



The Care and Feeding of the Human Gut Microbiome

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Introduction: Say Hello to Your Little Friends!

Whether you're a termite, a cow, a panda, or perhaps a human, none of us can digest the chemical bonds in insoluble dietary fiber. Instead, we rely on the trillions of organisms living inside of us. The fiber in our diets is food for our gut microbes and those microbes are critical to our health. We're gonna tell you how to keep your multitude of passengers alive and thriving so that they can help you do the same.

Keep Them Healthy. Keep Them Fed.

When a diet is low in fiber, [like it is for 90+% of the US¹](#), it is like a famine for our gut microbes. In general, there are two kinds of fiber: soluble and insoluble. Soluble fiber dissolves easily in water (or turns into a gel), whereas insoluble fiber can be suspended in water but will not fully dissolve.

[The soluble kind mostly feeds microbes²](#) and the insoluble kind mostly helps you poop by keeping your stool solid. There's a little more to it than that, but that's the main distinction between types of fiber you can have in your diet. The take-away here is that you want a good amount of both.

When microbial populations are starved, they become smaller and less diverse. They're also less active, which means we get fewer of their byproducts, which are what our systems crave. [Some of the most important bacterial byproducts are short-chain fatty acids such as butyrate, propionate, and acetate³](#). All of these are important building blocks of larger molecules (hence "short-chain"), but butyrate is particularly important and will be a focal point of this document.

Butyrate in Particular is Important Because

a) Butyrate is the energy source for colonocyte cells that line the lower intestine. If your colonocytes are under-nourished, this can lead to leaky gut and be a root cause for things like IBD/IBS and Crohn's. [Increased butyrate can help alleviate these syndromes⁴](#).

b) Butyrate is a glucose metabolism regulator. It increases the concentration of GLP-1 (yes, the Ozempic/Wegovy thing) in the body and increases insulin sensitivity. [Supplementing your diet with fiber and butyrate can help with type 2 diabetes and glycemic control⁵](#).

¹ <https://pmc.ncbi.nlm.nih.gov/articles/PMC6124841/>

² <https://pmc.ncbi.nlm.nih.gov/articles/PMC8624670/>

³ <https://doi.org/10.1007/s11033-020-05611-3>

⁴ <https://doi.org/10.3389/fnut.2021.672390>

⁵ <https://doi.org/10.3390/microorganisms10122507>



c) Butyrate is a neurotransmitter and a precursor for serotonin. This is a major reason that fiber can help with cognitive and neurological health, including issues like [depression](#)⁶ as well as [anxiety](#)⁷ and [sleep disorders](#)⁸.

Getting Enough Fiber

OK, so the little terrarium that is your gut wants some food from time to time, but how much?

[Most people should seek to consume 30 grams of insoluble fiber per day](#)⁹ — but don't start at that amount! Some people feel improvements at 25g per day and most can go up to 35g per day with no issues. If you're currently eating a low-fiber diet, you WILL want to ramp up slowly over a few weeks. Rapidly increasing fiber intake can lead to bloating. We cannot emphasize enough how unpleasant it will be if you jump suddenly from a low-fiber diet to a high-fiber diet. Like, *aggressively shit yourself* unpleasant. TAKE IT SLOW. That said, gradually-increased fiber can have effects on the microbiome [in as little as 24 hours following dietary changes](#)¹⁰. It may take 2-4 weeks for production of short-chain fatty acids to ramp up, so be patient if you don't immediately notice the benefits.

Butyrate Supplements

Supplementing butyrate [may be helpful for certain conditions](#)¹¹, but we haven't found strong evidence that it promotes general health the way endogenous butyrate made by your intestinal passengers does. Supplements are also more expensive than fiber and you're better off getting butyrate from a healthy gut ecosystem. Because of all this we don't recommend supplements as part of a general health regimen.

How to Keep Your Passengers from Going Hungry

The ideal solution for improved gut health is [a varied diet rich in dietary fiber, resistant starches, and fermented products](#)¹². That said, there are a few simple tricks to upping your fiber and keeping all the little friends in your guts well-fed and flourishing. We'll talk about these hacks first, then get into some easy dietary and cooking habits that can help.

⁶ <https://doi.org/10.15698/mic2019.10.693>

⁷ <https://onlinelibrary.wiley.com/doi/abs/10.1002/jnr.24476>

⁸ <https://www.mdpi.com/2072-6643/16/14/2259>

⁹ https://www.accessdata.fda.gov/scripts/interactivenutritionfactslabel/assets/InteractiveNFL_DietaryFiber_October2021.pdf

¹⁰ <https://doi.org/10.1016/j.chom.2018.05.012>

¹¹ <https://pmc.ncbi.nlm.nih.gov/articles/PMC11245831>

¹² <https://doi.org/10.1038/s41385-022-00564-1>



Fiber Hacks

Keto-Friendly products

One "cheat code" for getting more fiber is using certain "keto-friendly" products instead of regular baked goods. Because ketogenic diets are typically low in dietary fiber, many products designed to be keto-friendly are supplemented with additional fiber. For example: a slice of "keto-friendly" bread may contain as much as 7 grams of fiber. This means a single sandwich can get you halfway to the 30 grams per day recommended earlier. Be sure to check the nutrition labels to be sure the product contains added fiber. Please note that we do not recommend ketogenic diets generally as it involves starving your brain of essential nutrients.

Fried Rice and Rice Pudding

Look for foods that use starches that have been cooked and cooled. Common examples include porridge, leftover potatoes, and fried rice. That's right! Fried rice and potatoes are healthy now! In moderation at least. Enjoy!

Other "Low-carb" Products

In addition to keto-friendly products, flours like carbalose can be used in baked goods. [These pack as much as 14 grams of insoluble fiber in 1/3 of a cup¹³](#)!

Just Add Resistant Starches and Insoluble Fiber

Four tablespoons of raw potato starch can provide up to 32 grams of resistant starch (we'll explain more about what that means soon). You can add starches and fibers to other foods and drinks, like adding fiber your morning coffee or protein shake. This may change the texture depending on your fiber, but inulin is an example of a soluble fiber that dissolves readily in water. Start slowly (!!!) and ramp up over a couple weeks as rapidly increasing fiber like this can cause flatulence, discomfort, and gnarly pooping. Don't bother taking much more than the recommended 35 grams — once you pass roughly 50 grams, the excess passes through undigested. Other commonly available sources of dietary fiber include inulin fiber and psyllium husks.

Adding Resistant Starches to Your Diet

Resistant starches are starch granules that the human body does not digest on its own — they "resist" digestion in the small intestine. Instead, [these particles¹⁴](#) pass through the intestines and [are metabolized by your microbiome¹⁵](#). There are a few ways to get em — one weird trick is cooking extra rice or potatoes and eating them as leftovers.

¹³ <https://www.tovaindustries.com/carbalose/nutrition.html>

¹⁴ <https://hopkinsdiabetesinfo.org/what-is-resistant-starch>

¹⁵ <https://www.healthline.com/nutrition/resistant-starch-101>

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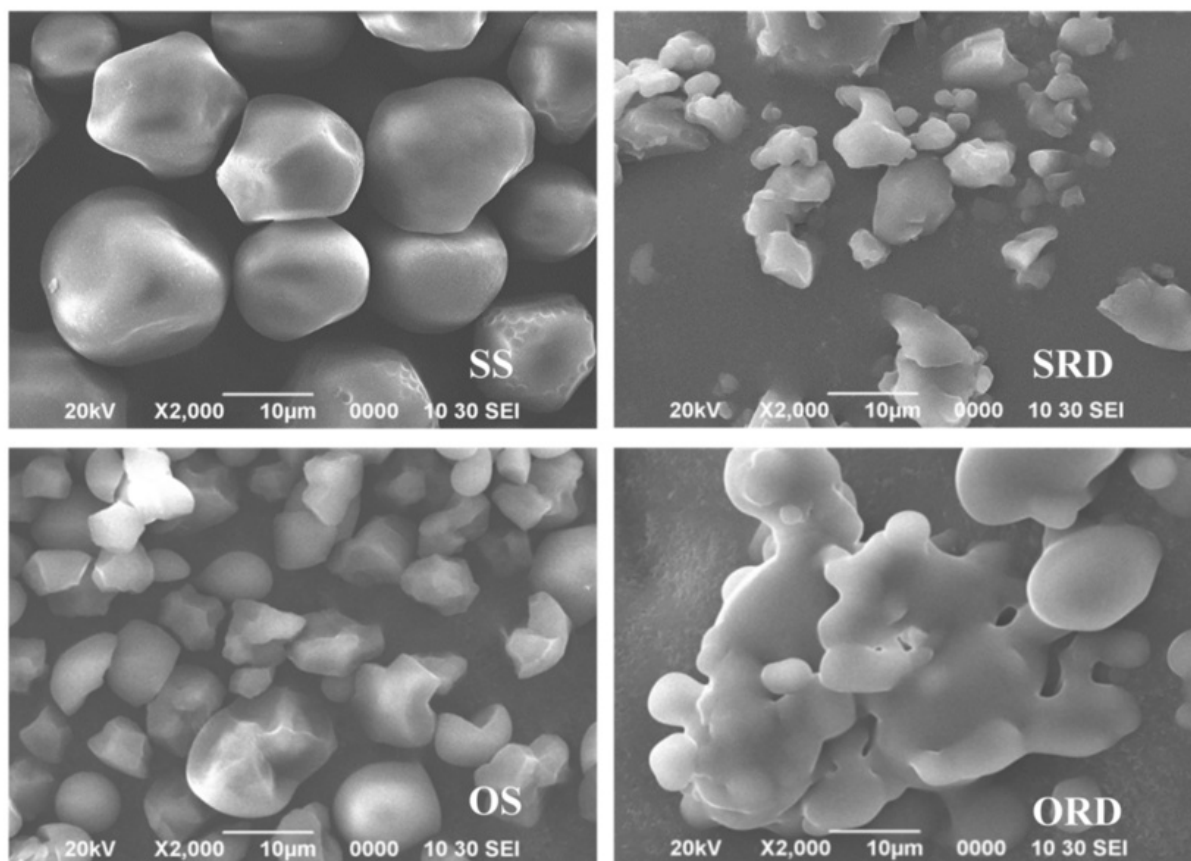


Figure 1: [Microscopy of resistant starch molecules](https://www.researchgate.net/figure/Scanning-electron-microscopy-2000-of-sorghum-oat-starch-and-sorghum-oat-resistant_fig1_361542154)¹⁶.

Here Are Some Easy Ways to Add Resistant Starch to Your Diet

- a) Cook foods like rice, potatoes, beans, and pasta in advance and allow them to cool in the refrigerator overnight. Reheating these foods the next day only slightly reduces the resistant starch content.
- b) Instead of cooked oatmeal, try soaking uncooked oats in yogurt, milk, or non-dairy milks overnight in the refrigerator. This is known as "overnight oats" and it maintains the resistant starch naturally present in the oats.
- c) Add pre-cooked lentils to a salad or soup.
- d) Add a small amount (1 - 2 tsp) of green banana flour, plantain flour, cassava flour, or potato starch to a meal or protein shake. Note that baking or cooking these flours will break down the resistant starches.

¹⁶ https://www.researchgate.net/figure/Scanning-electron-microscopy-2000-of-sorghum-oat-starch-and-sorghum-oat-resistant_fig1_361542154



High-Fiber Foods

Most plant foods have at least a little fiber. Check out the list below for a breakdown of what to eat so that your microbes also get to eat.

Fruits	Serving Size	Total fiber (grams) *
Raspberries	1 cup	8.0
Pear	1 medium	5.5
Apple, with skin	1 medium	4.5
Banana	1 medium	3.0
Orange	1 medium	3.0
Strawberries	1 cup	3.0

Vegetables	Serving size	Total fiber (grams)
Green peas, boiled	1 cup	9.0
Broccoli, boiled	1 cup chopped	5.0
Turnip greens, boiled	1 cup	5.0
Brussels sprouts, boiled	1 cup	4.0
Potato, with skin, baked	1 medium	4.0
Sweet corn, boiled	1 cup	3.5
Cauliflower, raw	1 cup chopped	2.0
Carrot, raw	1 medium	1.5

Grains	Serving size	Total fiber (grams)
Spaghetti, whole-wheat, cooked	1 cup	6.0
Barley, pearled, cooked	1 cup	6.0
Bran flakes	3/4 cup	5.5
Quinoa, cooked	1 cup	5.0
Oat bran muffin	1 medium	5.0
Oatmeal, instant, cooked	1 cup	5.0
Popcorn, air-popped	3 cups	3.5
Brown rice, cooked	1 cup	3.5
Bread, whole-wheat	1 slice	2.0
Bread, rye	1 slice	2.0





Legumes, nuts, and seeds	Serving size	Total fiber (grams)
Split peas, boiled	1 cup	16.0
Lentils, boiled	1 cup	15.5
Black beans, boiled	1 cup	15.0
Baked beans, canned	1 cup	10.0
Chia seeds	1 ounce	10.0
Almonds	1 ounce (23 nuts)	3.5
Pistachios	1 ounce (49 nuts)	3.0
Sunflower kernels	1 ounce	3.0

* Rounded to nearest 0.5 gram.

Source: [USDA National Nutrient Database for Standard Reference, Legacy Release](#)¹⁷
[An even longer list is available here](#)¹⁸.

For Those with Limited Diets

Some people have dietary limitations like allergies, limited food availability, or ethical or religious restrictions on what they eat. If this is you, pay extra attention to these fiber hacks. A balanced diet is the best thing for your gut microbiome, but fiber supplements and added resistant starches can help supplement a limited diet.

If you have a limited diet, you may also want to supplement with a multi-vitamin. Just like you, the bacteria need a variety of vitamins and minerals to do their thing. Deficiencies in any essential nutrient can limit the flourishing of your gut microbiome.

Increasing Biodiversity with Probiotics and Naturally Fermented Foods

You can [increase the diversity of your gut microbiome](#)¹⁹ by [eating certain kinds of fermented foods](#)²⁰. The key here is to look for foods that were "naturally fermented" or made with "wild fermentation" or "raw fermented". Read labels carefully to see if they mention live cultures. If they do, this means they were made with live bacterial probiotics. Lacto-fermentation is also a bacterial process. This differs from foods like pickles made with vinegar which will not do anything to improve your gut's biodiversity. As a DIY organization, we should mention that this is something with huge

¹⁷ <https://doi.org/10.15482/USDA.ADC/1529216>

¹⁸ <https://www.dietaryguidelines.gov/resources/2020-2025-dietary-guidelines-online-materials/food-sources-select-nutrients/food-sources-fiber>

¹⁹ <https://med.stanford.edu/news/all-news/2021/07/fermented-food-diet-increases-microbiome-diversity-lowers-inflammation>

²⁰ <https://doi.org/10.1016/j.cell.2021.06.019>



DIY potential. The book "[Preserving Food without Freezing or Canning](https://www.goodreads.com/book/show/823761.Preserving_Food_Without_Freezing_or_Canning)"²¹ is a great place to start. We'll explain more about **probiotics** and **prebiotics** soon.

A healthy gut microbiome is extremely welcoming to new friends, so even a small amount of [foods like condiments can alter the balance of organisms in your gut](https://doi.org/10.3390/nu14071527)²².

Examples of Probiotic and Prebiotic Foods

Probiotics contain live (or dormant) microbes. **Prebiotics** are the things in food that help those microbes thrive. Together, they can help you rebuild your gut ecology. As food they are usually cultured or fermented, and they come in a huge variety from all over the world. Here are few of the most common to get you started:

a) Pickled vegetables (cucumbers/carrots/artichokes/etc) can be found in foods like kimchi, poi, and sauerkraut. As we said before, [you can also ferment your own foods](https://nchfp.uga.edu/how/ferment/general-information-on-fermenting/general-information-on-fermenting)²³.

b) [Cocoa phytochemicals have a number of beneficial microbiome interactions](https://pmc.ncbi.nlm.nih.gov/articles/PMC7400387)²⁴.

c) Fermented foods like miso, tempeh, and natto are all probiotic (unless cooked).

d) Yogurts and other fermented products like kefir, lassi, sour cream, buttermilk, and crème fraîche contain a variety of healthy bacteria. This is another thing you can DIY. There are great resources out there, including "[Artisan Cheese Making at Home](https://cheesemaking.com/products/artisan-cheese-making-at-home)"²⁵.

e) Cheese (except "fresh cheese") is a fermented product.

f) Breads made with live cultures ([think sourdough](https://onlinelibrary.wiley.com/doi/abs/10.1111/jfpp.13883)²⁶) have prebiotic properties.

g) Condiments like fish sauce, shrimp paste, gochujang (korean red chili paste), soy sauce, Worcestershire sauce, and "live" vinegars are all probiotic as well. If you're buying from store, look for mentions of "live cultures" on the packaging. You can also, as we continue to remind you, make your own.

Jumpstart Your Microbiome with Probiotic and Prebiotic Products

There are many products available that can help [increase the diversity of the human gut](https://www.nccih.nih.gov/health/probiotics-what-you-need-to-know)²⁷. Just about any probiotic will do the trick, but look for those with the widest variety of bacterial strains and the ones that are kept refrigerated in the store. For

²¹ https://www.goodreads.com/book/show/823761.Preserving_Food_Without_Freezing_or_Canning

²² <https://doi.org/10.3390/nu14071527>

²³ <https://nchfp.uga.edu/how/ferment/general-information-on-fermenting/general-information-on-fermenting>

²⁴ <https://pmc.ncbi.nlm.nih.gov/articles/PMC7400387>

²⁵ <https://cheesemaking.com/products/artisan-cheese-making-at-home>

²⁶ <https://onlinelibrary.wiley.com/doi/abs/10.1111/jfpp.13883>

²⁷ <https://www.nccih.nih.gov/health/probiotics-what-you-need-to-know>



example, [this probiotic includes 16 species of bacteria](https://www.swansonvitamins.com/p/swanson-probiotics-dr-stephen-langers-ultimate-16-strain-probiotic-fos-3-2-billon-cfu-60-veg-drcaps)²⁸. You only need to take the probiotics once as long as you keep them fed with fiber and resistant starches.

Keep in mind that many prebiotic+probiotic capsules do not contain enough fiber on their own. If you go this route, be sure you are getting enough fiber to support the new populations you are introducing.

Health for the Long Haul

The tiny population of your body is essential to your health. A robust and diverse microbiome literally keeps us healthy from head to tail by promoting increased brain and intestinal activity. So try ramping up to a diet rich in fiber and resistant starches coupled with a diverse intake of probiotic foods. Take care of your little friends and they'll take care of you.

Just remember:

1. Introduce new friends with probiotic foods and supplements
2. Keep them fed with fiber and resistant starches
3. Give them treats like vitamins and phenols in cacao and dark chocolate
4. Keep each other healthy
5. Keep each other safe



²⁸ <https://www.swansonvitamins.com/p/swanson-probiotics-dr-stephen-langers-ultimate-16-strain-probiotic-fos-3-2-billon-cfu-60-veg-drcaps>



Appendix A: FAQ

Some questions you might be asking:

Q: Aren't bacteria gross and bad for you? Why would I want them in me?

A: Pathogenic bacteria (the ones that make you sick) in the wrong place can cause sickness and infections, which are generally considered bad. That said, bacteria are basically everywhere and they do a lot of important stuff for life on this planet. There's a whole tiny ecosystem out there doing the heavy lifting from the soil in a farmer's field to the lining of our own intestines. Without these little friends, everything would be well and truly fucked.

Q: Can I get beneficial microbes from eating dirt? What about eating pussy? What about licking doorknobs?

A: We were not able to find any studies on the probiotic effects of licking non-food items. Licking them for entertainment may have psychological benefits for you, but for building your biome, we recommend you stick to the fermented foods and probiotic supplements mentioned above.

Q: Does this mean I should starchmaxx? Can I live off of kimchi alone? Should I become an only-chocolate-and-potatoes health influencer?

A: The guidance in this document is intended to be a guide for *one aspect* of your diet. You (and your microbes!) still need all the other vitamins and essential nutrients.

Q: Can I get fiber from eating cardboard? What about grass? Weed stems? Old polyester fabric?

A: Just because something is fibrous does not mean it contains dietary fiber. Usually, it has to be food to count. You can look up values on nutrition labels or online resources to get fiber content (although they don't always break down soluble vs insoluble fiber).

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