

**Gastrointestinal Health** Pulses contain resistant starch which, when fermented in the large intestine, produce short chain fatty acids that support colon health. Pulses act as a prebiotic, feeding the friendly bacteria in the GI tract which helps maintain healthy gut flora. More technically [31]:

"The multiple beneficial effects on human health of the short-chain fatty acid butyrate, synthesized from non-absorbed carbohydrate by colonic microbiota, are well documented. At the intestinal level, butyrate plays a regulatory role on the transepithelial fluid transport, ameliorates mucosal inflammation and oxidative status, reinforces the epithelial defense barrier, and modulates visceral sensitivity and intestinal motility. In addition, a growing number of studies have stressed the role of butyrate in the prevention and inhibition of colorectal cancer. At the extraintestinal level, butyrate exerts potentially useful effects on many conditions, including hemoglobinopathies, genetic metabolic diseases, hypercholesterolemia, insulin resistance, and ischemic stroke."

When working to promote gastrointestinal health or to treat specific gastrointestinal conditions dietary recommendations should be highly individualized based upon tolerance and nutrition assessment. The elimination of an entire food group, such as legumes, may eliminate the problematic food along with nutritious, delicious and well tolerated foods. For example, we would not want to eliminate pulses if the problem is soy. Even within the pulses, some may be better tolerated than others.



# Pulses & Gut Microbiota



## How do these microbes contribute to disease?

Beyond the 1400 pathogenic bacteria, microbes are being shown to contribute to many diseases. Current NIH- HMP research is exploring microbes and onset of diseases such as inflammatory bowel disease and diabetes. When an imbalance occurs between the types of bacteria in the gut, the health of the human host, and functioning of these cells this is called dysbiosis. This can lead to damage in the gut cells, sometimes called leaky gut, leading to inflammation and immune responses.

## Can we change the microbes in our gut?

Scientists see shifts in the predominant microbe families present in the gut when the amount of fat, fiber and calories in a diet change. These changes are typically seen within 24 hours" of a diet change. A 2013 comparative study on gut microbiota and colon cancer risk between African Americans and rural Africans concluded; "our study supports the hypothesis that colon cancer risk is determined by the interaction between diet and gut microbiota and that the higher risk in African Americans could be attributed to their chronically lower consumption of fiber and resistant starch and their higher consumption of dietary fat."

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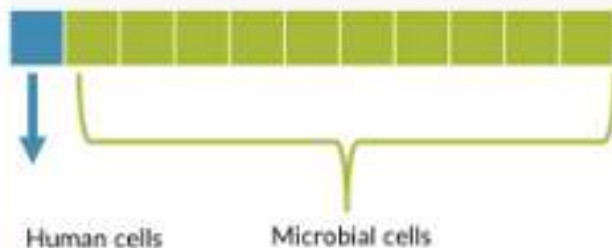
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# Pulses & Gut Microbiota

- **Microorganisms or microbes** are single-celled organisms that can live independently (an animal cell needs tissues and other organs to live) and viruses. They are so small that millions can fit in the eye of a needle.
- **Gut microbiota** is the community of microorganisms living in an individual's gastrointestinal tract, i.e. gut.

If you are germ-o-phobic you might be distressed to know that for every cell in your body you have 10 microbial cells.



Current estimates for total number of human cells is about  $3.72 \times 10^{13}$ . That means on average we have  $3.72 \times 10^{14}$  microbial cells in our body at one time! Fortunately, because they are microscopic bacteria only make up about 1-3 % of our body mass or roughly 2-6 pounds for a 200-pound person.

Microbes are a significant component of the human body. In fact some researchers consider one's gut microbiota as another organ. While we all have trillions of microbes living with us those in your gut most likely aren't the same as those of your neighbors. The type and variety of microbes present in a person's gut differs depending on genetics, geography, antibiotic use, and diet. Research programs such as the National Institute of Health's Human Microbe Project, one of several international research conglomerates studying microbiota and human health, is leading the way in studying human gut microbiota. However knowing the type of microbes in your gut does not necessarily tell you how it affects your health.

That being said, research into gut microbiota and health indicates it impacts immune system development, inflammation and inflammation related conditions such as inflammatory bowel disease, obesity, and diabetes.

## How do these microbes support our health?

- Teaches immune system as being formed how to distinguish between self from non-self invaders- implications for autoimmune diseases that confuse human cells for invaders to be destroyed
- Eats foods humans can't or don't digest - fibers, cells, mucous
- Makes helpful compounds like energy to fuel gut cells, neurotransmitters, fatty acids.
- Has the metabolic capacity of the liver to break down drugs, pollutants, toxins
- Creates signaling molecules used to communicate with human host including brain.<sup>2</sup>



## Prebiotics in Pulses

While the research is promising, there are a lot of questions for scientists to explore. Having a better understanding what type and how prebiotics such as resistant starches, impact gut microbiota and human health opens exciting opportunities for diet based preventive health interventions.

Pulse crops are nutrient dense foods with the potential, to improve the health of both human and gut microbiota

It is important to emphasize that it's not the prebiotic itself imparting health benefits, but how it is used by the gut microbiota. Of course with humans this varies from person to person. Therefore, use of prebiotics and foods containing prebiotic components is based on individual preference and health conditions.

Foods that feed and nourish beneficial bacteria are called prebiotics. The scientific definition is "selectively fermented ingredients that allow specific changes, both in the composition and/or activity in the gastrointestinal microbiota that confers benefits upon host well-being and health." In other words, gut microbes use these foods for energy, in the process creating gas and other substances such as very small fatty acids. Making gas and fatty acids is not enough though; to be a prebiotic it must benefit human health in some way. More on the health benefits, shortly. Since these prebiotics provide fuel and nutrients for microbiota it makes sense that the types of food we eat affects the types of microbes in our gut and what they can do for us.

### A few prebiotics:

**Fermentable Fiber:** inulin often extracted from chicory root, fructan found in cereals, fruits, and vegetables.

**Small carbohydrates called:** oligosaccharides such as raffinose

**Resistant Starches:** There are five types of resistant starches, ranging from uncooked green banana starch to cooked and cooled lentils.

Because the side effect of microbes using prebiotics is gas formation, slowly add prebiotic foods or products to your diet. Very slowly if using prebiotic products, e.g. powders start at 1 gram a day. Prebiotics aren't only in powders, shakes, and bars. They are naturally occurring in fruits, cereals, and vegetables including pulse crops.

*See section "Pulses Macronutrient Micronutrient Analysis" for more on fibers and resistant starches in pulses.*