#423_ Zoya Huschtscha, PhD – Understanding Sarcopenia & Potential Interventions

DANNY LENNON: Zoya, welcome to the podcasts. Thanks so much for taking the time to come and chat with me today.

ZOYA HUSCHTSCHA: Thanks for having me.

DANNY LENNON: I have a lot that I'm going to get into, and it's a topic that I'm particularly interested in and knowing some of your background, and I'm very intrigued to ask some of these questions. But before doing that, maybe to give some context for people listening, can you give a brief introduction to yourself and maybe talk about some of the work that you've done in academia and how that might relate to what we're going to discuss today?

ZOYA HUSCHTSCHA: Yeah, absolutely. So my background is nutrition and dietetics. So I did a master's of dietetics back in 2015, and then I did honors. I kind of did things a bit reversed. So normally you do a research within your master's or your bachelor's, but I knew I kind of wanted to do my PhD and get into research. So after that, I completed my honors, and then eventually did my PhD. So I completed my PhD in March this year, and essentially, it was in the areas of activating, looking at sarcopenia, which I know we're going to get a bit more into. So I have that research component, I also work as a

sports dietitian as well, so I do a lot of private practice work. And, I guess, a lot of my interest in areas is motivation to study sarcopenia and muscle really has come from my sporting background. So I do a lot of strongman training as well, so it's a bit of, you know, I live and breathe strength training in a work sense as well as in my everyday life. So, yeah, that's pretty much the nutshell of it.

DANNY LENNON: Awesome. I think we're going to cover quite a bit of that. And maybe before getting into sarcopenia, specifically, and some of the aspects of that, I think maybe a useful way to frame this is to maybe give an introduction or maybe a refresher for people listening around muscle protein synthesis. And you've obviously mentioned two of your big interests being nutrition and strength training, and obviously, they are things that relate here. Can you maybe just give a kind of brief overview to people about what we're talking about in relation to muscle protein synthesis, and then what factors can have an influence or an impact on that process?

ZOYA HUSCHTSCHA: Yeah, absolutely. So when you want to build muscle, essentially, we know that our muscles are constantly in turnover, so we have muscle protein synthesis, which is muscle building, so where our body essentially uses the amino acids from our diet, or that our body makes to repair and build muscle. So if we, I like to use the analogy of a brick wall, so each brick is an amino acid, and muscle protein synthesis is that building of that wall. Then we also have muscle protein breakdown, essentially, which is the process of breaking down those amino acids that are damaged or to be repaired, and then you have that constant turnover. So the turnover is around 1 to 2% per day, so it's constantly moving. And in order to, I guess, gain or to stimulate muscle protein synthesis, we need some sort of anabolic stimuli. So the two main anabolic stimuli that we know of, and that is the main focus in sarcopenia research, is

resistance training as well as protein intake as well.

DANNY LENNON: So if we talk about sarcopenia, first of all, it's probably best to start with a definition or an explanation of that, if people haven't came across that. What is the most accurate way to state what sarcopenia actually is?

ZOYA HUSCHTSCHA: Yes, so if you go back a little bit in terms of the history of sarcopenia, I think it was in the 1980s, that's when the word sarcopenia kind of came about to really identify or describe the loss of muscle as we age, and it comes from the Greek words, which essentially means a lack of flesh. And since then, it's really progressed, and in 2010, I think the European Working Group on Sarcopenia defined it as a progressive and generalized loss of skeletal muscle mass strength and performance. So it really included that strength and performance outcomes as well, because we know that it leads to such an adverse effect on the physical disability and poor quality of life. But it's really recently, 2018, where the European Working Group on Sarcopenia actually put the definition and changed it, so that strength is actually in the forefront of the definition. So when you measure sarcopenia, the operational definition includes three of the categories. So the first one being low muscle strength, and that's usually measured clinically using handgrip strength of our chair in terms of how many times you can actually get out of a chair, low muscle quality or quantity, so usually measured DXA, BIA, CT, MRI; and then the third being low physical performance. So if we use the European definition of sarcopenia, for you to be diagnosed with sarcopenia, you need to have category one, which is low muscle strength; and to confirm it, you need to have low muscle quality as well. And then the low physical performance, if you have all three of those, that's really considered severe sarcopenia. But that's just one definition, and, I guess, one of the biggest problems in the research is actually that there's a lot of different clinical definitions

of sarcopenia, and they have different clinical cutoff points. So that's been really challenging, there's no general consensus on what's the most appropriate definition to use. So, in general, all of them do say, a loss of muscle strength, muscle mass and performance is sarcopenia.

DANNY LENNON: Yeah. No, I think that's incredibly important, because I think sometimes maybe people, on first hearing it, may be associate it with just a loss of muscle mass. But I think, as you've outlined, and we'll definitely dig into, that might be one element, but we are also looking at muscle function being incredibly important here. Where we probably see some of the intersection with what we're going to discuss in terms of the interventions around sarcopenia, and what we've discussed in relation to muscle protein synthesis, comes down to this idea of anabolic resistance. Can you maybe give us an introduction to that, that concept?

ZOYA HUSCHTSCHA: Yeah, absolutely. So anabolic resistance is, as the name kind of suggests, where there is a resistance to anabolic stimuli. So this was really outlined in quite a few acute studies where they would give older adults and younger adults the same amount of protein, 20 grams of protein, and the younger adults would maximally, you know, max out their muscle protein synthesis, whereas the older adults wouldn't quite get there. So there's this idea of this blunting of muscle protein synthesis, which is then known as anabolic resistance.

DANNY LENNON: Awesome. How much do we know about some of the underlying mechanisms of this anabolic resistance or what is currently known, I suppose, in that area of literature?

ZOYA HUSCHTSCHA: When it comes to sarcopenia and anabolic resistance, there's no one specific cause. It's multifactorial. There’s a lot of different theories as to what causes it. One of the major ones is physical inactivity. So there was a study that was done in healthy older adults, where they

reduced their step count for two weeks, so I think it was down to a 1000, around a 1000 steps. And what they found was it significantly reduced their muscle protein synthesis, so essentially, going from active to sedentary can really affect that ability for that muscle to take up anabolic stimuli. Another big one is inflammation, or, I would like to say in the literature, inflammaging, like that combination of the word, but essentially, it's chronic, elevated levels of inflammatory cytokines. So thinking IL-6, TNF alpha. It's not really well understood how inflammation actually works, but it's likely to do something about the mTOR pathway, so reproduction of that. We know from cross-sectional studies, and the longitudinal studies, that there is an association between higher levels of IL-6 and TNF alpha and decreased fat free mass and strength in older adults, and it's likely that these pro-inflammatory cytokines might trigger muscle cell apoptosis, so cell death in the muscle cell. But, as I said, it's not really clear. So we have decreases in activity, inflammaging, also hormonal changes as well. So as people get older, we know that they generally, you know, testosterone decreases as well. In females, estrogen declines, especially after that first menopausal period. And it's mainly in cross sectional studies where they found that association between muscle mass and muscle strength, and that decline in those anabolic stimuli. And lastly, if you think about extrinsic factors, so I did briefly talk about physical activity, but also dietary changes. So decreases in protein intake, so that's the main focus of my research. So generally, we know that older adults and adults in general have that decline in protein as they get older. And also, there's a real skew of protein intake, so not really enough protein at breakfast and lunch, and then really backending all that protein at dinner, which I'm sure we'll touch on, but distribution of protein is also important. So there's a variety of factors. What's the single node factor? It's probably a combination of all

of them. So yeah, that's generally, the main factors that might cause sarcopenia.

DANNY LENNON: So given that kind of complex nature and multifactorial nature of the development of this disorder, presumably, then we have a wide difference in maybe the time course of this, because we obviously are going to think about this mainly in the context of older adults, and that's probably where most of the diagnosis is going on. But in terms of when some of this decrease in muscle function may start occurring, that could probably presumably be a bit earlier, depending on some of those factors you just outlined. How do we start thinking about the kind of time course of what we know about when this maybe even has its origins?

ZOYA HUSCHTSCHA: Yeah, absolutely. So we know that, I guess, depending on which study you read, peak performance and muscle strength really reaches around mid-30s to early 40s. So we know that we lose, from that, we lose muscle mass of around 1 to 8% per decade, up until our 50s and 60s, where there's a real sharp decline in muscle mass where it occurs 1 to 5% per year. And that's just muscle mass, but we know that strength is lost one to five times higher to that rate. So that kind of really, I guess, supports that idea of putting strength in the forefront of the clinical definition. So yeah, around 35 is when we, it's actually, that's physiologically happening, but it's really around at 50s and 60s of noticing it.

DANNY LENNON: Yeah, that reminds me of something that, when I first heard, it was one of the most interesting things to me about sarcopenia. And I think it was a number of years ago, Dr. Brendan Egan was talking to me about some of this, and had mentioned that we see essentially that that loss of muscle function is kind of disproportionate to the actual tissue loss that you mentioned. So in other words, strength seems to diminish more than the amount of muscle that one loses would necessarily predict, which is kind of an interesting aspect, but again, as you said,

brings the importance of muscle function and strength to the forefront, because it's not just, oh, a normal expected decline with how much muscle mass is getting lost with age, if I'm picking up correctly.

ZOYA HUSCHTSCHA: Yeah, absolutely. So if you kind of think of any old person that you know in your life, they might not necessarily look like that they changed, their weight might not change, their clothes might fit exactly the same, but it's more so the change in body composition that changes kind of underneath that you don't really see. So it's that increase of fat mass, decrease of muscle mass, so it's quite hidden and it's not really until they've reached their 70s or 80s where that acts of independent living, where they have to get out of a chair or open a jar or, you know, walk up or down some stairs, where it becomes really noticeable, and that's that functional aspect of it. And it's not necessarily too late then, but it's progressed quite a lot by then. So yeah, absolutely right there.

DANNY LENNON: So if we start to turn to some things that we can maybe look at as interventions that would kind of target this idea that there's some degree of anabolic resistance or ways that we want to either mitigate or offset potential risk of sarcopenia, if we first look at some of the nutrition interventions, the obvious place to start is by looking at protein, and this is obviously an area that you've done work in, what are some of the most important things with protein feeding that would fit into this picture, and can you maybe just kind of introduce some of the nutritional interventions we see in that area?

ZOYA HUSCHTSCHA: Yeah, absolutely. So when it comes to general guidelines, in terms of total protein intake, it's still kind of stuck on 0.8 grams per kilogram of body mass per day. But the literature is really showing that older adults do require a lot more protein to overcome the anabolic resistance. So the general guidelines for older adults over 65

is 1 to 1.2 grams per kilogram per day, and then, active older adults need more than that, so more than 1.2 grams per kilogram. So that's total protein intake. Then we also have protein intake per meal, or protein distribution, which I kind of touched on. So for – I did briefly mention about that study where older adults consumed 20 grams of protein, and worked maximally stimulating muscle protein synthesis. So a lot of acute studies, where they measured muscle protein synthesis levels after the consumption of protein, they found anywhere between 25 to 35 grams per meal or 0.4 grams per kilogram of body weight as well. So I personally like to use the relative amount, because 25 to 35 grams is quite broad as well. And if you've got a small female or a large male, that protein intake is very different. So that's per meal, and again, you're really trying to make sure that they're having enough protein at breakfast. So having that even distribution of protein throughout the day, could give yourself more opportunities to maximally stimulate muscle protein synthesis throughout the day, and create a nitrogen net positive, so allowing them to build or maintain that muscle mass.

Then the third one is really protein quality, so protein types that have high biological value, we know are superior at simulating muscle protein synthesis compared to plant protein. So what essentially a high biological value HBV protein is, is a protein that has all of your essential amino acids. So it's a complete protein. And generally, that's how animal based source is, so dairy and meats. The reason for the high HBV protein is the main amino acid is leucine, so we know that leucine is really the key for muscle protein synthesis. So it's, I like to call it the golden key of muscle protein synthesis, because it really switches on that process and acts as an activator for the mTOR pathway. Unfortunately, we know a lot less about whole foods, which is kind of where my PhD goes. A lot of these acute protein studies are done in supplements, so, you know, whey protein isolate, whey protein concentrate, soy

protein, etc. And we know that there is a whole food matrix effect, so I'm sure you've – it's probably mentioned on this podcast before, that classic study where they did the whole eggs versus just egg whites, then measured the muscle protein synthesis, I think it was in cyclists; and so, they matched the protein amount for the eggs, but whole eggs versus egg whites, and the group that had the whole eggs had higher rates of muscle protein synthesis, despite matching for total protein, and it's likely that the different components in the whole, in the actual egg yolk is contributing to that muscle protein synthesis effect. So you have vitamins, you have different minerals in that whole egg, as opposed to egg white, which is just mainly protein in water. And the last one is really protein timing, so again, in acute studies that measure muscle protein synthesis, we know that protein, especially closely consumed to exercise, and particularly, resistance training, really acts synergistically, and increases muscle protein synthesis a lot more than just protein alone. So yeah, if we think of it as a hierarchy, the main thing is, you know, of a pyramid, the base of the pyramid should be total protein, then protein per meal, protein quality and protein timing, in terms of that hierarchal effect.

DANNY LENNON: Awesome. Yeah, and I definitely want to talk maybe a bit about a couple of those elements, and you mentioned the whole food matrix impact, and some of the interesting work there. And I think the whole eggs study that you actually mentioned, I think the lead author, Stephan van Vliet, was on this podcast discussing some of that, that people can go and listen to. And there's also been some interesting work, because I noted that some of your work, looking at say, for example, milk has been something that other groups like Kevin Tipton's lab have looked at and see some interesting stuff when you see whole milk versus, say, a supplemental whey product as an example, so we can definitely circle back to that. One of the interesting things to also

consider is we have this kind of theoretical ideal way that we can maximize muscle protein synthesis that you've laid out in terms of the dose per meal, a distribution across the day, and then what types of sources are consumed. But if we think about, observationally, what maybe a lot of people are doing in the general population, or, maybe even specifically, older adults, what do we know about the typical protein intakes, the typical protein distribution of people in the general population, and how that might compare to a theoretical ideal in this sense?

ZOYA HUSCHTSCHA: Yeah, absolutely. So in terms of the distribution, I actually did a cross-sectional study looking at active older adults, and assess their dietary intake, even though they had quite high protein intakes, so I think it was 1.2 and over. They still had that inadequate protein at breakfast. So if we think about the maximum amount, let's say, 30 grams around that average, about 25 and 35, they're getting around 8 to 10 grams at breakfast, 8 to 10 grams at lunch, and really getting a 50-60 grams at dinner. So it's that real skewed intake of protein, which is, like I said, back ended at dinnertime. So that's what I've observed in my study, and then when you look at community dwelling adults in other studies, it's much the same thing. So it's really that cereal based breakfast at breakfast time, really inadequate at protein, most likely some sort of sandwich at lunch, and yeah, like a big protein serve at dinner. So yeah, it's observed, whether they're active or community dwellers. Yeah, it's the same observation for all.

DANNY LENNON: So one thing is trying to get either more protein but also a distribution, in cases where we're trying to improve this for certain people. I suppose, pragmatically, one of the things people often point to is a difficulty in some of these types of populations of being able to consume more food overall, never mind, more protein, and making some of these changes, whether that's through, not being used to

consuming certain foods, or a lack of an appetite or typical decreases in food intake we see with age, and that has kind of led to some attempts to look at different ways to maybe reduce this anabolic resistance. And I know, at least a few years ago, there was the emergence of some groups starting to look at other supplementation like creatine or I think omega-3 fatty acids, I think HMB some groups were looking at. But in the time course since that period, or more recently, has any of that stuff played out what we know about any other types of supplements, has there been any good evidence to actually do much in this area, or, where is that current literature at?

ZOYA HUSCHTSCHA: It hasn't really evolved much more. So you touched on creatine, you know, creatine is always, it's a safe supplement, it's great for muscle hypertrophy and strength. You mentioned omega-3, you know, that has some sort of mechanism to reduce that inflammaging that I briefly talked about before. And vitamin D is also one as well, but that's mainly beneficial if they've already got inadequate vitamin D levels in their blood as well. So making sure that ticking all those boxes definitely can help, but at the end of the day, it is about energy intake as well. So protein and energy, so if they're constantly in an energy deficit, they will be losing weight. So it's really about finding ways that they can actually improve their food intake, and you did mention lack of appetite, temptations are also going to have... can be all factors that contribute to it. So that's where supplementation is good. So I've worked as a dietician, as a clinical dietitian before, so having those, a high energy, high protein supplements for the aging population is always a good one, if we think more that clinical aspect of it. But I think it also comes down to education and awareness for a lot of this population really.

DANNY LENNON: Yeah, I guess, one of the difficult paradoxes maybe for dietitians to try and navigate in this area, relates to sarcopenic obesity, where you

have maybe an aging patient that has this sign of this decreased muscle function and sarcopenia. But it's also in a category of obesity that doing something to maybe reduce adiposity would have a benefit on their health; but also knowing that increasing their muscle mass would have an a benefit on their health for some of the reasons we've discussed today. And so, you're kind of left in this difficult decision of by the interventions you would typically go in order to help someone in the treatment of obesity, if they did want to attempt to lose body mass, would almost be counter to some of the things that might be useful in the context of improving muscle mass, notably with energy here, as you've outlined. How does even one go about navigating that, is there even a consensus at the moment for dietetic practice or of how to navigate such a kind of issue?

ZOYA HUSCHTSCHA: I'm not actually familiar with the latest guidelines in terms of that to be honest, because I've worked as a clinical dietician for a very long time. But from when I was in that area, it's just – it's about really maintaining weight or making sure that the cardiometabolic risk factors are improved. So you can have someone that is in a bigger body, but still be quite healthy, so making sure that they have those cardiometabolic risk factors are in line, and doing nutritional interventions as well as exercise intervention. So I mentioned resistance training is great for that population. So yeah, I'm not too familiar with the most up to date information on that one. But that's what I would do.

DANNY LENNON: Awesome. You've just introduced resistance training, which is something I wanted to ask about, because clearly, when we're talking about protein and this impact as an anabolic stimulus, that in itself is great, but it's probably far exceeded by the potential impact of something like resistance training. And then there's also other benefits of maybe other types of training modalities, if we're thinking about

reducing inflammation, or just actually getting the muscle to contract then have an influence. What's the kind of overview that we could come away with from certain interventions that have been done in these types of populations, and what type of results that are possible from some of these interventions?

ZOYA HUSCHTSCHA: Yeah, absolutely. I think there's a real use it or lose it mentality, when it comes to movement and muscle. So I did mention how just reducing step count can significantly have an impact on muscle protein synthesis. So just remaining active for older adults is imperative for maintaining muscle mass and strength, but if you look at the literature, resistance training is definitely a – you have to have resistance training to have that stimulus to build muscle. So studies where they've done four groups with resistance training protein, those two together or control protein alone is not effective at building muscle. So you need that stimulus to build muscle. Other studies have looked at interval training as well, not so much because then you have to think that the older population are quite frail. So you have to do what is appropriate for that type of group. But yeah, mainly resistance training, whether it's with weights, with resistance bands, bodyweight, have all shown to be effective at increasing muscle mass in older population.

DANNY LENNON: So where are the gaps in the current knowledge base, where do you have to go in terms of maybe future research? What are some of the questions that maybe we don't have good answers to at the moment, do you think?

ZOYA HUSCHTSCHA: Yeah, as I mentioned, in terms of whole foods versus supplementation, so there's a lot of preference for that supplementation versus whole foods. So learning what's the difference between dairy milk and yogurt, and there's high biological value protein sources, and the whole food versions. Other aspects, because my study, my PhD was mainly done in active older adults, or, my population where 56 year olds

that were running marathons, so very different to that clinical population group. I was really interested in knowing how can lifetime training affect individual's response. So if they have had a whole background of training, how can that affect their ability to gain muscle later on in life, even with a big break compared to someone that's been sedentary their whole life. And in my study, active older adults, the population group was a little bit younger, so I think the median age was around 60; so how would older athletes or masters athletes, so the 65 and overall 70 year old, how did they respond to similar exercise and nutritional interventions. Those are the main questions that kind of came out of my PhD. But this area is certainly involving so much, you know, I started my PhD in 2017, and nearly every single week, there was a new study on sarcopenia. So really, I had to stay on top of it. So yeah, mainly the whole foods, active older adults, I think is a really interesting area as well, so yeah.

DANNY LENNON: Cool. Before I start wrapping up here, is there anything I failed to bring up or forgot to address or any other particular points that you think are important for people to know, related to this topic?

ZOYA HUSCHTSCHA: I guess, just the main point as to why this is such an important area of research, and why people are so interested in it, I think. And the reason is, because we know that by 2050 that one-third of the global population will be over 60. So that's me, that's my generation, that's going to be over 60. So there's not going to be enough young people to support the older generation, and it's going to really impact the global healthcare system. So understanding the mechanisms a little bit more, and what's effective strategies, whether it's exercise and nutrition that can really mitigate these risks is important. So, I guess, just stressing that point a little bit.

DANNY LENNON: Very cool. For people who want to find more of your work and follow you on social media, any

of that type of stuff, where are some places on the internet they can go and find you?

ZOYA HUSCHTSCHA: Yeah, so I'm on Twitter and Instagram, and my handle for both is nourished_by_science.

DANNY LENNON: Awesome. And for everyone listening, I will link to that in the show notes of this episode, along with anything else relevant to this particular episode, you can go and check that out. And that brings us to the final question that I end the podcast on. This can be to do with anything even completely outside of what we've discussed today, and it's simply: if you could advise people to do one thing each day that would have a positive impact on any area of their life, what might that one thing be?

ZOYA HUSCHTSCHA: Well, in relation to what we've talked about, I would probably say, move every day in a way that feels good for you. So just keep moving, don't stay sedentary, and yeah, that's it.

DANNY LENNON: Awesome. Zoya thank you so much for taking the time to chat to me and for walking us through such an important and interesting topic. I'm sure people find it very interesting. So yeah, thanks for doing this.

ZOYA HUSCHTSCHA: Thanks again for having me.

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