



Transcript of “Mastering Ketosis with Dominic D’Agostino”

Bulletproof Radio podcast #85



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Dave: Today's cool fact of the day is: your brain has a hard time distinguishing between metaphors and reality. That's why if you do something as simple as clipping your resume to a heavier clipboard, when someone looks at your resume they'll actually assume that it's more serious because, subconsciously, we think of serious situations with gravity, or as weighty issues. They've actually done studies with identical resumes on different weighted clipboards and found out that it's a meaningful, impactful variable on how people read the resume itself.

Hey, everyone. Dave Asprey, Bulletproof Executive, here with Bulletproof Radio. Today's guest is Dominic D'Agostino. He's an assistant professor of molecular pharmacology and physiology at USF Health Morsani College of Medicine and one of the guys I really look to for knowledge about ketosis: that fat burning stage that we try to be in the Bulletproof Diet most of the time, but not all of the time. We're going to pick his brain today about how it actually works, the benefits of ketosis, the risks of ketosis, etc.

He's presented at TEDx and done a ton of different studies looking at metabolic disorders, Alzheimer's disease, muscle wasting, cancer, oxygen toxicity, all kinds of cool stuff that you might not think applies to you if you just want to feel good all the time, but it turns out the things we've learned by looking at the corner cases really help us know more about what's going on on our end.

It looks like you work out a bit. I've seen some pictures of you; I'd say you're a little more muscular than the average guy. Would you say that's true?

Dominic: Maybe, yeah, I guess so. I work out; it's part of what I do, although I don't have a whole lot of time nowadays. Powerlifting was a big part of my college days and I do network pretty closely with the natural body building world and have a few close friends that are tied to that community - so definitely an interest there.

- Dave: At the same time, you're into the keto diet, or different ways of going into ketosis. Are you in ketosis all the time?
- Dominic: I think so. Pretty much, unless I sleep on my diet, unless I eat something out of the ordinary, but generally, yeah. If you measure my blood ketones it would show that I am in ketosis 95% of the time or more. Sometimes I overeat on protein or occasionally I'll go out to the movies and have popcorn, but that's pretty rare. Special events.
- Dave: GMO popcorn, nooo! 95% of the time.
- Dominic: Yeah, pretty much. Obviously it's my research field. I do it for practical reasons too because staying in ketosis keeps me from getting hungry. I eat two meals a day spaced roughly about 12 hours apart. I come from a background of eating like six meals a day and I can't imagine going back to that pattern of eating or having the time or patience to do all the food preparation and the shopping and everything involved in eating multiple times a day, which a lot of people feel that they need to for performance - but I know that's not the case.
- Dave: You and me both. The idea of many meals a day is exhausting and just why would you? Can you summarize your research? I did my best; I mentioned some of the fields.
- Dominic: You did good.
- Dave: But for people listening, imagine they're driving; imagine that half of them have heard of ketosis. The other half may be interested in just how do they perform better or how do they lose weight. Little bit of an explanation of ketosis, how you enter it, and also why you care about it at the levels where you're doing research.
- Dominic: I got into this research because I was intensely looking into an anti-seizure strategy. I kind of exhausted all options and then I discovered that the ketogenic diet - I thought it was used primarily for weight loss - but I discovered the real function of the diet, how it came about, was for controlling drug resistant seizures, and it has roots back in the 1920s and earlier. That was essentially what I was being paid to do, to develop

an anti-seizure strategy for oxygen toxicity which can happen while breathing a high oxygen with a special unit ... Special ops guys use a closed-circuit rebreather and it can create seizures if they dive too deep.

The diet interested me; the evidence showed that it was probably better than most drugs out there, and obviously it didn't have side effects associated with anti-seizure medication. I became interested in that but more importantly interested in how to mimic this with a ketogenic agent. The ones that were out there are like MCT oil, but I wanted to develop a ketone ester, which if taken orally can put you into starvation level ketosis in 15 minutes to a half hour and sustain it for hours.

In the process of developing that and testing that, we demonstrated that it has very strong anti-seizure effects and that ketosis has the broad range applications for neurological diseases and even cancer, we're studying now. From a performance enhancement point of view, ketones function as an alternative fuel for your brain and for your muscles, too, so we are looking at the application of a ketogenic diet and also supplemental ketones to enhance cognitive performance and also physical performance.

Dave: I'm working on some studies of my own given that I make MCT oil and some of the even more filtered versions like my Brain Octane stuff. I'm interested in the cognitive performance aspects of it so I've done some limited experiments with EEGs and it's kind of amazing what mental endurance does when you have ketones in the body. Where can I get some of these ketones esters that you're talking about? Sign me up.

Dominic: They're pretty new, actually - at least in our lab. The military has been working on these things for a while. Maybe the last ten years, but probably only in the last few years have they been able to be produced in a way that's safe and that can be applied to humans. Ketone esters probably won't be available for a while as a nutritional supplement. Maybe it's a medical application. They taste horrible; stomaching them is really a hard thing. There is a product-

Dave: The quote I've heard is that they take like ass, like worse than glutathione so far. Is that true?

Dominic: Yeah, they do. There's not a whole lot of people who have consumed them so I probably know the person you're talking about, because there's a very limited amount of people who have used these - maybe some advanced athletes and military guys.

Dave: This [crosstalk 07:56] a connection.

Dominic: Okay. Patrick Arnold, he's a chemist, he has a company called Prototype Nutrition and he sells a product called KetoForce and that is kind of like a poor man's version of a ketone ester I think and it's essentially ketones that can be absorbed and rapidly assimilated and used for fuel. Our lab has found that that's a very effective way to elevate ketones but it's even more effective when it's combined with MCT oil. We're testing this right now and the application for this for cognitive function and performance is very real.

I think it would be best used in athletes that are already keto-adapted, meaning that their systems are already used to utilizing ketone bodies as an energy substrate. When we're in a keto-adapted state the mechanisms for utilizing and transporting ketone bodies to muscles in the brain are up-regulated. I have a hunch just based on our research that a person wanting to enhance performance would be best suited to use this in combination with a low-carbohydrate diet.

Dave: This has been an ongoing question.

Dominic: I think I know-

Dave: I use a lot of Brain Octane, which is the shorter chain MCT is extracted from plain MCT oil. I use both of them but I get a lot less of the GI problems when I use that, and I use it primarily for cognitive enhancement. I'm doing probably four tablespoons of that stuff a day, sometimes a little more, sometimes a little less. I can use ketones for energy all day long, I feel great, but I do eat carbs, probably 50 grams, sometimes 100 grams, and sometimes I go deep into ketosis. Am I going to be able to burn ketones and use those at the same time there's some glucose in my body if I have an extra-normal amount of ketones because I'm taking all that oil?

Dominic: Yes. Recently Joe LaManna, who's a top ketogenic diet researcher, gave a talk here at the University of South Florida and his research has shown that ketones spare glucose in the brain. The brain will preferably use ketone bodies over glucose. I get this question a lot: are ketones the preferred source of energy for the brain? I get this question no less than 50 times, I think. I always said "Well, we don't know that." The emerging research that's just starting to come out and will come out in the next year will demonstrate that ketone bodies are in essence a preferred fuel that the brain will use them in place of glucose and spare glucose.

We know from the work of Richard Veech and several others that ketones are very efficient metabolic fuel, probably more so than glucose. You have an alternative fuel that can potentially enhance metabolic efficiency and ATP production, and that can spare glucose. In part, the big advantage of the ketogenic diet is that when you're following a ketogenic diet and you're exercising, you can tap into your fat reserves and mobilize fat as a fuel source more efficiently and thereby preserving glycogen stores. The ultimate determining factor in how long you can go is the preservation of glycogen stores. Once they're depleted you basically bonk. If you're on a carbohydrate-restricted diet ... Your diet sounds like it's carbohydrate-restricted-

Dave: It is.

Dominic: 50 to 100 grams is, yeah. You're essentially in ketosis. You're bouncing in and out. I think you're probably an active guy. Some ways that could be optimal because a very strict ketogenic diet that's used for clinical application I think is restrictive and it may not be optimal. The athletes that I'm talking to, and even in myself, I think it's helpful to have some amount of carbohydrate in the diet because your body ... If there wasn't, your body's transport mechanism will likely be down-regulated, so keeping a little bit of carbohydrate in your diet - which I do too in the forms of salads and dark chocolate I probably have everyday.

I limit it, kind of like you; on real active days maybe up to 100, but I'm typically 50. It comes mostly from blueberries, dark chocolate, and broccoli, asparagus, stuff like that - stuff you probably consume. I've got going very strict ketosis and I've done this very minimal carbohydrate-

restricted diet bordering on what's considered a paleo-like diet. I feel better if I have a little carbohydrate in my system. I'm kind of with you on that. I'm always in ketosis so even if I don't take supplemental ketones I'm always some level of ketosis.

Dave: I found yesterday, I tried one of these new keto blow sticks. Have you seen these things?

Dominic: I'm testing them now, actually. Wow-

Dave: I'll show you mine if you show me yours.

Dominic: Not too many people have this. I'm curious, you must know Metron or the people from Metron. I think-

Dave: I know one of their advisors who's testing it out and hooked me up with those. I'm quite intrigued. Although it didn't turn purple yesterday, but when I travel I tend to eat more carbs because you're at a restaurant. I'm like "I'm not eating your crap meat [crosstalk 14:08] I do on the grass fed. I'd rather eat white rice soaked in MCT and butter and vegetables than I would their industrial chicken or some crap. I'm willing to go out of ketosis and still eat a lot of fat.

Dominic: Sushi and MCT is also good. It appears-

Dave: You're the only guy who's ever said that. Yes, it's a staple.

Dominic: Really? Wow.

Dave: So you eat a lot of sushi with MCT?

Dominic: Yeah, I was given this suggestion by a fellow that used to work for NASA, actually was one of the directors at NASA, and jumped on the ketogenic diet and it literally changed his life. He's like "You've got try sushi with MCT," so I brought my MCT to the sushi place and I got some strange looks but it was delicious.

Dave: I wonder if he might have got that from me. I've been talking about this a while on the podcast. I've done it in Hawaii; I've given it even in Japan



to sushi chefs and they try it and they give me this look like oh my god, it's really good. You think coconut, yuck, but it's just in more rice and more fish.

Dominic: Yeah.

Dave: So funny.

Dominic: It's a flavor-carrier. That's really why MCTs are used in food products; they're a flavor enhancer. It really helps the food spread it out on your palate. It's definitely a flavor enhancer.

Dave: Even when I make Bulletproof Coffee, I put the Brain Octane in. I used to use my Upgraded MCT but I prefer just the straight C8; it works better and it doesn't have as many of the GI effects. When I do that even the coffee and the butter taste spreads out. The mouthfeel is improved and as somewhat of a chef - more like a gastronomy meets health, instead of flavor - I think MCTs are essential for almost any meal if you want the maximum flavor. I haven't cooked anything without MCT on it when it was done in a long time.

Dominic: Yeah, I have MCT right by my stove. I use it; I cooked my eggs in it this morning. I put it on salads; I make salad dressing with it. I can't think of anything I don't use MCT for, actually. I make this ketopudding at night, chocolate ketopudding with whipped cream. Just get regular cream and whip it, so it has no sugar in it, and add stevia or something to it, and add chocolate baking powder to it and stir it in. I put it in the freezer and it's like chocolate mousse. You could do the same with sour cream; it works pretty good with sour cream. You could do the same with concentrated coconut milk.

Dave: That's what I do with the coconut milk version.

Dominic: You do?

Dave: That was my birthday cake. That was exactly it.

Dominic: Oh wow.

- Dave: All right, since we're sharing recipes-
- Dominic: These are things I only thought I knew
- Dave: I am shocked that you know this. I actually make a chocolate: the Upgraded Chocolate. I'll send you some just as a thank you. It's a powder that's raw and it's tested for absence of microtoxins from ancient species with more antioxidants and what not. I use that; I use sugar alcohols. By the way, what do you think? Xylitol, erythritol ... Yes? No?
- Dominic: Stevia powder is really concentrated and sometimes I'll take the xylitol. Jeff Volek, some of his ideas ... I borrowed from him with that idea. That's pretty good; I like it. I think it's okay. The sugar alcohols are in a lot of protein bars and things like that. It can cause some GI issues, but xylitol is pretty tolerable for me.
- Dave: Me too.
- Dominic: Got a good taste, too.
- Dave: I tend to use a blend of the two but if you take too much too fast, not a good thing for the people around you.
- Dominic: I was just going to say, I try to wean myself off hyper-sweet things anyway so I'm using much less overall sweetener now.
- Dave: Me too. I don't want to swim in it, I don't want to crave the sweet taste, but some recipes just to get a sweet hint at the end of barbecue. It's not barbecue without a hint. Here's the trick to enhance your whip cream thing or to do it with coconut milk. Melt straight cocoa butter, not the powdered baker's chocolate but actually just that when you're whipping it and the heavier saturated fats and chocolate flavor there make the mousse hold up better when you freeze it and it totally changes the mouthfeel. It's transformative.
- Dominic: That melts at a much higher temperature than just coconut oil. It comes in white; it's white or off white.
- Dave: I'll send you some.

Dominic: Yeah, I've worked with it before.

Dave: Those are two of my four items that I ended up putting on the site because enough people were asking about it. The reason that that feels good is it melts I think at right around 98-99, right about body temperature - cocoa butter melts. You get the lower temperature cocoa butter so when you put it in your mouth you get the different fats melting at different times and for a fat adapted person it just makes you smile. Oh, how exciting; I had no idea anyone else knew that recipe. That's cool.

Dominic: Yeah, I've done a lot of experimenting. You have to once you start doing this. Also, I communicate with a number of patients who are adapting this to manage a disease process. Compliance is the major issue and weaning someone off really high carbohydrates to a ketogenic diet to manage epilepsy or even cancer can be tricky. These desserts, these hints, can mean the difference between compliance and no compliance so they've really been helpful for a lot of people that I know.

Dave: It should be delicious when you-

Dominic: Bulletproof Coffee has been, too.

Dave: Oh really?

Dominic: Very helpful for a lot people that I know. Patients, yup, very much so.

Dave: Thanks for letting me know. I like to imagine people who, for their own life, need ketosis. For me, that was the easiest way to get in and turn off food cravings and just stay in as long as I wanted - so it is working. Do you put protein in it for these people or do you just tell them to go for pure fat?

Dominic: That's an option. What I do, I do two meals per day and I do fats in between. Like this morning I had eggs and bacon and broccoli, I think. Throughout the day I will have probably two cups of Bulletproof Coffee mid-morning and then again mid-afternoon about 2, 4:00 and I tell them to do the same because I can get my blood glucose down - which is part of the therapy that we're working with - in the 60s and then keep it.

Sometimes it will dip below 60. I take branch chain amino acids so that's another thing that I patients to take.

Dave: Those raise your insulin, though, don't they?

Dominic: Insulin's really dependent on total calories. If it did raise insulin it would really drop your blood glucose and I don't see that. I see a mild decrease in blood glucose and from all the blood work that I've seen, everyone's insulin is through the floor, some cases not even measurable. They're on a very calorie-restricted ketogenic diet. If it is, it's very transient. If your body's hungry, if you're at a calorie deficit, the insulin will likely stimulate muscle. Your muscles are hungry so the little bit of glucose that's available will go into the muscles.

Dave: Okay, just gets used?

Dominic: Branch chain amino acids are anti-catabolic too so I think they help preserve muscle tissue during periods of calorie restriction, but I think they can be beneficial. They tend to dampen appetite, too.

Dave: Are you on a calorie restricted diet usually or not?

Dominic: No, if there were a calorie deficit I would be losing weight and that's not the case. I typically maintain ... I've lost some weight over the years as I've shifted to this pattern of eating but I'm still technically overweight. I'm like 225, 230, and that's what I maintain. That's just off two meals per day, but my meals are pretty big, like six eggs. Actually, I had salmon with bacon this morning. I'm in a fasted state now. What time is it? I haven't eaten in about ten-eleven hours and I'm not hungry at all; I'm not the least bit hungry. Ten years ago I could have never imagined going eleven hours during the day and not being hungry.

Dave: It would make you whiny.

Dominic: I really have no appetite, and I have a lot of energy.

Dave: It's the energy thing that's transformative because normally you want to kill people or fall asleep when you're that hungry, right?

Dominic: Yeah.

Dave: As a former 300 pounder.

Dominic: [crosstalk 23:15]

Dave: I've been putting on some muscle. I'm decent here, not amazing. I'm probably only 80 pounds down from that but I've been around 200 plus some muscle for more than ten years. I remember the six meals a day were addictive. Literally, if you don't get it you're going to crater.

Dominic: And thinking that you needed it.

Dave: It's totally just bad information.

Dominic: And having stress when it wasn't there.

Dave: Oh yeah. I decided to show that the calorie thing didn't quite work right. I thought I would make myself gain a few pounds so I went on a very high calorie diet, between 4,000 and 4,500 calories a day. I slept 5 hours or less per night and I stopped all exercise. I was going to do this for a month or two; I was going to gain three pounds and the calorie tables say I should have gained twenty pounds. The equations are broken. I did it for two years and I grew a six pack. How does that fit into your research? Did I poop out a lot of extra fat? How is this possible?

Dominic: There's a couple things going on and we're actually studying it, I think, from a metabolomic point of view. There's technology available where you can pull blood and just look at the spectrum of metabolates and get some insight into how metabolism is working. In short, you push your body from a glucose, sugar-based metabolism to a fatty acid and ketone metabolism, and going from point a to point b. During that process you've up-regulated fat transport, you've enhanced mitochondrial function, mitochondrial biogenesis. The mitochondria are basically the little organelles that are burning fat in your cells and you've enhanced the number of mitochondria and their ability to oxidize fat for energy.

This is clear if you look at athletes that are keto-adapted, if you look at their respiratory quotient is much lower so they're basically just

burning fat completely for fuel. Jeff Volek is doing a lot of innovative, really cool studies on athletes that are fat-adapted and gave me a little bit of insight to some work that will be published pretty soon. These guys are just burning fat off the chart. Their bodies are just oxidizing massive amounts of fat because they're completely on very low carbohydrates diets.

Dave: Are these endurance athletes or are these power athletes?

Dominic: His guys are ultra-endurance athletes. We're setting up to do a similar study and put strength athletes on a ketogenic diet and do their blood work and look at a whole variety of parameters. We know these metabolic adaptations happen. The body's ability to oxidize fat for energy is increased tremendously and it will vary between some people but most people, once they're fat-adapted, you can use objective measures like respiratory quotient to show that they're just pulling off their fat stores for energy.

Dave: What's the downside of doing this?

Dominic: That's a good question because I do get some reports of people saying "My LDL cholesterol is off the charts. My HDL went up, my triglycerides bottomed out, my glucose is now under control, but my doctor sees my LDL cholesterol is elevated and is urging me to get off this diet." My response is something like "So all markers of metabolic health have improved and you're telling me this marker of metabolic health that your doctor is saying is so important, and the data is fuzzy, conflicting, and confusing whether that's the case. You feel better, your body weights down, you're telling me you're concerned that this high fat diet is going to decrease your lifespan just because your LDL's 10 to 20% elevated," which they think is alarming.

That's what I've seen. I would say it could be as high as 20 to 30% people have this response, this increase in cholesterol. It will increase total cholesterol because your good cholesterol goes up, too, in most people. If your LDL goes up, that can be a problem. Generally it stays the same but in some people it does go up. That can be a concern to some people but I tell them not to worry about it. A number of people that I've

told that to trust their doctor and they're now on a statin. My mom actually went on a statin and had a lot of side effects and had to get off of it.

Dave: Is she on the same diet?

Dominic: Not completely. I come from an Italian family where pasta was a staple. They've gradually replaced the starches with vegetables and went to that pattern of eating, but not completely ketogenic by any means -but much, much lower carbohydrates diet. Not everyone is going to adapt to the ketogenic diet or low carbohydrate diet but my mind at least 90% of the people will have an improvement in metabolic health, in their sense of wellbeing, and pretty much all markers of health will improve with carbohydrate restriction that I've seen.

I've been following a lot of people ... I'm a scientist so I want to see objective data, I want to see blood work, and I've looked at a lot of blood work. Rarely do I see ... and even on the few occasions where the blood work was kind of off, I couldn't really confirm whether they were eating too many calories or following the diet. When you tell people to measure their ketones and stuff it's kind of hard to get them to do it completely. That's usually an important thing. Usually glucose, triglycerides, and HDL will tell you the story. They're the things that I ...

Dave: The big ones.

Dominic: Things like C-reactive protein and markers of inflammation are important.

Dave: That was my next question. I notice when someone goes on the Bulletproof Diet, which is a cyclical ketogenic diet, I tell them once every week, maybe ten days, eat some carbs to let yourself come out of ketosis and then go back in. Lots of upgraded MCT, etc. 70% fat. When they do this you'll see HDL go up, you see triglycerides drop. Generally in six weeks C-reactive protein goes down a lot.

Dominic: A lot.

- Dave: Homocysteine goes down a lot. I also look at Lp-PLA 2, because if LDL goes up - which it does in some percentage of people including me. My total cholesterol is 250, 260. A couple of people have gone up to 300 - people I work with. You look at Lp-PLA2 and it drops in all but two people who have other smoldering infection kind of things. If you have high LDL and low Lp-PLA2, there's no vascular inflammation going on. Do you feel comfortable if that was your numbers? If you had that combination of no inflammatory markers but high LDL?
- Dominic: Yeah. I would be; most people wouldn't be but I would be. That's actually a pretty common scenario.
- Dave: I see it and I have it in myself and I'm totally comfortable with it and I perform better. Let's talk Lpa, LP little a. Actually, before we talk about LPa, that's not the one I'm thinking of. I'm talking about ApoB, sorry. ApoB is the protein associated with fat transport. That always goes up when people go on a ketogenic diet. Why?
- Dominic: Because you're transporting more fats.
- Dave: Amen, brother. People always freak out when when they see the numbers.
- Dominic: The simple answer is the right answer, so yeah.
- Dave: That's the ApoB 48, the fat transport ApoB, versus ApoB 100 that most labs don't look at all?
- Dominic: Yeah.
- Dave: Okay, cool. That means if you're on the Bulletproof Diet, you're listening to this, and you have high ApoB and your LDL is elevated, there's a reason for that. It's because you're in fat-burning mode, which you wanted to be in.
- Dominic: Yeah.
- Dave: Cool. Other big question for you, and this has been driving me crazy. I see in 20, 30% of people on the Bulletproof Diet elevated sex hormone

binding globulin. You ever come across that in your group of people, and if so, why is this happening?

Dominic: That's a good question. Some people have suppressed thyroid or T4 to T3 conversion. Carbohydrate restriction and insulin could be affecting these things and regulating these things. That could be coming into play. Also, if they're on the diet, are they exercising, are they over-exercising? There's a lot of factors coming into play so you need to control all variables, and I would need to see all variables to really comment on this. For males, this could be alarming because you're binding up testosterone so you have less free testosterone to work at the receptor.

This is what I know, is that when you're exercising, especially lifting weights, your androgen receptor density is going to increase at the cell membrane. Even if your testosterone goes down or more of it's bound and less in the free form, it's going to be more anabolic. Your receptor sensitivity will be higher; your androgen receptor density will probably be elevated. I've seen people that have a lot of muscle mass, they go on a ketogenic diet, they perform very well, they retain their lean body mass even after losing a significant amount of fat. Then they go get blood work and their testosterone's like 260 on a scale of 250 to 1000.

Obviously, that amount of testosterone is working for them. I think the muscle becomes sensitized to the effects of anabolic hormones, and insulin too. Your insulin sensitivity goes up and you secrete very little insulin but it's working well. A couple athletes that I know can consume carbohydrates and their blood glucose doesn't even go above 90 or a 100 with a carb meal.

Dave: Because they're so sensitive.

Dominic: Yeah, because they're so sensitive.

Dave: All right, this is so interesting.

Dominic: I wouldn't be alarmed. To tell you the truth, I don't know exactly why it happens but I have seen that with carbohydrate-restricted diets and

people who over-exercise, too, will tend to have a higher sex hormone binding globulin. That's kind of a stress response.

Dave: That's a great Dave response. One of the recommendations I make for people on the Bulletproof Diet is follow Body by Science. Every seven to ten or fourteen days, lift really heavy things until you can't anymore for fifteen minutes and spend a lot of time recovering. Ones who do that don't tend to have this problem. The ones who have to do a workout every two days to get the opiates, those guys tend to run into this problem more.

Dominic: Exactly, that's what I've seen. I'm a minimalist when it comes to working out. I go heavy maybe twice a week if I'm not traveling, and then just hit some chin-ups and push-ups and things at the house.

Dave: I do whole body vibration, more for the lymphatic circulation but you get the muscle stem. Everything I've got right now is all from electrical stimulation. I haven't picked up anything in a while but it's pretty heavy electricity.

Dominic: Really? I haven't done that but I'm aware of its benefits for recovery-type things and therapy-type things.

Dave: I was shocked at what it just does ... I look like I've been lifting but I really haven't. I'm kind of like "This is neat." We'll see when this machine is-

Dominic: Do you get sore?

Dave: You can get so sore you can barely walk.

Dominic: Okay, that's a good indicator that it's actually giving the force generation that's needed. I remember when I was younger in the back of magazines like Muscle & Fitness you'd see dudes all wired up with these things and it would just put millivolts into the muscle, not enough to really cause significant contraction. I know now that there exist devices that can really cause a strong stimulation. I'm interested in that.

Dave: I had stimulation on my sternum. I actually got a bruise for the first time from using this thing. It's rock hard; it's like you have 100 pounds and you're really trying to just crank on your delt. The machine I have is a prototype; you can't even buy it.

Dominic: When you do it, this obviously hurts a bit, so why don't you just exercise? Does it have benefits, is the contractile force above and beyond what you could do if you just lifted weights?

Dave: It is and you also get neurological benefits, so you get more myelination of the nerves, which is what I'm going for - so faster response times.

Dominic: Greater, yeah.

Dave: It's out there and I'm not suggesting this for everyone by a long shot. Body by Science protocols are well proven. At the same time, I get a much better vascularization, allegedly more mitochondrial growth. I'll tell you in another couple months where I end up, but so far I've put on about twelve pounds of muscle in the past month or so in ten minutes every other day kind of thing.

Dominic: I'm intrigued. Are you familiar with blood flow restriction? Occlusion training, it's called.

Dave: No, it sounds awesome.

Dominic: You put wraps around your arms here or around your legs and you can lift 20% of the load that you normally do. By impeding blood flow back you essentially create an acidic environment in the muscles and you create intermittent hypoxia and that activates a variety of growth factors including IGF-1 at that muscle where you're impeding blood flow. You have significant increase in muscle protein synthesis. '

One of my friends Jeremy Loenneke has published extensively. The Japanese people have been looking at blood flow restriction; they call it occlusion training. Just do a quick search on occlusion training and you'll come up with a number of articles. One was written by a good friend of mine, Layne Norton. He's advocated this; Layne is a top natural body builder and I've trained with him. Calve training with him is very

painful in his approach. There's a legit science. There's even journals of occlusion training, so you can use-

Dave: Would you hook me with up Layne?

Dominic: Yeah, sure.

Dave: I want to get him on the podcast to talk about this. What a cool idea.

Dominic: It sounds right up your alley. It's kind of like biohacking.

Dave: It turns out this podcast is number one ranked on iTunes in health so about half a million people a month will hear it. This is a way to get these ideas out there where people believe they have to work out 45 minutes a day, going for a run everyday to feel good. You're a pretty darn knowledgeable guy who's doing research on exercise, natural body building. You look great and look at what you're doing. It's so different than what the mainstream's doing and I'd argue it's more efficient - and certainly more interesting.

Dominic: I'm all about saving time; time is very important.

Dave: All right, one other big question you might be able to answer. About a year ago, a year and a half ago, when I was in my 4,000 calorie a day thing, I decided I was going to try and eat like an Eskimo. I eliminated all but one serving of green vegetables a day and I cranked up my fat. I was still eating a pretty good amount of meat, tons of eggs, stuff like that, a little bit of whey protein, all that. I did it for three months and during that time I went deep into ketosis but I started waking up nine times a night. I'd wake up feeling exhausted. My ZO showed almost no ... in fact zero deep sleep. I had super dry eyes, super dry sinuses, a rasping cough that wouldn't go away. Eventually I developed food allergies at the end of that that I hadn't had before. Have you seen this on people on extreme ketosis diets like that?

Dave: What exactly were you eating? Eggs for one thing, right?

Dave: Eggs - which by the way, I gave myself an allergy to, to my great annoyance. They were one of my staple foods for thirty years.

Dominic: Because you're overeating eggs.

Dave: Probably because I was overeating them. I believe that I stopped making mucus because the dry eyes, the nose problems, that I just didn't have enough polysaccharides to make it, so the mucus that lines my gut went away so I got gut permeability and some of my favorite foods made it through my gut. When I went off that diet, some of my other things like honey and sweet potatoes, which is how I refuel - boom. Both of those I've got food reactions to now. You ever seen that before?

Dominic: No, but I think this kind of diet, an extreme ketogenic diet or maybe eliminating some foods that may have been providing micronutrients that were essential for cellular function could have, in a way, sensitized you. Ketogenic diet, when people start it and get into ketosis there's actually a flood of stress hormones. The immune system is an immensely complicated thing but everyone's body can react differently to stressors. You might have had an overactivation of the immune system where it's picking up and detecting certain proteins or food constituents are identified as antigens when they otherwise weren't before. I know in a calorie-restricted ketogenic diet state, the body is kind of hypersensitive. We see this even with drug administration. You have a greater transport of certain drugs across the blood-brain barrier, for example, when your body is sort of hungry and in this fasted state.

Getting back to your question, I don't know. I would have to see exactly what you'd done and have to know a lot more information to really even comment. It's not out of the ordinary. You put your body through stress and the adaptation to that stress can vary between different people. We study that in the lab; we look at look hyperbaric oxygen. A young person will have a more robust adaptation to that stimulus than an older person. They may confer some of the benefits as far as wound healing or mobilization of stem cells than an older person wouldn't have. They would have an enhanced and heightened healing response compared to an older person, where hyperbaric oxygen may be just causing excess oxidative stress.

It's maybe not the dietary intervention but your adaptation to it. I've seen different things; I've seen some people who just cannot seem to

adapt to a ketogenic diet. They feel awkward or they feel awful initially and they're just sluggish. They go back to eating carbs and they do well on carbohydrates. Most people do better on a low carb diet but there are some people that I know that just do better with the carbs in their diet.

Dave: I had one client I'm thinking of. She's a really passionate, just powerful person, and after about three months without the refueling regimen, around say every seven to ten days eat some carbohydrates. She wasn't doing that and she stopped dreaming. Her sleep quality declined and she kind of felt like she lost her mojo, a little bit of an edge she had. When she added once a week carbs back in it worked.

One of the reason I built cyclical refeeds - not crap refeeds but just carbohydrate refeeds with low-toxin carbs - on a regular basis was because women need it more than men in my experience. Also, it just seemed to head off some of these problems, so you'd get the polysaccharides for mucus production. I wonder if the people who don't adapt to a wholly ketogenic diet would adapt to a cyclical one pretty easily.

Dominic: Yeah, that's a good question. Cyclical, that can vary between ... One diet that I followed before going completely ketogenic was ketogenic except during my workout I would throw in carbohydrates, about 30 to 50 grams right around in carbohydrates and I called that the targeted ketogenic diet or cyclical. The carb frequency would depend on how many times I worked out per week. If it was five days a week I was eating carbs five days a week, but it was kind of a smaller amount. Women in particular do not adapt to the ketogenic diet as well as most males. They will get cranky, they'll get some hormone issues and stuff. They do need some insulin and their hormone production seems to be somewhat dependent upon carbohydrates to some extent.

Dave: They seem to do really well, though, on MCT whether or not they're in ketosis. Have you seen research about MCT and thyroid activation at all?

Dominic: Not MCT, but calorie restriction and thyroid. Your thyroid, active T3 will definitely go down with calorie restriction, and your body temperature

will go down with time. Some people who get on a ketogenic diet will comment on that but what they fully don't appreciate is that in many times a ketogenic diet will result in self-restriction of calories so there will be a mild amount of calorie restriction associated with the ketogenic diet, inadvertently. Calorie restriction over time can lead to a decrease in active thyroid. Excess training too much can lead to an ... I remember Ben Greenfield, I was talking to him recently and he had some thyroid issues he thought resulted from ketosis. We were at the ancestral health meeting and I was like "What's your training like?"

Dave: It's kind of crazy.

Dominic: I was like "Wow." I think all my hormones would be in the floor if I was to do that kind of insane training regimen. My body probably could never take it.

Dave: I talked to him about that, too.

Dominic: Oh did you?

Dave: I'm like "You're going to get old someday, dude." I know you're trying to protect yourself or whatever but maybe the answer is to not do that to your body.

Dominic: He's gravitating towards a more minimalistic approach I think in his training.

Dave: Oh good. I hope he does because he's a nice enough guy. He uses a lot of the Bulletproof products to stay in ketosis. In fact, I'm having him on the show at some point coming up, I think after he does the Ironman drinking Upgraded MCT kind of stuff. The question, though, is like longterm longevity stuff, which I'm as much as an anti-aging guy as I am a performance guy. I just don't believe that the chronic cardio for years and years is going to make anyone live better, ketosis or not. Where do you come down on that spectrum?

Dominic: It varies between people but I do very little, if any, cardio. I used to in the past and I've experimented with it. I was into mountain biking for a while and I did a variety of different cardio things. Your body quickly

adapts to it so it's like you're a rat on a treadmill. You just got to keep going with it and if you stop there's always the rebound effect. It's time consuming ... When it comes to metabolic health, lean body mass will allow you to win over cardiovascular exercise in objective measurements of improved metabolic health. Decreased blood glucose, better insulin sensitivity markers, your lipid profile overall will improve with a strength training exercise, a weight lifting routine that optimizes lean body mass.

You're building metabolic tissues or metabolically active tissue that's just burning fat and helping to keep your blood glucose low, which is going to decrease inflammation and everything else. I know a number of people in preparation for contests or events, who have just over-exercised. There's only a certain amount of time in the day; you can't just keep adding hours and hours of aerobic exercise. Over time it's going to catch up to you. You can't do it. When you stop, people become insulin resistant. I've seen their blood work.

Dave: Oh, interesting.

Dominic: Especially people in northern climates where you can't ... If you're up in Buffalo, New York or something and you're a runner and you like to do it outside, it's not really good for your body to just ... prepare for a marathon for example and put your body through all that stuff.

Dave: Look at what happened to the first guy that ran a marathon, right?

Dominic: Yeah.

Dave: That whole dying and celebrating his death I always thought was funny.

Dominic: Yeah.

Dave: Another question for you: what about kids? Should kids be in ketosis? What about my 4 year old? He's not, by the way. He eats a ton of fat but I don't think he's in ketosis; he gets some carbs but not an excessive amount of sugar and corn syrup and all that stuff.

Dominic: Is ketosis optimal for kids? If that's the question, kids that are growing will benefit from having some amount of insulin in their body for growth and repair.

Dave: I agree.

Dominic: Kids are getting so big now and that's why people ... Girls in particular are entering adolescence much earlier now. I think kids are eating way too many carbs. I think carbs in the diet are probably a good thing but just to eliminate grains and sugars and basic common sense stuff. Carbohydrate restriction can be helpful for most kids. Then again, I'm thinking about my nieces and nephews; their metabolisms are on fire and they eat an enormous amount of sugar and carbs and they're like super lean anatomy charts.

I think it's going to vary. If your kid's fat then restrict his carbohydrates and give them fat. Kids love fat. They love bacon, they love eggs, they love peanut butter. It's not hard to get kids to eat fat and I think it would be relatively easy to take out sugars and carbohydrates and replace it with fat for kids. Most kids I know like fatty foods.

Dave: The first thing that my daughter ever asked Santa for, the first time she sat on his lap - she was 2, 2 and a half or something. He says "What do you want for Christmas, little girl?" She says "I want my own stick of salted butter." When I gave it to her Christmas morning, she picks it up like an Olympic torch and runs around the house screaming with the light and opens it like a Snickers bar and takes a bite and puts it back in the fridge.

Their relationship with butter is very healthy and they don't get carbs in the morning 6 days a week because it makes them misbehave and then they want snacks and they're cranky. They can have a few carbs at lunch, more at dinner, and it seems to help sleep. They're not restricted but in the morning they eat eggs and salmon and bacon and some vegetables and nuts or whatever, but they do not get fruit for breakfast. It's just not okay.

Dominic: The studies that were done at Johns Hopkins with kids that have pediatric epilepsy, they show pretty good that the ketogenic diet will not restrict growth and development like anti-seizure drugs, for example, and that kids develop and grow pretty well. You're probably familiar with the Charlie Foundation. The Charlie Foundation kind of popularized the ketogenic diet. It's a foundation that was started by Jim Abrams; he's a Hollywood producer. He produced the Airplane movie and his son Charlie had seizures that couldn't be controlled. Then he discovered that the ketogenic diet - in his own research discovered that the ketogenic diet was used to control seizures, and put his son on it. It was like this magical cure that controlled his seizures and wanted to tell the world about it, so he created the Charlie Foundation, and they're linked with Johns Hopkins Hospital.

There's probably at least seventy clinics across the United States that are ketogenic diet clinics that put kids on the ketogenic diet and monitor their health. Eric Kossoff and John Freeman have done incredible work to make this popular. Now it's like the standard of care; when drugs fail, kids are put on the ketogenic diet and enough studies have been done to show that it does not impact their development or their cardiovascular health.

Dave: That is really good news for people who do have kids in ketosis. I think it's nice for them to have some carbs. They benefit from more carbs than adults, but not excessive and not the wrong types.

Dominic: If your kid's fat, then just cut the carbs. If your kid's super-lean and hyper-athletic and growing and playing football or some kind of sports, carbs are easy calories are easy to get in. I think they can be titrated into the diet based on activity level and based on your ability to metabolize them. Everyone has different carbohydrate tolerance and I think it's important to know that.

Dave: We're coming up on the end of the show. There's one question that I've asked every single guest and that is: based on all the things that you know, if there were 3 pieces of advice you had to share with someone who wanted to just kick more ass in all domains of life - not just food - what would they be?

Dominic: I would take a step back and look at your life and determine what's not working and what has worked for you. I would minimize or eliminate the things that do not contribute to productive patterns. I would take a close look at the things that have gotten you to where you are today. This is going to vary between a lot of people but I would take a close look at what has gotten you to wherever you want to be. These things are usually associated with time management.

For me personally, it's diet and nutrition, so following a ketogenic diet has actually been liberating in that it's been able to free up a lot of time for me, as far as time during the day, so I'm more productive and I have more energy to do the things that I need to do. It's connected me with a network of people that have helped my research and inspired me to pursue and explore nutrition as a lifestyle. When you feel good you can be more productive. That was two things, nutrition ...

I think when it comes to as far as physical health, downtime is extremely important. A lot of people get so caught up in their jobs and don't take time; they don't take constructive - what I like to call creative downtime. I think everybody needs to have creative downtime scheduled into their day in one form or another. For some people that may be playing with their dog, taking their dog for a walk, working out, exercising, walk in the park, fishing, or whatever. I think that needs to be incorporated into a person's day everyday - if they can. Obviously there's some situations where they can't. I'm much more productive if I schedule downtime into my life. Otherwise, I just burned out; I become inefficient.

Dave: Yeah, schedule downtime, schedule recovery time. Great advice, man. Where can people learn more about your research or what you're doing?

Dominic: I have a website that's ketonutrition.org and I get a lot of emails from patients seeking a metabolic therapy to manage either their weight or cancer or epilepsy, and what I do, I just compile the research on there. Actually, I have clinical trials listed on there that people can seek if they're looking to metabolically manage some disease process. Ketonutrition.org, and our publications, which we have a number of them under review now. I would just look at those two things. I think I



put enough information on my website ketonutrition.org. I want to develop more of a comprehensive that tackles all these issues: cognitive performance, physical performance, epilepsy, cancer - and be a little more interactive. That's in the making but I've been too busy teaching and doing research to really invest the time to do that.

Dave: Awesome. Thanks for being on the show, Dominic. Really appreciate all the knowledge you shared.

Dominic: Pleasure being here. Thanks for having me.

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