societies, that's pretty straightforward. But if you go up into the Arctic Circle, for example, the traditional Inuit diet, there's no cows there, there's no dairy animals there, and there's not many plant foods, and where they're getting their calcium from is essentially from bone meal powder. They are taking fish bones and they're freeze-drying them, and pulverizing them, and they're consuming powdered bone to get their calcium. Go across the world to the Hadza, who are hunter-gatherers in Africa. And they consume a plant called the baobab, that has a lot more calcium than milk does, and it constitutes 20% of their diet. In fact, the ethnographers who have studied them have said that baobab is essentially a food group for them. And so, you know, you can look at plants foods or you can look at animal foods like bones, even in non-dairian cultures, the calcium intakes are often quite high, and generally hitting that thousand milligram per day mark. Nevertheless, there are some things that make it difficult to study the issue. One of those is that vitamin D and calcium cooperate with one another in ways that essentially lead to vitamin D and calcium kind of being on the same team.

And the more vitamin D you get, the less calcium you need. And the more calcium you get, the less vitamin D you need, within a certain range. So, you can't get zero calcium and just make up for it with lots of vitamin D. You can't get zero vitamin D and just make up for it with lots of calcium. But if you're in a relatively healthy window, it's probably the case that you could vary your calcium requirement up or down by the equivalent of one and maybe even two glasses of milk based on your vitamin D status. The second part of that is that phosphorus tends to be on the other team. So, the more phosphorus you get, the more vitamin D and calcium you need. The less phosphorus you get, the less vitamin D and calcium you need, again, within a certain window. So, you need phosphorus. You can't bring phosphorus down to zero and benefit from that. But, after you fulfill your basic requirements for phosphorus, and before you hit some point where you're getting phosphorus toxicity, there's a very big window, where, the more you get, the more you're antagonizing vitamin D and calcium. The less you get, the less you're antagonizing them. And the reason that's so relevant is that almost everyone in our society gets more phosphorus than they need. And in fact, if you look at the RDA for phosphorus, it's around 700 milligrams. The average American is getting about 500 milligrams of phosphorus from packaged processed foods that have it added as an additive that is not labeled.

So, the average American is almost doubling, not quite doubling, but almost doubling their needs for phosphorus through unlabeled food additives, through the consumption of packaged foods. So, even though we have a tremendous amount of data on our calcium needs, from teenagers, and from older people, and from middle-aged adults, and from young adults, either we have this voluminous data set, you could argue that most of those people, you know, are operating on this background of relatively poor vitamin D status and consuming lots of extra phosphorus from packaged foods. To make things worse, when they've done studies on how different sources of phosphorus impact your vitamin D and calcium requirements, those studies seem

to indicate that the phosphorus additives in packaged foods are dramatically worse than other sources of phosphorus. For example, one of the markers you would use to look in someone's blood at either not getting enough vitamin D or calcium, or getting too much phosphorus is a rise in parathyroid hormone. Parathyroid hormone goes up, in either of those situations, not enough D in calcium or too much phosphorus. And if you feed someone meat, which is very rich in phosphorus, it doesn't do anything to their parathyroid hormone. If you feed someone cheese, which is high in both phosphorus and calcium, it decreases their parathyroid hormone, which is a good thing.

And if you feed someone packaged foods that have phosphorus additives, it increases their parathyroid hormone, which is a bad thing. So, you have processed foods = bad, meat = neutral, dairy products = good, in terms of affecting the balance of vitamin D, calcium, and phosphorus. So, the reasons for that, probably has something to do with the forms of phosphorus that are added to the food. They might be much more absorbable than the phosphorus from natural food. But it's also because meat, for example, has amino acids that help you absorb calcium better from your diet. And so, meat isn't just providing phosphorus, it's also facilitating better calcium status when it's consumed in the context of a mixed diet. And then, dairy products are actually providing that calcium. So, even though the phosphorus can antagonize the calcium, they're providing enough calcium to not only make up for the phosphorus, but to put you in an even better situation than you would be without those dairy products. So, when we look at the calcium requirements, there's a gray area because we don't have a lot of data taking people who eat plenty of animal protein, plenty of dairy products, get really good vitamin D status, and don't have any packaged foods in the diet, we don't have a lot of data in those people. And it's probably the case that calcium needs are lower in those people. It's just, I don't know how much lower they are. So my opinion is, you know, shoot for the 1,000-milligram mark, you can probably get away with consuming maybe 600 or 700 milligrams of calcium if you optimize everything else.

But that kind of comes back to that principle we were talking about before, where you wanna shoot for this baseline, and the more you deviate from that baseline, the more you have to optimize everything else. If you shoot for the 1,000 milligrams of calcium, you can get away with maybe not having your vitamin D fully optimized, not having your phosphorous fully optimized, and so on. Whereas, if you make the choice that I'm going to ignore the 1,000-milligram target and I'm, by choice, going to eat less than that, say, 600 or 700 milligrams of calcium, then all of a sudden, it sort of behooves you to make sure that you are optimizing those other factors because you've made yourself more vulnerable by deliberately not hitting one of the targets. And then, I had mentioned pregnancy and lactation before. So, the RDA is not adjusted upward for pregnancy and lactation. But one thing that we do know is that in the third trimester of pregnancy, there is an enormous investment of vitamin D and calcium into the building of the fetal skeleton. And there are some studies showing that vitamin D levels in certain populations will drop to zero in the third trimester of pregnancy. And remember, building the fetal skeleton is requiring calcium, and you're meeting the needs for calcium using vitamin D to help you metabolize the calcium correctly.

And so, when you look at a study showing that the vitamin D levels drop precipitously in the third trimester of pregnancy, and in some cases, to zero, that's kind of telling you, you need both members of that team. Like if you had gotten more vitamin D, that wouldn't have happened, but also if you'd gotten more calcium, which is obviously the raw material that you're building the fetal skeleton with, then that also would have helped preserve that vitamin D in the mother. And then in lactation, you know that you're delivering milk to the nursing infant that has enormous amounts of calcium in it, that is coming at the expense of the mother. And

so, I think that the same principle is true there. The vitamin D status and the calcium status of the mother are going to be more important at those times because she's digging into her own supplies at her own expense to support the growth of the infant. You know, basically, the growth of the fetal skeleton beginning in the third trimester and then the growth of the infant all the way through the end of lactation. And so, I would say that you probably should increase that calcium requirement expressed as 3 glasses of milk worth of calcium for most adults, 4 for teenagers going through puberty, and 4 for men over 70, women over 50. And I would add to that, pregnant and nursing mothers, I would suggest, go up to four as well.

Katie: Got it. Okay. Very cool. And actually, this is a perfect segue because after our conversation at the event we both attended, I changed up my lunch a little bit. So canned sardines are a very common lunch for me, for a lot of reasons, obviously, the calcium in the canned bones being one of them, often with something like avocado. But I've also started adding nutritional yeast. And that's something that you mentioned and talked about in relation to vitamin B5, which I feel like very few people really know much about it at all, much less fully understand. So, can you walk us through a little bit of the explanation of vitamin B5 and why it's so important?

Chris: Yeah. So, vitamin B5 is also known as pantothenic acid. And what's ironic, or I think it's ironic, the name pantothenic acid comes from the Greek word "Pantos," which means everything, everywhere. And it's literally named after the fact that it is so common and widely distributed in foods, that it is impossible to become deficient in it. And I think this is deeply ironic because you could make a very strong case that most people don't get enough of it. And yes, it is found everywhere in foods, but if you look at where it's found, I mean, if you imagine the scale of foods as a 6-foot person, then nutritional yeast is at the top of that 6-foot person, in terms of how much B5 it contains. Liver is, like, at chest-level on that person. And then, basically, you know, a handful of other organ meats are at waist-level in that person. And then most other foods are like at knee-level on that person. So, yes, it's found in everything, but it's very small handful of foods that are dramatically higher than everything else. And liver, a handful of other organ meats, and nutritional yeast are really at the very top of that list. So, if you eat liver, heart, and nutritional yeast, you're just getting tremendously more B5 than almost anyone else. Now, the conventional response to that would be, "Well, it doesn't matter because no one is deficient in B5." But the evidence that no one is deficient is rooted in early studies where they tried to induce deficiency in people and the results were basically as follows. When they gave people a zero B5 diet, over the course of nine weeks, the only thing that they could show was that the people were very fatigued and they were complaining about fatigue, and they appeared to the researchers to have lost all their enthusiasm for life.

And so, they look at that, and they say, "Well, we didn't really produce profound clinical deficiency here because what they also found was that, if you gave them a zero B5 diet, and you gave them an antagonist that prevents you from turning B5 into the co-factors of enzymes that it's needed for in the human body, then you can produce much more significant clinical results. So, those people don't just get fatigued and lose their enthusiasm, they also get personality changes that are very negative. So, they start fighting with each other all the time, they become very petty and childlike. They start to get tingling in their hands and feet. The people who are given the antagonist, a lot of them would be constantly wringing their hands, shaking their hands to try to restore normal feeling or just stomping their feet on the floor to try to restore normal feeling. They would often spend all day in bed, not wanting to get out. They would have gastrointestinal disturbances, they'd start farting more. They would sometimes get vomiting or nausea, a lot of things like that. And so, the research community is looking at this and saying like, "Geez, nine weeks of zero B5 in the diet, all we could

produce was fatigue and loss of enthusiasm. We didn't get anywhere near the clinical effects of giving them this antagonist." And you know, on the surface, if you're not paying close enough attention, you can kind of think like, "Yeah, that's not a very strong effect. Just fatigue," right?

And it's kind of non-specific, you know, like, lots of people are fatigued, it could be for lots of different reasons. But I look at that and I'm like, "You only fed the diet for 9 weeks, you know, what if they fed the zero B5 diet for 18 weeks or, you know, 24 weeks, maybe they would have produced all those severe neurological problems that they produced with giving people the antagonist." Nine weeks just isn't a lot of time. And you know, a counter argument would be like, "Well, yeah, but no one out there is eating a zero B5 diet, everyone's getting B5." And it's like, "Yeah, that's true. But if you can produce in 9 weeks, if you can produce fatigue and loss of enthusiasm, then what if you produce like a 30% deficit in pantothenic acid, instead of a zero B5 diet." Presumably, you're gonna get the same fatigue and loss of enthusiasm if you triple the time that you're feeding the 30% deficit diet, right? So like 9 times 3 is 27. So, 27 weeks, 30 weeks of a 30% deficit, then you should be able to produce fatigue and loss of enthusiasm. And I don't know exactly how many longer weeks it would take to produce tingling in the hands and feet, or to produce extra farting, or to produce wanting to lay in bed all day.

But you know, maybe it's like 3 years of feeding a 30% deficit in B5, you start to produce those things. What I do know is that the signs and symptoms of B5 deficiency aren't all that uncommon, like farting is pretty common. You know, nausea is pretty common, even tingling in the hands and feet is pretty common. And for God's sake, being childish and quarreling too much are pretty common, you know. So it's like, the conventional idea is like, there's so much B5 in so many foods that no one is running deficient. And it's been almost impossible to produce any meaningful deficiency in humans. But I think actually, you could say, "Well, it's extremely common to not consume the richest dietary sources of B5, like nutritional yeast, liver, and heart. And it's extremely common to get fatigue. It's extremely common to get problems with not feeling enthusiastic enough about life. It's very common for some people to wanna lay in bed all day. It's pretty common for people to be emotionally vulnerable, petty, childish, quarrelsome. It's even not that uncommon, there's a lot of people out there whose hands and feet are tingling, like even that isn't that uncommon." So, I think part of the problem here is that we've just been working under this assumption that it's not a problem that, it's like a self-fulfilling prophecy. So because we know that no one's deficient, when they do studies of like, let's see what the blood levels of pantothenic acid are in pregnant teenagers, and they just do these random studies.

They'll collect data on the blood value or the urinary value, but they don't give questionnaires that say, like, how often do you feel fatigued or like how enthusiastic do you feel about life or do your hands and feet ever tingle or do you have any gastrointestinal problems? And so, they don't ask those because they assume that no one is clinically deficient. And then because they assume that, then when they collect data about blood levels and urine levels, we don't have any data that any of them correlate with any of those symptoms, and it sort of feeds into this belief that no one is running low in B5. So, I think that you could certainly make a case that if you consume foods that are rich in B5 like liver, heart, and nutritional yeast, and you feel like you have more energy and less fatigue, you know, or any of those other symptoms start resolving, then I would consider that positive evidence for you as an individual person that you needed more B5 and that you got more B5. And one of the things that we were talking about in the conversation that you mentioned and, you know, you can just sort of like turn me up or down at the level of detail that you wanna go into. There's good reason to think that the B5 in food is superior to the B5 in supplements, and that means that the number of people not

getting enough B5 is even larger. Because there might be a lot of people who aren't eating nutritional yeast, liver, or heart, but they are consuming multivitamins that have pantothenic acid in them, or they are consuming B complexes that have pantothenic acid in them.

But the thing is 85% of the B5 in food is in the form of phosphopantetheine and coenzyme A. People who have studied biochemistry at any level probably remember coenzyme A or CoA as the thing that holds on to two carbon units or acetyl groups to make Acetyl-CoA that lies in the intersection of all anabolic and catabolic metabolism. People who have not taken any Biochem probably have no idea what I'm talking about. But probably no one remembers talking about phosphopantetheine. So, let's leave it at coenzyme A and phosphopantetheine are enzymatic co-factors that are absolutely critical to our metabolism. They are the things that we need in our body from B5. And when we eat food, we get 85% of our B5 as phosphopantetheine and coenzyme A, the forms that we need. Although, a lot of that is digested as it's absorbed, the process of going from pantothenic acid to phosphopantetheine or coenzyme A is very energy-intensive and very complicated. It takes five energy-intensive steps to build your way up from pantothenic acid to phosphopantetheine and coenzyme A. And when you digest and absorb food, you actually break it down into that whole diversity of potential breakdown products. So, you do get pantothenic acid, you get phosphopantetheine, you might observe some coenzyme A, it's not quite clear. You also just get pantothenic acid, instead of phosphopantetheine, you just get a bunch of different things. And when you absorb it, probably 70% or 80% of what you absorb is more easily made into phosphopantetheine or coenzyme A than pantothenic acid is.

So, probably when you eat food, you could say that you are getting... Well, let's put it this way. We know that there are very, very rare genetic defects in the ability to turn pantothenic acid into phosphopantetheine and coenzyme A, and that in all the experimental models of that very rare disease, feeding phosphopantetheine or coenzyme A will cure it. And so, if we take that as a model, we could say, "Maybe if we cared more and we did more research on it, we'd find that 20% or 30% of the population has some genetic polymorphism, meaning variation in their genes, and that same enzyme that decreases the activity of the enzymes involved in making that conversion by 20% or 30%," or something like that. That might be a very significant portion of population where, even if they consume the pantothenic acid in the multivitamin or the B-complex or the fortified cereal, they are at a huge disadvantage to be able to turn that into the forms that we need versus consuming food sources of those nutrients where they come in the prepackaged form that we need, that bypass that enzyme that they're not good at using. So it's a little speculative, but you know, just anecdotally, like, if we were to just poll people who use liver, heart, and nutritional yeast, and just ask them questions like, do you feel less fatigued, or more energetic, or more enthusiastic, or healthier or whatever, after consuming those foods? Probably, there will be a lot of people who will say they do. And so, I think, you know, we need more research to work out the details, but right now, it involves guesswork. But I think it is a reasonable guess to say that many people would benefit from consuming food forms of B5 instead of consuming the B5 that's currently available in supplements.

Katie: And that makes sense too if you think of, like, those times when they would test it or times when people would be more likely to be more prone to being upset or fatigued or all those things that you mentioned, could be during the teenage years, I'm thinking early pregnancy. I felt like that quite often, or postpartum, which are all times of increased nutrient demand. And, for me, I wasn't eating things like nutritional yeast very much during those times. And if I'm remembering correctly, you also mentioned something about a theory of

how this might actually relate to things like teenage hormonal acne. And I'm remembering that we were talking about this when you said that.

Chris: Yeah, I was just about to pull what you just said about the emotional volatility of teenagers back to that. So, there is a hypothesis that the reason teenagers become more vulnerable to acne is because vitamin B5 is needed to synthesize cholesterol, which is needed to synthesize steroid hormones, which include the sex hormones. And because this is a time of hormonal spikes, then you need a lot more B5 to make those hormones. That's a hypothesis. And in support of that, there are a number of studies using pantothenic acid, both orally and topically. Orally, they just use straight up pantothenic acid. Topically, they use dexpanthenol, which is, it's vitamin B5 that has been modified to be stable in a topical cream. And the combination of the oral pantothenic acid and the topical dexpanthenol is very effective at reducing acne, in just general population teenagers with acne. And what's really interesting about this is that, they're giving the teenagers grams per day of pantothenic acid. Our usual requirement is 5 milligrams a day. And so, we're talking about, like, you know, 20 times 5 is 100 milligrams times... So 200 times 5 is 1,000 milligrams, and we're talking about several grams. So, we're talking about thousands of times than the normal requirement of B5. And what's fascinating is that no one knows what the body stores of B5 are, but it seems that we have somewhere between like 4 and 10 grams of pantothenic acid in our bodies.

And when people consume gram doses of pantothenic acid, remember, 1 gram is 1,000 times a requirement, you actually hold on to the bulk of that pantothenic acid. You actually use it. You know, most nutrients... Like, many B vitamins, if you took 1,000 times what you needed, you know, you won't absorb it, or you just pee all of it out. So, riboflavin, for example, if you take thousands of milligrams of riboflavin, instead of the 2 to 5 that you need, your pee is gonna turn neon yellow. And that's just like, all of what you didn't use is immediately leaving the body. And B5, it's totally different. Like, a teenager taking grams of B5 a day will suck it up like a vacuum. And so, I believe, my working model of interpreting this is that for B5, that 4 to 10 grams that you have stored in your body, it's not really storage, it's actually like, that's what you need to use the B5. And your body will adjust to having grams less than that, but you start to get increasing symptoms as the body pool shrinks. So, probably in those people who were after nine weeks of zero B5, maybe they had like hundreds of milligrams less B5, and they started to get those early symptoms. And then, when they were giving the antagonists, maybe those were the people that had grams less. The teenagers who are both emotionally volatile and getting more acne, who benefit from taking grams of B5 per day, they seem to have very high needs, but it seems like they're running grams per day short. Like, maybe their body stores of B5 are like 20% or 30% lower than what they need to be. And so, at least over the course of weeks, you have to give them very high doses to compensate for that.

Katie: That's so fascinating to me. And it would seem like nutritional yeast is a relatively safe way to do that. It's a great food source, like, you mentioned. It's also just food, so you would probably be less prone to running into issues with that. And one that ironically meets almost all of the dietary philosophies, even for vegans. Are there supplements that are safe for that, that you would consider safe? Because I'm guessing there's a lot of moms with teenagers listening, thinking, "This might be a really helpful thing for my teenager."

Chris: Yeah. So, pantothenic acid in gram dose is actually extremely safe. So, there's a very small percentage of people taking those gram doses that develop minor GI side effects. But it's probably not anything specific to the B5, it's sort of like, there's always a small percentage of people who develop temporary GI distress from

taking massive amounts of any kind of supplement. That's just sort of like the normal thing you would expect from people taking massive doses of stuff that they don't usually take massive doses of. And so, you know, there are other B vitamins that are not safe to take in those gigantic doses. So, this is an example where you wanna individualize something. You know, I would never say, "We should make a blanket statement that all teenagers should be taking 3 grams of pantothenic acid a day." But what I would say is like, first look at the diet, and if the diet looks like it doesn't have enough B5 in it, improve the natural food sources of B5. And so, a great way to do that would be to include, you know, up to 3 tablespoons per day of unfortified nutritional yeast is a completely natural way to get B5 in. Up to 8 ounces of liver per week is a completely natural way to get B5 in that comes with a whole host of other nutrients that you would want. And then getting heart into the diet too. I think there's almost no limit on the amount of heart that you can include. You can replace more than the average person would want to, of their meat, with heart and not run into any toxicity problems with any of the nutrients and you'd get a lot of extra B5 from that. So, you know, take that approach first and see where you get. And then, if the acne doesn't go away, keep in mind that the studies that have been successful have used several grams per day of pantothenic acid with topical creams. So, I think, at that point, you wanna say, "Okay. Well, getting the food sources in didn't work. Let's see if this works." And I think it's pretty safe to experiment on a trial and error basis with high dose B5 in the form of pantothenic acid.

Katie: Got it. That's so helpful.

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Katie: And I literally could talk to you for 12 hours, but I will try not to do that on this podcast today. But two more specific questions. The first being about niacin because I don't know if it's been in the news more, but I'm getting a whole lot more emails and comments related to niacin, and whether it's safe in what doses. So, I know that you covered this in both your nutrition ManyChat course that we'll link to, people can learn from Facebook Messenger, and also in your cheat sheet. But can you give us kind of an overview of niacin?

Chris: Yeah, so, the safety overview of niacin is that, in food doses, niacin is completely safe. But there are various reasons why people take doses that are much higher in foods than they're taking different forms of it. So, if you ask a nutritionist, the word niacin refers to all forms of niacin and niacin precursors. But if you go to the supplement store and you get a bottle that says niacin, in the supplement world, niacin refers to nicotinic acid. And nicotinic acid is what is used to lower cholesterol levels and, you know, the average person probably needs around 20 milligrams per day of niacin. People who are taking niacin for cholesterol are taking at least 300 milligrams a day usually and often taking 3, 5, 7 grams depending, and a gram is 1,000 milligrams, so 3,000, 4,000, 5,000 milligrams depending on how high their cholesterol is and what's working. And then there are people who are taking slow release or extended release of the same type because that form of niacin causes flushing, which is highly uncomfortable. And so, there are slow release and extended-release forms of niacin to decrease the flushing response. And then there's also niacinamide, which is another name for nicotinamide. And some people take that on the basis... Like, some people may misguidedly take that as a way to lower cholesterol levels, but that doesn't cause the flushing response. And also, it doesn't cause the cholesterol levels to come down. And then there's another category of people taking niacin and that's people in the anti-aging community.

So there's a lot of interest in the fact that the thing we make from niacin, NAD, decreases with age, it decreases with disease, and it is very important for DNA repair and for allowing us to age gracefully. And so the anti-aging community is all over it. And the forms that people are taking to increase their NAD for anti-aging purposes are usually nicotinamide riboside or sometimes called NR or nicotinamide mononucleotide, usually called NMN. And all of those forms of niacin will have the potential, at high enough doses, to cause liver toxicity. And they cause liver toxicity by sapping up methyl groups. And methyl groups are 1 carbon units that are part of the methylation system. And when people talk about vitamin B12, and folate, and choline, they're usually talking about those nutrients in terms of their ability to support the methylation system. So, niacin at high doses will be detoxified with methylation, and at high enough doses, will rob you of methyl groups. So, it's basically acting anti-vitamin B12, anti-folate, anti-choline. And if the dose is high enough, that can cause liver toxicity, but at a much lower dose, that can start giving you other problems. So, when you start sapping methyl groups, the earliest thing that you would expect would be a decrease in creatine synthesis. Creatine is most famous for its ability to support a muscular physique and athletic performance. But it's also been shown in women with major depressive disorder to cause a dramatic improvement in depression.

And we also know it's needed for digestion, to make sperm swim up the vaginal canal, for, you know, vision and hearing, and all kinds of things. So, if your creatine synthesis is lowered, you might expect depression as a result. You might expect feeling more weak or feeling like you don't have the same exercise capacity. And then methylation also is needed to regulate your dopamine levels in a way that keeps your mind more flexible and fluid. So, when you don't have enough methylation of dopamine, then you tend to be more mentally rigid, you tend to be too mentally stable, like, it can help you focus, but it can also make you ruminate on negative thoughts or thought patterns or emotions. So, if you feel like things... You know, like a healthy person, if you have a negative thought come into your mind, the healthy reaction is just to ignore it and let it go away. But for someone who, their mind is too sticky, that thought just, like, as soon as it comes in, it gets stuck there and they can't get rid of it, they just ruminate on that thought and it creates a vicious cycle of anxiety or depression or, you know, whatever the negative aspect of that thought is. So, having a brain that's too sticky like that, or depression, or weakness, or poor exercise performance, are all things that you can expect from sapping your methyl groups at levels that are way, way, way below what would cause liver toxicity.

So, every single form of niacin has this property. And what I would recommend is that either you moderate the dose of niacin and take it in the context of a very methyl-rich diet. So, if you're consuming it with a lot of animal protein, with a lot of choline, with a lot of folate and B12, you might be able to get away with saying like, "You know, I can handle taking 300 milligrams of nicotine in my driver side and it's no problem." But if your diet is not so high in methyl donors or if you're taking a larger dose than that, I would strongly recommend taking it with trimethylglycine or TMG, which is a methyl donor. And you can also pair it with other methyl donors, but I just think the math is way easier to keep track of with TMG because of the way that it's metabolized, that generally, you can count on, you know, one molecule given one methyl group in the methylation system, so it just makes the math really easy. And so, if you take that approach, what you would wanna do is take... If you're using niacin, also known as nicotinic acid or niacinamide, also known as nicotinamide, you want a 1 to 1 dose, so for every 500 milligrams of niacin or niacinamide, take 500 milligrams of TMG.

And if you're using NR, also known as nicotinamide riboside or NMN, also known as nicotinamide mononucleotide, you want a half the dose of TMG... Let me put it another way. For every 500 milligrams of nicotinamide riboside or nicotinamide mononucleotide, you would want 250 milligrams of TMG. In other words, half the dose of the niacin form, you would get in TMG. And even though I said before, you can probably get away with it without doing that if your diet is very rich in methyl donors. It's kind of a good insurance policy, like, there's no harm in taking a little TMG. So, I think the easier rule of thumb is just for everyone to take it that way. And then on top of that, if you are taking high doses of niacin, also known as nicotinic acid, for the purpose of lowering your blood lipids, you should do that for safety, and you should take half the dose of the niacin as glycine. And that's because that particular form of niacin is also detoxified with glycine. And if you do that, for example, if you're taking 1,000 milligrams of niacin, you take 500 milligrams of glycine, you could also get that from collagen or gelatin by tripling the dose. So, a gram and a half of collagen or a gram and a half of gelatin would provide roughly that half a gram of glycine.

Katie: That's so helpful. And I'll make sure I put some of those notes in the show notes. I feel like we have so much more than I wanna cover. So hopefully, I can talk you into a round two one day. But to wrap up on a practical note, I would love to hear, obviously, of course, everything is personalized, and that's why you have created these resources to help people figure out, like, what they need for their own lives. But I'm curious what your day looks like or what some of your normal meal rotations look like, knowing what you know about nutrition and what we need to try to include in our diets. What does that practically look like for you?

Chris: So, my diet tends to go in waves of three or four months, where I change it up as my goals are changing, and as I get sick of whatever I'm eating. But most recently, my typical diet will involve, I'll get up and I'll have fresh juice made from a variety of different vegetables. And then, for breakfast... For most of my meals, they basically involve three components. So, one would be legumes and I just rotate different lentils, and other...some beans, I don't tolerate that well, but I just rotate the different lentils and beans that I do tolerate well in that category. And then I add to that mixed vegetables. And generally, that's a rotation of... It's usually like a bunch of different vegetables mixed together, cooked in the Insta pot, and then just, like, what that bunch is just gets rotated with each batch. So in the fridge, I have, you know, a glass case of beans and another glass case of vegetables, and I just mix the two together. And then I have some kind of protein, that could be meat or it could be eggs. So usually my fridge I have a stash of soft or hard-boiled eggs. And I have a stash of pre-cooked meat of some type and that meat just goes into rotation. Like, I'll eat chicken for a while, I'll eat red meat for a while, just keep switching it up over time. And I'll take some of that and I'll take, you

know, just some spices and flavorings, tomato sauce or salsa, mix it together, reheat it and eat it. And that's like the base of most of my meals. And then added to that, I'll have a couple servings of fruit a day, usually. And right now, my gut seems to do really well with less fructose.

So, I'm actually rotating sweet peppers. Like, I have red, green, orange and yellow sweet peppers that are making my main fruit. So, like, every meal, I'll just, like, cut up half a pepper, just slice it out and eat it raw. And then there are some other fillers. Like, I usually end the day with some snacks. And I had been experimenting in the past with snacks that are kind of like dessert, but you know, they're just like sweetened with dates, and they have coconut and sesame seeds, and whatever. And in the interest of lowering fructose, I'm replacing those with dry roasted salted nuts as my main snack food. And that's mainly what I've been eating for the last six months or so. Right now, I'm modifying that a bit by doing a low FODMAP diet, so I'm replacing the beans with white rice at the moment. I am using nutritional yeast. And I am using oyster capsules and liver capsules as some of my main nutritional supplements. Although my plans for the future are to experiment with going back to different ways of incorporating fresh liver, possibly. I've never done the frozen bits of liver thing, I might try that. And I also wanna try working more heart into my diet because I haven't been eating much heart. And I've generally felt best in my life when I've eaten like an average of maybe an ounce of liver every day. And then most of my protein coming from heart and less of it coming from muscle meats, just like a little bit on the side. So I'm gonna experiment with that in the near future.

Katie: Awesome. I love it. So practical and really helpful, which is I think that's always really applicable to people to hear real-life examples of how those nutrients can come into play. And like I said, I could talk to you for so much longer. So, hopefully, you'll be willing to do a round two one day. But I know how busy you are, and I really appreciate your time in sharing today what you've shared.

Chris: Awesome. It's great to be here. I'll definitely be back for round two.

Katie: And thanks to all of you for listening and I hope that you will join me again on the next episode of the "Wellness Mama Podcast."

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