

Gut Microbes Linked to Stronger Muscles and Healthier Aging

Analysis by [Dr. Joseph Mercola](#)

November 01, 2025

STORY AT-A-GLANCE

- A new study in Scientific Reports identified specific gut microbes that enhanced grip strength, coordination, and muscle growth in aging mice, increasing muscle weight by over 150% and boosting growth-related markers
- Aside from boosting muscle, beneficial microbes improved energy metabolism and reduced inflammation. This helps maintain mitochondrial function and protects against muscle breakdown
- Earlier research showed that germ-free mice had smaller, weaker muscles and impaired metabolism, but restoring gut microbes or supplementing short-chain fatty acids (SCFAs) reversed many of these deficits
- Nutrition plays a central role in shaping your microbiome. Fiber-rich vegetables, resistant starches, polyphenol-dense fruits, and herbs like red ginseng promote microbial diversity
- Beyond diet, other strategies include supplementing with probiotics, prebiotics, synbiotics, and next-generation microbes like Akkermansia, as well as experimental fecal microbiota transplantation (FMT)

Your ability to walk with steady strength is one of the clearest markers of healthy aging. Strong muscles are essential for protecting your independence, regulating metabolism, and lowering the risks that come with frailty. The age-related loss of muscle, known as sarcopenia, is one of the most serious threats to healthy aging because it erodes your capacity to move freely and maintain vitality.¹

For years, exercise has been recognized as the foundation of muscle health, but researchers are uncovering another influence you may not have considered — the gut microbiome. Growing evidence suggests these microbes are shaping your muscles in ways that determine how well you move later in life.

A recent preclinical animal study published in the journal *Scientific Reports*² set out to explore this gut-muscle connection more closely, asking whether certain microbes are linked to stronger muscles and healthier aging. The results add a new layer to how you understand strength — not only as something built through movement, but also as something nurtured within.

New Study Finds Gut Microbes Support Muscle Resilience with Age

In the featured study, researchers sought to determine whether gut microbes from healthy humans impact muscle strength. The team used fecal microbiota transplantation (FMT) to introduce new microbial communities into animals whose native gut bacteria had first been eradicated.³

- **Microbiota transfer tested in controlled conditions** — To reduce the effect of the mice's own microbial background, the researchers first cleared their intestinal bacteria with a short course of antibiotics and antifungals. They then introduced a pooled mixture of gut microbes via FMT from healthy adults who had not taken antibiotics or probiotics for at least six months and who ate a regular diet.
- **Performance tested with standard strength measures** — Over the next three months, the mice were evaluated using two established methods. The Rotarod test measured how long they could balance on a rotating rod, while the wire suspension test assessed how long they could hold onto a thin wire using their front paws. These tools are typically used to gauge motor coordination, balance, and grip strength.

- **Microbial transplants led to varied outcomes** — Some mice improved their strength and endurance, others showed little change, and some declined. By grouping the animals into “strengthened,” “unchanged,” and “weakened” categories, the team linked these differences directly to the microbial communities that had established in their intestines.
- **Gut samples revealed higher microbial diversity than stool** — The animals that improved carried more diverse microbial populations compared with those that declined. Species richness, a measure of how many different types of bacteria are present, rose by 9% to 15% after FMT when researchers analyzed intestinal contents, rather than stool alone.

This broader microbial variety allowed them to identify specific bacteria that were closely linked to muscle improvements. Stool alone, they found, did not capture the full picture of microbial diversity in the gut.

- **Three species consistently linked to strength** — Across both motor tests, mice with better performance carried higher levels of *Lactobacillus johnsonii*, *Limosilactobacillus reuteri*, and *Turicibacter sanguinis*. Their abundance followed a stepwise pattern — the more of these microbes present, the greater the improvements in muscle performance.
- **Direct probiotic supplementation boosted muscle function** — To confirm the effect, the researchers introduced *L. johnsonii* and *L. reuteri* into a new group of older mice, which better represented aging physiology. Over three months, both strains enhanced grip and coordination, while the combination produced the largest gains.
- **Muscle tissue confirmed structural and growth benefits** — In the dual-strain group, muscle weight increased by 157% compared with controls. Microscopic analysis showed larger fibers in the gastrocnemius, soleus, and extensor digitorum longus muscles, confirming tangible strength gains.

Growth-related markers supported these findings. Follistatin, which counteracts myostatin to promote muscle development, nearly doubled in the *L. johnsonii* group, while insulin-like growth factor 1 (IGF-1) increased most in mice receiving both strains together.

- **The microbial effects extended to metabolism and inflammation** — Mice that received the probiotics had lower triglycerides, total cholesterol, and LDL cholesterol compared with controls. Inflammatory signaling also shifted. Levels of interleukin-6 (IL-6) were elevated in the *L. johnsonii* group but reduced in the group that received both strains, suggesting that the combination helped ease systemic inflammation.

This study is the first to show that specific gut microbes directly improve muscle strength. It also revealed that examining microbes from the intestinal tract, rather than stool alone, is important for pinpointing the species most relevant to muscle function. Together, these findings position the gut as a new frontier for preserving strength and resilience with age.

Previous Research Highlights Microbes as Key to Muscle Health

Several earlier studies have already examined how the gut microbiome relates to muscle health and aging, and these investigations laid the groundwork for the 2025 research by establishing key mechanisms and highlighting connections across animal and human models.

- **A 2019 study in Science Translational Medicine established the foundation** — Researchers compared mice raised without any gut microbes (germ-free) to mice that had a normal, healthy microbiome. The germ-free mice had smaller muscles, less strength in their grip, and changes in the activity of genes that normally control muscle growth and breakdown.⁴

They also showed weaker communication between nerves and muscles, linked in part to lower levels of acetylcholine, the chemical messenger that nerves use to signal muscle fibers. Moreover, they exhibited disrupted energy metabolism with

reduced mitochondrial function and an unusual buildup of glycogen, the form in which muscles normally store sugar for fuel.

- **Short-chain fatty acids (SCFAs) protect muscle from wasting** — When gut bacteria ferment dietary fibers, they produce acetate, propionate, and **butyrate**, which provide fuel to muscle cells, protect mitochondria, and reduce oxidative stress. The researchers found that supplementing germ-free mice with SCFAs improved muscle mass and strength while lowering the expression of atrophy-related genes.

Butyrate in particular was shown to preserve muscle mass in aging models, enhance mitochondrial proteins, improve glucose tolerance, and stimulate IGF-1 production. Acetate supported glucose uptake and glycogen storage, further stabilizing energy supply in muscle tissue. These findings demonstrate that a diet feeding SCFA-producing bacteria has direct consequences for your muscular resilience.⁵

- **A 2023 Gut Microbes review extended these insights across species** — Drawing on both animal and human research, the review confirmed that gut microbes are deeply involved in maintaining muscle and metabolic health as people age. The authors described how certain bacteria produce SCFAs when they break down dietary fiber. These SCFAs act as fuel for muscle cells and help mitochondria work more efficiently.⁶

The review also noted that age-related shifts in the microbiome reduce diversity, make the gut lining more permeable, and allow bacterial molecules such as lipopolysaccharides (LPS) to enter circulation. This process triggers inflammatory chemicals, including $\text{TNF-}\alpha$ and IL-6, which interfere with muscle-building pathways and accelerate muscle loss.

- **Probiotics showed measurable benefits in muscle mass and function** — Strains such as *Lactobacillus plantarum* TWK10, *L. paracasei* PS23, *L. reuteri*, and *Bifidobacterium longum* improved muscle mass, endurance, and strength in animal

studies. Human trials and a meta-analysis cited in the review found similar improvements in body composition and physical performance, though effects varied by strain and dosage.⁷

- **Prebiotics and lifestyle factors further supported the gut-muscle axis —** Oligosaccharide supplementation reduced inflammation and increased muscle mass in animal models. The review also noted that vitamin D and calcium intake improved gut barrier function and microbial diversity, while physical activity increased the abundance of beneficial taxa such as *Bacteroides* and improved musculoskeletal health.⁸

Together, these studies demonstrate that your gut microbes are active regulators of muscle biology. This sets the stage for targeted strategies that help preserve muscle function and vitality throughout your lifespan.

Dietary Strategies to Nourish Your Gut Microbes

As research continues to reveal how gut microbes shape muscle health and aging, it's worth asking what you can actually do to support them. A 2025 review in *Genome Medicine* evaluated multiple microbiome-based strategies for healthy aging, and among them, diet stood out as the most practical and effective. The authors identified the following foods and nutrients that optimize gut health:⁹

- **Fiber-rich foods —** Whole plant foods provide the fibers that feed gut microbes, supporting a more diverse and balanced microbiome. Examples include broccoli, Brussels sprouts, cauliflower, and leafy greens. These deliver a broad range of fibers that different microbes use to thrive, creating a more resilient gut ecosystem.

However, if your gut is compromised, introducing large amounts of fiber too quickly will worsen symptoms like bloating, discomfort, and irregularity. A disrupted microbiome may not yet have the capacity to process fiber efficiently, which means even healthy foods trigger negative reactions.

My recommendation is to first work on restoring balance by removing dietary disruptors, such as seed oils high in **linoleic acid** (LA), ultraprocessed foods, and excess sugars, while also minimizing unnecessary antibiotics and other substances that disrupt the microbiome.

At the same time, focus on healing your gut lining with gentler carbohydrates like white rice or whole fruits to let your gut adjust without causing trouble. As your gut improves, add more veggies, whole grains or starches. Resistant starches like cooked-then-cooled potatoes or green bananas, in particular, fuel butyrate production.

- **Polyphenol-rich fruits and vegetables** — Polyphenols from colorful plants, including berries, grapes, apples, and leafy greens, stimulate the growth of beneficial gut bacteria. The researchers noted:

“[P]olyphenols accumulated in the large intestine have been found to modulate the microbiome composition through antimicrobial effects or prebiotic-like action of metabolites generated through polyphenol metabolism in the colon.

For instance, the intake of diets rich in anthocyanin and procyanidin B2 is known to increase butyrate-producing bacteria and alleviate age-associated changes in aging rodent models.

Furthermore, a polyphenol-rich diet, supplemented with specific probiotics, was found to alleviate chronic low-grade inflammation, thereby reducing biological inflammaging, accompanied by an increase in probiotic bacteria and SCFAs in the gut microbiome of adults aged 50 years and older.”¹⁰

- **Red ginseng** — The review highlighted red ginseng as an antioxidant-rich herb that exerts antiaging effects by reducing oxidative stress, promoting the growth of healthy gut bacteria, and reinforcing the intestinal barrier. According to the researchers:

“Studies with specific probiotic-fermented ginseng interventions have also demonstrated antiaging properties attributed to upregulation of specific genes linked to antioxidant activity and positive modulations in gut microbiome communities.”¹¹

However, while the review contained several recommendations I agree with, it also endorsed foods and nutrients that I do not support based on their LA content and long-term impact on health.¹²

- **Polyunsaturated fats (PUFs)** — The review described PUFs as part of “healthy fats” for older adults. However, research has shown that excess PUFs, especially omega-6 LA from vegetable oils, damages mitochondrial function and drives oxidative stress. Oils such as soybean, corn, safflower, and sunflower should be avoided. Omega-3s, while beneficial, need to be consumed in moderation as well.
- **Certain nuts and seeds** — Although the review praised nuts and seeds as beneficial fat sources, many of them are high in LA. Peanuts, sunflower seeds, and similar varieties contribute to the very imbalance I warn against.
- **Olive oil** — Often promoted as a healthier alternative to seed oils, olive oil is high in monounsaturated fat, mainly oleic acid. Excess oleic acid produces lipid byproducts that disrupt mitochondria, slow energy production, and promote fat buildup in the liver and muscles. While its polyphenols offer some protection, they cannot fully offset these effects.¹³

When olive oil is exposed to heat, it oxidizes quickly, and many store-bought versions are diluted with cheaper vegetable oils. If you choose to include it in your diet, use only small amounts, unheated, and in high-quality cold-pressed varieties. Stable saturated fats such as grass fed butter, ghee, tallow, or coconut oil are more reliable sources of fat.

When you consistently choose foods that build microbial diversity while avoiding those that disrupt it, you create conditions that keep your muscles more resilient, your metabolism steadier, and your capacity for vitality intact as the years go by.

Microbial Interventions Beyond Diet

Alongside dietary choices, the Genome Medicine review outlined several other ways to influence your gut microbiome to support aging. Some of these approaches are already accessible, while others remain under study and represent the next wave of innovation in longevity science:¹⁴

- **Probiotics** — The researchers noted that probiotic supplementation in aging models and older adults restores gut barrier integrity, lowers inflammatory markers, and supports healthier metabolism. Moreover, multistrain formulations outperform single strains for bowel function and overall well-being in older cohorts.

Some of the strains that were noted to be beneficial for aging include *B. longum*, *L. paracasei*, *L. rhamnosus*, *L. plantarum*, and *L. fermentum*. For guidance on selecting probiotic supplements and using them effectively, check out “[The Science of Probiotics — How Beneficial Bacteria Support Health.](#)”

- **Prebiotics** — Prebiotics such as galactooligosaccharides (GOS) were reported to improve mucus thickness, enhance epithelial integrity, and increase SCFA production. These changes supported both microbial diversity and intestinal resilience. However, it’s important to first optimize your gut health before taking prebiotics to keep them from nourishing harmful microbes instead of the beneficial ones.
- **Synbiotics** — Combinations of probiotics and prebiotics, known as synbiotics, improved blood lipid profiles and gastrointestinal health in older adults. The review emphasized their role in promoting synergy between microbial growth and beneficial fermentation processes.
- **Next-generation probiotics** — Species such as *Akkermansia muciniphila* and *Faecalibacterium prausnitzii* were identified as promising “next-gen” probiotics. Early studies suggest they protect against muscle wasting and age-related inflammation, with effects tied to improved metabolic and immune function.

If you've been following my articles, you know I've previously underscored the importance of these microbes, particularly *Akkermansia*, as keystone species for gut health. Clinical trials have demonstrated that *Akkermansia* supplementation improves insulin sensitivity, lowers cholesterol, reduces body fat, and reinforces the intestinal lining.^{15,16}

Learn more about the benefits of *Akkermansia*, how to choose a high-quality supplement, and the dietary steps that help it thrive in “[Gut Microbes Influence How You Handle Stress.](#)”

- **FMT** — In the research highlighted above, FMT served as a way to test what happens when an entire community of gut microbes from a healthy donor is introduced into another host. This method involves transferring stool, with all of its living bacteria, into the recipient's gut to reestablish microbial balance.

While FMT is still in the experimental stage, early evidence links it to improvements in gut health, muscle performance, immune function, and aspects of aging. Learn more about this emerging therapy in “[‘Crapsules’ — The Latest Feces Transplant Pill.](#)”

These emerging tools show that your microbiome is influenced in far more ways than diet alone. What you do to care for your microbes today directly influences how well your body performs in the years ahead.

Frequently Asked Questions (FAQs) About Gut Microbes and Muscle Aging

Q: How are my gut microbes connected to my muscle strength?

A: Your microbes produce metabolites, regulate inflammation, and influence how efficiently your muscles use energy. When your microbiome is balanced, your muscles stay stronger, recover faster, and resist age-related decline.

Q: What does research show about specific microbes improving muscle strength?

A: The featured study shows that *Lactobacillus johnsonii* and *Lactobacillus reuteri* directly enhanced grip strength, coordination, and muscle fiber growth in aging mice. When given together, these strains produced the greatest effects, including more than a 150% increase in muscle weight and higher levels of growth-related signals like follistatin and IGF-1.

Q: What foods do I need to focus on to improve both my gut and my muscles?

A: You benefit most from fiber-rich vegetables, colorful fruits, resistant starches, and polyphenol-rich foods like berries and apples. These feed beneficial bacteria that generate SCFAs, which directly support your muscle metabolism and resilience.

Q: Are there foods I need to avoid if I want my gut to support my muscles?

A: Yes. Seed oils high in LA, like soybean, corn, safflower, and sunflower, disrupt your mitochondria and damage your microbiome. Be careful with nuts and seeds that are high in LA, as well as olive oil, since excess oleic acid burdens your metabolism, and many commercial products are adulterated.

Q: What role does *Akkermansia* play in muscle and healthy aging?

A: *Akkermansia muciniphila* is a next-generation probiotic species linked to reduced inflammation, stronger gut barrier function, and healthier metabolism. By supporting this keystone microbe through diet or targeted supplementation, you give your body an important ally in protecting muscle strength and resilience as you age.

Sources and References

- ¹ Saudi Med J. 2019;40(6):568-574
- ^{2, 3} Sci Rep 15, 30179 (2025)
- ^{4, 5} Sci Transl Med. 2019 Jul 24;11(502):eaan5662
- ^{6, 7, 8} Gut Microbes. 2023 Oct 6;15(2):2263207
- ^{9, 10, 11, 12, 14} Genome Medicine volume 17, Article number: 75 (2025)
- ¹³ Cell Reports April 22, 2025, Volume 44, Issue 4, 115527
- ¹⁵ Gut Microbes, November 23, 2021;13(1)
- ¹⁶ Nat Med. 2019 Jul 1;25(7):1096-1103