THE MODEL HEALTH SHOW

EPISODE 697

Master Your Blood Glucose To Enhance Immunity, Sexual Function, & Longevity

With Guest Dr. Casey Means

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SHAWN STEVENSON: Welcome to The Model Health Show. This is fitness and nutrition expert Shawn Stevenson, and I'm so grateful for you tuning with me today. What is one simple biomarker that we all contract that can tell us about what's happening with our metabolic health, that can tell us how our bodies are responding to the various foods that we're eating? With recent innovations in science and nutritional science, there are so many different biomarkers that we can manage, we've got various lipid panels, we've got hormone panels, we've got isolated thyroid panels, T3, reverse T3. There's so many different things that we could track today, but when it really boils down to it, two things are really telling the tale of what's happening with our health, and also these numbers can be modulated, can be shifted based on our choices. One of them has to do with inflammation, and we got biomarkers like C-reactive protein, we've got homocysteine and the like, but getting those numbers oftentimes requires getting a full blood panel done and having a practitioner being able to relay that information to you.

So outside of that, what is something that we on the ground, what is something that we can easily tap into that we can manage ourselves, that we can monitor ourselves, that can give us feedback about how our body is doing? And that metric is our blood sugar or blood glucose, our blood sugar can tell us a lot about what's happening with our bodies, both from our response from various foods, how our body does during times of fasting, and also how our bodies are responding to stress, because stress can also dramatically alter our blood sugar, and there is nobody better on the planet to help us to break down and understand the impacts of our blood sugar on various outcomes from our health, and she's going to connect how our blood sugar deeply influences some of the primary causes of death in our society today. People don't think about blood sugar, they think about other things that start with the letter B and S, other BS, and they'll think about how our blood sugar is impacting our health outcomes, and she's going to share the science on exactly why that is. And so, I have something truly special that I put together for you today, and it's a compilation of conversations that I had with the one and only Dr. Casey Means.

She's a Stanford University educated physician and researcher, and she was also the Associate Editor of the International Journal of Disease Reversal and Prevention, so a top tier medical journal, a peer-reviewed journal, and she is the person who was, again, Associate Editor of that, and really being an influential piece in research and also education now because she's getting out and sharing these insights that are deeply, deeply science-based, but are deeply lacking in education, in medical schools right now, and she's working to change that and also, of course, most importantly for people on the ground, everyday folks who can use this information to take control of their health right now. One of the things Dr. Means is going to be talking about

is how utilizing hundreds of thousands of data points from real people is showing us what the very best foods are, and the very worst foods are for our blood sugar, for our metabolic health overall.

And so again, not just hearsay, not guessing, but using real data points from monitoring people's blood glucose levels. Now, I want you to also keep this in mind, yes, our nutrition is going to have a powerful influence on our blood sugar, but stress can make your blood sugar go absolutely bonkers. Now, that's not necessarily a clinical term, but this is what we see in the data, and we don't think about this because stress in many ways is invisible, it's based on our perception of things, it's based on our thoughts, our emotions, and really again, how we're perceiving the world. Now, what is a simple thing that you can add into the mix to help to create a stress buffer for you and for your family?

Well, this simple nutrient is incredibly powerful when it comes to helping our bodies to manage and modulate stress. According to data published in the Journal of Nutrition and Food Sciences, both emotional and physical stress can affect a person's vitamin C status, it can increase the requirement for vitamin C to maintain normal blood levels, when stress depletes vitamin c levels in the body, it reduces the body's resistance to infections and diseases and increases the likelihood of further stress. When vitamin C intake is increased and corrected, the negative effects of excessive stress hormones are reduced and the body's ability to cope with stress responses improves, so under stress, our adrenals are just pumping out Vitamin C because it's needed to help to basically help the body to defend itself from what it's seen as an incredibly stressful situation where the immune system needs to be front and center. The problem is, today, we're very good at going from zero to 100, shout out to Drake, but we're not very good at going from 100 back to zero and revving things back down, oftentimes we're living in the state of chronic low-grade stress, where we're depleting our bodies of these key nutrients, and we need to have a strategy and intelligence and making sure that we're optimizing this key nutrient.

Again, vitamin C is believed to be a powerful stress modulator and reduces our stress by supporting the adrenal glands allowing a person to bounce back more quickly. In a randomized double-blind placebo-controlled trial, published in the journal, Psychopharmacology, looking at the stress of public speaking and other stressors. Now, public speaking, it's one of the biggest fears of people in our society, but the scientists found that those who received Vitamin supplementation experienced less stage fright, maintained more balanced blood pressure, and had a faster recovery of their cortisol levels. This was a randomized double-blind placebo-controlled trial without vitamin C being added to the mix under this, again, intense stressor for a lot of people, our bodies are inherently going to struggle to return back to homeostasis, to return to baseline. And so again, that can lead to higher risk of infections, diseases and also ironically, more cortisol and higher levels of vitamin C depletion, so again, further stress, so we

want to break that vicious circle, create a virtuous circle by making sure we're optimizing our vitamin C. So, of course, eat vitamin C rich foods. It's pretty difficult to not find Vitamin C in a variety of fruits and vegetables.

Now, the key here is understanding how much we need and how frequently we're getting those foods in, and also the depletion that's taken place in our soil, and so if you're going for vitamin C supplementation like I did today, I'm experiencing higher than normal levels of stress, I'm working to optimize some things in my life, shifting some things around, got kids doing multiple things, like I got one son getting on a flight, I got another son got an AAU tournament, it's a lot going off, from family to work and mission and everything in-between. But there's an important insight that you have to know because people just don't know this, they're trying to do the best that they can, but they don't realize that they're being duped, and this is the fact that most vitamin C supplements on the market are derived from synthetic ascorbic acid made from GMO corn syrup or corn starch. So we're trying to do better for our health, but then being taken advantage of by marketers who are not delivering the science with integrity because they can be providing something that's far more efficacious and delivering real value by utilizing whole food, super food, concentrates of vitamin C rather than the synthetic version, again, derived from GMO corn syrup.

So, the emergency pack, those little packets that you see as you're checking out and they're like... They also oftentimes have added sugar and all this unnecessary crap, that's not what we want, we want to make sure that we're getting our Vitamin c from real super food concentrates, whole food concentrates versus, again, matter of fact, listen to this, by being devoid of other essential cofactors, synthetic vitamin C supplements can be outright harmful for your health. For instance, a 2013 study published in the Journal of the American Medical Association, Internal Medicine, found that participants taking synthetic vitamin C supplements had twice the risk of developing kidney stones, that's a no good, trying to do something better for your health by taking a vitamin C supplement, but taking this synthetic stuff, again, derived from GMO corn syrup, it's not what you're looking for. It's not good for your health. Now, going up against synthetic vitamin C versus the vitamin C whole food concentrate that I use coming from camu-camu Berry, we have a randomized placebo-controlled study published in the Journal of Cardiology that had people who were inflicting on themselves an excessive stressor.

And this is in the form of smoking, they had them to consume a helpful concentrate of vitamin C in the form of camu camu berry daily over the course of the one-week study and found that it led to significantly lowered oxidative stress and lowered inflammatory biomarkers. And there were no changes in these markers with people taking the synthetic vitamin C. So, there's no comparison. Camu camu berry is number one. Emu berry, acerola cherry, these are the top three vitamin C rich super foods that are bioavailable, you can get these organic all together in one source from PaleoValley, go to paleovalley.com/model, and you're going to get 15% off

their incredible essential C complex. Again, I had it today, when I'm dealing with extra amounts of stress, I'm always adding this into the mix, just as an insurance policy, and again, all organic, no synthetic ingredients, no binders, and fillers, plus it has a 60-day 100% money back guarantee. So, if you aren't absolutely thrilled with it, you'll receive a full refund, no questions asked, go to paleoValley.com/model right now and you'll get 15% off your order at checkout store-wide, so not just their essential C complex, but which is mandatory for me, but store-wide. Again, that's paleoValley.com/model. That's P-A-L-E-O-V-A-L-L-E-Y.com/model. And now let's get to the Apple Podcast review of the week.

ITUNES REVIEW: Another five-star review titled "Fantastic podcast, great host," by BP Writer. "Recently discovered The Model Health Show, and I'm really enjoying it. Absolutely loved episode number 673, The Truth About Medicinal Mushrooms. This research is fascinating, and Shawn, you explain it so well, and love your sense of humor, got so many unbelievable health takeaways. Can't wait to listen to more episodes. Thank you."

SHAWN STEVENSON: Thank you. I really do appreciate that. Thank you so much for leaving that review over on Apple Podcast, and if you have to do so, please pop over to Apple Podcast and leave a review for The Model Health Show, and without further ado, we've got this incredible compilation of conversations with Dr. Casey Means, one of the foremost experts in the world on metabolic health, and in this first segment, she's going to be sharing with you the truth about blood sugar management and why it's so important, she's also going to share how through hundreds of thousands of blood glucose data points from real people, her and her team were able to find out the very best and very worst foods for blood sugar management, and also some easy strategies you can instantly implement to improve your blood sugar variability and your blood sugar management, and so much more. Let's dive into this incredible segment from Dr. Casey Means.

DR. CASEY MEANS: Blood sugar is an incredible biomarker because it's a readout of so many different aspects of our health. Of course food impacts blood sugar, when you eat a food with carbohydrates, it gets broken down, goes into the blood stream, and we're going to see that as a rise in blood sugar, but what a lot of people might not realize is that other things can cause an increase in blood sugar, like if we're stressed, stress alone can cause cortisol to be released in the body, and that cortisol goes to the liver and actually tells our blood sugar to raise, and the purpose of that is to provide energy for our body to mount a response to whatever that stress signal is, so stress can raise our blood sugar. Exercise, of course, has a profound impact on our blood sugar because muscles, when we use them, that's a glucose sink, it takes glucose out of the blood stream. Sleep also has a profound impact on blood sugar, when we don't get enough sleep, our glucose can be more erratic and can be more up and down and more spiky, our microbiome has a profound impact on our blood sugar, and people with different patterns of microbial composition in their gut actually respond to different foods differently in terms

of how much their blood sugar raises, so it's really this incredible readout in our bloodstream of so many different variables in our diet and lifestyle.

And so, big picture what it does is show us what's going on with our metabolic health, and we're hearing the term metabolic health so much more these days, thank goodness, because we're realizing that metabolism and our metabolic health is really one of these links and these connectors between so many of the different symptoms and diseases we're seeing today. Blood sugar is actually related to nine of the 10 leading causes of death in America right now. If you go to the CDC website and you type in leading causes of death, you will see 10 different conditions, and nine of the 10 of them are either directly caused by elevated or dysfunctional blood sugar, or are worsened or accelerated by dysfunctional blood sugar, so you're going to see things like, of course, type 2 diabetes, which clearly is linked to blood sugar, but also things like cancer and Alzheimer's dementia, Alzheimer's dementia is now being called type 3 diabetes because it's so linked to blood sugar, you're going to see heart disease, which is directly linked to blood sugar, but you're also going to see things like respiratory infections, we know that respiratory infections, even things like influenza, the mortality and morbidity in these conditions are much worse in people with unstable blood sugar.

One of the things that we see, certainly across the board, is that processed foods cause a large spike, these ultra-processed foods based in refined grains and flours and whatnot, and sugars, and those are kind of... We'd expect that, but we actually also see that there's a lot of foods that we typically consider to be healthy, which actually cause a really large glucose spike, so some of the ones in our data set that have been really high spikers are things like grapes, actually, sweet potatoes, oatmeal, corn, funnily enough acai bowls are one that get logged a lot that have really big spikes, these are foods that have lots of nutrients in them, of course, they're beautiful plant foods, but when eaten in isolation tend to cause a really big glucose spike. So that leads us to something else that we've really seen in the data set that when we balance meals and balance foods that have high carbohydrates, we actually see a much lower glucose response, so often adding fat, fiber and protein to a carbohydrate actually causes a more gentle rise in glucose, it slows down digestion, fiber actually may decrease the amount of total glucose you even absorb from the food, protein also slows digestion, and so balancing foods and meals with other macronutrients and not eating naked carbohydrates is something that's really helpful for a lot of people.

The difference between an apple alone and an apple with a little bit of almond butter and maybe some chia seeds sprinkled on top, it actually can be a really big difference, and that's why I think we see something like grapes being such a high spiker, grapes are something you often just sort of eat by the handful on their own, you're not really pairing it with a lot of other protein sources usually, or fat or fiber, and so we just see these really, really big rises. But another thing that we see that's really kind of interesting is how you can take like a food

category and see that there's quite a big spectrum in responses, so for instance, like sushi, people who just log sushi in the Levels community tend to have quite a large glucose spike, well over 30 milligram per deciliter rise after sushi, but people who log sashimi which is of course this fish without the rice, another thing you could order at a Japanese restaurant, have a very low glucose response, less than 10 milligrams to deciliter.

So maybe that kind of gives us the information of like, "Mmh, I'll order more sashimi and less of the rolls with the rice," and then there's this whole new category of Sushi that some people are doing, which is like cauliflower rice Sushi, which actually tastes totally delicious, and I make it at home and I love it, which has virtually no glucose response, even though you're still getting these beautiful sushi rolls, and so it helps you kind of think through, what am I going to order at a restaurant if my goal is to keep my glucose more stable or more flat? Similar with, one that's really fascinated me is nutrition bars, so you go into Whole Foods or Erewhon or whatever, and there's 100 different bars.

You can get LUNA bars, Cliff Bars, bulletproof bars, Quest bars, there are so many... How do you choose? You're just like, look which box is prettiest, which has the best claims on it, whatever. Well, we can see in our data set just like a total spectrum from bars that have virtually no glucose response to bars that have really high glucose response. In fact, I won't name names right now, but some of the healthy nutrition bars that are in a nice brown paper wrapper that look like you should take it camping or something like that, have a much higher glucose response than a Snickers bar, and then there's other bars like the bulletproof bar, quest bar, perfect keto bars that have virtually no glucose response, so what I get so excited about is thinking that the future of nutrition is going to be people being able to make these choices in the grocery store based on data, not based on food marketing, not being at the whim of these industries who want us to buy this food, but actually making a decision based on data, not only their own data, like the bio-feedback loop they've had by testing something and seeing what worked for them, but on population data, what was the responses of over 10,000 people, over a million people, we have 51 million glucose data points in our data sets, 1.5 million food logs that have been logged, the power of people being able to tap into what's happening on a population level, these foods, I think that's going to be the future of nutrition.

I think in five years, it's going to seem very like quaint and outdated to choose your foods not based on objective biometric data that has been tested both in you and in a large population. You can imagine, right now we go on to a... We google some recipe we'll want to cook for dinner and a million recipes pop up and we usually pick by how many stars does their reviews have and does this have any ingredients I don't want to eat, but we're just a couple of years probably away, maybe less, from a time when there's actually going to be another section there that says this is how the population responded to it in terms of glucose rise, and then you can test it for yourself and find your own data about that, and that to me is power, that to

me puts the power in the hands of the population and totally out of the power of the food industry, and I think it's going to open up radical transparency that's going to be demanded by people for both the healthcare and the food system saying, "Don't try and just sell this to me with marketing claims." Because essentially marketing is going to become obsolete because the marketing is going to come from within, from how we respond to it.

And so that really excites me, and I think when I look at like, I scan the data set of what's happening with just nutrition bars or brands of non-dairy milk, you see a big spectrum of what is causing glucose spike and what's not, and that is already driving a lot of the decisions of people in our community, which I think is exciting, and the last one I'll mention is that breakfast foods have been a massive thing, I think I've seen interesting data in our data set, which is that if you look at our best scoring foods, so when I say best scoring foods, I mean foods that had the most minor glucose response, very flat and stable response, versus the worst scoring foods which have big spikes and dips, across breakfast, there are clear breakfasts that are not working for people's blood sugar and clear ones that are. So, when you look at what's in the worst, the big spiking category, it is waffles, pancakes, bagels, donuts, pastries, it's all these white beige, flour-rich, sugar-rich foods, which if you walk into a coffee shop, that's what you're going to see behind the counter.

We have normalized that these are breakfast foods, cereal is another big one, Cheerios actually specifically, is one that has a huge glucose response, so for me, those are just kind of off the table now. When you look at the best scoring foods, it's things like eggs and avocado, eggs and greens, actually the Fab 4 Smoothie, which is a smoothie that was popularized by Kelly LeVeque, an amazing nutritionist, which is basically a smoothie that's a mix of greens, proteins, fat, fiber, minimal sugar, very good score. Frittata has a minimal score, I'm thinking about other things in the data set, Chia seed pudding, very minimal glucose response, so it's not like it's just animal-rich foods, it's also some of these plant-based foods, like a green smoothie, a specific type of green smoothie that's well balanced, and chia pudding.

So I look at all this and I'm like, "Great, if I'm trying to lose weight, if I'm trying to keep my blood sugar down, if I'm trying to improve my risk of chronic disease, I'm not eating these things, even though they're covering the grocery store, even though a lot of the foods in these foods are subsidized by our government, so it's normalized that they're okay, not eating them, but I am going to eat eggs and avocado, eggs and greens, Chia pudding, Fab 4 Smoothie, Frittata, et cetera." And so that's kind of some of the stuff we're learning about food in the data set. I could go on and on, but it's just, it's a whole new world of how we're going to judge food and nutrition.

SHAWN STEVENSON: Yeah, this is so powerful. This is taking it from, again, there's still a level of theory when we see a bagel that I know that this is really high and refined carbohydrates

and added this and that, same thing with the pancake, but it's still a theory that this food is bad for me. Now you can see yourself what it's doing to your body. And again, this doesn't... We don't want to get to a place where folks are being erratic or this is the end-all be-all, and also, of course, this is individual regardless of any other foods that you just mentioned, but just being able to get a beat on things because I think that ultimately what we want folks to be able to do, because we already know that waffle is probably not the best thing for you, but now we can start to listen to our bodies, get to a place where we can listen to our bodies, and if we have the waffle, know we want to get to a place really... And this is what I think the greatest gift is with Levels, is getting your body to a place where there's a healthy metabolic range that your body's staying in with your blood sugar, it's managing things very well.

You're in a good state of health, and so that when you do have the waffle it's not just totally messing you up, your body can kind of clean house, get things back to baseline with some grace. And so, I think that that's one of the great gifts. And also you mentioned some of these foods that tend to be some of the biggest influences of derangement potentially, again, from all your data sets, and I love that you mentioned this, so it's not that the oatmeal is going to be, 'cause I know some folks are like, "Not my oatmeal, you'll never take it from me," where it's like, what if we have the oatmeal and you add some protein along with it, or you have the oatmeal and you add some almond butter, mix that in there, or you've got... I love acai bowls, I'm super into that. Just the last couple of months, we went to, I took my family to Huntington Beach for a little staycation over the summer and we got some acai bowls, and I was like, "I can do this better." And so now I blend the acai with protein immediately, so I'm blending with protein, some nut butter.

You know, bring down that glycemic spike, and now also with Levels, I can track this and see it first hand, and it's just such a wonderful thing, and also with grapes, these are foods that we tend to eat in isolation, as you mentioned, so let's take that out of the context, unless your body does well with it, which is cool, you got to understand, even the grapes that we're eating, they're not the same grapes that are in the historical references, there would be seeds there, and so you would also have to slow down or you're chomping through some seeds, we can just pile on a bunch of grapes really quickly, and what if we take those grapes, if you still want to dabble in some grapes and cut them up, throw them into a summer salad or something like that, so just getting this data and being able to become more intelligent in our choices and creative and expansive, I don't think this closes the door on things, I really think it opens the door for much more.

DR. CASEY MEANS: I think you brought up such an important point, which is, this is not about restriction or elimination necessarily, this is about awareness, this is about informed choices, this is not about never eating a waffle again, but it may mean that, oh, I'm going to try Birch Benders Keto almond flour waffles instead, and see how that works for me, or I'm going to eat

the same waffle, but I am going to do some things around it that make it work better for my body, like add almond butter on top of it, add chia seeds, take a walk after the meal, just a simple 15-minute walk after eating a high carb meal can have a significant impact on lowering your blood sugar from that meal, 'cause again, you're soaking up that glucose out of the bloodstream into the muscles for use. And the really cool thing about muscle is that unlike almost every other tissue in the body, muscle can take up glucose without the action of insulin, just the muscle contraction alone can allow for glucose to be taken out of the blood stream, so it's like a freebie, like use it, use those big muscle groups and even a two-minute walk every half an hour throughout the day can statistically significantly decrease your 24-hour glucose levels compared to people who are more sedentary throughout the day, so this is like...

Just use those muscle groups, do a few squats after your waffle, whatever, and there are so many other things you can do, you could take, for instance, an apple cider vinegar shot before your waffle, we know that vinegar actually tends to have an effect of lowering our glucose levels, you could pre-load your meal with some vegetables, have a little... I don't know, it'd be weird to have a salad before breakfast, but not really, I think in our role, I'd be happy to do that, but put something in the stomach before eating the carbs. So what I'm trying to say here is that there is this whole context around these foods that you can do to enjoy that food and have less of a glucose spike, and so there's just a whole tool box we have to basically minimize that response, so it's not so much about restriction as it is about context, about awareness, and I would say personally in my own life, I really think about sleep and stress as well when I'm choosing what foods to eat.

If I have had a poor night sleep, I typically wear a whoop strap, and we actually did a small pilot with Whoop, which is one of the wearables that tells you about sleeping activity, that showed that the Whoop Recovery Score, which is a marker of your sleep quality, your resting heart rate, your heart rate variability, and your respiratory rate, that actually correlated with your glucose variability the next day, and so if my sleep is poor for whatever reason, I stayed up late working or whatnot, I know that I'm going to try and be a little bit more cognizant of what types of carbohydrates I'm eating the next day, because I'm probably going to have more of an erratic response to the same food after a poor night of sleep. So same with, if I was quite sedentary the day before, the next day I'm probably going to avoid the higher carb, higher spiking foods for me, 'cause I know I'm going to basically have a worse impact, so just setting up that whole context around what you're eating, it makes it really fun and it's, again, like you said, it's not about restriction, it's about pairing things really thoughtfully to create the best metabolic impact for our body, and it's also not about just trying to game the system with super low carb foods or low carb bars to keep our glucose flat.

You could chug canola oil and your glucose would stay flat, that doesn't mean it's healthy. It's about holistically building a healthy body that processes energy effectively, that is the goal,

and that is what our program in our app is really trying to drive people to do by taking in other data streams as well, we take in sleep data, we take in step and heart rate data, so that people can build this holistic context, and I think the future is really exciting because right now, the only continuous biomarker that we can track is glucose, that's the only sensor that's available for use, but in the future, like what if we can check inflammatory markers, what if we can check by-products of fructose metabolism in the bloodstream, we can see a more holistic picture of what foods do in our body, and I think that is really the future, is more continuous biomarkers that let us make these decisions in our lives for optimal health.

SHAWN STEVENSON: This is great, it's such a great segue because I was going to ask you about, outside of food, which food is kind of that tangible thing, we can see the food, we eat the food, we have a relationship with it, but we don't think about the metabolic implications of stress, because it's invisible in a sense, you can't really touch it, you can't eat it, you can kind of stress eat, but you're not eating stress in a sense. Sleep deprivation, same thing. And for me, in looking at my data, there was one particular day that I was dealing with a random stressful thing, and this was the one day that my blood sugar was bonkers, it was stress, it wasn't, you know, and matter of fact, I was intermittent fasting and the stress thing happened and my blood sugar went up significantly, I'm just like, "What the... " But then again, if I'm listening to my body, I already knew, that's why I checked it at that time, it's just like these catecholamines that I'm producing, these stress hormones, they might be like, let my body know like, "Hey, there's a stressful event coming." The fight or flight scenario, because our biology, even though we believe we're so evolved, we're still very...

We have very primitive out-picturing and processing, and so this fight or flight feeling that I'm getting, it's getting my body prepared, it's like, "Hey, he's got some stuff stored in these muscles here, some glucose, let me go and unlock that and put that in his blood stream because he might need to roll out." And so, to get to see that firsthand, I was just like, "Wow. That is so nuts." And so, but here's the thing, even with that, I'm still empowered, I don't have to be a victim to this stress, and also stress isn't bad, that's going to happen in our lives. But I have tools to reframe things even in that moment, or to take some breaths to just tickle the parasympathetic nervous system a little bit in that moment, versus just like this sympathetic dominance taking over, we are so powerful, we just kind of, again, outsource our biology to the external world, when all of this is within us, so let's talk about, you mentioned sleep deprivation being one of those things, let's talk about stress in the context of our blood sugar.

DR. CASEY MEANS: Yeah, stress is a really profound variable in what our glucose levels are doing during the day, and something I really tell patients and that I think is important to know is that you could have the perfect metabolic diet, everything is totally dialed in, but if you're not managing your stress, you are not going to be absolutely metabolically healthy. Food is necessary but not sufficient for optimal metabolic health. Again, we are a whole complex

system, this is not like everything's separate. Stress, sleep, food, exercise, these things all weave together in this incredible hormonal chemical milieu that leads to the outcome, so you've got to think about each of them and how they relate to each other. So, with stress, you really nailed it. I love how you put it, it's telling the body like, we might need to roll out, and so we need some energy available to feed these muscles, so our liver stores a few hours' worth of really quickly accessible glucose for energy for emergencies like that in this storage form called glycogen, and when your stress hormones release catecholamines, cortisol, it goes to the liver and it tells the liver, dump that stored glucose, break that glycogen down, put it into the bloodstream so that our muscles have a quick source of energy for mobility. And that's an evolutionarily advantageous thing, if you're being chased by a lion, you want that glucose to dump so that you can use your muscles.

Unfortunately though, in our current world, we are under chronic low-grade stress basically all the time, the text dinging going off, the honking, the emails we're getting constantly, the body doesn't really realize that this is not a lion chasing you, it's the same threat signal, we're not safe, and it's happening all the time, not to mention biologic forms of stress, the toxins in our food, water and air, even being sedentary is kind of a form of stress for the body, so it's coming at us from all angles and we're constantly just like, like you said, hitting that sympathetic nervous system button, and so that can kind of create a situation in which we're just constantly keeping the blood sugar a little bit elevated. I have noticed myself, the very first podcast I did a few years ago, I was really nervous, and I looked at my blood sugar afterwards and I had gone... I was totally fasted, I went up like 40 points, it looked like a food spike because of that cortisol, catecholamines, liver dumping, et cetera, and so we want to do whatever we can to avoid that, and the beauty is there's so much that we can do about it.

We can, as you said, tickle the parasympathetic nervous system, and we can do that with tried-and-true practices like breath work. So, to me, I'm really using my glucose monitor as a mindfulness biofeedback tool now, and when I see or feel that I'm under stress, I will just immediately go towards that deep diaphragmatic breath, whether it's a deep four breath inhale, four breath exhale or a 2:1 ratio of inhale to exhale, do 10 deep breaths. I can feel my body change immediately in terms of how I just subjectively feel, it's that beautiful release of calm, but I also know that it's doing something good for my blood sugar because of what it's doing, 'cause it's translating to my body that I'm safe. It's changing the hormonal milieu in my body saying, "You're safe, there's not a threat, we don't need to mobilize energy for your muscles, you can simmer down." And so that's been something really super powerful for me about the link between blood sugar and stress, and of course, it all comes back to some of these ancient practices like breath and just getting ourselves and our body into a state of realizing that it's okay.

SHAWN STEVENSON: Yeah, you even shared with me before we got started, that even proactively doing this before you eat your meal can improve your body's response to said food afterwards. And if you think about... Well, first of all, can you share a little bit about that, and then I'll share an example that it reminds me of.

DR. CASEY MEANS: Yes, absolutely. So there have actually been research that's shown that in people with type 2 diabetes, just mindful eating, so really getting centered and sitting down and relaxing and taking a few deep breaths and taking a moment to look at your food, appreciate the food, have gratitude for the food, look at the colors, the smells, the textures of what's in front of you just for a couple of minutes can actually significantly reduce the glycemic impact of that meal compared to if you just plough into that meal essentially mindlessly, which is how I think many of us eat a lot of the time, eating on the go, shoveling food in our mouths while eating. I think about surgical residency when I was like, I don't think I had a single meal sitting down for 4 1/2 years, I was on the staircase, eating food in between surgeries, just shoving... The cortisol was high, my body was not in a rest and digest state, and I'm sure it had an increased impact on what the glucose was doing, and so that's a definite thing I would recommend to people is that it's not just fuzzy advice to say, mindfully eat, there's a real impact on what's going on with our hormones and the way we're digesting food, and so if you can just sit and maybe practically speaking take 10 deep breaths into your belly, take a moment to express gratitude for the food and then eat, it can actually have a significant impact on how your blood sugar raises in response to that meal.

SHAWN STEVENSON: Yeah. And if you think about just this concept of taking a moment to pray before you eat, for example, that folks have been doing for centuries, that's kind of like calming down, getting centered, going within, and allowing for the parasympathetic door to open. Because it's really a binary system, by the way, you can't do both at the same time. And I think that a big reason, as you just mentioned, you said plowing through, which is a great term, is like we're just, because of our constant fluctuations in our blood sugar, when food is around, it's just time. Let's go for it. Instead of just, and I know I've had those moments as well, but I still, every time I eat, I take a moment. Even if I'm in the middle of a restaurant, I close my eyes, just take a moment, I give thanks for the food, and take a couple of deep breaths and just become centered. And it's just like the channel gets changed in reality for me. And suddenly the food is here. Like, it's just like a completely different experience. Because I just want to plow into that food, especially if you're hungry. That's another thing, getting ourselves to the point where we're, "starving", which we're not starving. Then it's going to increase the incidence where we don't take a moment just to stop.

Because we tend to think like this food is in front of us, it's the last meal, we got to go for it. And so, this provides, again, more empowerment for us. And also, it brings us back to more humanity. Because we have something going on today that we didn't have before, which is

even while we're eating, our minds are getting outsourced. It's not like we're having the meal like in a parasympathetic around good friends, having conversation or just being there present with our foods. We're probably working, as you mentioned, being in the staircase. My wife shared the story. She actually told me yesterday, she was like, "Babe, did I tell you what I used to eat for lunch?" When she was in high school, multiple times a week, I think she said like every day, which is scary, but then again, she had her mom cooking these incredible Kenyan meals for dinner, but she said every day she had a rice crispy treat and a Snickers bar for lunch and eat it in the staircase. Because, you know, she was coming from Kenya. She's feeling, you know, like she wasn't fitting in. And I'm just like, "Bro, how did you survive?" But then again, you know, it's just, it's going to get balanced out somehow.

SHAWN STEVENSON: And I think that if we can really back in a little bit, and it's not that you can't have a movie night and eat your dinner or whatever, but if that becomes the norm where your mind is somewhere else than with your food or with what's happening in reality right there, it's probably not going to have a good out-picturing for our body's response. And so, I love this so much and one of the other things that I wanted to ask you about is, and this brings to light something so powerful. I've been talking about this for years, like literally since the first year of The Model Health Show, because we still can get tunnel vision when it comes to food and think that this is everything, which I know that I'm guilty of that, because I'm a nutritionist. So, food to me was everything. This is the end-all be-all. But in reality, you can overeat your way into creating excessive fat. You can under exercise or under move your way into excessive fat. You can under sleep your way into excessive fat, and you can also overstress your way into excessive fat. And Levels helps you to see that firsthand that your blood sugar can go nuts just when you're stressed. And if you're chronically in that state, which we're talking hundreds of millions of people are living in perpetual stress and anxiety.

It's no wonder we're in this place that we are. It's not just about the food. The food is a major portion of it, for sure. But this is bringing to light how stress and anxiety is such an issue. And so, the thing that I want to ask you about and it's going to all tie together, and especially for our time that we're living in right now and talk about solutions. The CDC's report, I've mentioned this several times, I'm going to keep hammering this away till we get it because something just happened this week that we talked about right before the show reiterating this point. But they analyzed the data from 540,000 plus COVID-19 patients, over 800 US hospitals. The number one risk factor for death from COVID was obesity. This was back in July 2021. Everybody could see it, published article. And the second leading cause of death was anxiety and fear related disorders. The second leading risk factor for death. Third risk factor was diabetes and its complications. So, the first and third is something like, oh, of course, we're not doing anything about it. But of course, but that middle one, the stress component is literally killing people. And I just read a paper this morning looking at an anti-psychotic

medication, an anti-anxiety medication, reducing the risk of death from COVID. And I'm just like, what the hell? Why are people not talking about this?

Because anxiety, that anxiety is going to exacerbate your immune system, it's going to cause more dysfunction. We know about this. We have entire fields of psycho neuroimmunology, years of data. We know this stuff. And so, this is what I want to ask you about. You mentioned this that a new report just came out this week finally saying, hey, you know, being excessively overweight is going to lead to worse outcomes from COVID. And losing weight can possibly help to mitigate those things. It's just like we've been talking about this for a long time now. But with that said, obesity is arguably the biggest risk factor for these chronic conditions as well. And as you mentioned, abnormal blood sugar ties in very neatly with that. So, let's talk about this. How can we address our obesity epidemic? Because right now we're knocking on the door of about 250 million of our citizens being overweight or obese. And this is tied to over 400,000 deaths a year, at least. This is looking at, again, just the major things, diabetes, heart disease, not to mention all the other stuff. So, what can we do in this scenario? Because our blood sugar, as you mentioned, is leading to worse outcomes with infectious diseases as well as chronic diseases.

DR. CASEY MEANS: I think one thing that people might not realize is that there's just such an incredible bi-directional relationship between metabolic health and mental health. Actually, people with metabolic dysfunction and blood sugar dysregulation have about twice the rates of depression and anxiety as people without it. And of course, when there's more fear and anxiety, it's going to drive that high cortisol and catecholamine state that leads us to be more metabolically dysfunctional. So, they're very, very tied into each other. And fear and sense of threat in the body and the mind, of course, is going to mobilize this inflammatory sort of cascade in the body that says there's an issue, there's a threat. We need to mobilize our resources like our immune system, which is the part of the body that fights threats. So, we're living in this state where we're just creating the physiology in the body, in part by how we're thinking, that sets us up for dysfunction. And concurrently, that dysfunction is contributing biologically to what's going on in our minds. So, it's just an incredible bi-directional relationship that I think most people are not aware of. If you ask the average person with depression and anxiety, are you tracking your blood sugar? Do you know where you stand on the metabolic health spectrum? I think the majority are going to say no, even though there's a strong, both epidemiologic and mechanistic link linking the two.

So then moving into the question of COVID and what I'd like to see happen, I think you've touched on this so much in the show. And I think it's in many episodes. And I think it's so important is that we need to be talking at the highest level of public health about how important it is to optimize our metabolic health and our weight in order to make ourselves biologically resilient to face this virus. The data is so clear. I actually published a paper in the

journal, Metabolism, sole author paper about... This was in... I submitted this in April of 2020. This was over a year and a half ago. It was published and printed in June. I had basically just been reviewing the research and it started basically in February of last year about what was going on with COVID, and it was becoming clear that there were several biologic mechanisms that were leading to worse outcomes in people with type 2 diabetes or metabolic dysfunction, conditions like obesity, and we even knew then that it was not just a correlation, but there were potentially causative mechanistic links of why people were doing worse, now which we're seeing a lot more which is great. But for instance, obesity and diabetes create a baseline pro-inflammatory state in the body.

People with these conditions have elevated immune chemicals like cytokines already in circulation, and we know that then when the virus affects the body, it mounts even more of an immune response and we get this cytokine storm that actually leads to the organ damage. It's the body's response to the virus, this overwhelming response that can cause the organ damage that leads to such severe morbidity and mortality. So, if you're at baseline in that pro-inflammatory state with elevated cytokines like interleukin-6 and TNF-alpha, then when the virus hits you, you're going to mount that exaggerated response that hits your organs. And this circles all the way back to like what we were talking about with curcumin and turmeric and NF-kappa-B pathways. You know, there are foods, I'm certainly not saying that turmeric is going to prevent us from having poor COVID outcomes at all. There's no research to suggest that, but just the fact that what we're eating has a direct impact on these inflammatory pathways, on the levels of cytokines in our bodies that we know are related to outcomes. So that was one of the things that was a mechanistic link, is increased baseline pro-inflammatory state in the body in the setting of metabolic disease.

The second is that high blood sugar on its own can cause immune cell dysfunction. Basically, for an immune cell to work and to do its job, it has to get to the site of infection in the body. It literally has to move through the bloodstream, out of the bloodstream into the tissue and fight the infection and the cells that are infected. And that's a process called chemotaxis, which is the cells moving to the site of infection, and phagocytosis, which is actually eating cells that are infected or eating, you know, viral particles, whatnot. And high blood sugar can directly impair the cell's ability to both move and phagocytose infection. And so, we're literally stunting the ability of our immune cells to do their job just by having elevated blood sugar. The opportunity here is massive. You know, figure out how to keep our blood sugar under better control and we know that it's going to have positive impacts on the body. And there's several other things that have come out, of course, like that in the setting of diabetes, the ACE2 receptor, which may be one of the sites of entry of the virus is upregulated. So, you've got more of these receptors on the cell membranes, maybe makes it easier for viral entry into the cells.

We also know that people with diabetes had higher sugar in their lung fluid. So, like the sugar is everywhere, right? And that higher levels of glucose sort of even in the lung tissue may have been part of what made the lung tissue so affected by the virus in people with diabetes. So, all of this I went into in this paper a year and a half ago and really the call to action was we can talk all we want about masks. We can talk all we want about Clorox. We were talking at that point about like cytokine inhibitors to help stunt the cytokine response, but none of that... Those are all reactive measures. None of those increase biologic resilience, and one of the things that can is getting our metabolic health under control, which has all these multifarious effects on our immune system and how we're going to show up in the face of this virus. Not to mention, it's not just about creating readiness and resilience in the face of COVID, every single flu season, people with type 2 diabetes or metabolic dysfunction have about a five-time higher rate of hospitalization, mortality from these respiratory illnesses. So, it's not just about this one virus. This is about in the face of any infectious agent. We want to be resilient. And so certainly, I think that every billboard in the country should just have five steps of how to stabilize your blood sugar.

It's not that hard. And what we know is that even for people with full-fledged type 2 diabetes, you can in many cases reverse that condition or improve the condition. That's not something we hear a lot. When I was in medical school, I definitely thought type 2 diabetes was irreversible. That is not true. And for those 80 million people with prediabetes, it's even more likely that you can reverse the disease. And so, I just think that we should be talking about this nonstop. What if the billboards out there or the front page of the New York Times every day said, "Hey, balance your meals, walk after meals, get good sleep, take deep breaths when you're stressed," things that can actually improve blood sugar. That's what I would love to see. There's many other facets of it, of course, but the baseline is we just need to be talking about this and what the data shows.

SHAWN STEVENSON: All right. I hope that you're enjoying this very special compilation of conversations with Dr. Casey Means. In this next segment, you're going to hear some powerful insights about ATP, adenosine triphosphate, what's often glorified as our body's energy currency. But you're going to discover a key nutrient required to actually make ATP biologically active. And so, Dr. Casey is going to share her perspective and her science-based evidence on this. But I got to give you a heads up. Our ATP is produced by our mitochondria. And our mitochondria are deeply dependent upon key electrolytes for them to function, one being the sodium-potassium pump. So that speaks to sodium and potassium. These key minerals that have an electric charge that enable essentially every function in our body to take place. So being deficient in these two things can cause major problems obviously. And our mitochondria being able to generate and to create ATP in the first place. But also, magnesium, another key electrolyte, is required. It has to be bound to ATP in order to make ATP biologically active. So this is why optimizing our electrolytes is so very important, especially today where many of

these electrolytes we're developing deep deficiencies. In particular with magnesium, it is the number one mineral deficiency in our society.

Right now, about 56% of the US population is chronically deficient in magnesium. That's a huge problem. There's hundreds of biochemical processes dependent on magnesium in order to work or in order to work optimally. Our bodies are incredibly intelligent trying to find another way. But what if we just give our bodies the base nutrients, the key required nutrients in order for it to function at its best. And so, number one of course, making sure that we're eating plenty of electrolyte rich foods, fruits and vegetables, all those good things. But also, this is a place to supplement especially if you're more active, if you're dealing with more stress. So, if you're more cognitively active, more physically active, we know the importance of supplementing with electrolytes. And there is one company that is doing this the right way, the sourcing of the electrolytes and also not adding unnecessary nefarious sugars and artificial colors. And I'm talking about the incredible team at LMNT. Go to drinklmnt.com/model to get your hands on the very best electrolytes out there. If you're trying to stay salty in a good way and we're talking about optimal ratios of potassium salts, magnesium salts, sodium salts, utilizing hundreds of thousands of data points from everyone from high performing CEOs to professional athletes, seeing what is the optimal ratio.

That's what they use to design LMNT. Again, go to drinklmnt.com/model. Grapefruit salt is back for a limited time right now. It's hot on the streets, grapefruit salt, and for good reason is one of the all-time favorites, but it comes in seasonally. So, hop over there. Check out drinklmnt.com/model and also you get a free gift with every purchase. You're going to get a free bonus sample pack of electrolytes for you to try out their different flavors, go to drinklmnt.com/model. And now in this next segment with Dr. Casey Means you're going to learn about the key nutrient deficiency that's depressing people's energy and metabolic health. What it means to have a nutritional and lifestyle mismatch, the connection between sunlight and human function and so much more. Check out this next segment with Dr. Casey Means.

DR. CASEY MEANS: For ATP, this energy molecule to be biologically active, it has to actually be bound to magnesium, and magnesium has over 400 biologic activities in the human body ranging from so many metabolic processes, but also to, you know, neurotransmitter synthesis and all sorts of things. And we, I think many people are deficient in magnesium and it's actually, I think, very much our responsibility to actually learn and understand what micronutrients are actually really important for our body to function and then understand where we get those things. So, what are the sources? So, for instance with magnesium, I know I want that to be just like on point. And so I've got pumpkin seeds at the ready basically all the time. It's one of my favorite sources of magnesium. There's like you can meet the recommended daily intake of magnesium just by eating, you know, a handful basically of pumpkin seeds. So that's like one

of my go-tos. And so, if I'm making a nut milk one week in the Vitamix, I'll throw in some pumpkin seeds. If I'm making a trails mix, I'll throw in some pumpkin seeds. There's lots of sources but doing the research to understand some of this stuff, it actually is something we have to do.

I mean, we have this body. And unfortunately, because of the way the system has been designed, the healthcare system and the influence of the pharmaceutical industry and a lot of other complex factors at play, we've unfortunately kind of, I think, gotten this cultural mindset that we outsource that type of empowerment or knowledge to other people like, oh, they'll tell me what I need to do, they'll tell me what I need to eat. That's not working. Your doctor is not telling you which micronutrients are super important for your health, even if they are actually critical for particular health issues that you are facing like obesity and diabetes and heart disease. So fortunately, there's lots of great resources out there now like your podcast. We have lots of posts about this on the Levels blog, really practical information, but virtually no one's coming to fix this in your life. You really actually do have to kind of understand this information for yourself and advocate for yourself and learn. The information is not that complex, we can all do it.

SHAWN STEVENSON: You just said it. You know, that's the thing, too, is that this can be actually a really fun experience, because for me, when I was going into my conventional university setting, which again, same here, I was not taught that magnesium was required for ATP to be biologically active. We were just taught this process, ATP, the body's energy currency, woo, end of story. About 56% of United States citizens are deficient in magnesium.

DR. CASEY MEANS: I didn't even know it was that high. That's incredible, 56%.

SHAWN STEVENSON: Yeah. So, we're talking, again, the majority of the population, and a big reason why, you just mentioned, it's responsible for hundreds of biochemical processes in the body, and what that means... This is going back to your... There's some screws loose or some screws missing in that factory, our metabolic factory. We literally can't do certain processes... Our body can't do it or can't do it efficiently if we're deficient in these key nutrients. Magnesium is a big one, and you mentioned the diversity, like magnesium is critical for your cardiovascular system, your immune system, your muscles, just being able to contract and relax your muscles, and that's the thing, too, that I want to talk about. Magnesium plays such a huge role in your body's management of stress like that switching from parasympathetic to the sympathetic and back so that sympathetic fight or flight to the parasympathetic, rest and digest. Magnesium is key in this equation, and the reason that... Number one, is responsible for so much, but the reason we're so deficient, it's just getting zapped. Our body is using so much of it today, we're just... We're in stressful conditions whether we realize it or not, and so being adamant about getting food sources. So you mentioned pumpkin seeds being a great

one, anything green really is going to be a decent source of magnesium. Chocolate, funny enough.

Now, what if you combine some of these things together and make some food bars of your own? Dr. Casey's Kitchen, you teach us how to make fun stuff like this, but again, this can be a fun process, it could be joyful, but to go back to my original point, it's really about how we're taught and making it relevant. We're so inundated with the idea that our health is out of our hands, right? We're victims and we're just being indoctrinated with these beliefs that if this problem is going on, I'm just missing a drug, I've got a drug deficiency, f*** magnesium, I need this prescription.

SHAWN STEVENSON: But again, these are things that our bodies require in order to have healthy function. It's basic stuff.

DR. CASEY MEANS: Yeah, I mean, you brought up such a great point, too, which is that these needs aren't static, they're actually very dynamic based on your particular conditions at the time, and I think that's another level of complexity that's actually really important for us to try to tune into as people. You mentioned that sometimes with stress, you may be depleting your magnesium more quickly as you're trying to adapt to these conditions. So, your functional need for optimal function is actually higher than it might be on a day that you're totally chilled out and on vacation.

And so, the beauty of food is that it's this tool that we can use to flex up and flex down these substrates that are needed to help us function optimally. This is one of the reasons I'm so excited about the future of expanded continuous biomonitoring, because one of the ways that I really think about health, a framework that I think about health is that it's actually a matching problem. We have this body that's this complex machine, and we have all these things that can go into it, like food and sunlight exposure, and exercise, these external things, and really, when we match what the machine needs in a given moment with what we're putting into it, we have optimal function, and that is health, and that is minimization of symptoms or disease, but when there's a mismatch between what the machine needs and what you're putting in, that is the root of symptoms and disease, and right now we have very little visibility into the black box of that body, like what's going on inside of it, and so it's actually a crapshoot to figure out what we should be putting in in any given moment.

This is one of the reasons why I'm so passionate about continuous glucose monitoring in Levels, like when you think about that type of matching problem, it's like, okay, well, I just had this breakfast, my glucose went up through the roof, I need to match that with a walk 'cause I want to bring that down. I have a particular condition, and so either there is something I should do to bring myself back to homeostasis. But right now we can't do that for anything else, we

can't do it for micronutrients, we can't do it for our stress hormones, if we knew that our cortisol was high in this moment, we could match that with a diaphragmatic breath or a 10-minute meditation app, and so right now we're relying mostly on body awareness, which is a great thing, but a lot of us are missing that. It's not something that we're taught, how to sit still and think about what the body is feeling in a given moment, but I think when you start just learning some of these basic principles about the dynamic needs of the body and then how to meet some of those needs, it can be really empowering.

So, for instance, like you said, if you're in a stressful situation, I'm often thinking about more magnesium, I'm thinking about... So, I'm thinking pumpkin seeds, you've dark chocolate, leafy greens, and then I'm thinking also about B vitamins, 'cause those can be depleted when we make some of our stress hormones. So, if we're pumping those out all the time, we may need higher B vitamins. So, when I was, for instance, very stressed after losing my mother last year, I totally changed my supplement regiment. I was like my body is in a totally different state right now and I need to actually supplement with more of these types of things to help with my production of these hormones, especially, and then I think I'm also often thinking about with COVID for instance, it's like, okay, I always want my immune system to be super on point, but like zinc, selenium, magnesium, like vitamin D, like make sure that I am just super dialed in.

I'm not on the low end of normal for vitamin D, I'm on the top end of normal. So, kind of just always in real time adjusting to the realities of our circumstances, trying to kind of almost intuit what's going on with the biologic dynamic realities, ideally use lab testing to verify that and then meet those needs with the choices you make through food and lifestyle activities. And that is essentially the framework that I think we really need to focus on for optimal health, and it sounds complex, but I think as you know, once you kind of get these principles down, it's actually pretty straight forward to let this play out in your life.

Yeah, I don't want to miss this. You said the S word in there, you said sunlight. How does sunlight affect our metabolic health?

DR. CASEY MEANS: Sunlight is... I am so excited to be more a part of the health conversation and shout out to Andrew Huberman, who I feel like has been such an amazing person bringing this to the daylight.

But what I... The way I think about sunlight is that just like food is molecular information for our bodies, sunlight is energetic information for our bodies, and so we need to get the right information in at the right times if we want the body to function properly. So, we... It's so incredible that we actually have cells that respond to photons, to packets of light energy that have travelled from the sun.

SHAWN STEVENSON: Millions of miles.

DR. CASEY MEANS: It's so amazing.

SHAWN STEVENSON: Bananas.

DR. CASEY MEANS: And we have cell receptors that can absorb them and that can make... That energy that they absorb creates, again, a tiny physical conformational shift in some proteins that sets off a neuron to fire, and this is happening in our retina, so the light is going in, travelling millions of miles, binding to our photo receptor cells in our retina, setting off a axon, an impulse to our brain, goes to the suprachiasmatic nucleus of the brain, and that's sort of like the internal biologic clock part of the brain, and from there, sets off this incredible cascade of events that goes on throughout our entire body that essentially tells the body this is what time of day it is, and this is what the body needs to do right now. It's amazing. It's awe-inspiring to me, and unfortunately, [chuckle] a lot of bad news, I feel like, when we're talking about this stuff. In our modern living, in our modern world, we've totally changed our relationship to sunlight, and that's actually an incredibly modern phenomenon, that we can have an entire day go by where we don't go outside. This even happens to me sometimes. I wake up, I brush my teeth, I make my coffee, I sit down at my desk, all of a sudden, it's 3:00 PM, and I'm like, "S***."

I have not been outside, which means that my body has not been exposed to the energetic information that will travel to my brain and tell my cells how to work properly. And one of the things that's really important about what's going on with the suprachiasmatic nucleus is that it is basically telling the body which genes to be turned on and off during the day and during the night. So, you're changing gene expression by your exposure to light. You're also changing hormonal pathways, and many metabolic pathways are controlled by circadian rhythms and by sunlight. So, what I... What's really, I think, just like a simple takeaway for people is that it is very important for your body to know when it is in the morning, and it's really going to know that most strongly if the eyes are exposed to sunlight. So, you need to go outside in the morning, whether it's cloudy or whatever, there's still sunlight coming through and expose your body to that energetic information.

And so, I now brush my teeth outside every single day, no matter what. I just walk outside, and I do that two or three minutes to make sure, and I stare at the sky, don't wear sunglasses, don't do it through a window, 'cause that will actually block a lot of that sunlight energy and let your body know what time it is essentially in that energetic way. So, I think that's a really big missing piece of the weight and metabolism conversation, 'cause again, we focus so much on food and exercise, but all these things all work together to create homeostasis, and we got to lean into them. The micronutrients, avoiding some obesogens, good exposure to sunlight, microbiome

optimization, and then of course, sleep, stress management, exercise, and healthy food. Those are really the pillars that we need to think about.

SHAWN STEVENSON: What is our skin made out of, right? Because isn't our diet affecting how the sun might affect us?

DR. CASEY MEANS: Oh, absolutely. I mean, something I think about when I've gotten a little bit more sun exposure... And we know that UV rays can be mutagenic and can cause DNA damage. But the cool thing about... Something cool about the body is that it's actually got lots of DNA repair enzymes that actually are like little machines that go around and repair DNA that's been broken or mutated by different mutagens of which UV rays is one. And it's like... When you think about this again, it's like, well, what gets our gene pathways to work properly? Well, food is a big one. Micronutrients are a big one. These are just little machines that essentially need to be expressed properly, function properly, and so I'm always thinking about how do I get my, basically, DNA repair enzymes to be working properly? So again, you obviously... It's same thing as we talked about with obesogens. You want to reduce excessive exposure to things that are harmful, but you also want to focus on the things that your body can do to protect you from the inevitable risks that happen because of living. And we're living in a world right now, unfortunately, where we've really started having a very confused relationship with risk, I think, where success criteria is that we have zero risk and then forget that the flip side of that coin could actually be potentially more damaging or sometimes more lethal than the steps we're taking to minimize risk. So that's a whole nother...

But to focus back on the sunlight question and just sort of that conversation, I think... There's this term that I love, which is essentially talking about what's happening to the modern body, which is we're getting lots of irregular photic signals. And so, what that means is that the light our bodies have evolved over millions of years to experience and to interface with at certain periods of the day, we're giving it irregular signals. So that means no sunlight in the morning, and then lots of blue light at night 'cause we're staring at our screens and looking at... We've got the light bulbs and all this stuff. And so, can you just imagine how confusing that is for our cells? It's like, wait a minute, okay, millions of years, we did sun in the morning and dark at night, and now we're doing dark in the morning and sun at night? Like it's... Of course, we're sick. And I think there's been studies that have looked at how this affects metabolic health, and when you are exposed even for one night to excessive blue light at night, it impairs glucose and insulin function the next day. And this is happening to us every single day.

And so, it has this really important impact on our metabolic health, and then just... And you mentioned vitamin D, which I think are another really important part of the conversation. Light is required for the vitamin D synthesis process. Vitamin D is just pleiotropic in its effects in the body. We need it for optimal health, and so if we are just not exposing our bodies to sunlight,

we're going to have issues with vitamin D production, and you can't have optimal functioning without really adequate vitamin D levels. And the last thing that I really think about a lot when I think about sunlight is that we have chosen to essentially disconnect ourself to source and to this source energy that gives all things life and on sort of a bit more of like a woo-woo or a philosophical level, it's like that can't be good for us to be separated from this life-giving energy, and so you think about metabolism... Well, where does glucose come from? Glucose comes from the sun, essentially. Sun interacts with plants and with chloroplast and generate carbohydrates from the reaction, and it's like this cycle... Without the sun, there's no glucose, there's no carbohydrates that are created by the plants, and then what do we do? Either the animals eat those things, or we eat those things, and then we then basically are just a secondary conversion process of what the sun has created in plants to create our own ATP.

So, we are so intimately linked to the sun. We are essentially just a downstream manifestation of chemical reactions that started on this star. I mean, it's kind of wild to think about, but it helps make me feel more compelled and connected to live in a bit more of a natural way, because when you take away that connection it's... Similar to how I think about the microbiome, the microbiome, the bacteria were here a long time before us, our mitochondria or even... We know that mitochondria are essentially remnant bacteria that prokaryotes cells took up to make eukaryotic cells, which are what make up the human body, and we're poisoning them. We're poisoning these parts of our cell that give us our spark, that give us energy, that give us life, and so I think a lot of the future of health and really reversing our chronic disease epidemic is having respect for where we've come from and what gives us life and gives us energy and stop separating from it and stop poisoning it.

SHAWN STEVENSON: Let's talk about sex, all right? Fertility and metabolic health are tightly linked, and I don't think the average person has any idea about that. So, let's dive in and talk about that association.

DR. CASEY MEANS: This is a fascinating relationship, because the way I would sum it up is if you care about fertility, sexual function, or sexual pleasure, then it's in your best interest to focus on your metabolic health and metabolic optimization because they are inextricably linked. And there's a lot in this connection, but I think it's actually really important to understand some of the stats around sexual health and sexual function right now because they're pretty bad and the research is really showing us that there may be a very direct mechanistic link between the sexual function issues that we're seeing in society and the underlying metabolic issues that we're seeing in society. So, looking at sexual function, so if you look at women, around 85% of women after menopause report sexual dysfunction symptoms, so this means issues with desire or orgasm. And even before menopause, that number is in about the 40% to 50% range. If you look at men, 52% of men are recording issues with sexual dysfunction. So, this is things like erectile dysfunction. And even under the age of 40, that number is still 25%. So, this is not

like 10% of people are having issues with desire, libido, erection. This is like, we're talking the majority of people, and it's like, what is more evolutionarily vital than like our desire and ability to reproduce?

And that's under siege right now, essentially. And the evidence suggests that these numbers are going up. So, then we think about how this could be related to metabolism. Well, first big picture thing, again, metabolism is how we produce energy in the body. And sexual function is a really complex process. A lot of... The whole body has to basically be firing on all cylinders for this process to happen, 'cause we are talking about psychological elements, neurologic elements, hormonal elements and vascular elements. So vascular, we need blood flow to the penis to have an erection; hormonal, we need testosterone to make sperm; psychological, we have to be in a good mood or in a particular mood...

SHAWN STEVENSON: A particular mood.

DR. CASEY MEANS: A particular mood to want to pursue sex; and neurologic, we need the nerves to actually be going to the penis or the clitoris or whatnot to not only feel and transmit what's happening, but also to stimulate the nerves to kind of get the function that we need. So, it's like the body needs to be just like boom, boom, boom, boom, boom for all of this to work. And how do we get the body to be firing on all cylinders? Well, we need energy and energy comes from metabolism, and 88% of American adults are metabolically dysfunctional. So that's just kind of big picture there. And then you think about some of the specific links, and you really can break it down into three things. That word metabolism is directly impairing sexual function and it comes down to blood flow, hormones, and psychology. And so, when we talk about blood flow, really metabolism is... Often the term cardiometabolic health is used, because cardiac health and metabolic health are so inextricably linked. When we have metabolic dysfunction and we are having trouble processing glucose into energy in the body, trouble making energy in the body, this can create oxidative stress and inflammation, both of which can cause issues with the blood vessels, causing them to narrow and thicken and have more difficulty getting blood flow to where it needs to go in the body.

We talked about this on our last episode, but having something like type two diabetes, this puts us at much higher risk for stroke and heart disease and these issues where we're having blood flow, having trouble getting somewhere in the body. But this is no difference than having trouble getting blood flow to the reproductive organs. And so, for women to even have adequate lubrication, you need blood flow to that area so that that can actually happen. The clitoris and the penis both are erectile tissues that fill with blood when they are stimulated. So, if you're having issues with that process, it's going to have an impact. The other big piece is nitric oxide. So, insulin resistance, which is the process that ensues towards type two diabetes and pre-diabetes where the body has trouble taking up glucose out of the bloodstream and is

a sign of metabolic dysfunction, insulin resistance actually affects the brain in such a way that the brain has trouble setting off the pathway towards creating nitric oxide synthesis in the body.

And nitric oxide is this amazing chemical in the body that causes blood vessel dilation. So, you've got inflammation and oxidative stress that are leading to blood vessel thickening and narrowing. You've got insulin resistance leading to nitric oxide issues, so you're not getting the dilation you need of the blood vessels. And all of this is going to have a huge impact on our ability to feed erectile tissue with blood. The other thing that nitric oxide does is it actually causes... It has an impact on vaginal wall function. It's a relaxer basically. And so, it's going to have an impact on female sexual function in several different ways. So that's kind of just the blood flow piece right there. And then we've still got hormonal and mood, but kind of just starting to paint the picture that like these things mechanistically are very linked and so we want to optimize metabolic health so we can optimize vascular health and that of course is going to feed into optimal sexual health.

SHAWN STEVENSON: Wow. Wow. This is freaking blowing my mind truly, because again, we don't put these pieces together, we just kind of feel victimized by a condition and we don't know the origin. We're seeing some really scary things happening with fertility in our culture in the last few decades. One large study found that infertility rates globally have risen 15% from 1900 to 2017, so about 100 years. And that was knocking on the door of almost being half of a percent each year fertility rates going down. It's like, what the heck is going on? And people are really not talking about this. And you also mentioned some of this research on sperm count. So, can you talk about the sperm issue and just overall fertility?

DR. CASEY MEANS: Absolutely. So, evidence suggests that sperm counts are down 50% in the last 30 years, and this is shocking. Because like, what's the end state of this if this just keeps getting worse?

SHAWN STEVENSON: That's so crazy.

DR. CASEY MEANS: And we look at the relationship between metabolism rate and sperm count. And there's a study out of Harvard that showed that compared to a normal weight man, if you are a man with obesity, you are 80% more likely to have zero sperm in your semen. So, like sperm-free semen. And so, we're now in the country at 74% rate of overweight and obesity. And so, you start putting these things together and it's like, this could be a big problem. About 50% of infertility that we're dealing with today is male factor infertility. And a lot of this seems to be related to weight. There's also a lot of talk about how these endocrine disrupting chemicals like we talked about earlier maybe relating to declining sperm quality and quantity.

But in this more systems biology perspective that we talk about of how these things are all interrelated, you can see how these are not separate issues.

It's like the endocrine disrupting chemicals, its affecting sperm, it's affecting metabolism. We've got weight going up that's affecting hormones. And the end result here in this whole milieu is that we have poor sperm count and quality. One of the things that's affecting this is that in men, when you have excess body fat, fat is this amazing organ that I don't think we recognize very often is actually an endocrine organ. Fat actually can convert testosterone to estrogen. And Dr. Ben Bikman who wrote Why We Get Sick, he creates this analogy of like, fat in a man is like basically a giant ovary, and it's converting testosterone to estrogen.

SHAWN STEVENSON: Aromatization.

DR. CASEY MEANS: Aromatization, and this, you need the right balance of testosterone in a man's body in order to produce sperm effectively. So that's kind of what's happening on the male front. And then of course, you've got the issues with erectile dysfunction like we just talked about. So that's like getting the sperm out of the body. And so on...

SHAWN STEVENSON: Step one.

DR. CASEY MEANS: Step one is make the sperm, step two, get it out. And it's like both of those issues are having big problems. And let's not forget, we actually know that men with erectile dysfunction have 192% higher chance of depression than men without erectile dysfunction. And it's kind of a question of like, what's the chicken and the egg there? But because we know the relationship between metabolism and depression, we can see how a lot of these things may actually be linked mechanistically by what's going on under the hood. But there are several things that...

SHAWN STEVENSON: Under the hood.

DR. CASEY MEANS: Under the hood.

SHAWN STEVENSON: All right.

DR. CASEY MEANS: But even just things like stress management, getting adequate sleep, aerobic exercise, resistance training, and high-quality nutrient-dense diet, we know that all of those things can help with testosterone production in the body, and specifically weight loss. Even losing 10% of your body weight can have a significant impact on testosterone levels. So that's just, this is all what's going on with men. Then you look at female fertility, and this, I don't know, both are so alarming, but with women, the leading cause of infertility in the United

States is Polycystic Ovarian Syndrome. And Polycystic Ovarian Syndrome is actually fundamentally a metabolic issue. And actually in 2012, the NIH wanted to change the name of PCOS to Multisystem Reproductive Metabolic Syndrome. So really call it what it is, multisystem reproductive metabolic issue. But instead, we've kept this name that's really difficult to understand, Polycystic Ovarian Syndrome.

Not every woman with this disease actually has cystic ovaries, so it's just a strange name. But really what it is, is fundamentally there's a strong mechanistic overlap with insulin resistance and metabolic issues. And the reason for this is because, when we have high insulin levels in the body, which is what happens when we are insulin resistant or have metabolic dysfunction, the body overcompensates to this block of being able to get insulin... I'm sorry, of being able to get glucose into the cells by producing more insulin to help drive glucose into the cells to overcome the insulin resistance, we end up with hyperinsulinemia, high...

SHAWN STEVENSON: It's like a layette.

DR. CASEY MEANS: Yeah, exactly. We end up with high insulin levels. And what do those insulin levels do? They do stuff all over the body, but in the ovary, what they do is they stimulate the ovary to make more testosterone. So now you've got women making more male hormones, androgens, and then that is setting off menstrual irregularity, issues with infertility, as well as some of the other associated symptoms of PCOS, like hirsutism, which is like excess hair growth, more central obesity, storing fat more in the midline, and acne. So, these are a lot of the things that people with PCOS deal with. And insulin also stimulates the ovary to up-regulate the cell type called the theca cell that make these androgens. So, you not only get higher stimulation of androgens, but you get proliferation of this cell type. So that's happening. And what's interesting though is that in the research, several studies have shown that lowering your insulin levels, improving insulin sensitivity, improving metabolic health can significantly improve PCOS symptoms and normalize sex hormones.

There was amazing study about two years ago that I loved that was looking at a ketogenic Mediterranean diet in 14 women for just 12 weeks, and they all had PCOS. And the diet was actually, what I loved about this study is that it was actually a very healthy diet. It was ketogenic, but not focused on just like all animal protein. It was actually unlimited quantities of leafy green vegetables so there was no restriction. They could have as much of those as they wanted. A very moderate amount of animal protein, and it had, it was fish and poultry. And then they added in supplements of plant polyphenols. So, these plant chemicals that can be very protective. And so it wasn't restrictive. It included a lot of greens, and it was overall a low carbohydrate diet. They did this for 12 weeks.

The women lost on average 20 pounds in the study, average. Their insulin levels plummeted, triglycerides plummeted, HDL went up, LDL went down, insulin sensitivity went up, fasting glucose went down, and their sex hormones by and large in all the patients went to more normal levels. And so, it's just like why, again, front page news. It's like, this is doable. We can do this. And I don't think the average woman with infertility knows this. I think there's often just a treadmill that you go on towards hormonal therapy, assisted reproductive technology. We're doing about 200,000 assisted reproductive technology procedures per year, things like IVF. And we're doing this before we do some of the foundational stuff like focus on dietary and lifestyle habits and think about the true physiology of what might be going into some of these issues. So, I want that to be a message that women hear so they feel empowered to maybe dig into this a little bit more before they go through the pain and expense of more interventional fertility paths. And of course, this isn't going to work for everyone, I'm not making universal statements about what's causing infertility, but it's clearly a well-defined link that we should be more aware of.

SHAWN STEVENSON: Our metabolic health influences every aspect of our lives, whether it's the general lens of metabolism, our ability to optimally burn fat and store energy, or stretching that out to the metabolism of our brain and being able to utilize fuel to drive signal transduction for our cells to talk to each other. We want our brain cells to be able to communicate. It's kind of important in order for us to sustain our livelihood and our cognitive function and our memories. Also, our immune system, we have an entire field of immuno metabolism looking at how our immune cells themselves, their metabolic health is going to help us to keep ourselves more resilient and our tissues more resilient against infections, but also how the overall metabolic health of the individual is impacting the function of our immune system. The list goes on and on. There isn't a facet of human health that isn't influenced by our metabolic health. That's why this conversation is so important.

So, I hope that you got a lot out of this and definitely follow Dr. Casey Means. Matter of fact, take a screenshot of this episode and tag her, shout her out. She's @drcaseyskitchen on Instagram, that's D-R-C-A-S-E-Y-S-kitchen on Instagram. And I'm @shawnmodel, if you want to tag me as well, and I love to see that, I'm always checking in when the new episodes come out to see who's sharing the love. So that's one way to share with your friends and family. And of course, you could send this directly from the podcast app that you are listening on to spread this empowering information. We have got some epic masterclasses and world class guests coming your way very, very soon. So, make sure to stay tuned. Take care, have an amazing day, and I'll talk with you soon.

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