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The Differences Between Prebiotics, Probiotics, and Postbiotics

Analysis by Dr. Joseph Mercola | May 16, 2026

STORY AT-A-GLANCE

- The relationship between prebiotics, probiotics, and postbiotics is symbiotic, meaning they work together to support and maintain optimal gut health
- Prebiotics are nondigestible food components that promote the growth and activity of beneficial microorganisms in your intestines
- Probiotics are live beneficial bacteria that directly contribute to maintaining a healthy gut microbiome
- Postbiotics are bioactive compounds produced when your body digests prebiotics and probiotics; they're also produced during the fermentation process
- Prebiotics fuel the growth of probiotics, which in turn produce postbiotics that offer additional health benefits

Among the many components that contribute to a healthy gut, prebiotics, probiotics, and postbiotics stand out as key players. These compounds play distinct yet interconnected roles in maintaining a balanced and healthy digestive system.

Prebiotics, the nondigestible fibers, serve as nourishment for beneficial bacteria. Probiotics, the live microorganisms, directly contribute to a healthy gut microbiome. Postbiotics, the bioactive compounds produced during fermentation, offer additional health benefits. Understanding the differences and functions of these three elements can help you make informed choices to optimize the health of your gut.

What Are Prebiotics?

Prebiotics are nondigestible food components that promote the growth and activity of beneficial microorganisms in your intestines. They are typically high-fiber compounds found in various plant-based foods and serve as food for probiotics and other beneficial bacteria in the gut.

According to the International Scientific Association of Probiotics and Prebiotics (ISAPP), a prebiotic is "a substrate that is selectively utilized by host microorganisms conferring a health benefit."[1] They help to ensure proper balance of gut microbiota by accelerating the growth of beneficial bacteria, such as Bifidobacteria and Lactobacilli, and suppressing growth of harmful bacteria.

Prebiotics may also help increase the growth of beneficial bacteria while boosting production of short-chain fatty acids (SCFAs) like butyrate and propionate, which play a role in building the gut barrier,[2] helping to make it less permeable to disease-causing microorganisms.[3] Further, butyrate has been shown to induce programmed cell death of colon cancer cells[4] (in vitro research).

In addition, prebiotics play a role in regulating immune response, controlling gene expression in bacterial cells, and improving absorption of micronutrients. Research suggests prebiotics may be useful for supporting the management of several common conditions, including:[5]

- Obesity
- Chronic enteritis
- Skin disease
- Autism
- Ulcerative colitis

Note: *Evidence supporting prebiotic use for these conditions remains largely preliminary. Those with compromised gut health should introduce prebiotic fiber gradually, as rapid increases in fiber intake may worsen symptoms by increasing endotoxin load in some individuals.*

In one animal study, dietary prebiotics were even found to have a significant effect on rapid eye movement (REM) and non-rapid eye movement (NREM) sleep cycles, which may positively affect your sleep quality.[6] The study authors said:[7]

> *"Given that sufficient NREM sleep and proper nutrition can impact brain development and function, and that sleep problems are common in early life, it is possible that a diet rich in prebiotics started in early life could help improve sleep, support the gut microbiota, and promote optimal brain/psychological health."*

Inulin is one type of water-soluble prebiotic fiber found in asparagus, garlic, leeks, and onions. Other examples include fructo-oligosaccharides (FOS) and galacto-oligosaccharides (GOS). Common food sources of prebiotics include honey, fruits, and vegetables, such as **prunes** and Jerusalem artichokes.

What Are Probiotics?

Many people are familiar with probiotics, or "good" gut bacteria. Probiotics can help restore healthy balance to your gut microbiome, which can be disrupted by factors such as antibiotics, poor diet, and stress. While both probiotics and prebiotics are essential for gut health, they have distinct differences.

Probiotics are live beneficial bacteria that directly contribute to "reseeding" and/or maintaining a healthy and balanced gut microbiome, while prebiotics promote the growth and activity of existing beneficial bacteria in your gut by providing them with the necessary nutrients. Traditionally fermented foods, including yogurt, kefir, sauerkraut, kimchi, and miso, are naturally rich in probiotics.

Because up to 80% of your immune system is located in your gut, probiotics play an important role in immune system function; a healthy gut microbiome has been associated with stronger immune defenses and overall well-being. As noted in a scientific review published in Cells:[8]

> *"Probiotic bacteria can interact and stimulate intestinal immune cells and commensal microflora to modulate specific immune functions and immune homeostasis. Growing evidence shows that probiotic bacteria present important health-promoting and immunomodulatory properties. Thus, the use of probiotics might represent a promising approach for improving immune system activities."*

Further, aside from improving conditions like irritable bowel syndrome[9] and ulcerative colitis,[10] research published in JAMA Psychiatry[11] highlights the importance of probiotics for mental health as well.

The study, by researchers with the Institute of Psychiatry, Psychology & Neuroscience at King's College London, found supplementing with probiotics led to greater improvements in symptoms of depression compared to placebo, along with reduced anxiety symptoms.[12]

What Are Postbiotics?

Postbiotics are bioactive compounds produced when beneficial gut bacteria ferment prebiotic fibers.[13] They're also generated during the fermentation of foods. This means that if you regularly eat prebiotic-rich foods alongside probiotic-rich fermented foods, you'll likely support higher levels of postbiotics in your gut. Examples of postbiotics include short-chain fatty acids (SCFAs), functional proteins, metabolites, and extracellular polysaccharides.

In my interview with Dr. Colleen Cutcliffe, a microbiome scientist, she explained, "What happens in your body naturally, if you've got all the right microbes, is that you eat a meal, your microbiome metabolizes that food and generates postbiotics [excretions from

beneficial bacteria] like butyrate [and] a protein called P9."

Postbiotics consist of non-living microbial products or metabolites, meaning they do not contain live bacteria. Still, they offer a range of health benefits, including antimicrobial properties that may help inhibit the growth of pathogenic bacteria in the gut and anti-inflammatory effects.

Postbiotics may support gut barrier function by promoting mucus production and helping maintain the integrity of the intestinal lining, which can help reduce the translocation of certain harmful substances.

They also have anticancer potential, with researchers writing in Probiotics and Antimicrobial Proteins, "Postbiotics have recently been explored as a potential novel adjunct in breast cancer research, due to their immunomodulatory effects and the potential to mitigate the adverse effects of conventional treatments."[14]

These beneficial compounds also have antiobesity effects. "Postbiotics are also able to prevent obesity by reducing hepatic insulin resistance and activating transcription factors that regulate glucose intolerance and adipose tissue inflammation," according to a study published in Engineering in Life Sciences.[15]

Examples of postbiotics include SCFAs like butyrate, propionate, and glucagon-like peptide-1 (GLP-1). In short, postbiotics are the beneficial byproducts of probiotic activity. They also offer many of the benefits of probiotics without the need for live bacteria, which can be advantageous for individuals who may not tolerate live microorganisms well, such as those who are immunocompromised.

The relationship between prebiotics, probiotics, and postbiotics is often described as symbiotic, meaning they work together to support gut health. Prebiotics fuel probiotics, which can in turn produce postbiotics that may offer additional benefits.

Have You Heard of Akkermansia?

Akkermansia muciniphila is a specific keystone species of beneficial bacteria naturally present in the human gut.

It's so beneficial that it should, ideally, constitute as much as 5% of your gut microbiome, if you're healthy. However, DNA analyses suggest that many people have mere trace levels of Akkermansia,[16][17] and I suspect this is due to insufficient energy production (low metabolism) and resulting oxygen leakage in the gut.

Akkermansia is associated with many different health benefits, including enhanced gut barrier function, reduced inflammation, and improved metabolic health.

Having higher levels of Akkermansia is also associated with lower bodyweight, while lower levels of Akkermansia have been linked to obesity. Interestingly enough, **drugs like Ozempic** mimic the effects of Akkermansia on GLP-1. Along with affecting insulin regulation, GLP-1 may influence the nervous system, leading to an appetite-reducing response. As explained by Cutcliffe:

> *"Some… postbiotics… signal your body to produce GLP-1. All that signaling is happening from the microbiome directly to the L cells. And so you eat a meal, your microbiome digests them, these postbiotics get created and tell your L cells, 'Hey, go produce GLP-1,' and then you get a spike in GLP-1 in your body.*
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> *GLP-1 stimulates your body too. It says, 'We've got to metabolize the sugar in the bloodstream, release insulin.' It also signals to your brain, 'We just ate, we're full, we don't need to eat again.' After a period of time, GLP-1 goes down — until the next time you eat a meal. Then it spikes again.*
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> *So that's the natural way of things. There are only two strains that have been published, to date, that have been shown to be able to stimulate L cells to produce GLP-1, and one of them is Akkermansia. It actually secretes three different [postbiotics] that stimulate L cells to produce GLP-1.*

So, what's been found is that if you are low or missing Akkermansia, your body is not naturally producing as much GLP-1 as it's supposed to be. By giving people back Akkermansia, you can now have these physiological benefits of reducing A1C and lowering blood glucose spikes.

To be clear, the natural GLP-1 you produce is different from the drug. The drug is a mimic. It's an analog. It looks like GLP-1. It gets injected into the bloodstream directly, which means that rather than the natural spike after you eat [followed by a decline], the [drug] is keeping those levels really high all the time.

So, this signaling of 'we got to metabolize sugar in the blood and we're full, we just ate' is going on constantly. That's why people experience these incredible, amazing overnight effects because that's how those drugs are working. But if you actually have the right microbes, you can generate your body's natural GLP-1 and get back into this natural cycle."

The good news is you can enhance the abundance of Akkermansia in your gut via dietary interventions,[18] including supplementing with probiotics and prebiotics that promote Akkermansia growth in the gut.

Specific examples include Lactobacillus rhamnosus, Bifidobacterium animalis, Lactococcus lactis (probiotics), and oral fructo-oligosaccharides (a prebiotic). Eating more fiber is also important, as the SCFAs that form from fiber as it ferments in your intestines feed beneficial bacteria, including Akkermansia.

Why Mitochondrial Function Is Key to Successful Akkermansia Supplementation

When your cellular energy decreases, your body struggles to effectively eliminate oxygen from your colon. This has serious consequences for the normal inhabitants of your colon, which can be killed when oxygen levels rise. This is why Akkermansia supplementation alone is not a complete solution.

It is crucial to commit to a program designed to decrease mitochondrial toxins. This is because reduced mitochondrial function needs to be compensated for to ensure oxygen can be removed from the colon. If you fail to address this issue, even the best Akkermansia supplement with the most effective delivery system will have limited benefits. The newly introduced Akkermansia bacteria will likely be killed soon after arriving in your oxygen-rich colon environment.

This is one of the primary reasons why I recommend drastically reducing or eliminating seed oils from your diet for at least six months before starting an Akkermansia supplementation program. This preparatory period allows your body to recover mitochondrial function and create a more hospitable environment in your colon for the beneficial bacteria.

By taking these steps, you can maximize the potential benefits of Akkermansia supplementation and support overall gut health. Remember, addressing the root cause — mitochondrial function and colon oxygenation — is essential for the success of any gut health intervention.

Probiotic Potency Explained: CFU, AFU, and TFU

When evaluating the potency of probiotics, three units of measurement often come into discussion: Colony Forming Units (CFU), Active Fluorescent Units (AFU), and Total Fluorescent Units (TFU). Understanding the distinction between these units is crucial for both consumers and healthcare professionals to assess the effectiveness and quality of probiotic supplements accurately.

- **Colony Forming Units (CFU) —** This is the most widely recognized and utilized metric for quantifying the number of viable bacteria or fungal cells in a probiotic product. One CFU represents a single microorganism capable of dividing and forming a colony under specific laboratory conditions. This measure is important because the therapeutic benefits of probiotics are directly related to the number of live microorganisms that reach your gut.

Probiotic manufacturers typically list CFU counts on product labels, indicating the number of live organisms per serving. Higher CFU counts are often marketed as more potent, though the optimal CFU dosage can vary depending on the specific strains and the health outcomes targeted.

It's important to note that not all CFUs are equal; the efficacy of a probiotic also depends on the strains used and their ability to survive the acidic environment of the stomach to colonize the intestines.

- **Active Fluorescent Units (AFU) —** This unit is a less conventional and not widely standardized measure in the context of probiotics. While CFU shows the number of bacteria that are alive, AFU refers to the total number of bacteria present, both dead and alive. It is primarily a unit used to measure enzymatic activity.

  For instance, AFU could be used to evaluate the activity levels of specific enzymes produced by probiotics, which contribute to their health benefits, such as breaking down lactose or producing vitamins. In some specialized applications, AFU is also used to assess the metabolic activity or functional potency of probiotic strains beyond mere viability.

  However, because AFU is not a standardized metric in the probiotic industry, its use can lead to confusion and inconsistency in product labeling and efficacy claims.

- **Total Fluorescent Units (TFU) —** This unit measures the total bacterial mass including both live and dead cells through fluorescent labeling, and is typically used only for pasteurized products. Like AFU, TFU values are higher than CFU counts for the same sample since they include both viable and non-viable cells.

The primary difference between CFU, AFU, and TFU lies in what they measure: CFU quantifies the number of live microorganisms; AFU assesses the functional activity of those microorganisms; and TFU measures the total bacterial mass, regardless of their functional activity.

While CFU provides a clear indicator of the potential for colonization and survival of probiotics in the gut, AFU could offer additional insights into the functional capabilities of the probiotic strains.

However, due to the lack of standardization and widespread recognition of AFU in the probiotic market, CFU remains the gold standard for assessing probiotic potency. Consumers are generally advised to focus on CFU counts and the specific strains included in a probiotic supplement to ensure they are selecting a product with established efficacy for their health needs.

Current Akkermansia Clinical Trials: Dosages and Applications

As research advances, numerous clinical trials are underway to evaluate the efficacy and safety of Akkermansia-based interventions.[19] Clinical trials investigating Akkermansia muciniphila employ a range of dosages to determine optimal therapeutic effects.

The typical dosages being tested span from 100 million to 10 billion CFUs per day. This wide range allows researchers to assess both the minimum effective dose and the potential benefits of higher bacterial concentrations.

For human trials focusing on metabolic health and obesity, a dosage of 10 billion CFU is often used.[20] For example, a trial examining the impact of Akkermansia on insulin sensitivity in insulin resistant overweight and obese volunteers administered 10 billion CFUs daily.[21]

After three months, the treatment group had improved insulin sensitivity, reduced insulinemia, and lower total cholesterol compared to the placebo group. They also lost 1.37 kilos of body fat and reduced their hip circumference by 2.63 centimeters (cm) compared to baseline measurements.

Blood markers of liver dysfunction and inflammation were also reduced, causing the researchers to conclude that "this proof-of-concept study shows that the intervention was safe and well-tolerated and that the supplementation with A. muciniphila improves

several metabolic paramaters."

Research exploring Akkermansia's role in strengthening the gut barrier and preventing leaky gut syndrome and liver cirrhosis[22] often employs a dosage of 1 billion CFUs per day.

Prebiotics, Probiotics, and Postbiotics Work Together to Promote Gut Health

Incorporating prebiotics, probiotics, and postbiotics into your daily diet may support gut health and overall well-being. Research supports including a variety of prebiotic-rich foods such as garlic, onions, kiwi, and prunes. Fermented foods like traditionally made sauerkraut and kimchi are naturally rich in probiotics; if using dairy-based options like yogurt or kefir, opt for raw or traditionally fermented varieties rather than commercially pasteurized products.

With both anti-inflammatory and immune-modulatory properties, fermented papaya is another option that contains both prebiotics and probiotics, and may help stimulate the immune system in the colon.[23]

To benefit from postbiotics, continue consuming fermented foods and consider evidence-based supplements containing postbiotic compounds. By integrating these elements into your diet, you can gain meaningful amounts of prebiotics, probiotics, and postbiotics to support balanced gut microbiota, support immune function, and promote digestive and overall health.

Reminder: For individuals with compromised gut health, rapid increases in dietary fiber can worsen symptoms by increasing endotoxin production. If you experience gas, bloating, or digestive discomfort when adding prebiotic-rich foods, introduce them gradually and consult a knowledgeable healthcare provider.

**The animal model and in vitro findings referenced in this article (including the sleep study, butyrate/cancer cell research, and antiobesity postbiotic data) have not been confirmed in human clinical trials. Such results may not translate directly to human health outcomes.*

FAQs About Prebiotics, Probiotics, and Postbiotics

Q: What's the difference between prebiotics, probiotics, and postbiotics?

A: Prebiotics are nondigestible food components — primarily fibers found in foods like garlic, onions, and prunes — that act as food for beneficial gut bacteria. Probiotics are the live beneficial bacteria themselves, found in traditionally fermented foods like sauerkraut and kimchi, that directly populate your gut microbiome.

Postbiotics are the bioactive byproducts — including short-chain fatty acids (SCFAs) like butyrate and functional proteins like P9 — that your gut bacteria produce when they ferment prebiotic fibers.

Q: How do prebiotics, probiotics, and postbiotics work together?

A: Their relationship is symbiotic. Prebiotics fuel the growth of probiotic bacteria in your gut. Those probiotic bacteria then produce postbiotic compounds as metabolic byproducts. Postbiotics in turn support the gut barrier, modulate immune function, and generate signals — like GLP-1 — that influence metabolism and appetite.

Q: What is Akkermansia muciniphila, and why does it matter?

A: Akkermansia muciniphila is a keystone species of gut bacteria — meaning it plays an outsized role in maintaining microbiome health relative to its abundance. It ideally makes up around 5% of a healthy person's gut microbiome, yet DNA analyses suggest many people have very low or undetectable levels. Akkermansia is associated with enhanced gut barrier integrity, reduced inflammation, and improved metabolic health.

Q: Why does mitochondrial health matter before starting Akkermansia supplementation?

A: Akkermansia is an anaerobic bacterium — it thrives only in an oxygen-free colon environment. When mitochondrial function is compromised, your cells produce less energy and struggle to clear oxygen from the colon. This oxygen leakage creates a hostile environment for Akkermansia and other beneficial anaerobes, meaning newly introduced bacteria are likely to be killed before they can colonize.

Q: What should I look for when choosing a probiotic supplement?

A: Start with CFU count (Colony Forming Units), which measures the number of viable bacteria per serving — this is the industry standard and the most meaningful potency metric. Be cautious of products that use AFU (Active Fluorescent Units) or TFU (Total Fluorescent Units) instead, as these count dead bacteria alongside living ones and are not standardized measures of probiotic potency.

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