Macronutrients: Protein Structure and Function

Transcript

Hello and welcome to our Institute of Nutritional Endocrinology video on *Macronutrients: Protein*. Protein is one of the macronutrients. We are going to talk about structure and function and how that applies clinically to your clients in helping them to achieve vibrant health and overcome issues that arise when protein becomes out of balance.

Before we begin let's talk about the fact that this is not medical advice. This is just a sharing from my information to you, from my research and from my clinical experience and to make sure that when you are working with clients that you let them know that you are not diagnosing, you are not treating. You are assessing their status, their nutritional status and helping them with lifestyle and diet, things that you can change.

We've been talking about macronutrients in this module and there are the four primary macronutrients that we've covered; water, fat, and now we've moving into protein and after that we'll go into carbohydrate.

These are the macronutrients, these are the nutrients remember that we need in big amounts: several quarts of water every day, multiple grams of fats every day, protein maybe 60 to 80 grams depending on your size and your activity level. Carbohydrate, there is no set amount but generally we are going to get in the neighborhood of 100 grams, or if we are on the low carbohydrate diet we may go lower than that, if we are not we'll go a little bit higher.

But those are big gram doses versus vitamins and minerals where we need milligrams and sometimes even microgram doses: so little tiny doses. These are the macronutrients, and those are the micronutrients and we'll get to those later. Protein is a biggie. We have a lot of people are worried about their protein and whenever I hear this I have to laugh because people all the time will look at me and they'll say, where do you get your protein?

You can't survive eating plants and I eat only plants, some people eat primarily plants. I think it's very helpful to eat primarily plants because that's where we get most of our nutrition from. But if you eat a little bit of meat you are going to get more protein in a little bit of meat but if you eat a lot of plants you are still going to get a lot of protein.

But it's really funny because the people that are asking they are so concerned about my nutrition, they are not so healthy themselves. I run, I bike, I swim, I have lots of energy, I build muscle and I don't eat anything but plants, so where do you get your protein? It's this crazy question because everything has protein in it.

Not just meat, not just beans, but everything. Actually kale and spinach and broccoli are in the 40-50% protein. Now, granted they don't have very many calories, so you have to eat a lot of them; but it's not that hard, it really isn't, you just have to pay attention. The people who eat a vegetarian diet and focus on eating a lot of grains and pasta and fruit, don't get a lot of protein and run the risk of being protein deficient.

But it's been said that it's impossible to have a protein deficient diet if you are eating whole foods, no matter what it is. Whether you are a heavy-duty meat eater, whether you are having a lot of greens, grains and beans, or whether you are having a lot of vegetables, as long as you are getting a calorie sufficient diet that has a balance.

It's really impossible if you are eating enough calories to not get enough, unless it's all fruit, if you are just eating all fruit, or you are eating junk but I'm saying a whole foods diet. It's really not something to worry about and a lot of your clients are going to be worried about it and you are going to have to show them charts and it's easy enough to do.

You can have them run their diets through www.fitday.com or other online free services and just show them that they don't really have to worry about this. Then some people do have to be concerned about their protein intake because they are eating the standard American diet which is loaded with processed foods, lots of sugar, no protein in sugar, thank you very much, so really watch that.

Let's look at what we are going to cover today, a lot. We are going to cover some chemistry but don't get scared, we are going to look at what protein really is, how to resolve the dilemma of too much versus too little protein because there are a lot of misconceptions about that, how to determine if you are low in protein, what are some of the signs, what are the food sources of protein and how much is in each of those?

Do we need protein powders versus whole food proteins? I want to go through when protein powders can be a really good idea to help supplant it and how and when to consume them, and what's good protein powders versus not so good protein powders. There is a lot we are going to cover.

What's the function of protein? Protein is your structure. It composes your muscles, your ligaments, your tendons, your hair, your skin, your nails, all those things that you can see, feel, hear, and touch. Also, there are the components: the enzymes. Enzymes are made of proteins, enzymes are required for metabolic reactions, for digestion, for the immune system, for hormones, for pretty much everything, detoxification big time.

We need proteins to make our hormones. We also need fats to make our hormones, so we need to have that balance. Proteins transport things, they transport hormones around the bloodstream. We have these binding proteins that attach hormones because most hormones are fats and fats don't dissolve in the blood, they can't really be transported in the blood, they need to be bound to proteins to be carried in the blood.

Energy intermediates, so in the Kreb's Cycle there are a lot of amino acids required to generate energy, and we talked about that in our *Cell Metabolism* module. Also growth and repair, so if you are going to be making tissue or muscle, or you are injured or broken bone, or even just metabolic responses, lifting weights; you are going to need proteins for growing and repairing.

Growth and repair happens all day long every day but especially while you sleep. Proteins are important for neurotransmitters, the bases of all the neurotransmitters are various amino acids and we'll be going through those. Proteins are required to maintain pH balance. If you don't have enough protein your balance can go off, but also if you have too much protein your pH balance can go skewed in the direction of acidity.

Those are all the things that protein are important for. So what does protein look like? Well, it looks like a bunch of carbons and hydrogens and oxygens, and is different from fats and carbs which also have a lot of proteins and hydrogens and carbons, they have some other molecules. They have nitrogen and that's what distinguishes protein from carbohydrates and fats.

They also have other groups, these R's that you are seeing throughout are little side chains and some of them have phosphates, some of them have sulfur. We have a lot of things besides hydrogen, oxygen and carbon like we have in our fats and carbohydrates. Let's look at what is protein, what does it look like, what is it made up of.

They are vital components of body tissue of your enzymes, of your immune cells and they account for about 20% of your body weight. Unlike water, which accounts for probably 60-80% of your body weight. The combination of different amino acids are linked together in very unique combinations containing carbon, oxygen, hydrogen, just like fats and carbs, but in addition nitrogen and sometimes sulfur and also some phosphates.

Deficiencies in essential amino acids cause your body to have to break down muscle protein and sometimes vital organ protein. If you are not getting enough amino acids, you definitely have to make break down. If you are on an extended fast, that's a period of time when you are not getting enough protein coming in, you are going to breaking down muscle tissue.

What are amino acids? They are the building blocks of protein. They are biologically important organic compounds. They consist of an amine group, which is nitrogen and two hydrogens, NH2 that's called an amine group. They also have a carboxylic group, COOH. So we have an NH2 group, we have a COOH, and then we have a side chain that's specific to each amino acid. The R is the side chain.

And then we have the key elements that are in there which are carbon, hydrogen, oxygen and nitrogen, and sometimes sulfur and other things. That's your basic amino acid structure. It's going to be a longer chain generally in the middle but basically it's the carbon, the hydrogen, the side chain right in the middle, the NH2 over to one side, the COOH over to the other side.

That's the basic structure, that's the mystery of what amino acids are, that's all that they are. Here is a list of the nine essential amino acids, and like we talked about with essential fats, just because an amino acid isn't considered essential doesn't mean it's not essential to your life. We need to get that straight.

Essential means it has to be coming into the diet because your body cannot make it. No matter how many other amino acids you have, for these nine we just can't make them. It doesn't mean the other 22 amino acids aren't important. They are. If you don't have enough of the essentials you are not going to be able to make the others.

Leucine, isoleucine and valine, those are often called your branch chain amino acids and they are able to be broken down into fuel. Lysine, methionine, tryptophan, phenylalanine, threonine and histidine. There are pictures of them here. Do you have to memorize them all? No. Do I have them all memorized? No.

If you were to show me an amino acid, would I be able to look at and say oh, that's valine or that's glutamic acid? No, that's not the important piece and if you've taken a chemistry class, you've had to memorize that, that's fine. What we are looking is more you need to understand the chemistry, the structure and the function.

Then we have a list what's called 'conditionally essential amino acids' because sometimes they are essential if we don't have enough of the building blocks. They are arginine, asparagine, glutamine, glycine, proline, serine, tyrosine and cysteine.

We are going to talk about the functions of the various amino acids and where they play into the body so that you know what a deficiency of that might look like.

Let’s look at the non-essential amino acids. This means that we generally don’t need to have these in the diet, our body is able to make them as long as there is an abundant supply of essential amino acids plus a chemical called alpha-ketoglutarate and vitamin B6 that synthesizes it.

If you've ever done a laboratory test you know there is a bunch of things called ALT, Alanine Leucine Transfarase. There is a bunch of transferase enzymes that take groups off of one amino acid and move it to another and create a new one. Okay, B6, very important vital nutrient for that to happen.

So let’s look at the amino acids that are neurotransmitter precursors. Which ones are those? Phenylalanine and tyrosine, those guys get together and form dopamine. Tryptophan, glutamic acid and GABA (gamma amino butyric acid). GABA is actually a neurotransmitter but it’s also considered an amino acid, just as glutamic acid is a neurotransmitter but is also an amino acid. Then we have *Collagen Related Amino Acids*, we have proline, hydroxyproline, glycine and arginine.

These form the basis of the collagen structure in the body. The collagen structure is the musculature, the joint tissue, anything that’s structurally holding you together. So if you are working with somebody who has a muscle injury or bone injury they may need more of these collagen related amino acids in order to build back and recover from the injury.

They are also going to need some Vitamin C, because Vitamin C is important for taking these amino acids and creating the synthesis of collagen. Then we have the *Sulfur Containing Amino Acids* and sulfur is an important component in the body for cleansing and detoxification. We have methionine and cysteine and homocysteine and cystathionine and taurine. Those are your sulfur containing amino acids.

Next we have the *Energy Producing Amino Acids*. We have isoleucine and leucine and valine, which are considered your *branched chain amino acids*. 30% of muscle protein and 50% of dietary amino acids is embraced in this. So they are really important and you need a lot of these and I’ve worked with people therapeutically with using these.

Not only in helping them with increasing their energy and sparing their lean muscle, but in terms of some very significant issues. There is a lot of research around isoleucine, leucine and valine, and some work with some neurological symptoms. Histidine is important for energy and it’s usually high when you are breaking down a lot of muscle.

If somebody is doing a lot of heavy-duty workout where they are lifting really heavy weights and there is a lot of muscle breakdown and then rebuilding, they may require more histidine. Or if they are in a process of cancer or some sort of a disease state where the muscle and the tissue is breaking down.

You find that histidine levels are low in people with rheumatoid arthritis. Lysine causes the collagen cross linkages, it helps with those so it's really important for building tissue. And then threonine: low levels of threonine can actually be contributory to hypoglycemia. So it's really important to have amino acid balance not only for the structural things but for some of the functional things in the body.

Let's take a look at too little protein and too much protein, and what's the cause of each and the manifestation of each. Too little protein; a person might have little energy, they may have poor immune function like the healing that doesn't happen or more tendency towards infectious disease.

They could have hormone imbalance and that can range from thyroid, adrenal, insulin levels. It could be related to female and male hormones, it could be related to hormones in very many parts of the body because it's the structural component of making the hormone. Too little protein can lead to depression.

It can also lead to muscle weakness, if you don't have enough protein to build good muscle, the muscles are going to be weak. Weak, brittle nails if you see those people they say just can't grow my nails, they grow, they break, they grow they break, possibly protein, also possibly mineral deficiency. Hair that thins or falls out can be a lack of protein.

Again that could be other things: low thyroid function, low adrenal function can create a loss of hair. Poor recovery from injury so we don't have the raw materials that the body needs to repair and build new collagen tissue: that can be a manifestation of too little protein. If you have somebody lifting weights, they are doing all these workouts, and they just don't seem to be able to build, their muscles aren't growing, they are not getting any stronger, that's a sign.

Somebody says, I just tried to do these push ups and every day I get to four push ups, I can't get further than four push-ups, they are not building the strength. Whereas, somebody that has plenty of protein has no problem. If I try to do push-ups and I haven't been doing them for a while, after I broke my arm and I hadn't done push-ups in a long time, I got down and did 12 push ups, the first day back, and within a week I was able to do 20, and now I'm able to do 30 or 40 if I keep it up. If I don't then I go back down because it's a build up. But I wouldn't say that I have a deficiency of protein because I'm able to build up the bulk and the strength if I do the work.

If you have too much protein it puts stress on your kidneys and that lead to low back pain and that can lead to kidney stress and kidney failure and poor clearance rate.

It can lead to bone loss because too much protein creates nitrogenous waste and acidic waste and it causes bone to be broken down in order to neutralize and alkalize. It can create decreased appetite. It's just one of those things that if you have too much protein it causes you to decrease your appetite and people find that they do this when they are trying to lose weight, they load up on the protein.

Well it's fine because it decreases your appetite and they may lose weight, but on the other hand they are causing a lot of nitrogenous waste, stress on the kidneys and bone loss. It could be nauseous, people who have too much protein sometimes it's not all the time, acidic urine and saliva, very common with too much protein.

If you are having somebody test their urine and their saliva and they are getting very acidic readings even though you are having them eat more greens or taking some alkalizing minerals, it could be that they are just getting too much protein. A lot of people err on this side they say "oh yeah I can't go on carbs because carbs are no good for me because I have blood sugar problems," so they go and they eat too much protein and that can be problematic.

Like people who are taking Paleo diets to the extreme. Paleo diets if done properly can be really healthy, where it was in the way it was in Paleolithic times where there was a feast of meat and then there was a famine it was mostly greens and vegetations and whatever was around. But when you start to eat like six, eight ounces of meat at every meal you can be running into some really serious issues with kidney overload there.

Dehydration can amount from too much protein. You can have constipation because there is just not enough fiber and the protein is slowing down the transit time and causing constipation. Increase of skin cancer and heart disease has been attributed to too much protein and specifically too much in the way of animal protein but certainly plant protein, excessive soy can create those risks so we've got to really watch out for that.

We are going to come back in the next video and we'll continue with the protein and we've given you some basics now and now it's time to move to the next level. Thanks for sharing and we'll see you on the next video.