

Paleo Solution - 218

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Robb Wolf: Howdy folks, six listeners can't be wrong. This is the PaleoSolution podcast. I'm your host Robb Wolf. Today it is my huge honor to have Ben Greenfield in the house, how are you doing man?

Ben Greenfield: I'm good, I'm good. I just got back from vacation at Lego Land in Florida chasing a couple of twin boys around Lego Land so just getting settled back into chilly Washington State.

Robb Wolf: Oh nice. So you're in phenomenal shape then from chasing the kids and have all kinds of like move, net, skills, launching over objects and all that stuff or what?

Ben Greenfield: Dodging and weaving Legos all day long.

Robb Wolf: Perfect.

Ben Greenfield: Actually we got back with a big warning on our front door that our municipal water supply was somehow infected with E. coli and they've put massive amounts of chlorine into the water. So I've been tackling that basically boiling water every morning for several months then dumping it into a big glass mason jar to settle overnight and let the chlorine kind of dissolve off the top and then just getting nervous about whether I'm dumping either (a) E. coli or (b) chlorine into my body all day long so.

Robb Wolf: Yeah. You kind of – that's a little bit of a rough one to figure out which one you would want to do so.

Ben Greenfield: Yes, toss up really.

Robb Wolf: Nice man. Well hey let me hammer out my podcast sponsors super quick and then we'll jump into the goodies. Folks should check out FrontDeskHQ.com. FrontDeskHQ is your mobile-based solution to service based businesses, crossfit and dogwalking, Pilateing, yogaing, anything that's a service-based business fits well with FrontDeskHQ. You can ping those folks and get a free demo anytime. WellFoodCo.com, Well Foods is a fantastic source for grass-fed meat, jerky, cookies, snack foods galore. We made some kiddo packs, which Ben maybe excited to check those out here. We'll talk about some of his recent ketoadapted athletic activities.

We have some other post workout mixes kind of trend to find some better quality MRE type stuff so check out WellFoodCo.com for that.

PerformanceMenu.com, Journal of Nutrition and Athletic Excellence. MasaMeats.com, actually MasaNaturalMeats.com, these are the folks that I actually get my meat from. They're based out of Orland, California. They ship anywhere in the continental 48 and have great prices and really, really good quality stuff. CavemanCoffeeCo.com, Caveman Coffee these guys are awesome. Tait Fletcher, Keith Jardine, they can beat up any other coffee producer on the planet so there you go. If you buy some stuff from them, if you put in the code Robb Wolf then you get a 10% discount on that and 10% of that sale goes to the farm to consumer legal defense fund.

Finally Highlite.com. I was an early adopter with these folks. They make fantastic athletic gear. If you use the code RW25, you get a 25% off on all of their shwag, boom there you go.

Dude, I was going to go through your list of bona fides but your bio is like the Encyclopedia Britannica like you were picked as the top trainer of the year in 2008 by the National Strength and Conditioning Association. You've founded like more companies than Donald Trump. You've competed in everything from what body building up to triathlon? What have you not done man?

Ben Greenfield: No hotels yet.

Robb Wolf: Okay.

Ben Greenfield: So there's that.

Robb Wolf: Okay.

Ben Greenfield: And yeah and by the way keto cookies seriously?

Robb Wolf: Uh-hum. Yeah.

Ben Greenfield: Really?

Robb Wolf: Yeah.

Ben Greenfield: Interesting.

Robb Wolf: Yeah.

Ben Greenfield: Wow. My equivalent of a keto cookie at this point right now is looking at a cookie while drinking MCT oil so. Anything has got to be better than that.

Robb Wolf: Yeah, some almond meal and some coconut and they actually taste pretty darn good so. Wow. Cool.

Ben Greenfield: Yeah.

Robb Wolf: So dude, so do you want to jump in? We were talking briefly before we started rolling the tape here. You just got back from Jeff Volek's lab. Do you want to launch in on that or what do – how do you want to jump in on this thing?

Ben Greenfield: Yeah, sure. Painful memories of muscle and fat biopsies kind of burned into my memory at this point so.

Robb Wolf: Awesome.

Ben Greenfield: Why not. That was a pretty cool study. They ran it over – it was over at the Yukan Human Performance lab, which actually it's a pretty lab. They've got one of the number one ranked kinesiology doctoral programs in the US and I think they were ranked number one in research productivity, whatever that means for their kinesiology doctoral program too and Volek is over there doing a bunch of his low carb studies and pretty cool human performance lab.

Robb Wolf: Uh-hum.

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Ben Greenfield: And they brought a handful of high carb ultra-endurance athletes over there along with a handful of low carb ultra-endurance athletes and these were folks who they specifically required had been following a low carb diet for at least six months, preferably longer. So they --

Robb Wolf: And low carb like you know, there's a spectrum on that so like a hundred grams a day, 50 grams a day, 20 grams a day.

Ben Greenfield: He wanted the folks in ketosis basically.

Robb Wolf: Okay.

Ben Greenfield: Consistently in ketosis and so I mean based on activity levels that's obviously going to vary. You know, I personally would fluctuate from anywhere between 50 and a hundred grams of carbs a day and you know, on a real rough and tough day sometimes get as high as 200 grams and still be in ketosis. But ultimately the important thing here is that most of the studies as I think you know and probably a lot of your listeners know, most of the studies that have been done on fat versus carbohydrate oxidation and meal intake or macronutrient intake going into exercise with a look at fat and carbohydrate oxidation have not been in folks who are "fat adapted." So you know, most of the time it's well here's a group of athletes off the street and we're going to feed these folks a high fat preworkout meal and these folks a high carb preworkout meal and kind of see what happens to oxidation rates. So instead what they want to do is look at folks who really truly have been following a macronutrient ratio kind of skewed away from the traditional carbohydrate laden protocol and kind of more along the lines of ketogenic or high fat protocol.

So what they did was they took all the athletes in the lab and started off with a VO2 max protocol and that was just to set a baseline for the next day's adventure, which was a three-hour treadmill run. I wasn't --

Robb Wolf: They give you some valium for that or what was --

Ben Greenfield: You know,

Robb Wolf: - or just play porn in front of you to keep you entertained for that long or what?

Ben Greenfield: Yeah I was hoping for like a plasma screen TV or you know, I had heard the Yucan program had some decent funding --

Robb Wolf: Right.

Ben Greenfield: And yeah but it really was a white brick wall. There was a little piece of red tape on one part of the wall and I just know that because I had to stare at that wall for three plus hours. It was kind of a blow your brains out kind of activity. I mean like I have never run on a treadmill for that long before and never will again. I think the longest I've ever been on a treadmill was about an hour and a half.

Robb Wolf: Right.

Ben Greenfield: So it was tough. It took a little bit of focus let's put it that way.

Robb Wolf: What type of rate did you have to maintain on the treadmill relative to your VO2 max?

Ben Greenfield: So we're shooting for about 60% to 65% VO2 max. so it wasn't exactly a jog. You know, it was close to the RPE that I had run for example an iron man marathon in. So it took a little bit out of me you know, to run three hours on a treadmill at that rate. So I did the VO2 max test the day before to determine what that speed was going to be and then the next day what they did was monitor food intake of course and then also started things off with muscle biopsy and fat biopsy. So the muscle biopsy and fat biopsy were actually repeated throughout the day and the way that they did that was they took about 200 mg of muscle tissue out of either the left or the right thigh. They did that before the run and then they did it immediately after the run then post workout meal and then another biopsy two hours after the post workout meal to kind of look at glycogen replenishment, glycogen storage, and then also you know, the biopsies allow for you to look at triglycerides, fiber type, you know, markers of inflammation, markers of immunity. They even look at some gene expression patterns and some pretty interesting things with the muscle biopsies and then also fat biopsy as well. The same time as the muscle biopsy. So they took about 100 mg or so of fat so I guess some free liposuction out of the deal.

Robb Wolf: Right.

Ben Greenfield: And those hurt, those muscle biopsies hurt. The pre muscle biopsy actually was really bothersome running on the treadmill you know, with that whole punched in the quad.

Robb Wolf: Right.

Ben Greenfield: It actually was a little bit tough. Later on at night it really hurt. But the muscle biopsy they did prior to the task they did a DEXA scan to look at primarily body fat percentage and body fat distribution. They did urine collection so that will allow them to look at nitrogen utilization and you know, how much was actually burned from protein and then also stool samples to look at bacteria and microbes in the gut so.

Robb Wolf: So they did a really comprehensive look at this thing.

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Ben Greenfield: Super comprehensive, yeah. It was not just fat oxidation. Resting metabolic rate test before --

Robb Wolf: Let me ask you really quick.

Ben Greenfield: Yeah.

Robb Wolf: How many people were roped into this thing?

Ben Greenfield: You know, I think they had about 30. So the end was --

Robb Wolf: Oh wow, okay.

Ben Greenfield: - the end wasn't super big but I mean when you're looking for -- I mean even for them to just find you know, 15 fat adapted athletes who are ultra-endurance athletes they were looking for people kind of at the pointy end of the spectrum. You had to be able to run a marathon and pretty close to three hours or do a nine to ten-hour iron man. So they didn't want folks who were just kind of coming off the street.

Robb Wolf: Uh-huh

Ben Greenfield: Yeah, they wanted to look at what some of like the more slightly elite ultra-endurance athletes were doing. So it was a combination of like professional athletes and kind of elite amateurs.

Robb Wolf: Okay.

Ben Greenfield: They also did blood draws so they looked at cholesterol and triglycerides, glucose, insulin, inflammatory marker, white blood cells, just a basic blood panel and they actually did... They wanted to run a cannula all day long but --

Robb Wolf: Okay.

Ben Greenfield: Yeah.

Robb Wolf: Who.

Ben Greenfield: I wasn't that excited about running with my arm at a 90-degree angle with the cannula in it for three hours. So we actually ended up stopping four times during the treadmill run for blood draws and then there were three blood draws before that and two after so.

Robb Wolf: The only thing more fun would be a --you know, tapping your bladder directly.

Ben Greenfield: Yeah.

Robb Wolf: -- through your pelvis or something.

Ben Greenfield: Exactly. Exactly. And they did of course blood lactates too to look at lactic acid production. They did that during the VO2 max test and also multiple times during the three-hour treadmill run and then resting metabolic rate test and that one was really important because they got a prebaseline respiratory exchange ratio to look at fat percentage versus carb percentage. Then they did the same thing of course during the test. They had me wearing the mask to look at fat and carb oxidation and then they did a post, immediately post they did a 60-minute post and a two-hour post to look at continued fat oxidation post workout. So what else did they do? Cheek swabs, that was a new one for me. I wasn't aware that you could actually get this stuff from a cheek swab but apparently the cheek cells can be used to look at membrane fatty acid composition.

Robb Wolf: Uh-hum.

Ben Greenfield: So there are specific essential fatty acids as well as free radical stressors that can be measured via cheek cells. So we did a cheek swab before and after and then those were the basics. I've actually gotten some of the data back and it's super interesting data because for example the biggie really is that what they say is the maximum amount of fat oxidation that can occur is something like 1.1 grams I believe. It's like 1.1 grams per minute is what theoretically you should be able to burn, you know, through research from the Gatorade sports science institute and you know all the other data out there that actually looks at the maximum amount of fat oxidation that can occur. What they say is that it's pretty much impossible to burn anything more than a gram per minute of fat period.

Every time I looked over at the treadmill and also looking at my results afterwards, I was up around 1.4 to 1.5 grams per minute. Dr. Volek told me that I was about s middle part of the range when I spoke to him after the test even though I haven't seen the data from the other athletes yet. So what we're looking at is basically a rewriting of a textbook when it comes to potential for fat oxidation during exercise in fat adapted athletes who are not consuming carbohydrates during exercise. So this was totally a fuel less three-hour run.

Robb Wolf: Okay.

Ben Greenfield: And then also --

Robb Wolf: Not even like MCTs ingested or anything like that?

Ben Greenfield: Dude, it was actually so normal if I was going to go run three hours on a treadmill I'd have a pretty hefty shake like a few hours prior I'd do kind of like an 800, 1000 calorie-ish shake you know, with some coconut milk and some nuts and something that will keep my appetite satiated for three hours. It was almost humorous what they gave me two hours prior to this test. It was this little paper, ironically a Dunkin' Donuts cup.

Robb Wolf: [Laughs]

Ben Greenfield: I looked inside and it was about four ounces of fuel and I was told it was 400 calories. I think that that was probably an overestimation and it was a combination of olive oil, walnut oil, some heavy whipping cream, a little bit of whey and about, this is the way that the described it about ¾ of a strawberry so. [Laughs]

Robb Wolf: [Laughs] Don't go overboard on that stuff.

Ben Greenfield: So yeah exactly. Got to make sure you don't get the extra quarter of the strawberry in there or else everything will get messed up so same thing for post workout. You know normally post workout I'd go hammer like a big old you know, grass-fed chunk of beef with some nice vegetables and afterwards I got to the same little paper cup about the same size with the same smoothie in it. So the actual caloric intake on the day was not that hefty but the –you know, everything was controlled and the data is super interesting in terms of fat oxidation for hours after the test as well as fat oxidation during the test.

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None of the muscle biopsy or fat biopsy results are back yet. Some of the blood results are back and you know, inflammation is very low. CRP is very low so there's no issues there. So ultimately I would say probably within six months they'll have most of the data in and I'm going to try and put together a blog post at some point over a Ben Greenfield fitness report on it. But yeah it was an interesting test and I think ultimately kind of the big takeaway point is we can probably oxidize way more fat than what current research is indicating if we go into exercise in a fat adapted state.

Robb Wolf: Right. So now you know I've been a fan of ketosis, cyclic ketogenic diets for ages. I've tinkered with them. I've found better success when I've been more in the strength side of things like doing some Capoeira, doing some Olympic weight lifting and stuff like that when I started tinkering

with crossfit when I'm doing some pretty intensive Brazilian jujitsu like going three to four days a week which is... I mean it's probably a 50/50 aerobic glycolytic sport and I just haven't been able to get the wheels on the wagon with a ketogenic protocol. I gave a three month adaptation window, which again is short compared to what you've done, short compared to what Peter Attia has done. But I hit a spot where I felt like I had that like 60% to 70% aerobic deal where I could roll a long, long time but it actually wasn't even a deal of fatigue so much. But when I needed to do a really quick scramble, some really quick hip switching and stuff like that, that gear just didn't exist.

Ben Greenfield: Uh-hum.

Robb Wolf: Like what do you think about that? Like do you think that this is –you know, I guess a couple of things. Is this a protocol you know doing a more fat adapted protocol, is this going to lend itself more and more and more for the longer duration and activity is. Would someone like me just need to ride this thing out further and then really pay attention do a post workout carb ingestion so that I had a little bit more of that power band for doing stuff? Like what do you think about all that?

Ben Greenfield: Yeah. So first of all I consider ketosis to be a great bio hack for endurance. When I say endurance, I'm talking about something somewhere where we just got to talking about you know, 55% to 65% VO2 max three-hour marathon or an iron man triathlon or something like that. So that's where I consider it to be most handy when you're looking at things from a performance standpoint. You know, not talking about disease management of epilepsy or addressing hypoxia in Navy Seals or some of the other things --

Robb Wolf: Right.

Ben Greenfield: --like that they're using ketosis for. So from a strict performance standpoint, endurance is where it comes in most handy for some of the reasons that you've just mentioned. I mean there's no denying from a physiological standpoint that you do reach a point where carbohydrate oxidation becomes predominant and that's just based off of limited rates of ATP production through fat oxidation. So the second thing is that for me because I do a great deal of high intensity interval training just because I don't have a lot of time with my job and my kids and everything to do high volume endurance training. So I actually do quite a bit of short intense efforts and last year did quite a bit of that for training in Iron Man.

I've found that some things would help out quite a bit. For example about five to ten grams worth of an essential amino acid source to stave off central nervous system fatigue.

Robb Wolf: Uh-hum.

Ben Greenfield: That helped out quite a bit. That was also something that I used during iron man. MCT supplementation combined with super starch for a little bit of like a slow carbohydrate bleed that helped out quite a bit as well so that was a fuel mix that I used during iron man. That was one that I would pull out during some intense efforts where I knew I'd need some exogenous fuels to be tapping into you know, above and beyond my own fatty acids and the ketones that were being produced through their utilization.

As far as you know, carbohydrate use and ketosis, you know, the other important thing to realize here is that you can get a lot of these fat adapted benefits not necessarily by being in strict ketosis but by using some of these cyclo ketogenic protocols that you're talking about. Where you actually are perhaps before your higher intensity efforts you're on, your more voluminous days actually taking in a little bit more carbohydrate than usual to give you that extra glycogen or that extra glucose to be able to tap into.

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So I right now after having completed that test, I'm kind of on a break from the whole ketosis strict high fat thing and kind more of into that deal where especially having just come back from vacation where I'll eat carbs before a really intense workout. I do notice that you feel a little bit better or you're able to push yourself a little bit harder. Do you lose off some of the benefits of say like the fat adaptation that gives you a boost for endurance performance? Probably but it does make the higher intensity efforts a little bit easier.

Robb Wolf: Uh-hum.

Ben Greenfield: There are some people like you know, I've heard this from Jack Cruz, I've heard it from Mark Sisson that theoretically you could boost mitochondrial density to the point where you're churning out so much ATP from fat oxidation that you don't actually need the carbohydrates much at all even for the intense efforts. You know that combined with glucose from lactic acid, getting shuttled back up into the liver via the Corey cycle. That looks good on paper but I'm not sure that that's necessarily true in terms of the really intense stuff, you know, like you're

talking about like jujitsu or anything that's high intensity that really taps off--

Robb Wolf: 800 meter run right?

Ben Greenfield: You know, soccer, I mean any of that stuff. So you know, I think that this has – I mean there's obviously thousands and thousands, hundreds of thousands of marathoners and endurance athletes and triathletes and folks who would benefit from this who are not tapping into those energy systems during performance or tapping into them very infrequently who could definitely benefit from this type of thing but I still think that there's a place to be – to kind of put your foot down and say okay you're still going to need some carbs before that type of effort.

Robb Wolf: Right, right. You know, Peter Attia has done some great N=1 experimentation and tinkering with that. I think a similar experience that you've had after a long period of quite low carb intake then you know, he'll play with okay I did this much volume, this much intensity on this day. So I may be as high as 200 grams of carbs in that kind of post workout block then I notice the next morning I'm still ketogenic whereas if he had tried doing that previously or if he has a low volume training day, does that volume of carbs and the next day he's out of ketosis.

Ben Greenfield: Right.

Robb Wolf: So finding some ways of playing with that.

Ben Greenfield: Right. Exactly and that's what I found was there were some days especially training for iron man last year for Canada and for Hawaii where I would take in as high as 200 grams on a really though weekend day and still be able to maintain ketosis you know, above 1 ml or more. So you know, but there's not a lot of people out there who are doing that type of volume or intensity who would be able to take in that amount of carbohydrates and not be knocked out of ketosis for example.

Robb Wolf: Right. So a good question that gets thrown around out there and I think it's worth asking is a ketogenic approach going to produce a world champion in say like you know, the western states 100 or you know, iron man Hawaii or something like that. Like is this going to –you know, clearly in that story you're probably going to need somebody who is both genetically talented and then it's always a question of is it simply genetics or is it genetics and fuel. But I mean is this going to be enough of a boost, is there enough of a performance edge with this that even with the fiddling with carbs and appropriate timing and volume and all that stuff?

Is this going to be something that would take somebody who might have been a second or third or fourth in the world and is going to stick them in first place do you think?

Ben Greenfield: I think that there is huge potential for performance advantage but you know, the question is you're comparing it to the current let's say endurance protocol encouraged by most of the prevailing sports science or exercise science literature that's out there and that is 7 to 12 grams/kg of carbohydrate. That would be like in the days leading up to an event you know, to boost performance. The question is does ketosis really give you any advantage over and above that? I think it could certainly put you on the same level but I don't think that the simple act of using fat adaptation or a high fat diet is going to make you necessarily faster than someone who's taking in what's currently recommended for carbohydrates.

Robb Wolf: Right.

Ben Greenfield: For me it comes down to you know, the performance versus health issue and the advance glycation end products and potential for reactive oxygen species, the you know, all of the deleterious health effects that can go hand in hand with blood sugar fluctuations or chronic high blood sugar. Because a lot of these athletes who are using higher carbohydrate intake are also relying upon carbohydrates as their staple outside of exercise as well. You know, for me that's what it comes down to is the performance versus health paradox.

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If I can be just as fast by not eating as many carbohydrates, then I'm happy. If we can produce a world champion in endurance sports who's not going to get nervous system damage or diabetic retinopathy or something like that later on in life from high high carb intake for 20 years training for endurance events then I think that that's --

Robb Wolf: Possibly a win.

Ben Greenfield: -definitely- yeah I mean I think it's a win. You know, you've got an elite athlete who's able to go through their career without getting pancreatic dysfunction at the end of it.

Robb Wolf: Right.

Ben Greenfield: So you know, I think that there's more health advantage than there is a performance advantage once you get to the elite level especially.

Robb Wolf: So let me ask you this then. I think when we did our AHS deal together you talked about this a little bit, what about the potential for different hormonal kind of consequences of ketosis, some thyroid down regulation, potential to flip like the cortisol-testosterone access? Like what are your thoughts on that and did you talk to Volek at all about that stuff? Is he tracking any of that stuff?

Ben Greenfield: You know, I don't think he's tracking thyroid hormones at all and that was thyroid was the one that I noticed definitely took a turn for the worse when combining high levels of physical activity with carbohydrate depletion. We know from research that caloric depletion plus physical activity does a number on the thyroid. You know, metabolic down regulation, you know, inability to adequately convert, inactive to active thyroid hormone. But carbohydrate depletion appears to make it all the more worse.

So what I've found when I was doing ketosis for iron man was a consistent rise in TSH over the course of the entire training season for which I used this protocol. Eventually when I figured out that I was called all the time, my TSH was going up, my T3 levels are dropping, you know, everything was indicating a thyroid dysregulation, I started to experiment with some things to turn that around. For example thyroid extract like I used a T1, T2, T3, T4 combo called thyro gold. That one was out of New Zealand. It's like an A2 cal from New Zealand that's pretty hypoallergenic stuff. It's a good blend and that one I think it's like natural thyroid solutions or something like that. But that one worked pretty well and that actually I started into after doing axillary and oral temperature measurements for about two weeks and Dr. Attia and I were actually talking and I sent them over my temps. He was like yeah you'd probably benefit from a little bit of thyroid help. I also added in organ meats as well and I noticed more of a difference for those on my testosterone because testosterone was dropping down into the 300s, which is pretty low for total T for an athlete especially to be able to do well on.

Robb Wolf: Right.

Ben Greenfield: I started adding in organ meats, you know, started doing the brunch rigor from US Wellness Meats, I was ordering that in. The organ meat seemed to help quite a bit with that from both libido as well as a blood testosterone standpoint. Ultimately what this comes down to though is that regardless of what you're eating you're putting your body through an unnaturally high level of physical activity when you're training for a marathon, much less a full iron man. So I think when you combine that with messing around with ways to bio hack your performance or your fat

utilization there comes a point where you need some help from a hormonal standpoint. So you know, I think that anyone who is restricting carbohydrates or who is even training for iron man period you know, and just burning through a huge number of calories, they may need to not just track things like thyroid and testosterone and progesterone and DHEA and cortisol and sex hormone binding globulin. But they may also need to pay close attention to adding in things like organ meats, potentially like a thyroid extract and ensuring that they're kind of covering their basis from that standpoint. Because you know, some people I think would like to sit back and say I can just –you know, I can replete all this through just eating a lot of food or through eating a standard diet. But I think you're still asking your body to do an unnaturally high level of physical activity and you may need some help when you're doing that, you know, some – kind of this better living through science type of approach.

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Robb Wolf: Sure and I mean that to your point that's true whether we're talking a carb fueled athlete or a noncarb fueled athlete.

Ben Greenfield: Yeah.

Robb Wolf: We frequently see these things pop up.

Ben Greenfield: Yeah and ultimately from everything that I've seen I mean when it comes to thyroid dysregulation, you know, it's really not excessive exercise that really does the number on your body. It's excessive exercise combined with caloric depletion.

Robb Wolf: Right.

Ben Greenfield: You could even achieve it with caloric depletion in the absence of excessive physical exercise. Then like I mentioned once you –you can take it to the next level by not just getting excessive exercise and caloric depletion but specifically excessive exercise and complete carbohydrate depletion. That's kind of like the worst hole to dig yourself into and where you got to be really careful with this stuff.

Robb Wolf: You know, I've seen folks particularly in the crossfit scene really tinker and like I'm probably the root cause of people tinkering with this stuff because I messed with intermittent fasting, messed with cyclical carb and stuff like that. It definitely seems like you know, particularly in the crossfit scene where people are being asked to basically trained literally to failure almost on a daily basis. That you know (1) it would be smart if we had

better programming and a little better planning in that but if folks are tackling that volume and intensity and particularly in the glycolytic pathway I'm nervous of folks playing with too much carbohydrate restriction in that scene. You know to your point there's probably an argument that mitigating advanced glycation end products and reactive oxygen species by being a bit, even a bit fat adapted is probably a good thing. That maybe shines a little bit of a light on, you know, if you've got a volume and a level of activity that is necessitating some really heroic efforts on nutrition to be able to fuel it, there's possibly some downside associated with that. I mean what are your thoughts with that, not to ask too leading of a super long run on question?

Ben Greenfield: Yeah. You know, I think that when it comes to consistent hard efforts like that and I've looked over the diets of a lot of athletes because I do consulting with wellness effects or look over the blood and biomarkers every week. they send me --you know, they're crossfitters and they're triathletes and folks like that. You know again what I see more often than not is just basic caloric depletion even in the absence of consideration of macronutrient ratios just folks who are straight up not eating enough food based off of their level of physical activity because they're afraid that they're going to get fat or reduce their power to weight ratio. I mean even me training for iron man I felt really good when I was slamming a lot of calories. You know, --

Robb Wolf: Right.

Ben Greenfield: -- that may seem like a lot of food but many times you need more calories than you think and it may sound like a dumb answer but a lot of times it just comes out of the fact of eating more, not necessarily eating more carbs, just eating more food.

Robb Wolf: Right.

Ben Greenfield: Period. And I think that that's one thing to think about. And then of course like the programming thing is a whole different beat altogether. I really don't think that the nervous system you know, just looking at myself from a straight up tracking of heart rate variability standpoint, I don't think you can handle much more than about three very high intensity sessions per week before you're really tapping pretty deep into the tank. You know, and so I think from a programming standpoint if they did a better job or if crossfitters in general or you know, anyone who's really putting themselves through a hard workout. Like you know, I think from Spartan training to soccer you know, I think that's where heart rate variability comes in really handy to be able to keep a finger on the pulse

of your nervous system specifically and determine whether or not you can actually handle anything more than three high intensity interval training sessions per week.

Robb Wolf: And it's totally objective. It's not about pushing out or getting neurotic about it. It just gives you red, yellow, you know, green light and you --

Ben Greenfield: Yeah.

Robb Wolf: --base things around that, yeah. Yeah.

Ben Greenfield: Yeah, exactly. I mean super simple and I mean obviously there's a ton out there. The omega wear, the bio force. I use the sweet beat but I mean I'm not even that scientific about it honestly because I don't have a ton of time to dig into a high frequency parasympathetic data versus low frequency sympathetic nervous system data. I just mostly look at my score for that day and that determines whether or not I'm going to be able to go to the well that day. If I'm below 90 on my HRV score, then I wait until I'm above 90 to actually throw it on the hard work out. That means that your programming a lot of times is more based off of you know, kind of micoperiodization and day to day fluctuations and kind of making decisions literally on the morning of the workout. But you know, if you really want to take good care of your nervous system and also not cause a lot of the hormonal fluctuations that you see in many of these hard charging athletes, that's a really good way to do it.

[0:35:21]

Robb Wolf: Very cool. We just did a gymnastics body seminar with Coach Chris Sommer and he's just got amazing depth of knowledge in the gymnastics scene and he made the comment and it was very offhand as part of another point that he was making but he said that he could peak an athlete once a year and maybe one or two other minor peaks throughout the year but that was about it. If he -- so you know, to -- using your terminology if you go to the Well More often than that then the people started breaking down. When you start looking at some of the frequency of people competing in local throw downs and different stuff like that, like it's one thing to show up and just kind of be there and it's another thing to really try to give a rock star performance on all of these things. Maybe just giving some thought about like okay what are the maybe three times this year that I really want to have a stellar performance and the rest of the time it's a training process?

Ben Greenfield: Yeah.

Robb Wolf: So you got to have to live a little bit in the tank.

Ben Greenfield: Yeah and I think that that's all the more true for a sport that requires more intensity versus more skill and planning. I mean I think you could peak like and adventure racer or an iron man tri athlete or something like that. Potentially more than that because a lot of times it's not necessarily fitness that wins the day. It's experience, ability to juggle nutrition and you know, pacing strategy, things of that nature. So I think it kind of depends on the sport and there are certainly iron man triathletes out there for example that will win multiple big races in a season and that's a lot of times experience and skill just as much as fitness.

Robb Wolf: Hmm.

Ben Greenfield: I think that once you get into the very, very high intensity sports where pretty much fitness is king that's where it starts to be one of those peak once a year or just have a couple of peaks a year type of a thing.

Robb Wolf: Right, right, very cool. So dude, you have a new book coming out. What's the down low on that?

Ben Greenfield: Yeah, I've got this – it's about a 480 page hardcover manual so a little bit of a weapon on all things that go kind of above and beyond training. Like we talked about heart rate variability just now and tracking that and that will be one of those things I would put into that beyond the workout kind of category. Bunch of chapters on recovery on using everything from you know, cold laser to topical magnesium to you know, vibration platforms. Big section on nutrition, fixing the guts, how to eat before, during and after workouts. A lot of helpful kitchen tools. I have got a lifestyle strategy section in there where I talk about a lot of the things that I do myself for time management and for kind of staying fit without actually working out so to speak.

Robb Wolf: Uh-hum.

Ben Greenfield: Yeah --

Robb Wolf: Walking with your kids, wearing a weighted vest?

Ben Greenfield: Actually yeah. I mean you know, like we were talking about it I think that was before we started recording but yeah I mean like I'll go on walks with my kids and I'll wear a 50-pound weighted vest and if I'm not in a public area, a lot of the times an elevation draining mask for hypoxia. You know, when I know I'm going to be flying down to LA and stuck in traffic

for three hours I'll bring along my power along. I'll literally train with my power along until I'm blue in the face while I'm sitting in traffic just to train the inspiratory and expiratory muscles. You know, I do a lot of cold thermogenesis. For example I'll wear a cooling vest anywhere from two to four times a week in the mornings, you know, fastened for a few hours during work in the mornings just to put that hormetic cold stress under my body. You know, it's pretty good for building up brown adipose tissue, for tapping into fat that type of thing. Just a lot of little things like that. But I pretty much get into every bio hack I've ever discovered in the book. When it comes to getting the most bang for your buck out of recovery, out of nutrition, out of kind of that minimal effective dose of exercise.

Robb Wolf: Uh-hum.

Ben Greenfield: Yeah it's called beyond training mastering endurance, health and life. Yeah it's BeyondTrainingBook.com is kind of the website for it and at the time that we're recording this, it ships in the next couple of weeks so.

Robb Wolf: I think this podcast goes up let me see here what day is this going up. This is going up April 1st and then that will be – so it's available on Amazon right now I'm sure and then it's released everywhere April 15th you said?

[0:40:00]

Ben Greenfield: Yup. That's --

Robb Wolf: Okay.

Ben Greenfield: --about what we're looking. I think there was only a couple of months before that and you know how publishing goes.

Robb Wolf: Yes.

Ben Greenfield: So yeah. You know, and even get into like brain hacking and smart drugs and stuff like that. So there's quite a bit in there just pretty much everything I've kind of dug up in the trenches for the past decade or so doing this stuff.

Robb Wolf: Very cool. You know, just as a little diversion into the smart drug deal like do you – Have you found that a lot of what you're focusing on with that, is it kind of dopaminergic type stuff that needs to be repaired in people or is it kind of broad spectrum that seems to give people the best return on their investment?

Ben Greenfield: Well a lot of times there is some neurotransmitter depletion. Typically you see that in more of like the vegan vegetarian population who are low on essential amino acid intake and that's a lot of times where you see neurotransmitter issues. I mean there are both urinary neurotransmitter tests as well as like direct labs for example you could go in there and get a neural endocrine panel and actually see what your neurotransmitters are at. But you know, in a lot of folks especially like a paleo athlete who's getting adequate amino acids, neurotransmitter depletion isn't as much an issue if it's kind of a neurotransmitter deal compared to gut issues either an imbalance in gut flora, you know, and neurotransmitter issues created from that. Sometimes you know, brain inflammation, leaky blood brain barrier things of that nature. But you know, from a smart drug standpoint, you know, a lot of times athletes do need to be careful with some of that stuff. I think the last time I checked, I think Aniracetam was actually on like the WADA panel.

Robb Wolf: Okay.

Ben Greenfield: That they're looking at on athletes. But there are safer alternatives out there like for example one of my favorite stacks is I'll do caffeine with L-theanine and then throw creatine into the mix. There's a -choline also works really, really well with that like doing a - I get some cytocholine or some alpha-GPC and you can mix that in with creatine, theanine and caffeine and that pretty much will keep you going all day long. I think he even did that the morning so the first or second morning of lego land last week just to allow me to go hardcore all daylong and then still squeeze a workout in. But you know, some of this stuff is just pretty good for keeping you really, really mentally alert all day long and then you know, the theanine balances out the caffeine so you're not up all night and then alpha GPC or a lot of these choline derivatives as well as creatine they're neuroptropics but they don't actually keep you awake at night. They're not really central nervous system stimulants. So you know, once you throw those into the mix with L-theanine, you can really be very, very alert during the day without having it affect the sleep later on.

Robb Wolf: Which is a huge bonus. You mentioned that you tackle some gut health stuff so where are you at with the resistant starch? Like have you done tinkering with that?

Ben Greenfield: Barely any at all. I'm not a huge fan of the whole bloating and gas component. So even --

Robb Wolf: Right.

Ben Greenfield: --even like the -- so the super starch for example that I talked about for iron man or for people who want to stay in ketosis during endurance events. Super starch is made from a non-GMO based corn starch. They put it through about I think it's somewhere close to 40 different kind of heat treatments and it's kind of similar to resistant starch. It is metabolized however and it's a very, very high molecular weight starch. It does tend to ferment in the digestive track though if you over do it. by overdoing it, I mean if you take in more than about 200 calories per hour of this stuff, you can really do a number on your stomach. When I first started using it, I just took it in as much as I was accustomed to taking in per hour in terms of carbohydrate intake and I was close to 300 calories per hour.

I will be bloated literally for two days afterwards and just you know, nasty stuff going on in the bathroom and --

Robb Wolf: Right.

Ben Greenfield: -even after using something like a super starch, you know, a high molecular weight starch that ferments in the digestive tract is somewhat similar to a resistant starch. I've found that after iron man you know, typically I go to pop some activated charcoal for a few hours afterwards just to soak up some of the gas and stuff that results from that alone. So I haven't done much as far as like green bananas and parboiled rice and you know, what else are they doing? The potato starch and stuff like that for resistant starch.

You know, I've heard some of what Richard Nicolai has to say and it seems interesting. But it's not really something I've messed around with too much.

Robb Wolf: I've done a little tinkering with it and so far I've liked the results and it kind of for me it's weird because I had eaten a lot of you know, fermentable potential foods you know, like onions and different stuff like that but I had never quite hit a mix that seemed to really normalize my digestion the way that I would come into. Like it would still kind of be a little hit and miss as far as all that stuff goes so I've been playing more with really, really green bananas, very green plantains, doing a little bit of potato starch. I have found some sort of a sweet spot between like two to four table spoons of that a day. I tried bumping beyond that and like my wife literally was kind of like do I need to call you know, like ghost busters or something. Like there were some horrible things going on after them.

[0:45:42]

Ben Greenfield: [Laughs]

Robb Wolf: It went on for a long, long time and it's funny like there was abo none of that and then all of sudden it was like good god, what have I done to myself. Like there was no little bit of worsening. I just hit this threshold where it was like okay that was way too much so.

Ben Greenfield: Uh-hum. Uh-hum.

Robb Wolf: Yeah, yeah.

Ben Greenfield: Yeah. You know, maybe it's because like we do a lot of fermented foods. My wife does a lot of fermented food prep, you know, everything from kimchi to sauerkraut to a lot of these things are a combination of both fiber and good bacteria.

Robb Wolf: Uh-hum.

Ben Greenfield: So I know there's a good amount of good colonization of the digestive tract taking place with that stuff. The probiotics compound that I travel with has a pretty good amount chickaree root in it, which I guess is basically resistant starch. So maybe I'm getting some of that stuff anyways. But you know, so far I just haven't been brave enough I guess to venture in and see what happens from a gas standpoint.

Robb Wolf: Right.

Ben Greenfield: Messing around with the resistant starch but --

Robb Wolf: I'll tell you it's like MCT oil like you want to speed up on it. Because when you've done too much.

Ben Greenfield: Yeah. Yeah.

Robb Wolf: You need to take everything planned off the schedule because you're not going to be there for it that's for sure so.

Ben Greenfield: Yeah, yeah and I can tell you with MCT oil for anybody wanting to try it out for endurance performance, I wouldn't go any higher than about a tablespoon per hour because once you get the cumulative dosing more than about 80 grams of the stuff in a day you're pretty much toast. So I've found that that for me about a tablespoon per hour doing something like a nine to ten hours out there racing iron man that was about the

maximum amount that I could do without diaper time so. Make sure that you note that. That's why I'm mix MCT oil with super starch with amino acids and then you know a little bit of caffeine and that's a pretty good mix for fat adaptation during an endurance event or a fat oxidation during an endurance event. But yeah you're right MCT oil you got to be careful with.

Robb Wolf: Awesome. Awesome. Well Ben remind everybody about the book and the book website and then your website and how they can track you down.

Ben Greenfield: Yeah. You can grab the book at BeyondTrainingBook.com. I know probably some of your listeners will be at Paleo FX. I'll be talking down there as will my wife. We'll have a lot of books down there as well I'm sure and then my website is over at BenGreenfieldFitness.com. That's where my podcast and blog and all that jazz is --

Robb Wolf: Very cool. Well you know, I don't know if folks remember but when my book was released way back in the dark ages of the interwebs and everything Ben actually had me on his show. So thank you for that so.

Ben Greenfield: Yeah.

Robb Wolf: I think that you played a pretty pivotal role in getting the message out there about that. So thank you very much for that.

Ben Greenfield: Yeah that was a while. What was that back in the '80s?

Robb Wolf: Dude at least yeah in dog years yeah.

Ben Greenfield: Yeah.

Robb Wolf: Cool. That was before several kids ago I think so yeah.

Ben Greenfield: Yeah.

Robb Wolf: Yeah.

Ben Greenfield: Cool man.

Robb Wolf: Well Ben thank you so much for being on and you know when the Volek information is available for some deeper review, we would love to have you back on the show and talk about that stuff.

Ben Greenfield: Yeah definitely. I've got to a bunch of gnarly picks. I've got biopsy scar photos and all sorts of jazz. So I'm actually putting together a blog post right now on it. It's kind of an epic post but it's preliminary results and then once I get more stuff out there I'll certainly ping you so.

Robb Wolf: Awesome. Well I don't know if chicks are into biopsy scars the way that they're into tattoos and other scars but who knows, who knows.

Ben Greenfield: Oh they are. My wife hasn't left me alone to stick up back.

Robb Wolf: Okay.

Ben Greenfield: Sure.

Robb Wolf: There you go. There you go.

Ben Greenfield: She'll face those fat biopsies.

Robb Wolf: Well there is some upside to that even beyond the information. Right on man.

Ben Greenfield: There you go.

Robb Wolf: Awesome Ben. Well take care. We'll talk to you soon.

Ben Greenfield: All right. Talk to you later Robb.

Robb Wolf: Okay, bye-bye.

[0:49:36] End of Audio