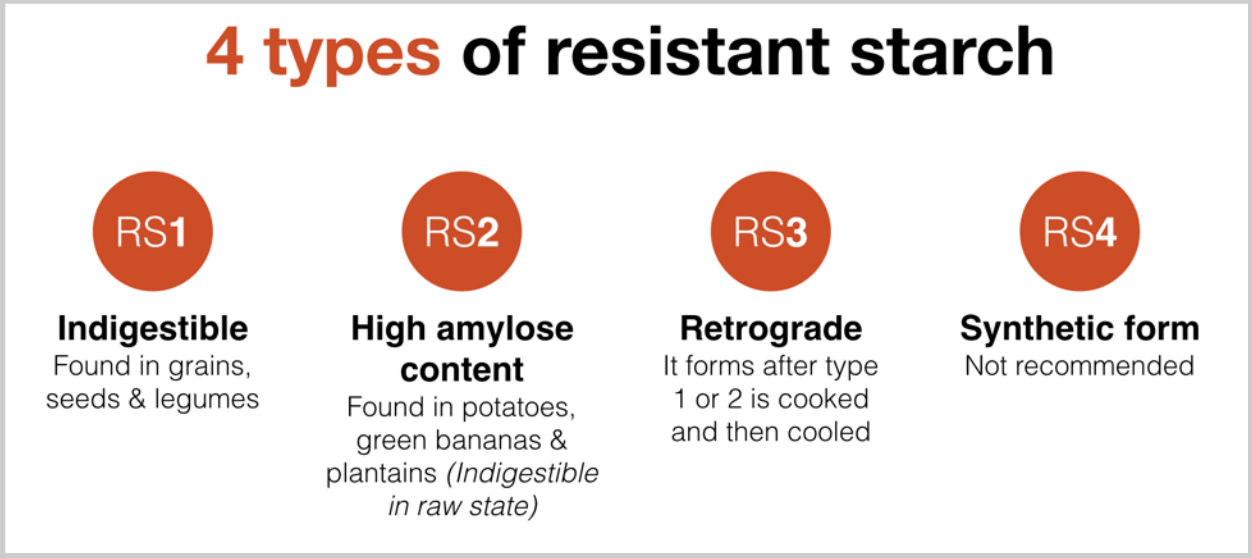
KRESSER INSTITUTE
FOR FUNCTIONAL AND EVOLUTIONARY MEDICINE

Gut: Probiotics and Prebiotics — Part 3



Finally, we have resistant starch. This is a type of starch that's not digested in the small intestine or the stomach, and it reaches the colon intact. Although it is a starch, it does not have any impact on blood sugar for this reason. It's not broken down into glucose and it doesn't hit the bloodstream, so it doesn't have any effect on blood sugar. As I said before, it's an insoluble fiber, but unlike other insoluble fibers, which generally aren't fermented much by colonic bacteria, resistant starch, or RS, is.

There are four different types of resistant starch. There's RS1, which is indigestible and found in grains, seeds, and legumes.

There's RS2, which is a starch with high amylose content; it is also indigestible in the raw state but becomes digestible when it's cooked, and this is the type that's found in potatoes, green bananas, and green plantains, so cooking these foods causes the changes in the starch that make it digestible and remove the resistant starch, which is why you hear so much discussion about eating cooked and cooled potatoes or eating dehydrated green plantains or green bananas, because if they're uncooked or they're cooked and they've been cooled, that's where the resistant starch is found.

RS3 is also called retrograde RS, since this is the type of resistant starch that forms after type one or type two resistant starch is cooked and then cooled, so we just talked about that. These cooked and cooled foods can be reheated at low temperatures less than 130 degrees and maintain the benefits of RS. So examples would include cooked and cooled parboiled rice, white rice, cooked and cooled potatoes, and cooked and cooled and properly prepared legumes like lentils. Finally,

RS4 is a synthetic form of resistant starch that I'm including for completeness but would not recommend; a common example of this would be high-maize resistant starch.

Several studies have looked at the impact of resistant starch on gut flora and health. Like other prebiotics, resistant starch selectively stimulates the growth of beneficial species like Bifidobacteria and Lactobacillus. It also increases the concentration of short-chain fatty acids like butyrate and propionate, and it's been shown to protect against colon cancer, improve metabolic health, reduce fasting blood sugar and body weight, and improve insulin sensitivity. And I've seen big changes there actually with resistant starch; I've seen reductions in fasting blood sugar of up to 10 milligrams per deciliter or more in some cases. Empirically, resistant starch can also help with sleep and mood, so patients who have insomnia, depression, anxiety, issues like that can actually improve with resistant starch, and that effect is possibly mediated via the gut-brain axis. As I mentioned a few slides back, some studies have shown that high intakes of resistant starch with no other fibers can actually decrease the diversity of beneficial bacteria species in the gut, which is definitely the opposite direction than we want to go, so resistant starch should always be part of a wider spectrum of fiber intake.

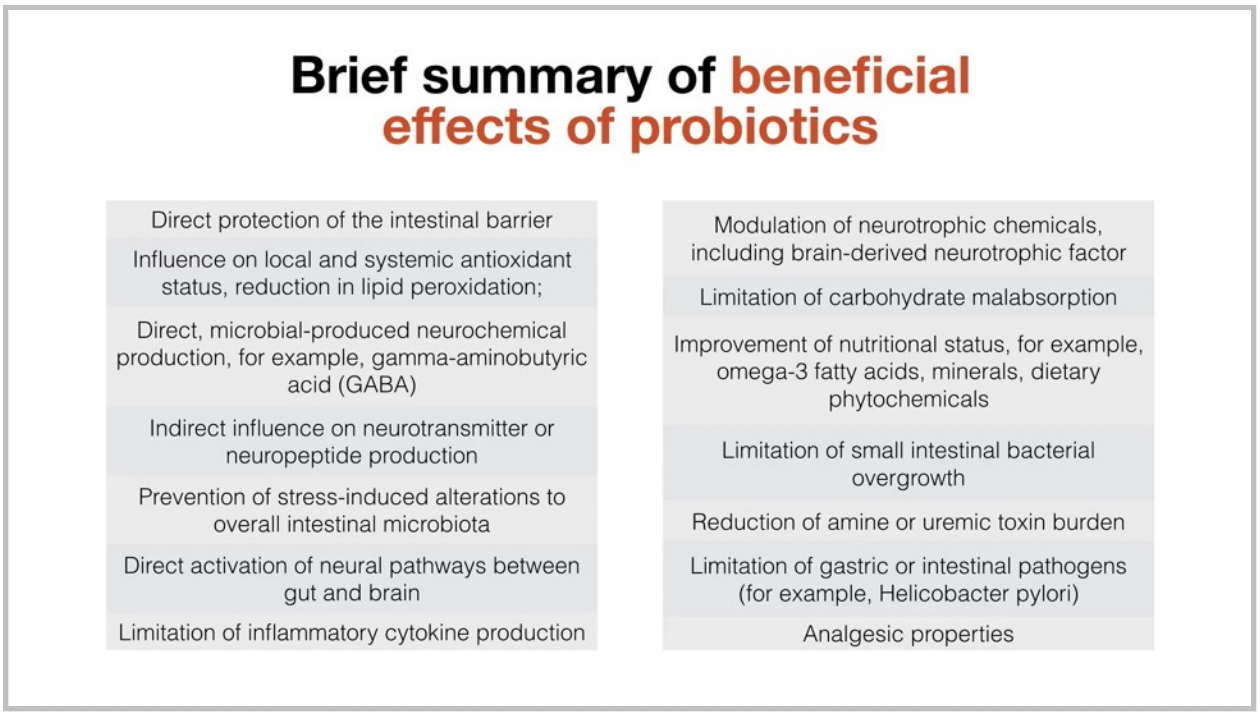
The easiest way to supplement with resistant starch above and beyond the foods that I just mentioned is gluten-free unmodified potato starch—Bob's Red Mill is a good brand—or green banana flour or green plantain flour. So you could add this to smoothies, but not soups because you don't want to cook it; that would inactivate the resistant starch. You can also eat the foods we talked about, white potatoes, white parboiled rice or lentils that have been cooked and cooled, and there is a commercial product called Prebiotic Plus with potato starch and green banana flour.

The dose of the potato starch of the commercial product, actually I'm not sure of the dose of the commercial product because I haven't used it much, but for potato starch it would be two to four tablespoons a day of potato starch or green plantain flour for a maximum therapeutic effect. However, do not start the patient there; you have to start really slowly, maybe a quarter to a half teaspoon per day, because it can produce pretty intense GI symptoms. In fact, I had a patient call the office one day, and he was basically doubled over in pain on the floor, and said that he was going to go into the hospital and thought he was having appendicitis or something like that, and it turned out to be gas pains just from the resistant starch. He had just jumped right in at two to four tablespoons a day, which is often advised online, so definitely don't advise your patient to do that; a quarter to half teaspoon per day, and the more GI symptoms they have, the more careful and cautious they need to be. In the additional resources, I'm going to provide a list of resistant starch levels in various foods, and you can consult that to determine which foods have the highest amounts.

So, I mentioned a few slides back, the biggest clinical challenge of prebiotics and fermentable fiber is that the people who are most likely to need them are also the least likely to tolerate them. The low-FODMAP diet reduces the intake of many of these fibers and has been shown to relieve symptoms, but what are the long-term consequences of the low-FODMAP diet? We already have

some studies showing that the long-term low-FODMAP diet reduces levels of beneficial bacteria in the colon. This is obviously not ideal; we may end up fixing one problem, like SIBO or IBS, and causing another, which could be increased susceptibility to a wide variety of chronic modern diseases. So our approach in the clinic is a two-stage treatment where we address the underlying pathologies that cause these gut symptoms and then we rebuild a healthy gut ecosystem. So for example, if a patient has SIBO and that's causing the fiber and FODMAP intolerance, then we treat it and slowly reintroduce the beneficial fibers over time.

All right, let's move on from prebiotics and fermentable fibers to probiotics and fermented foods. An important concept to understand is that recent studies have shown that while probiotics are beneficial, they don't work by quantitatively increasing the good gut bacteria. We talked about this before in the presentation, but I want to emphasize it here again. I think typically people have thought of probiotics as like beneficial bacteria; it's maybe like the gas tank analogy, like if you have low levels of beneficial bacteria, probiotics will kind of fill up the tank and take you from having low amounts to having high amounts. But we now know that that's not really how probiotics work. They work by transiently, meaning temporarily as long as you're taking them, tuning and regulating the immune system, promoting anti-inflammatory pathways and creating a favorable environment for beneficial bacteria. Another way to think about it is that prebiotics increase what's already there and probiotics regulate what's already there.



A comprehensive review of the effects of probiotic bacteria found in fermented foods and commercial products is beyond the scope of this presentation, but there are literally thousands of studies in the literature on this subject. It's been a hot topic for years, and in keeping with the practical focus of ADAPT, I'm going to spend most of our time on the discussion of how to use

probiotics therapeutically in practice. But for those that are less familiar with the research on probiotics, I've summarized some of the key effects that beneficial bacteria can have on this slide. I'm just going to quickly go through them to give you an idea of the scope of their effect; it goes far beyond just helping with gut symptoms like constipation and diarrhea. So they can directly protect the intestinal barrier; they influence local and systemic antioxidant status; they have direct microbial-produced neurochemical effects, for example, they can increase GABA levels; they have an indirect influence on neurotransmitter and neuropeptide production; they can prevent stress-induced changes to the overall gut flora; they can activate neural pathways between the gut and the brain, that's the gut-brain axis; they limit inflammatory cytokine production, so they're anti-inflammatory; they limit carbohydrate malabsorption so they can help with FODMAP intolerance; they can improve nutritional status, can help with omega-3 fatty acid absorption, mineral absorption, and absorption of phytochemicals; they can limit small intestinal bacterial overgrowth, so we know that from discussing probiotics in the treatment of SIBO; they can reduce amines, like histamines, certain probiotics degrade histamine; they can limit gastric or intestinal pathogens like H. pylori, we talked about how Saccharomyces boulardii is effective for the treatment of parasites and pathogens like H. pylori; and they have pain-relieving properties. So that's just a partial list, there's many more effects, but probiotics can have a pretty remarkable impact.