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Gut Microbes Linked to Stronger Muscles and Healthier Aging

Analysis by Dr. Joseph Mercola | November 03, 2026

STORY AT-A-GLANCE

- A study in Scientific Reports identified specific gut microbes that enhanced grip strength, coordination, and muscle growth in aging mice. When two of these strains were given together (L. johnsonii and L. reuteri), they increased muscle weight by over 150% and boosted growth-related markers
- Aside from boosting muscle, the two-strain combination lowered blood fats and kept an inflammatory marker lower in the mice. Previous animal research suggests gut microbes may also help maintain mitochondrial function and protect 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) partly reversed these deficits
- Nutrition plays a central role in shaping your microbiome. If your gut is compromised, gentler carbohydrates like white rice and whole fruits are the best starting point. Once your gut is functioning well, fiber-rich vegetables, resistant starches, and polyphenol-dense fruits may help support microbial diversity. Herbs like red ginseng have also been linked to beneficial gut bacteria
- Beyond diet, other strategies under study include 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 may help shape your muscles in ways that influence how well you move later in life.

A 2025 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.

Mouse Study Links Gut Microbes to Muscle Resilience with Age

In the featured study, researchers sought to determine whether gut microbes from healthy humans impact muscle strength in mice. The team used fecal microbiota transplantation (FMT) to introduce new microbial communities into 50 female mice, 9 months old, whose native gut bacteria had first been depleted.[3]

- **Microbiota transfer tested in controlled conditions —** To reduce the effect of the mice's own microbial background, the researchers first depleted their intestinal bacteria with a two-day 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 that included meat daily.*

- **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 to the microbial communities that had established in their intestines.*

- **Gut samples revealed more microbial diversity than stool —** Species richness, a measure of how many different types of bacteria are present, rose in all groups after FMT. When the researchers analyzed contents from the intestinal tract rather than stool alone, they found greater microbial diversity and clearer differences between the strengthened, unchanged, and weakened groups.

  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 40 older (12-month-old) female mice — 10 per group — 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, which was consistent with the strength gains seen in testing.

  Growth-related markers supported these findings. Gene activity for follistatin, which counteracts myostatin to promote muscle development, nearly doubled in the L. johnsonii group, while gene activity for 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 both strains together 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 may help ease systemic inflammation — though the authors note that these inflammatory responses need further study.*

The authors describe this experiment as the first evidence that specific gut bacteria can directly improve muscle strength (in mice). 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.

Because the work was done in mice, the authors caution that its applicability to human physiology may be limited. Still, these findings suggest the gut may be a promising new frontier in research on preserving strength and resilience with age.

**These findings are from laboratory or animal research and may not directly apply to human health.*

Previous Research Points to Microbes' Role in 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 signs of weaker communication between nerves and muscles, including lower blood levels of choline — the building block of acetylcholine, the chemical messenger that nerves use to signal muscle fibers — and reduced activity of genes needed to assemble the junction where nerves meet muscle. 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 can serve as an energy source and, in laboratory experiments, boosted the activity of genes involved in mitochondrial function.

  The researchers found that giving germ-free mice SCFAs in their drinking water partly reversed their muscle impairments, improving strength, nudging muscle mass upward, and lowering the atrophy marker atrogin-1, though not every marker improved.

  In other animal research, butyrate helped preserve muscle mass in aging female mice, increased mitochondrial proteins, and improved glucose tolerance, while SCFAs more broadly have been shown to stimulate IGF-1 production. Acetate

promoted glucose uptake and glycogen storage in rabbit muscle, further stabilizing energy supply in muscle tissue.

Together, these findings suggest that a diet that feeds SCFA-producing bacteria may have meaningful 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 concluded that gut microbes appear to be closely 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 may serve as fuel for muscle cells and support healthy mitochondrial function.[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 promotes inflammatory chemicals, including TNF-α and IL-6, which have been linked to disrupted muscle-building pathways and faster muscle loss.

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

  However, human evidence was more mixed — in the trials and meta-analysis cited by the featured review, some strains improved endurance, body composition, or muscle mass and strength, but the said meta-analysis found no benefit for total lean body mass, and some studies in older adults found little or no effect on muscle.[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 — most of them in animals — suggest that your gut microbes may actively help regulate 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 noted that among the factors influencing the gut microbiome, diet plays the most prominent role. The authors highlighted the following foods and nutrients that support 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 can 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 can 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 supporting 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 to your meals. Resistant starches like cooked-then-cooled potatoes or green bananas, in particular, can also help fuel butyrate production.

- **Polyphenol-rich fruits and vegetables —** Polyphenols from colorful plants, including berries, grapes, apples, and leafy greens, may encourage 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 may confer antiaging effects by reducing oxidative stress, promoting the growth of healthy gut bacteria, and supporting 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 dietary fats that I do not support, and the eating patterns it favors typically rely on foods I advise against, based on their LA content and long-term impact on health:[12]

- **Polyunsaturated fats (PUFs) —** The review lists PUF-rich diets among its microbiome-based strategies and credits diets rich in mono- and polyunsaturated fats with lasting health benefits. However, other research suggests that excess PUFs, especially omega-6 LA from seed oils, may damage mitochondrial function and drive 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 featured review doesn't single out nuts and seeds, they are common sources of the PUFs fats it favors, and 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. A 2025 study in Cell Reports found that oleic acid was the only dietary fat that drove the formation of new fat cells in mice at typical dietary levels — olive oil diets included.

  Moreover, higher blood levels of monounsaturated fats were associated with obesity in a large U.K. cohort. Excess oleic acid has also been proposed to disrupt mitochondria and slow energy production. While olive oil's polyphenols may offer some protection, they may not fully offset these effects.[13]

  When olive oil is exposed to heat, it can oxidize, and some store-bought versions have been found to be diluted with cheaper seed 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 may help 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 specific probiotics may help restore gut barrier integrity, lower inflammatory markers, and support healthier metabolism, based largely on studies in aged mice. However, they stressed that larger trials in older adults are still needed, given how widely microbiome responses vary from person to person.*

  Some of the strains that were noted as beneficial in aging mouse studies 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 metabolite profiles, including high-density lipoprotein (HDL) cholesterol, and overall bowel health in older women in one clinical study. 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. In one mouse study, giving both species eased features of muscle atrophy by lowering myostatin, an inhibitor of muscle growth. Both are believed to play a role in mitigating age-related degeneration.

  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. In a small pilot clinical trial of 40 overweight or obese adults with insulin resistance (32 completed it), three months of pasteurized Akkermansia helped improve insulin sensitivity by about 29% and lowered total cholesterol compared with placebo, and also reduced blood levels of LPS, a marker of gut barrier leakage.

  Reductions in body weight and fat mass were small and did not reach statistical significance. A follow-up analysis of the same volunteers identified related shifts in blood metabolites.*[15,16]

  If you're considering Akkermansia, I recommend a two-phase approach. Start with a pasteurized Akkermansia postbiotic in an enteric-coated or microencapsulated format, so more of it reaches the colon intact. Introduce live Akkermansia, alongside gentle prebiotics like small amounts of resistant starch, only once bloating is minimal or absent, your stool form has stayed consistent for at least seven days, and you can tolerate more fiber without symptoms returning.

  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, mostly from animal studies, links it to improvements in gut health, immune function, and aspects of aging — though in the featured mouse study, transplanted microbes strengthened some animals and weakened others. 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 may influence how well your body performs in the years ahead.

**These findings are from research conducted in clinical settings. Results may not apply to all individuals.*

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. Research, mostly in animals, suggests that a balanced microbiome may help your muscles stay stronger and better resist age-related decline.

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

A: The featured study shows that Lactobacillus johnsonii and Limosilactobacillus reuteri 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 gene activity for 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: If your gut is compromised, start with gentler carbohydrates like white rice and whole fruits. As your gut improves, fiber-rich vegetables, whole fruits, resistant starches, and polyphenol-rich foods like berries and apples can feed beneficial bacteria that generate SCFAs, which may help 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, can disrupt your mitochondria and harm 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 some commercial products have been found to be 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, and in mice it has eased features of muscle atrophy. Supporting this keystone microbe through diet or targeted supplementation may be one way to care for your gut as you age, though its effects on muscle strength in people have not yet been tested.

This article is for informational purposes only and does not constitute medical advice. Consult a qualified health care provider before making changes to your health regimen.

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