PLANT PROTEINS: ASSESSING THEIR NUTRITIONAL QUALITY & EFFECTS ON HEALTH & PHYSICAL FUNCTION

Featuring:

Steven Hertzler, PhD, RD, LD
Courtney Allgeier, MS, RD, LD

TRANSCRIPT

Maura Bowen: Hi listeners, and welcome to Abbott Nutrition Health Institute's POWER OF NUTRITION podcast. Today, we're talking about plant PROTEIN-based diets, which are becoming increasingly popular around the world, and there are lots of good reasons why. For instance, eating more plant proteins can:

- Offer potential health benefits
- Help you avoid or even counteract some of the ADVERSE health effects of eating large amounts of animal protein
- Improve the environmental sustainability of food production
- And so forth

Just as importantly, more and more people *understand* the role PROTEIN plays in improving and maintaining overall health. It helps us build and maintain muscle strength, boost immunity, prevent injury and hold onto our IN-dependence as we age. Which begs the question: While plant PROTEINS play an important role in health and physical function, how do they compare to the nutrient density of animal proteins?

I'm Maura Bowen, and Steven Hertzler and Courtney Allgeier, two of our senior scientists here at Abbott, have joined me in the studio today to discuss their article published in the December 2020 issue of *Nutrients*, titled "Plant Proteins: Assessing Their Nutritional Quality & Effects on Health & Physical Function," where they consider the merits, risks and safety issues of increasing plant protein intake.

Steve, Courtney, thank you for being here.

Dr Hertzler: Thank you.

Ms Allgeier: Thank you so much for having us. It's a pleasure to be here.

Maura Bowen: Great. Well, let's start with some proper introductions. Would you both mind telling us a little bit about yourselves and your backgrounds and how you came to focus your career on nutrition? Steve, would you like to go first?

Dr Hertzler: Sure. My name is Steve Hertzler. I'm a registered dietitian and I'm a senior scientist here at Abbott. I've been here at Abbott now for almost 14 years, worked in the areas of sports nutrition, medical safety, and surveillance. I've seen a lot of different areas within the field, and then also I was a professor in academia for about 10 years before I came to Abbott, teaching nutrition at the college level. I really enjoyed that a lot.

Maura Bowen: Well, thanks, Steve. And how about you, Courtney?

Ms Allgeier: Well, I'm a registered dietitian. I began my career as a clinical dietitian at Dayton Children's Medical Center in just general pediatrics, pediatric oncology, and inborn errors of metabolism. that's actually what brought me to Abbott. I joined Abbott in 2007, probably a similar time as Steve, and I've always been in nutrition science.

Maura Bowen: Let's start by speaking generally about protein. Why is it an essential component of our diet, and what are the recommended daily requirements?

Dr Hertzler: From the perspective of why is it required every day, there are essential amino acids that are found in proteins. Amino acids are the building blocks of larger protein molecules. There's about nine essential amino acids that you can't get from other amino acids in the diet, and therefore you need a dietary source each day for these essential amino acids. We are focused on getting those amino acids from a variety of protein sources in the diet, plant or animal, to help us achieve that intake of getting the essential amino acids that are required.

Ms Allgeier: Yeah, and just to add on that, protein are made up of amino acids and they're found in so many different parts of the body, including your hair, blood, skin, muscles. When we eat foods containing protein, this protein is split into amino acids during digestion. Those amino acids are later put back together, and I like to think of it like beads on a necklace, to form new proteins. Those proteins are used to build and repair the body's tissues. Like Steve was saying, there are essential amino acids and they're essential because you have to get them through food and your body has to have them for normal growth and development.

When you look at typical requirements per age and how many grams you need, I mean, I'm thinking about it from the pediatric perspective, we always look at it more programs per day, but if you're following a typical

growth on a growth chart it equals to about 0.8 to 1.1 grams per kilo per day. I think that follows from pediatrics up through adulthood.

Dr Hertzler: Yeah, just to kind of put this as a frame of reference for an adult who is say 70 kilograms or 154 pounds. A 70-kilogram person at 0.8 grams of protein per kilogram of body weight per day, that's 56 grams of protein per day. Some recommendations go a little higher than the RDA's. We are starting to see some recommendations for older adults now, closer to 1.2 grams of protein per kilogram of body weight per day. It gives you a little sense of what the recommendations would be, for a 70-kilogram person that would be 84 grams of protein per day.

Maura Bowen: Okay, that's super helpful. As we alluded in the introduction, not all proteins are created equally, right? What would constitute a high-quality protein?

Dr Hertzler: There are a variety of different ways to evaluate the quality of protein. Historically, a number of different techniques have been used. Sometimes they'll feed protein to laboratory animals and measure their growth and see which proteins support growth the best. Other ways we do it include the most accepted practice right now, which is an amino acid scoring technique. Essentially, we have some information in the scientific literature about how much of those essential amino acids is required for each individual essential amino acid. What you can actually do with the proteins that we talk about is you can do a comparison of the amino acid composition of that protein and compare it to a reference protein, which is established by experts in the scientific literature. That's an approach called the protein digestibility corrected amino acid score. You create an amino acid score for the protein based on its content of essential amino acids and then you correct that for the digestibility of the protein, how much of that protein that your body can actually take in and utilize.

Some proteins are very highly digestible, milk proteins, animal proteins in general are probably over 90% digestible. Then you have some of the plant proteins from higher fiber foods and things like that that maybe have a little bit lower digestibility. Then you have some of the plant protein isolates and concentrates that we see in supplements now, those typically have very high digestibility as well, probably 90 plus, because a lot of the fiber and other elements are removed when the protein is isolated from the whole food plant source.

Ms Allgeier: I do find one thing that's interesting, in doing this paper, is that there was a survey done in 2014 of dietitians that didn't even know about the assessment methods to determine protein quality, and that they didn't realize, one, that there were multiple methods of determining protein quality, and then even the differences of protein quality between animal proteins versus plant-based proteins.

Dr Hertzler: Yeah, one of the things we did with this article is we put together a table that compared some of the higher quality animal proteins and a wide range of plant proteins with their PDCAAS scores, the protein

digestibility corrected amino acid scores, we call it PDCAAS for short. We have the PDCAAS values for 13 different plant protein sources in the article, and listed them in numerical order so you could see where they rank compared to animal proteins. Animal protein, for instance like say whey protein or casein or egg or beef, typically has a PDCAAS around 1.00. That means that that protein meets all of the essential amino acid requirements and is highly digestible and is suitable as a sole protein source in the diet. Most plant proteins are not quite at a PDCASS of 1.00, with the exception of soy. Soy hovers right around that 1.00 range. Other plant proteins can range anywhere from 0.2 to 0.6 to 0.8, it just depends on the different protein source.

Maura Bowen: Okay, interesting. Then with that in mind, where do most plant proteins fall on the quality spectrum based on their own?

Dr Hertzler: Again, it depends on the protein source. You'll see a protein like soy, which is right around 1.00 on that PDCAAS scale. You'll have a protein like pea protein that is also a pretty high-quality protein. Pea proteins are typically around the 0.85, 0.86 type of range. Then some other plant proteins that are poorer quality, you might see 0.6. Wheat gluten and stuff like that as even a little bit less than 0.6. It doesn't necessarily mean that they're bad, it just means that they're missing certain essential amino acids. There can be some benefits from consuming those plant proteins if you consume them with other proteins that are high in the essential amino acids that they're not, and vice versa. There are proteins that fit together kind of like hand in glove.

Maura Bowen: If some plant-based proteins are not as high in quality or they're lacking in amino acids, as you just said, compared with animal proteins, how would you recommend wisely using plant proteins in the diet to make sure individual amino acid requirements are met?

Dr Hertzler: I think one technique is to make sure that you're consuming a wide variety of protein sources throughout the day. If you are a vegetarian or vegan, then it becomes that much more important to provide a wider variety of plant protein sources because you're not getting the automatic high-quality PDCAAS of animal proteins. It's still very possible to get high-quality protein on a vegan diet, but you have to pay attention to the types of proteins that you're consuming and making sure that you're getting a variety of proteins from different sources.

So, for instance, there's a lot of ways we do this and we don't even realize we do this. If you're a person who likes to eat rice and beans, for instance, rice protein is a grain protein that is typically high in the sulfur-containing amino acids that are essential, but as low in lysine. But on the other hand, you can have legume type of proteins, like beans, that are exactly the opposite. They're very high in lysine, but they're low in the sulfur-containing amino acids. When you put those two together or eat them within a short time of each other, they provide enough of all of the essential amino acids. They make up for each other's weaknesses,

they're called complimentary proteins. That type of thing happens a lot. If you eat a peanut butter sandwich, or if you're consuming a meal that has some animal protein in it and some plant protein in it. The animal protein will make up for any of the essential amino acids that might be missing from the plant proteins in the diet as well.

Dr Hertzler: Really, the best way to protect yourself and make sure you're getting all those essential amino acids is choosing proteins from a wide variety of sources and knowing that not all the plant proteins are limiting in the same amino acids.

Ms Allgeier: Yeah. I think something to add on that too, is I do think a blend is best, but another way that you could also make sure that you're meeting your amino acid requirements is just looking at serving sizes and portion sizes. Because even though you have a pea protein, which is what, like we said, a 0.86 and it's got a lesser amount of certain essential amino acids, but it's almost there, so just by eating a little bit more of that protein source during the day to help you meet those minimum requirements that your body needs for growth and development is another great way to make sure that you're meeting those needs as well.

Dr Hertzler: Yeah. There are studies showing that rice protein, even though rice protein is not a complete protein in and of itself, there have been some studies showing that if you supplement with rice protein. Let's say you're an exerciser or a weight trainer or something like that, if you supplement with the rice protein, you can still get benefits from that rice protein. It's just that you have to eat more of it, relative to an animal protein. You might have to eat a supplement with 50 grams a day instead of 30, for instance, or something to that effect. As Courtney said, portion size and overall amount of protein is an important factor to consider.

Ms Allgeier: Well, and I think something else that we have available to us today that we didn't even really see 10 years ago is you're starting to see more protein isolates and concentrates coming out on the market for supplemental use, versus before, we would just eat the whole food for the plant protein to obtain that. Now, by utilizing those, you're able to get more of that plant-based protein available to you in a smaller amount, so that helps as well.

Dr Hertzler: Yeah. It's tough to eat 25 grams of protein from whole peas.

Maura Bowen: I'll bet. Well, that all makes perfect sense. I noticed, your Nutrient article does such a fantastic job of presenting the most recent evidence and analytical reviews for the effects of plant-based proteins on target areas like cardiovascular health and metabolic syndrome, diabetes, cancer, renal function, lean body mass. Can you tell us a little bit more about how various attributes of increasing plant-based protein might impact the risk of these chronic diseases?

Dr Hertzler: One of the things that is an interesting research question right now is how much of the benefits of plant protein in the diet are attributed to the protein itself versus other things that come along with that protein in a plant protein-based diet. When individuals make the decision to adopt more plant protein sources in their diet, other things change as well. They start to get maybe more fiber than they did before, there are certain plant-associated nutrients called phytonutrients that are found in those plant-based foods that might have an impact on chronic disease risk. There's all kinds of polyphenols and catechins and those types of compounds that are found naturally in fruits and vegetables and in whole grains that might have some disease-protective effects, anti-cancer type of effects, and health-promoting effects in general. In some instances it's not necessarily the plant protein itself that's creating the benefit, but it could be some of the other things that go along with it.

Having said that though, there's also people who have suggested that maybe the amino acid profile of plant proteins is also helpful from the chronic disease perspective. Plant proteins, for instance, are higher than animal proteins in the amino acid arginine. Arginine is an amino acid that has a potential impacts on blood flow in the body. It's possible that plant proteins can have impacts on their own, independent of fiber, phytochemicals, et cetera. It's an area that we need a lot more research on right now. It's really growing and expanding, especially as people are starting to get more in tune with trying to get more plant protein and thinking about ways to improve sustainability of protein production and things like that. I think in the next 10 years, this field is going to grow exponentially, from a research perspective.

Ms Allgeier: Yeah. I think something else to add on to that is, like you said, in regards to the additional benefits that come in, I mean, when you look at plant protein versus a meat protein, for example, you have lower saturated fat, you have lower cholesterol. Paired with the vitamins and the minerals and the different phytonutrients, you're seeing the anti-inflammatory effects and then you're also seeing this overall mortality effect as well. There was a report that just replacing 3% of your protein intake with plant protein versus animal protein had a 10% reduction in mortality overall, across both men and women. I think that's really interesting.

Even looking at it from the perspective of pediatrics, all of this research that we're seeing in adults is even translating over to the pediatric population as well. There was a study done in children: I think the mean age was eight years old, and they had familial hypercholesterolemia. It was a three-month intervention and just replacing half of their protein with a plant-based protein, and I think they used soy in this study, they showed a decrease in their LDL, which is their low-density lipoprotein, 6% beyond the 11% decrease that they typically see with just a low saturated fat diet. I think it's really interesting to see these benefits across the age span in all different areas.

Maura Bowen: It's very reassuring, because as a mother of two children with food allergies who have been taking in plant-based milks their whole lives, it's nice to hear that there are some positive effects there, which leads me to my next question. What can you tell me about plant proteins and food allergies?

Ms Allgeier: Oh, well, all protein sources have the potential to have an allergenic effect. I mean, as novel plant-based sources of proteins emerge into the market, they're inevitably going to elicit an allergenic response in someone. Your more common food allergies today in children and adults in the US, for example, are your peanut, your milk, your shellfish, your tree nuts. When you look at other countries, common ones are sesame seeds and mustard in Canada and the EU, or the European union. You've got buckwheat in Japan and Korea, and lupins in the European Union as well. The reason these are all common food allergens is because they're frequently consumed, they're consumed in relatively large amounts, and they're consumed in early stages and all throughout life. I think as your plant protein consumption increases, so will the percentages of allergenic responses for these very reasons.

I mean, for example, we were talking about pea protein earlier. Pea protein is kind of exploding into the marketplace in the United States. It's a part of the legume family, which also includes the peanut, beans and soy. Due to other plant proteins, such as soy and wheat, having documented allergenic responses, your pea protein has been viewed as a potentially less-allergenic alternative to those. But I think what we're finding as you're increasing this, when you ate the whole food itself, if you ate a plate of peas, you have only about 8% protein in that plate of peas coming from the pea itself, but when you start introducing these pea protein isolates and concentrates, you're increasing that protein load to a response that they might not have had before. That's a very large dose of protein coming from the pea itself. Even though these pea proteins are not required to be identified as a potential allergen on food labels, I think some people are taking notice that you are seeing some of these plant proteins emitting this allergenic response.

I think that it doesn't mean that pea protein or any new plant-based protein sources shouldn't be explored, but I think people need to realize that as we continue to increase our usage of them we are going to see some people eliciting a response to them.

Maura Bowen: What can you tell me about the impact of plant proteins on lean body mass and strength?

Dr Hertzler: It's really an encouraging note that has happened from the literature, I would say in the last five or 10 years, as more and more people are starting to study plant proteins. Soy protein is widely studied in the resistance training literature, because that's where we see a lot of interest in alternative plant sources, is helping individuals who are trying to increase lean body mass while they're exercising with weights. There've been some really nice meta-analyses that have been done. Basically, what they have shown is that even though some earlier clinical studies had shown that animal proteins, for instance like dairy protein, tend to be better at triggering muscle protein synthesis post-workout. Even though in the short-term clinical setting like

that, dairy proteins seemed to be superior to soy, when you look at it on a long-term basis over the course of an exercise program and you use soy protein supplementation on a roughly equal basis with, say, dairy protein sources, you get about the same muscle protein gains.

Dr Hertzler: One of the things that I do caution people about when they look at the research and literature on plant proteins is don't just look at an isolated acute study where they measure an effect on protein synthesis for two to three hours after you exercise. What counts in the end is what are your results from the training program over 16 weeks or longer. Generally, those longer-term studies show that a good, high-quality plant protein like soy, and I'll have to say that soy tends to be more studied than a lot of the other protein sources, can have pretty equivalent gains. In some cases, you may have to take a little bit more pea protein, rice protein that I mentioned, you may have to supplement with a little higher level than you might with an animal protein, but there are studies showing that both of those types of plant-based proteins as well can still stimulate gains in lean body mass.

We're also seeing a lot of athletes now who are tending to go more toward a vegan type of lifestyle. Typically, the advantage for those types of athletes is that they generally eat a lot of food, they eat a lot of calories because they burn a lot of calories during their training and during their competition, and so just due to the sheer volume of food that they're consuming and the volume of plant protein they're consuming, they generally don't have too much problem getting enough complete protein. It's definitely a good way to do that if you are a person who wants to not consume as much animal protein.

Then you see people who use a flexitarian type of an approach where they like to have some plant-based protein and they increase their intake of that, but at the same time, they still want some animal protein in the diet and they get a little bit of the best of both worlds.

Maura Bowen: I had wondered about veganism and athletes, so I'm glad that you covered that. Let me ask you too, there are some safety-related myths around plant proteins. Can you speak to some of those?

Ms Allgeier: I think one of those myths that you hear a little bit about are the hormonal effects. Typically, in the United States, we hear that around soy. I mean, you've got phytoestrogens, which are also called isoflavones. They're in soy products, they are plant compounds that are or have very weak estrogen-like activity. I mean, we've known for decades that phytoestrogens are naturally present in many foods of plant origin, so it's not just in soy alone. You do have phytoestrogens in other plant proteins such as wheat, rice. They're very different, isoflavones are very different from the hormone estrogen. Their chemical structure is similar to estrogen, but they bind to the body's estrogen receptors very differently and they function differently in the body.

Ms Allgeier: We hear myths about the hormonal effects of soy. Phytoestrogens, they're also called isoflavones, in soy products are plant compounds that have very weak estrogen-like activity. We've known for decades that phytoestrogens are naturally present in foods of plant origin, so not just soy alone, but wheat and rice as well. Isoflavones are very different from the hormone estrogen. Their chemical structure is similar to estrogen, but they bind to the body's estrogen receptors differently and they function differently.

There have been about three clinical studies that were designed to determine whether isoflavones or soy foods exerted any type of a hormonal effect, specifically in children and adolescents. The results have shown no effect, and that lack of clinical evidence on the hormonal effects in children is consistent with adult research showing that isoflavones exposure from soy foods had no effect on circulating testosterone levels in men or estrogen levels in men or women.

Not only in the effect there, but also there is a myth in regards to this early pubertal development and girls and boys. Thinking back to there was a study that was done on isoflavones exposure in girls, I think they were ages six to eight years old, and they were really trying to determine if there was any type of correlation with early pubertal development, and they did not find any correlation. We're finding that consistent in studies that were done in Germany, studies that were done in Korea. There was also a cross-sectional study that was done in the US with boys and girls, looking at early puberty onset, and that was found to be within normal range as well. That's one of the common myths that I've heard.

Dr Hertzler: Just to follow up on that too, in the adult nutrition literature as well, we've known about the potential effects of phytoestrogens for a long time and soy foods have been studied in particular for at least a couple of decades. It's important for people to understand that there's a big difference between a study that is done in an isolated cell culture type of system or in our rodent type of model and potentially seeing an effect of a very large dose of a phytoestrogen type of compound in that setting versus consuming whole soy foods or soy proteins in a human's diet.

When we look at the enormous volume of literature that has been accumulated over the past 20 years or so, there've been meta-analyses that have been done on these studies for individuals who have estrogen receptor-positive type of cancers and a bunch of different scenarios. Essentially, what they're showing is really no significant impact of soy proteins on those types of hormonal parameters. The American Cancer Society has endorsed soy foods, even for cancer patients. Really, there's been a large acceptance of soy protein now, as opposed to the early concerns that were expressed about soy and adverse reproductive effects. In general, we just don't see that type of concern in adults, either.

Maura Bowen: With all of this evidence in mind, what are your suggestions for future research then?

Ms Allgeier: Well, I think in almost every clinical study that I've read, the authors all call for longer, larger clinical trials to confirm the results because the sample sizes tend to be relatively small in the studies that were reviewed. I think that's probably one of the biggest things. Plant proteins is such a growing area of focus for future research, just to better understand the plant protein itself and if it confers any other benefits of whether the adoption of better dietary habits associated with increased plant protein intake just helps to drive favorable health outcomes. I think that's where we'll see the most research coming.

Dr Hertzler: Yeah, yeah, I think so. You'll see, as I mentioned before, we've been trying to separate what effects come from the plant protein itself versus the nutrients that might accompany it, so I think that's an area for further research. I think in general, just getting more of an understanding of how much protein you need to supplement if you're interested in increasing lean body mass and how does it vary depending on the type of protein that you're consuming, how these plant proteins work together with animal proteins, for individuals who like to consume a little bit of both. There's plenty of room there for more studies. I'm a former professor, I can always think of ways to do more studies.

Ms Allgeier: Yeah, and I think something else you mentioned too, just looking at the whole protein itself. I mean, I don't think people realize, pea protein for example, how much fiber comes in with pea protein, so looking at the effects of the plant proteins on the whole microbiome and how that will even affect health. I think that's another one to think of.

Maura Bowen: Well, Steve and Courtney, I would really like to thank you both. We get questions about this topic all the time so it seems like your study came along at the right time so that we can talk about it today. You're welcome back anytime if you have follow-up studies or anything that you want to talk about. Thank you both for being here on the podcast today.

Ms Allgeier: Thank you so much for this opportunity. Thanks for having me.

Dr Hertzler: Yeah, it was a pleasure to be here. We really enjoy being able to talk about the research that we have going

Maura Bowen: Thank you again, and for our listeners. If you're looking for more podcasts, we have dozens and dozens across a variety of different nutrition science topics, and you can find them on ANHI.org by clicking RESOURCES at the top of the page, then PODCASTS & VIDEOS. We're also on Spotify now; if you're so inclined, look for ANHI's THE POWER OF NUTRITION PODCAST so you can subscribe and tell your colleagues about us.

Thanks everyone. Stay healthy and safe.