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** * * Intro Music * * **

Welcome to Supplementing Health, a podcast presented by Advanced Orthomolecular Research. We are all about applying evidence based and effective dietary lifestyle and natural health product strategies for your optimal health. In each episode, we will feature very engaging clinicians and experts from the world of functional and naturopathic medicine to help achieve our mission to empower people to lead their best lives naturally.

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[01:08] *Cassy Price:* Welcome to another episode of Supplementing Health. There is a lot of talk about the risks of too much sugar in our diets especially with the increased consumption that comes from processed and pre-packaged foods that are very common in our day to day. Here with me, I have Dr. NavNirat Nibber who is a naturopathic doctor and a medical advisor for AOR. She is here to do a deep dive with me into exactly what happens when we consume sugar and what that means for our health long term. Welcome NavNirat, thanks for chatting with me today.

[01:34] *Dr. NavNirat Nibber:* Thanks so much for having me. I am excited to be here and talk about this ginormous topic.

[01:41] *Cassy Price:* Awesome. Let's dive right in because as you said it is a huge topic and there is so much to cover. Like I mentioned there is a ton of messaging around the negative effects of sugar on the body. Can you share what the physiological impacts of sugar are?

[01:57] *Dr. NavNirat Nibber:* Absolutely. What is so interesting is that you always hear this blanket statement of 'sugar is bad.' We are never really given too many specifics and today we will really get into that. It ultimately starts with what is happening in our body when we are exposed to different types of sugars, and we will get into that as well. Our bodies are really well adapted at handling sugar and converting that into energy. Sugars can be classified into all of these different categories of the size of the molecule but at the end of the day they are fuel. There is this complicated process of first absorbing, then we break down into those smaller subunits and then shuttle them to the tissues that need that fuel the most; the brain, the muscles. Then it is a matter of are we storing it or are we excreting that excess? Now, of course this sounds like a very simple process, but it is a well-oiled machine, so the concerns really start to arise when we are talking about those excess added sugars, these excessive sugars from things like sugary drinks or refined grains, and those can actually trigger these neuroadaptations both in our reward system in our brain that cause us to consume more, but then also how that then can impact our heart health, weight management and inflammatory disease. It all can be broken down into the fact that when we consume a lot of processed sugars we can induce inflammation, glycation, oxidative stress and insulin dysregulation. We can get into that a little bit more, but it is really important to understand that there is a built-in process that helps us utilise this fuel, but then there is that overcorrecting, and when we flood any system with too much of a good thing, that is when we really start to see those four processes that I talked about.

[04:19] *Cassy Price*: You mentioned the brain and the muscles, do all of our tissues and organs utilise the energy from sugar or are there certain ones that are more inclined to utilise glucose and the energy that comes from that sugar?

[04:33] *Dr. NavNirat Nibber*: Yes, ultimately every cell will utilise these fuel sources, however there is an order of preference. We start with the brain; brain will always get preferential utilisation. Obviously, the different types of sugars will also have different impacts on the brain. So compared to other organs, our brain, it has a disproportionate energy requirement relative to its weight, compared to muscles which are heavy weight, they don't need as much of it. I guess the answer to that question is it depends on the usage and the tissue type and yes, there is quite a lot of variability there, but our brain always kind of gets the preference first.

[05:29] *Cassy Price*: Fair enough. I guess it kind of runs the show, right? So that makes sense. Can the body tell the difference between naturally occurring sugars and those that are added in in manufacturing or that are sugar replacements, or does it treat them all the same?

[05:45] *Dr. NavNirat Nibber*: Yes, so this is a bit of a tricky question because ultimately, at the end of the day, the body will break it down into the glucose, the fructose and they are called monosaccharides. Fructose and glucose. Then you can get disaccharides which are sucrose and lactose. Each of them do have different impacts, but the body can distinguish between the proportions between each of those. Once it is fully broken down, I guess then sugar is sugar but the process of breaking down has significant impacts, and they are preferentially sorted. For example, when we talk about added sugars, we are talking about those high-fructose corn syrups which do have negative impacts or sucrose which is our table sugar. High-fructose corn syrup is actually 55% of that fructose, so anything above that. Again it's that proportion of how it is made up, is really going to change both its metabolism, absorption and then ultimate impacts. But the sugar molecule itself once in the tissue can then be used as a fuel, so it depends on whether it is a fructose or the glucose.

[07:24] *Cassy Price*: Another term that comes up a lot when we are talking about excess sugar and eating sugar in the diet regularly is insulin resistance. What actually leads to cases of insulin resistance?

[07:40] *Dr. NavNirat Nibber*: Insulin resistance is this really complex and fascinating area of research and pathology. Insulin resistance is a progressive, reversible state, that really is the result of our ability or inability to take up glucose into the cells, because once it is absorbed it then needs to go into the cell, and insulin facilitates that movement or that transmission. Insulin resistance begins to develop when those responders are no longer listening. Those locks on the door are either not being as sensitive so the glucose is just sitting in circulation, where really it should be being taken up into the cell. Like I mentioned, it is progressive and reversible. There are periods of our lives where we are naturally more insulin resistant, such as during growth spurts and pregnancy. It often gets correlated directly with diabetes and blood sugar dysregulation, but I think the more appropriate and correct term is that it precedes and is more of a process that can lead to the development of diabetes rather than them being one and the same.

[09:14] *Cassy Price*: Are the symptoms very similar then to diabetes or does insulin resistance have its own set of signs and symptoms that people can be looking out for?

[09:22] *Dr. NavNirat Nibber*: Because the insulin resistance precedes generally the development of diabetes, which is a disease, there is some overlap in symptoms but there are earlier signs that you can start to tell. With insulin resistance, things like skin tags, acanthosis nigricans – so that is that

dark patches of skin on your neck and armpits, excessive thirst - which we know is one of those tell-tale signs of diabetes, a lot of that abdominal weight gain, fatigue and excessive urination. Those are all also signs of the insulin resistance and can again, precede those really vast changes in blood glucose dysregulation that leads to diabetes.

[10:16] *Cassy Price*: You mentioned that it is kind of a spectrum or a process that you could be on for insulin resistance, how can people correct it, or does it change depending on how far along that process someone is to how they would treat their insulin resistance?

[10:36] *Dr. NavNirat Nibber*: That is exactly correct. It is progressive, so there does at some point come a point of, I wouldn't say no return but difficult return, much more difficult. There are modifiable and nonmodifiable factors associated with that progression. Our genetics can help dictate how sensitive we are initially to the insulin. *Do we need a lot of insulin to help get that glucose in or do we need a little bit?* is kind of set from a genetic point of view. Those modifiable risk factors again would be the lifestyle, things like exercise, and the types of foods that we are eating particularly the sugar content – there are two terms the glycemic index and the glycemic load of these foods. They are going to help dictate how our body responds to that sugar and how much sugar there is in those foods. Those are considered modifiable. If we start to be mindful of those modifiable risk factors early on, then it is more likely to be able to reverse an insulin resistance than we would be if you just keep consuming those things.

[12:05] *Cassy Price*: You mentioned both glycemic index and glycemic load. What is the difference between the two?

[12:12] *Dr. NavNirat Nibber*: Thank you for asking this because so many people don't know the difference and often just go to glycemic index because I think that is the one that has more of the fame. Glycemic index is how fast the carbohydrates or the sugars are actually broken down and enter into your blood stream, whereas the glycemic load is the actual total amount of those sugars in a serving of a particular food. When I am saying 'sugars' here, I am using them more as the carbohydrates, those simple carbohydrates, rather than, well it can also include those added carbohydrates. But it is important to understand again, those ratios and to put into context what is both the glycemic index and the glycemic load. A lot of times when guidelines say "avoid foods" like carrots have a high glycemic index, but carrots as we know are quite good for us. So yes, the carrots do infuse those sugars into the system but the glycemic load that they have is actually quite low, so it is not like there is a ton of sugar in that food anyway. Also, it is in combination with fibres and all these antioxidants. It is very important when we are talking about management to look at both glycemic index and glycemic load.

[13:48] *Cassy Price*: When you are looking at the glycemic index diet and there is the list of green foods, yellow foods and red foods, is the glycemic load taken into account when those lists are created or is that an additional factor that should be considered?

[14:03] *Dr. NavNirat Nibber*: That is a very good point. Up until recently it hasn't been considered but I think more and more research that comes up, more and more of the diabetes support literature that is coming out, is taking into account the glycemic load. I think it would depend more on where you are getting your information and how current it is.

[14:27] *Cassy Price*: How does eating with the index in mind help to correct insulin resistance?

[14:36] *Dr. NavNirat Nibber*: Essentially what you are doing is that you are ensuring that when you are intaking glucose and absorbing it, then you can slowly infuse that sugar overtime, so the insulin

isn't being hit all at once to have to help absorb all of this glucose all at once. It is like if you are at a line or at a grocery store, and everybody comes in all at once and then you only have a certain number of cashiers to process that, versus if people are slowly trickling in - it is less of a burden for those cashiers. Essentially with low glycemic index food and glycemic load food you are saying we are going to regulate how much is actually coming in, so that the insulin and the insulin receptors aren't overburdened, so there isn't this huge flux all at once.

[15:46] *Cassy Price*: For people that want to take the glycemic load into consideration when they are choosing their foods, are there things they should be looking for on the labels to decide where they would fit on the spectrum?

[15:59] *Dr. NavNirat Nibber*: Yes. That would be the total amount of sugars in the foods. Again, with vegetables and stuff we are not looking at packaging but when we are looking at added sugars, we really want to be mindful of, on those packages, making sure that it is less than 5% of our daily caloric intake from the sugar. Anything where it says 24 g of sugar, this is really where we need to be careful and cognisant. Always be looking at the serving size of each of these foods because sometimes they will give you sugar content just for a small portion, but as we know sometimes, we eat the whole box of macaroni, and then you are looking at your total. Calculate your total sugar intake for the day and it should be less than 5% of your total caloric intake. If you are at 1,200 calories a day which is quite low, maybe that'd be for weight loss – let's do 2,100 calories a day, then you want to be at that less than 5%. There are a lot of tools and apps, like MyFitnessPal, that I think people are using more often to understand the breakdown and how they're consuming their macros and then how added sugars can play into that. I think that is kind of an exciting opportunity now that we have. These tools are right in our pocket to help us manage that.

[17:38] *Cassy Price*: It is true. You just have to be good about actually logging all the stuff that you're eating so that you can see a true picture of it, right? When you are mentioning the portion sizes, I know drinks are a terrible culprit for that. They will say for 250ml but the bottle will be 500ml or something, so you are actually getting double the sugar that it makes it seem like.

[18:01] *Dr. NavNirat Nibber*: [18:01 inaudible] actually recommended with children to not drink fruit juices before the age of one because of that really high sugar content. I would argue that that could even be increased in age. Most of us shouldn't be drinking these really, really high sugar concentrated drinks. In fact, juices present this interesting conundrum because everybody thinks "*hey, this is fruit, it's fruit sugars, so they must be good.*" But fruit sugars are usually in our body and throughout history have been considered manageable because fruit comes as a whole fruit, that you're adding in these fibres, you are adding in all of these other components that change the total weight of the sugar in that fruit, so that you are not getting this influx of sugars all at once. What juices do is they distil and concentrate those sugars so that you are again, getting that hit all at once. Which really changes, while it might be from the same source, it does change how your body is going to react to it.

[19:25] *Cassy Price*: That is actually one of the things that I was wondering about. The different types of sugar that you mentioned, like fructose, glucose, sucrose, lactose, etc. do they impact the insulin resistance response differently depending on which sugar you are consuming?

[19:47] *Dr. NavNirat Nibber*: Yes. The difference lies in the different pathways of metabolism. We know that glucose is absorbed and causes this insulin response. But then something like fructose, that consumption is not insulin mediated, so it is actually going to your liver and then being broken down and metabolised into glucose from the liver. That pathway is going to look very different.

Lactose has to then be modified in the microbiome and often times it gets used as a prebiotic so absolutely what is going to happen is, there are lots of charts that help support the grading and the impact of each of these different molecules, but it will tell us what your insulin response is going to be. Fructose is not going to have that. Glucose in different foods you can see depending on fibre intake how that is going to change. What is interesting is that our insulin response can be measured. The gold standard is quite an invasive process for assessing your insulin response. It is a eugenic clamp technique which is not super accessible, but what we can see in certain measuring is serum blood flow. So, if we have blood sugar and that we do have really fast tests for. You can start to see after eating and consuming different foods how your blood sugar is starting to respond. What was interesting is there was a study that was done, I want to say in 2015, subjects received a drink that was either pure fructose or glucose. Then they also did a functional MRI. They were actually seeing where it goes in the brain. What was interesting is that the group receiving the glucose has this significantly reduced amount of the cerebral blood flow into this particular area of the brain that is responsive for that blood sugar reward pathway. It was diverting more of the blood flow to this nutritive reward pathway. It was saying *“let’s make sure that there is a shut off mechanism so that when we are full and we have received the nutrients that we need it can shut off.”* Whereas the fructose group, it didn’t really reduce that hunger, so they didn’t get that shut off mechanism. That is often why anything that is really high in fructose is not going to induce your satiety. So, you can actually then end up increasing a lot of the total calories consumed because it is not activating that same nutritive reward pathway in your brain. I thought that was really interesting from the brain perspective and this can get really complicated really fast, but just that, each of our responses is going to be so different depending on what sugar we are exposed to. Yeah, both from the insulin management perspective, the hormones that it is supporting, then also from your brain response and the neurotransmitters that are being activated and the reward pathways in your brain.

[23:55] *Cassy Price*: It is super interesting. Then there is the perspective out there that natural sweeteners such as honey or maple syrup are considered healthier, is that really true in this context?

[24:14] *Dr. NavNirat Nibber*: Like a good naturopath I am going to say that it depends on the person. It depends on how – again, we mentioned those genetic components and all of these things, when we look at the breakdown of things like honey which is 30% glucose and 40% fructose, what we are seeing is all of these honey, maple syrup, agave, they are all going to have different components of their fructose and glucose combinations, because they are disaccharides, so they still have to be broken down to monosaccharides. In someone who is fairly insulin competent, and they have good sensitivity, they may be better attuned at something that has an appropriate ratio that skews more towards glucose because that is going to be how it gets taken up into the cells. Then, also we need to look at someone’s liver status. Are they able to, if there is a high fructose content, are they able to have liver functioning that will allow for appropriate breakdown of that fructose and excretion? Or is it just going to sit there and increase your triglycerides and again lead to more weight gain and basically is it going to wreak havoc in the liver? The natural sweeteners, whether they are good or bad, depends on who they are in, but is it preferential to something like the table sugar or the high-fructose corn syrup? Yes.

[26:06] *Cassy Price*: Makes sense. Shifting a little bit, everyday there is more and more exposure to artificially sweetened foods and drinks. Even in some cases supplements and stuff are now using them like if you take gummy supplements or some of the drink powders, they are now sweetened with sucrose or aspartame or any of these artificial sweeteners. Are there any concerns around using those artificial sweeteners? They are made out to be a healthier option, but how do they fit into this picture?

[26:51] *Dr. NavNirat Nibber*: Absolutely. They are certainly not transparent about what impact they can have and a lot of the times, the sweetness quotient of these sugar alternatives is actually quite a bit higher than what is advertised. So yes, they are not considered real sugars, but they still activate those sweetness reward pathways that I mentioned in the brain. That is then going to possibly lead to the inability to shut off those satiety signals that get sent out, so you end up consuming more calories. There is a lot of discussion right now about toxicity, particularly in some things like aspartame that can cross blood brain barrier. Is that actually toxic? Are we doing a lot more damage? It's still being uncovered, the full impact, but certainly I would say that if we're looking at some of these artificial sweeteners or alternatives, really staying away from the saccharin or aspartame, and anything with multi dextrose. Which I guess goes back to looking on the label and again the content of it. Things like Stevia are a little bit better if you do need a sweetener, but I think what is also interesting is that we need to start getting attuned to the degree of sweetness or the reward pathways that sweetness induces. When we have something really sweet it is activating two pathways in our brain. That is often why people can get sugar addictions because it is a dopamine led reward pathway that is saying "*you are getting nutrients, this is really good, keep consuming.*" That is one reward pathway that it activates. The second reward pathway that it activates in the brain is the pleasure centre or the happiness response. It can really induce the same reward pathway that gets activated by nicotine or other addictive substances. It really can be addictive. That is where we need to be really mindful. I think I got away from your original question.

[29:41] *Cassy Price*: That's okay. It is super interesting to hear how it plays into that whole craving piece as well. Unfortunately, we've actually reached our time for today however we will be having you join us again next week to continue this discussion and we can dive in a little deeper to that blood brain barrier piece that you were talking about there and how it affects our neurological pathways. Listeners can tune in next week to learn more about the influence sugars have on those various body systems such as the brain, the cardiovascular system and even our digestive health.

[30:14] *Dr. NavNirat Nibber*: Yes. We are going down the rabbit hole so we might as well enjoy the ride. It is a rabbit hole and there is so much that we can discuss. Thank you so much for today.

** * * Outro Music * * **

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