A detailed illustration of a human gut microbiome. The background is a warm, golden-brown color with a soft, glowing light source in the center, creating a sense of depth. The foreground and sides are filled with numerous small, colorful, pill-shaped bacteria in shades of pink, purple, blue, and yellow. These bacteria are scattered throughout the scene, some appearing to be on the surface of the gut lining, which is depicted as a series of small, rounded, pinkish-brown protrusions. The overall composition is symmetrical and visually appealing, emphasizing the diversity and density of the gut microbiome.

GUIDE to the GUT Microbiota

Learn how foods affect your microbiome.

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INTRODUCTION



Do you have high cholesterol? Trouble losing weight? Indigestion? There's a surprising link between all of these health problems—and it lives in your gut. Your gut bacteria consist of the thousands of microbes that live in your intestines. Some promote health, while others do not. Keeping these bacteria in balance is essential for good health.

Think of yourself as a gardener and your digestive tract as a garden. Just like you want to keep weeds at bay so flowers can grow, you'll want to minimize the bad bacteria in your digestive tract so that the good bacteria can flourish. In the same way that you need the proper elements—water, sun, and nutrients—to grow a healthy garden, you need the right ingredients to cultivate healthy bacteria. Eating a healthy diet is key.

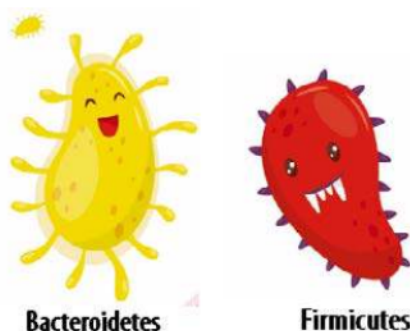
Studies show that people who eat a plant-based diet rich in fruits, vegetables, whole grains, and beans have healthier gut bacteria than people who eat a diet high in animal products. In turn, these healthful bacteria help you digest food, improve immunity, promote a healthy weight, and boost cardiovascular health.

Bad bacteria have been linked to a host of health problems, including inflammation, acid reflux, irritable bowel syndrome, obesity, atherosclerosis, diabetes, cancer, and even Alzheimer's disease.

Want to learn how to cultivate the healthy bacteria and crowd out the bad ones? Let's get started!

BALANCING YOUR GUT BACTERIA

A healthy digestive tract requires a balance of different kinds of bacteria. One type is called bacteroidetes. They are beneficial. A second type, called firmicutes, are not so beneficial. You'll want to boost bacteroidetes and have fewer firmicutes.



Your diet affects this balance. Eating mostly (or exclusively) plant-based foods builds up your healthful bacteroides population. In turn, that can help you lose weight and stay healthy. Animal-based diets tend to boost the unhelpful firmicutes population. Overweight individuals tend to have more firmicutes than bacteroidetes.²⁰

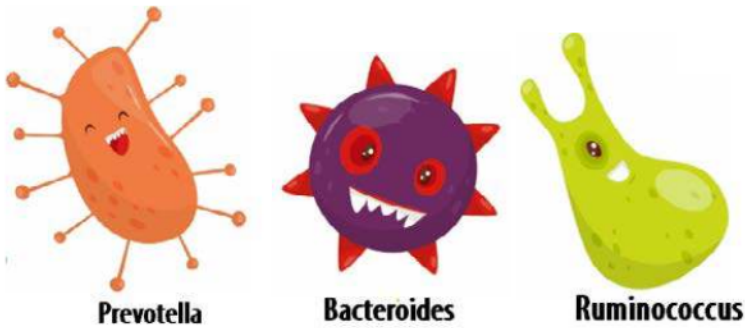
One study compared the diets of a Chinese population to an Indian population.²² The main difference was that the Chinese consumed significantly more animal products and fatty foods, while the Indians consumed more whole grains and plant-based foods. The Indians had almost four times the amount of bacteroidetes and a better bacteroidetes-to-firmicutes ratio when compared to the Chinese.

Another study compared Italian children, who ate a low-fiber Western diet high in animal products, sugar, and fat, with children living in ru-

ral Africa, who consumed a lower-fat diet rich in starch, fiber, and plant foods overall. The African children had more than double the amount of bacteroidetes and a higher bacteroidetes-to-firmicutes ratio.

BACTERIA: THE GOOD, THE BAD, AND THE MYSTERIOUS

Although we have been describing bacteroidetes as “good” and firmicutes as “bad,” there are actually different varieties within these groups that have their own personalities. One kind of bacteroidetes bacteria is called prevotella. Prevotella are the “good guys”: They help crowd out the bad bacteria and can even help reduce the inflammation that could contribute to headaches, digestive problems, rheumatoid arthritis, heart disease and stroke, type 2 diabetes, and even certain forms of cancer. Prevotella are abundant in people who eat a plant-based diet, and it’s great to have plenty of prevotella in your digestive tract.



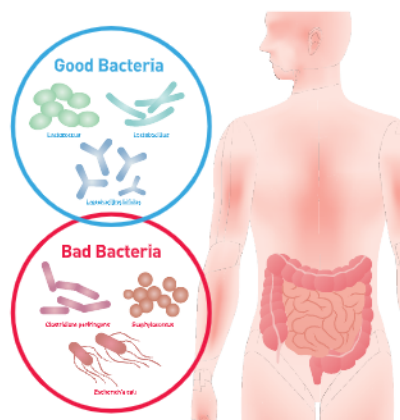
Another kind of bacteroidetes is called bacteroides. While their name is almost the same name as the overall group, bacteroides are like chameleons. They can have plenty of beneficial effects on your health, such as playing a role in weight control and strengthening your immune system. However, once in a while, bacteroides will misbehave. Based on their surroundings, they will sometimes turn into “bad guys.” When this happens, they can become pro-inflammatory and may increase the risk of heart disease, diabetes, and other health problems. Eating a meat-heavy diet is linked to higher levels of bacteroides. This may be because

bacteroides thrive in an environment that contains bile, which is common in the guts of those who consume animal products.

Within the firmicutes group—the “bad guy” group—there is a mysterious kind of bacteria called ruminococcus that actually tries to be helpful. It may promote a healthy weight and boost cardiovascular health. Additionally, ruminococcus bacteria specialize in breaking down complex carbohydrates. When they break down dietary fibers—found only in plant-based foods—they produce a compound called butyrate that can help reduce inflammation.

DIVERSITY

One of the most important indicators of a healthy microbiome is a diverse set of bacteria. Ideally, a majority of these species are “good guys” that can keep the smaller amount of “bad guys” in check. Studies suggest that a great way to boost your microbial diversity is to consume a plant-based diet.



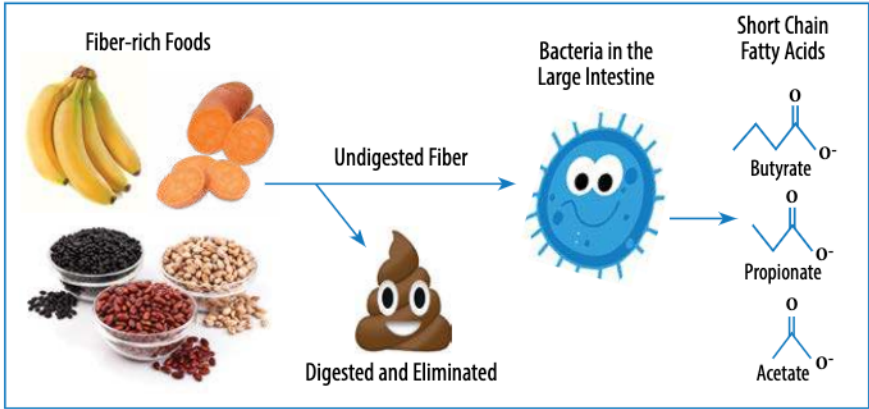
In part, this may be because a plant-based diet promotes a healthy weight. Studies have suggested that people with excess body weight tend to have less microbial diversity.⁶

A lack of diversity is linked to inflammatory diseases including rheumatoid arthritis, inflammatory bowel disease, and multiple sclerosis.⁴²

SHORT-CHAIN FATTY ACIDS

In your digestive tract, beneficial bacteria create helpful compounds called short-chain fatty acids (SCFAs). SCFAs are important for maintaining good health and preventing disease.¹² Specifically, SCFAs

improve body weight, type 2 diabetes, immunity, and inflammatory bowel disease.^{5,19}



SCFAs also support the cells that line the colon and ease the passage of waste.^{15–17} Not producing adequate levels of SCFAs can lead to inflammation in the colon, which can increase the risk of colorectal cancer.¹⁸

CARBOHYDRATES AND FIBER

Carbohydrates—found in fruits, vegetables, whole grains, and legumes—are important for fostering good bacteria. Long-term diets rich in carbohydrates increase the presence of certain healthy SCFA-producing bacteria.

These same foods also bring you healthful fiber—that is, plant roughage. Fiber is a prebiotic, which means it encourages the growth of good bacteria.² Asparagus, onions, wheat, oats, and



soybeans are just a few of the plant foods naturally high in prebiotic fiber.³ If your meals are built from beans, vegetables, fruits, and whole grains, you'll get about 40 grams of fiber per day, which is a good goal.

PROTEINS



Beans, vegetables, and grains are rich in protein, and it turns out that protein from plants, rather than animal products, is beneficial for gut bacteria. This may be because plant proteins increase good bacteria that produce SC-

FAs and decrease bad bacteria.²⁴ In contrast, animal protein can increase the bad bacteria.²⁶ Of course, if you are eating more animal protein, that probably means you are consuming less carbohydrates and less fiber—both of which are found in plants. Without carbohydrates and fiber, you may have fewer of the beneficial SCFA-producing bacteria.¹⁸

FATS

Just as different kinds of protein have different effects on your gut bacteria, the same is true of the type of fat you eat.²⁷ Studies have shown that the traces of natural fats in plants can benefit your gut bacteria, while a diet high in animal fats reduces beneficial bacteria.²⁸

This is not to say you need a lot of plant-based fats. You don't. But the traces of fats naturally in beans, vegetables, and other plant foods help nourish your good bacteria.

On the other hand, animal products typically harbor plenty of saturated ("bad") fat, which can increase quantities of unfriendly firmicutes.^{23,29,30} Trans fats, which are abundant in fast food and processed food, may produce similarly unhelpful effects in the gut.^{23,29}

POLYPHENOLS AND VITAMINS

Polyphenols—most commonly found in fruits, vegetables, seeds, cocoa, and tea—are antioxidants that protect against



cardiovascular disease, inflammation, and pathogens.³¹ Polyphenols also have positive effects on body weight and digestion.^{19,28,32} Some of these benefits may occur because polyphenols positively affect gut bacteria. Polyphenols stimulate the growth of beneficial SCFA-producing bacteria.

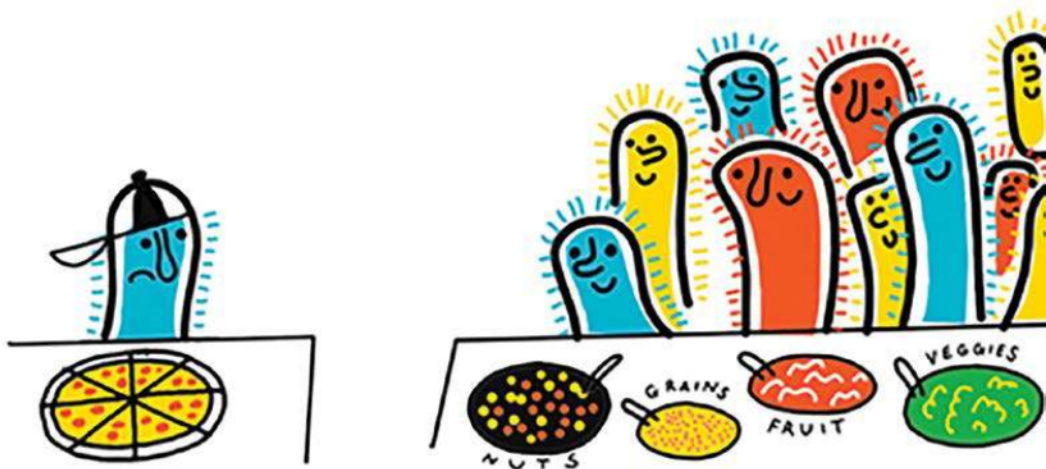
Not only does a healthful diet foster healthful bacteria; it works the other way, too. Healthful bacteria can produce compounds that promote good health. We saw that with the bacteria that produce SCFAs. In addition, good bacteria make B vitamins and vitamin K.^{39–41} A plant-based diet appears to be best at helping these bacteria grow.

TRIMETHYLAMINE N-OXIDE (TMAO)



Animal products such as cheese, fish, eggs, and meat are high in the compounds L-carnitine and choline. The bacteria in the gut convert these compounds to trimethylamine (TMA). Afterward, TMA is converted into trimethylamine n-oxide (TMAO) by the liver.⁴⁵ This is problematic, because TMAO narrows the arteries, increasing your risk of heart attack, stroke, and death.^{45,46} A diet rich in animal products has been linked to higher TMAO levels.^{1,49,50}

Plant-based foods have the opposite effect. They tend to inhibit the growth of bacteria that produce TMAO, resulting in lower TMAO levels.¹



CONCLUSION

A plant-based diet is a powerful way to promote a healthy digestive tract that, in turn, can boost heart health, reduce inflammation, improve immunity, help control your weight, and more. Get started today with these healthful recipes!

<https://www.pcrm.org/good-nutrition/plant-based-diets/recipes/enchanted-smoothie-bowl>

<https://www.pcrm.org/good-nutrition/plant-based-diets/recipes/yes-you-can-black-bean-chili>

<https://www.pcrm.org/good-nutrition/plant-based-diets/recipes/banana-bread>

<https://www.pcrm.org/good-nutrition/plant-based-diets/recipes/broccoli-burritos>

FUN FACTS



- We have 30,000,000,000,000 (that's trillion!) microbes in our bodies, and many of them live in the digestive tract!⁴⁸

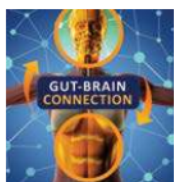
• We are more bacteria than human. Our bodies hold 3.3 million microbial genes in the gut, while we only have 21,000 genes in our DNA. That's 150 times more!⁴⁹



- Our human genomes are about 99.9 percent identical, while our gut microbiomes can be up to 80-90 percent different.⁵⁰

- There are more than 1,000 gut microbial species.⁵³

- Changing our dietary habits can change the composition of our microbiome within one week!^{25,51}



- Research suggests that the microbiome plays a role in brain health, the immune system, autoimmune diseases (e.g., allergies, inflammatory bowel disease, and type 1 diabetes), and more.⁵²

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