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Low Metabolism and NAD+ Deficiency Implicated in Wasting Syndrome

Analysis by Dr. Joseph Mercola | December 05, 2025

STORY AT-A-GLANCE

- Muscle wasting in cancer and chronic illness is driven by a breakdown in cellular energy production, not just poor appetite or inflammation
- Low levels of NAD+, the molecule that powers your cells' mitochondria, cause muscles to weaken and shrink even when calorie intake is sufficient
- Researchers found that restoring NAD+ with niacin (vitamin B3) helps rebuild muscle mass, improve strength, and stabilize energy metabolism — even during chemotherapy
- Seed oils high in linoleic acid interfere with how your cells make energy and promote chronic inflammation, while replacing them with stable fats like grass fed butter or ghee supports recovery
- Simple strategies such as taking niacinamide, eating nutrient-dense whole foods, reducing stress, and getting regular sunlight help recharge your metabolism and rebuild strength from the inside out

Each year, millions of people battling cancer or chronic illness face a hidden, life-draining enemy: their bodies begin to waste away from the inside out. Muscles shrink, energy fades, and strength disappears — even when food intake stays the same. This wasting process, known as cachexia, isn't caused by poor appetite alone. It reflects a deeper breakdown in your body's ability to produce and use energy, leaving people weaker by the day despite their best efforts to recover.

What makes cachexia especially devastating is how quietly it develops. Early signs like fatigue, declining stamina, or subtle muscle loss are often dismissed as side effects of aging or illness. Yet behind these symptoms lies a profound shift in metabolism — one that turns your body from a builder into a burner, consuming its own tissues just to keep systems running.

Over time, this internal energy crisis accelerates frailty, worsens treatment outcomes, and robs people of the vitality needed to heal. Researchers are now rethinking this condition through the lens of metabolism rather than malnutrition.

By tracing how energy production falters deep within the cell, researchers have begun uncovering why muscle and strength vanish even in well-fed individuals — and how restoring the body's energy balance could stop or even reverse that decline. This emerging science points to a powerful idea: rebuilding strength isn't just about calories or protein, but about reigniting your body's capacity to generate life-sustaining energy.

Stopping Muscle Wasting Starts with Restoring Energy

A study published in Molecular Metabolism found that muscle loss during cancer and chronic illness happens because your body's energy system breaks down — not just because of inflammation or poor nutrition.[1]

The researchers discovered that muscles in animals with severe wasting had much lower levels of nicotinamide adenine dinucleotide (**NAD+**), a key molecule that fuels energy production inside mitochondria — the "power plants" of your cells. When NAD+ runs low, cells can't convert food into energy, forcing your body to break down its own muscle tissue to survive.

- **Energy failure drives muscle loss —** When scientists examined muscle tissue, they found that the mitochondria were barely working. This energy shortage caused muscles to weaken and shrink. At the same time, NAD+ levels had collapsed, showing that the body's entire energy-making system was out of balance.

- **Restoring NAD+ brought muscles back to life —** When researchers used a treatment that blocked the harmful signals driving this breakdown, NAD+ levels bounced back, and energy production restarted. The enzyme that helps your body make NAD+ from nutrients like vitamin B3 also returned to normal. As a result, muscle cells began repairing themselves and regaining strength.

- **Muscles got stronger even without shrinking the tumors —** Treated animals lived longer and maintained muscle mass, not because their cancer improved, but because their cells could once again make energy efficiently. That finding showed that fixing metabolism, not just treating disease, is key to rebuilding strength.

- **Inflammation plays a role but isn't the main cause —** While inflammation was present, the real problem came from the cells' loss of energy capacity. Once NAD+ and mitochondrial function were restored, muscle repair resumed even in the presence of ongoing inflammation.

- **Energy restoration, not calories, reverses wasting —** NAD+ acts like a rechargeable battery that keeps your cells running. When that battery drains, your body loses the ability to power movement, repair tissue, and stay resilient. Restoring NAD+ recharges the system, helping you regain energy, preserve strength, and slow the spiral of wasting from the inside out.

Low Metabolism Is the Real Cause of Wasting

A commentary on the Molecular Metabolism study[2] by bioenergetic researcher Georgi Dinkov reinforced that cachexia reflects a breakdown in metabolism, not just inflammation.[3] Muscle wasting in cancer and other chronic conditions happens when oxidative metabolism — your body's main energy-producing process — slows down.

- **Energy loss begins inside the mitochondria —** When these engines stop working properly, levels of NAD+ drop sharply. This loss of energy is not just a symptom of disease but one of its main causes — the engine driving the wasting process.

- **Inflammation and environmental factors worsen the decline —** This drop in cellular energy is often made worse by long-term inflammation and by polyunsaturated fats like linoleic acid (LA) found in seed oils. These factors further weaken your body's ability to make energy. Dinkov emphasized that inflammation happens after the energy system breaks down — it doesn't start the problem.

- **Cancer shifts energy production into an inefficient state —** When mitochondrial metabolism fails, Dinkov explained, cancer cells compensate by producing energy in the cell's fluid compartment instead of the mitochondria. This process regenerates small amounts of NAD+ but produces large quantities of lactate — a form of metabolic "emergency mode" that feeds further dysfunction.

- **Supporting NAD+ regeneration helps block wasting —** According to Dinkov, preventing NAD+ depletion or restoring mitochondrial NAD+ levels could stop or even reverse muscle wasting. He highlighted that simple compounds that sustain oxidative metabolism — including niacinamide (vitamin B3), methylene blue, CoQ10, vitamin K, and emodin — help maintain mitochondrial energy, block the wasting process, and support recovery.

Niacin Recharges Your Body's Energy System and Slows Muscle Wasting

A study published in Nature Communications found that giving niacin, a form of vitamin B3, replenished NAD+ in both muscle and liver tissue of mice with severe cancer-related wasting.[4] When NAD+ levels were restored, muscle mass and strength improved, mitochondrial function rebounded, and energy production stabilized, even during chemotherapy.

While this study demonstrates NAD+ repletion's therapeutic potential, I disagree with the use of niacin as the optimal delivery form. Based on my review of the literature, niacinamide (nicotinamide) is a far more effective NAD+ precursor with several critical

advantages: it converts more efficiently to NAD+ via the salvage pathway. For oral supplementation, an effective dose is approximately 50 mg three times daily.

However, we're launching far superior next-generation formulations early next year that utilize advanced liposomal delivery to place niacinamide directly into cells with near-complete absorption efficiency. This targeted delivery eliminates first-pass metabolism and allows us to achieve equivalent or superior NAD+ repletion with dramatically lower doses — as little as 1-2 milligrams — while avoiding the gastrointestinal and hepatic burden of higher oral doses.

These innovations represent a significant leap forward in NAD+ optimization, combining the correct biochemical precursor with delivery technology that maximizes cellular uptake and minimizes waste.

- **Muscle loss was traced to a failure in the cell's ability to make NAD+ —** In cancer cachexia, the enzyme responsible for turning nutrients like vitamin B3 into NAD+ was found to be dramatically reduced in both animals and human cancer patients.

  This drop meant that even when nutrients were available, the muscle cells couldn't convert them into energy. In humans, low expression of this enzyme was linked with abnormal metabolic profiles, even before patients began losing weight, suggesting that energy failure begins long before visible wasting.

- **Niacin helped rebuild energy balance in multiple organs —** In mice with aggressive cancer and those with slower-growing tumors, niacin increased NAD+ in both skeletal muscle and liver tissue. This not only boosted adenosine triphosphate (ATP) — your body's main energy molecule — but also improved **mitochondrial health** and protein synthesis.

  Muscles treated with niacin regained mass, showed fewer signs of breakdown, and partially recovered grip strength. These benefits occurred without shrinking the tumors, showing that the improvement came from fixing metabolism, not suppressing cancer.

Niacin also increased the number and quality of mitochondria by raising levels of a protein that controls mitochondrial growth and renewal. Treated animals had higher mitochondrial DNA, greater energy capacity, and stronger muscle fibers. This effect was consistent across both fast and slow models of wasting, meaning niacin worked regardless of disease severity.

- **The findings open the door to simple metabolic therapies —** The study revealed that both muscle and liver NAD+ deficiency are central to cancer wasting, making energy repair a system-wide issue. By correcting NAD+ metabolism, niacin helped maintain energy homeostasis and prevent further tissue breakdown.

- **Clinicians are exploring early, targeted treatments to complement metabolic repair —** A review in the British Journal of Clinical Pharmacology noted that millions live with undiagnosed muscle wasting, often before visible weight loss occurs.[5]

  Researchers are testing new drugs like selective androgen receptor modulators (SARMs) and ghrelin agonists to stimulate muscle protein synthesis. Yet, results so far show these drugs boost muscle size more than strength, underscoring that restoring NAD+ and metabolism — not just building tissue — remains the true key to lasting recovery.

Rebuild Your Energy from the Inside Out

If you've been losing strength, struggling with fatigue, or watching your weight drop even when you're eating enough, the problem isn't just what's on your plate — it's how your body is using that energy.

The research shows that muscle wasting, weakness, and metabolic decline all start when your cells lose their ability to make energy efficiently. To reverse that, you need to recharge your metabolism and restore NAD+, the molecule that powers your mitochondria and keeps your body's repair systems running. Here's how to start rebuilding your strength and energy from the inside out:

1. **Restore your cellular "battery" with niacin-rich foods and niacinamide —** If your energy feels drained no matter how much you rest, it's often because your NAD+ levels are low. Niacin and its gentler form, niacinamide, provide the raw materials your body needs to make NAD+ again.

   Adding small daily doses — whether through food sources like grass fed beef liver or mushrooms, or through a supplement — helps your cells switch back to efficient energy production. This change supports your muscles, liver, and brain at the same time. Long-term use of niacin carries a risk of side effects, so consider taking niacinamide instead, at a dosage of 50 milligrams three times daily, to increase NAD+ production.

2. **Feed your mitochondria with the right nutrients —** Your mitochondria need more than calories — they need cofactors like CoQ10, vitamin K, and riboflavin to generate ATP. If you've been feeling persistently tired or weak, restoring these nutrients helps your body "remember" how to produce steady, clean energy again. Think of them as tools that rebuild your inner power plant.

3. **Eliminate the metabolic "brakes" hiding in your diet —** If you're using seed oils like soybean, corn, sunflower, or canola oil, it's time to stop. These seed oils are high in LA that interferes with how your cells produce energy and triggers chronic inflammation. Replace them with stable fats such as grass fed butter, ghee, or tallow. Over time, this swap lightens the oxidative load on your body and helps your metabolism run smoothly again.

4. **Lower your stress hormones through deep rest and real food —** When you're in a prolonged stress state, your body floods itself with cortisol and adrenaline, which accelerate tissue breakdown. Balanced meals with enough protein, natural carbs like fruit or white rice, and mineral-rich salt calm your nervous system and bring your metabolism back into balance. Avoid long-term fasting or extreme calorie restriction — these approaches only drain your energy further.

5. **Use light and movement to activate recovery —** If you're able, get daily exposure to natural sunlight and gentle activity like walking or stretching. Sunlight stimulates mitochondrial enzymes that boost ATP production, and even short bursts of movement tell your muscles to stay active and responsive. The goal isn't intensity — it's consistency.

   Every step, every ray of light, is a signal to your cells that you're rebuilding strength from the inside out. When you nourish your metabolism this way, you're not just treating symptoms — you're resetting your body's ability to generate energy, heal tissue, and regain vitality on its own terms.

FAQs About Low Metabolism, NAD+, and Muscle Wasting

Q: What exactly is cachexia, and how is it different from normal weight loss?

A: Cachexia is a wasting syndrome that causes muscle and weight loss even when you're eating enough. Unlike dieting or starvation, it isn't caused by calorie restriction. Instead, your body's metabolism shifts into crisis mode — it stops producing energy efficiently and begins breaking down muscle tissue to stay alive. This process drains strength, weakens immunity, and makes recovery from illness more difficult.

Q: What role does NAD+ play in preventing muscle wasting?

A: NAD+ is a molecule every cell needs to convert food into usable energy. When NAD+ levels drop, your mitochondria — the parts of your cells that make energy — stop working properly. This leads to fatigue, weakness, and muscle loss. Restoring NAD+ helps your cells generate energy again, rebuild tissue, and protect against further breakdown.

Q: How does niacin help restore energy and strength?

A: Niacin, also known as vitamin B3, replenishes NAD+ in your cells. Research from Nature Communications showed that niacin restored NAD+ in both muscle and liver tissue of cancer patients and animals with severe wasting.[6] Once NAD+ levels normalized, muscle strength, energy production, and mitochondrial health all improved — even during chemotherapy.

Q: Why are seed oils like soybean or canola oil harmful to metabolism?

A: Seed oils are high in LA, a type of polyunsaturated fat that disrupts how your cells produce energy. These unstable fats oxidize easily, promoting inflammation and damaging mitochondrial function. Over time, this slows metabolism and worsens fatigue and muscle loss. Replacing seed oils with stable fats such as grass fed butter, ghee, or tallow helps restore healthy energy production.

Q: What are the best ways to support healthy energy metabolism naturally?

A: Start by nourishing your body with niacin-rich foods or niacinamide, CoQ10, vitamin K, and other nutrients that feed your mitochondria. Avoid seed oils and processed foods, eat balanced meals with natural carbohydrates and protein, and manage stress with rest and sunlight exposure. Gentle movement, such as walking or stretching, helps reactivate muscle function. Together, these steps recharge your metabolism and help you rebuild strength from the inside out.

Sources and References

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- [3] To Extract Knowledge from Matter October 3, 2025
- [4, 6] Nature Communications April 3, 2023
- [5] Br J Clin Pharmacol. 2017 Aug 24;83(12):2599-2601