

# What Lives in Your Gut?

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## STORY AT-A-GLANCE

- › Your gut is home to bacteria, viruses, fungi, archaea and eukarya; bacteria make up the vast majority of microbes in your microbiome
- › While your highly acidic stomach may host only about 1,000 colony-forming units (CFU) of bacteria per milliliter (mL), your large intestine is home to up to 1 trillion CFU/mL
- › Bacteroides are the dominant microbe in your large intestine; the composition of these microbes, and those elsewhere in your gut, are linked to health conditions like obesity, depression, Alzheimer's disease and inflammation
- › Your age, health status, diet and environment all influence the numbers and diversity of microorganisms in your gut
- › A healthy gut microbiome depends on the consumption of whole, fermented foods and the avoidance of unnecessary antibiotics and other environmental assaults; spore-based probiotics are one option to help

The human gut is finally receiving the respect it deserves – and so are its trillions of inhabitants.<sup>1</sup> You are, at your core, a microbial being,<sup>2</sup> and while microorganisms are found everywhere from your skin to your mouth and even your blood,<sup>3</sup> it's your large intestine where your body's largest bacterial ecosystem resides.<sup>4</sup>

If you treat it and the rest of your microbiome well, good health – both mental and physical – is likely to result. By nourishing this complex microbial community, you can

even influence your gut-brain axis, which regulates digestion, mood, immune function and much more.<sup>5</sup>

## **The Number of Microbes Living in Your Gut Is Staggering**

Your gut is home to bacteria, viruses, fungi, archaea and eukarya. The latter two resemble bacteria but are distinct groups of microorganisms. Bacteria, meanwhile, make up the vast majority of microbes in your microbiome. Three main phyla or groups of gut microbes make up the human microbiome and serve diverse structural, protective and metabolic functions:<sup>6</sup>

- **Bacteroidetes** – Porphyromonas, Prevotella and Bacteroides
- **Firmicutes** – Ruminococcus, Clostridium, Lactobacillus and Eubacteria
- **Actinobacteria** – Bifidobacteria (the most prevalent type)

Broken down, the average person may host the following quantities of bacteria in different body regions.<sup>7</sup> Remember that this is just an average – your age, health status, diet and environment all influence the numbers and diversity of microorganisms in your gut.<sup>8</sup>

### **Mouth – 100,000 colony-forming units (CFU) per milliliter (mL)**

The digestion process begins in your mouth when you chew your food, making it easier to break down in your gut. Your mouth contains an impressive number of microbes to maintain oral health but if they become out of balance, disease may result.

For instance, the bacteria in your mouth are thought to play a role in blood pressure via nitric oxide (NO), a soluble gas stored in the lining of your blood vessels, called the endothelium. However, antiseptic compounds in mouthwash may destroy beneficial oral bacteria that are important for maintaining blood pressure, thereby contributing to high blood pressure levels.

In one study, the use of the mouthwash twice daily was associated with a significant increase in systolic blood pressure after one week, while once the mouthwash was stopped, "recovery from use resulted in an enrichment in nitrate-reducing bacteria on the tongue."<sup>9</sup>

Differences in more than 10 species of bacteria living on the tongue were noted after mouthwash use, including lower microbial diversity after one week of use.<sup>10</sup> As noted in a *Frontiers in Bioscience* review, nourishing and protecting your oral microbiome may reduce your risk of multiple diseases:<sup>11</sup>

*"Recent studies show that one approach to reducing the risk of chronic infections, such as caries, gingivitis, periodontitis, and halitosis, is to control the ecology of the oral microbiome instead of completely removing both the harmful and beneficial microorganisms.*

*This is based on the knowledge that oral diseases are not caused by a single pathogen but rather by a shift in the homeostasis of the entire microbiota, a process known as dysbiosis."*

Pseudomonadota, which are present in higher concentrations in the mouth than in the gut,<sup>12</sup> also play an important role in producing short-chain fatty acids and boosting the growth of beneficial gut microbes.<sup>13</sup> Fusobacteriota represent another prominent type of microbes in the body. While they can help stimulate inflammatory responses to fight pathogens, they may also drive inflammation and are linked to periodontal disease.<sup>14</sup>

## **Esophagus – 10 Million CFU/mL**

Firmicutes tend to be particularly abundant in the esophagus. While relatively low in numbers compared to elsewhere in the gastrointestinal tract, Firmicutes are useful for helping to break down sugars and carbohydrates from the foods you eat.<sup>15</sup>

Interestingly, Firmicutes, which are centrally involved in glucose and insulin metabolism, belong to the phylum most adversely affected by the artificial sweetener sucralose.<sup>16</sup>

Animal studies suggest the sucralose-altered gut microbiome could be involved in inflammation of the gut and liver, as well as cancer.<sup>17</sup>

## **Stomach – 1,000 CFU/mL**

Your stomach's low pH levels limit the growth of microbes. But even in this high-acid environment, some microorganisms survive. Actinomycetota tend to be the dominant microbes in the stomach, along with Streptococcus, Staphylococcus, Peptostreptococcus and Lactobacillus.

Lactobacillus has been dubbed a "psychobiotic"<sup>18</sup> because of its effects on mental health, particularly anxiety and depression. Lactobacillus bacteria – found in many fermented foods – helps dampen stress responses and prevent depression and anxiety, in part, by modulating your immune system.<sup>19</sup>

## **Small Intestine – 1,000 CFU/mL to 100 Million CFU/mL**

The concentration of microbes in the small intestine gradually increases, starting with 1,000 CFU/mL in the duodenum – the first part of the small intestine – and rising to 100,000 CFU/mL in the second part, known as the jejunum. In the third part, the ileum, there are about 100 million CFU/mL.

Firmicutes are abundant in the small intestine, but actinomycetota, which help break down complex carbohydrates and produce vitamins B12 and K2, are another dominant species. They also help protect against pathogens.<sup>20</sup>

Bacteroides are also found in the small intestine. They also play a role in breaking down complex carbohydrates and producing vitamins, as well as helping to regulate the immune system.<sup>21</sup>

## **Large Intestine – Up to 1 Trillion CFU/mL**

Bacteroides are the dominant microbe in your large intestine, the area of your body with the highest concentration of bacteria. Bifidobacteria are also present. The composition of these microbes, and those elsewhere in your gut, are linked to health conditions like obesity and inflammation.

As noted in a review published in *Nutrients*, obese individuals tend to have higher proportions of Firmicutes and Lactobacillus and lower proportion of Bacteroidetes and Bifidobacterium compared to normal weight individuals.<sup>22</sup>

Studies have also linked specific strains to specific health problems. For example, high levels of *Bacteroides vulgatus*, which is abundant in the human gut, appear strongly associated with inflammation, insulin resistance and altered metabolism. Low levels of certain bacteria in the Firmicutes phylum, including *Blautia* and *Faecalibacterium*, have been linked to the accumulation of trunk-fat specifically.<sup>23</sup>

## Your Gut-Brain Axis Is an Information Highway

Gut microbes' effects don't only apply to your gastrointestinal tract. They interact with your central nervous system via the microbiota-gut-brain axis, a two-way information highway that involves neural, immune, endocrine and metabolic pathways.<sup>24</sup> By promoting proinflammatory cytokines, bacteria may also play a role in damaging the integrity of the microbiota-gut-brain axis and the blood-brain barrier.<sup>25</sup>

There are also 10 gut microbiota genera with a significant link to Alzheimer's. Six are negatively associated with Alzheimer's, meaning they're less common in people with Alzheimer's than in those without the disease and may therefore have a protective effect.

The remaining four are positively associated with Alzheimer's, meaning they're more abundant in those with Alzheimer's disease, making them a risk factor for the condition. Specifically:<sup>26</sup>

- Bacteria protective against Alzheimer's include Firmicutes phylum (*Eubacterium nodatum* group, *Eisenbergiella* and *Eubacterium fissicatena* group) as well as from

Actinobacteria (Adlercreutzia, Gordonibacter) and Bacteroidetes (Prevotella 9)

- Bacteria associated with Alzheimer's include Firmicutes (Lachnospira and Veillonella), Actinobacteria (Collinsella) and Bacteroidetes (Bacteroides)

## What's Hurting Your Microbial Health?

Researchers are only beginning to tap the surface when it comes to unveiling the complex relationship microbes have with human health and disease. But it's known that microbial diversity in your gut is a good thing, while decreased diversity in the gut microbiome has been linked to chronic conditions such as obesity and Type 2 diabetes.

In general, gut microbial diversity decreases with age,<sup>27</sup> but even younger people are being affected. The overuse of antibiotics, elective C-sections and processed foods have been described as primary factors "driving the destruction of our inner ecology."<sup>28</sup> C-section delivery is associated with an increased risk of immune system and metabolic disorders, possibly due to altered microbes.<sup>29</sup>

Dramatic increases in chronic diseases, including Type 1 diabetes, asthma, obesity, gastroesophageal reflux disease and inflammatory bowel disease, are also linked to the loss of bacterial diversity in our guts — caused by the overuse of antibiotics.<sup>30</sup>

Consumption of whole foods, meanwhile, is linked to higher gut microbiota diversity,<sup>31</sup> as is consuming herbs and spices, for instance.<sup>32</sup>

But processed foods, which are devoid of fiber needed to feed a healthy microbiome, contain chemicals such as the herbicide glyphosate that also disrupt microbes.<sup>33</sup> From EMFs and air pollution<sup>34</sup> to antibacterial soap, your microbiome is under constant assault from the world around you.

## How to Optimize Your Gut Microbiome

Avoiding antibiotics, including those found in conventionally raised meat, is key to keeping your microbiome health intact. Ultraprocessed foods, artificial sweeteners,

chlorinated and fluoridated water, elective C-sections and antibacterial products are other culprits that can worsen your microbial health.

A healthy gut microbiome depends on the consumption of fermented foods. A study assigned 36 adults to consume a diet high in fermented foods or high-fiber foods for 10 weeks. Those consuming fermented foods had an increase in microbiome diversity as well as decreases in markers of inflammation.<sup>35</sup>

If you do take antibiotics or are looking for another supportive measure for gut health, consider **spore-based probiotics, or sporebiotics**. These are part of a group of derivatives of the Bacillus microbe and have been shown to dramatically increase your immune tolerance.

Spore-based probiotics do not contain any live Bacillus strains, only its spores – the cell wall or protective shell around the DNA and the working mechanism of that DNA. As such, they are not affected by antibiotics and may be able to reestablish your gut microbiome more effectively when taken in conjunction with the antibiotic.

In your gut, the Bacillus species also convert sugar into vitamin C, a nutrient well-known for its anti-infectious effects and, according to Dr. Dietrich Klinghardt, a long-time mentor of mine, sporebiotics also massively increase reproduction of acidophilus, bifidus and other beneficial microbes in your gut via the electromagnetic messages they send out.

This is entirely unique. When you take a regular probiotic, they primarily take care of themselves. Bacillus spores, on the other hand, enhance many other beneficial microbes. Bacillus spores also create 24 different substances that have strong antimicrobial properties. But they do not kill indiscriminately the way antibiotics do. As noted by Klinghardt:

*"Seeding the gut with things that make it stronger, more resilient towards the offenses we present to it is a huge key to our time. We need to live through this insane time, and we need to use all the tools that give us more resilience, which is for me like a holy war."*

*Resilience means immune tolerance – tolerating the stresses of our time, and any tool that does it, that is healthy, that doesn't have side effects, is important to have in our tool chest. [Sporebiotics] is one of the major ones."*

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