

One Molecule, Two Wins: How Beets Can Support Circulation and Strength

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STORY AT-A-GLANCE

- › In a controlled study, a single serving of nitrate-rich beetroot significantly increased nitric oxide-related compounds in healthy young men, and was associated with improved blood vessel function and more flexible arteries within hours
- › Researchers found that a moderate nitrate dose from beetroot produced the strongest improvement in blood vessel responsiveness, while a higher dose delivered the greatest reduction in pressure inside major arteries near the heart
- › Beetroot juice paired with blood flow restriction training helped participants maintain more jump height, force, and explosive power after fatigue developed, showing its greatest benefits during demanding physical activity
- › The nitrate in beets is converted into nitric oxide through a process that depends on beneficial bacteria in your mouth, highlighting why oral health practices influence more than just your teeth and gums
- › Including nitrate-rich vegetables such as beets, arugula, spinach, and celery — alongside strength training, recovery, and adequate carbohydrates — supports healthy circulation, muscle function, and fatigue resistance

For thousands of years, people have turned to beets as both a food and a traditional remedy. Today, science is uncovering why this humble root vegetable earned that reputation, and the answer comes down to a single molecule your body makes from the nitrate that beets supply in abundance.

That molecule is nitric oxide. Produced from dietary nitrate, it may help relax your arteries, improve circulation, and deliver oxygen where your body needs it most. When nitric oxide levels decline, blood vessels can become less responsive, circulation suffers, and physical performance often follows.

Research published in Food & Function set out to measure exactly how much nitrate-rich beetroot it takes to move those markers in the right direction, and what it found about the relationship between dose and benefit is more nuanced than you might expect.¹

Yet circulation is only half of the story. Evidence published in the Journal of the International Society of Sports Nutrition points to a second benefit of nitrate-rich foods: stronger physical performance.² Better blood flow means more oxygen and nutrients reach working muscles, so your body performs the same work with less physiological strain, supporting strength, endurance, and exercise capacity, especially when fatigue sets in.

Taken together, these findings highlight a fascinating connection. The same molecule that helps your arteries stay flexible also helps your muscles perform at a higher level. Understanding how researchers uncovered that relationship begins with a closer look at what happened when healthy adults consumed different doses of nitrate-rich beetroot.

Beetroot Helped Improve Artery Function and Reduce Pressure on Major Blood Vessels

For the Food & Function study, researchers recruited 17 healthy young men and used a randomized, double-blind crossover design, meaning every participant tested all three **beetroot** doses — 200 milligrams (mg), 400 mg and 800 mg of nitrate — on separate occasions.³ This allowed the researchers to compare the effects of each dose within the same people rather than between different groups.*

- **Not all doses produced the same benefits** — Many people assume that if a little helps, more will work even better. The results told a more interesting story. The 400-mg dose produced the strongest improvement in endothelial function, which refers

to how well your blood vessels expand when blood flow increases. Researchers measured this using flow-mediated dilation, a test that evaluates the flexibility and responsiveness of artery walls.

Participants experienced a 3.07% improvement in this measurement after the 400-mg dose compared to the control condition. The lower 200-mg dose did not significantly improve this marker, while the higher 800-mg dose also failed to outperform the middle dose.

- **Blood vessel flexibility improved across all doses** — Another important finding involved arterial stiffness. Healthy arteries expand and recoil with every heartbeat. **Stiffer arteries** force your heart to work harder and are associated with a greater risk of cardiovascular problems.

All three beetroot doses improved markers of arterial stiffness, suggesting that even relatively modest amounts of dietary nitrate support healthier blood vessel function. This means the benefits of nitrate-rich foods aren't limited to elite athletes or people with diagnosed heart disease. Improvements appeared in healthy young adults whose cardiovascular measurements were already within normal ranges.

- **The highest dose delivered a unique advantage** — While the 400-mg dose produced the best endothelial response, the 800-mg dose stood out in a different area. Researchers recorded a 4 mmHg reduction in aortic systolic blood pressure after the highest dose.

Aortic blood pressure measures the force exerted against the body's largest arteries near the heart and often provides a more meaningful picture of cardiovascular strain than the blood pressure reading taken from your arm. The aortic reading reflects the load your heart and brain actually feel; the arm cuff is a downstream echo. So some real improvements register at the source before the standard reading catches up.

- **The body's nitrate levels rose dramatically within hours** — Researchers timed their measurements approximately 2.5 hours after supplementation because that is when nitrate metabolism reaches its peak. The changes were striking. Blood nitrate concentrations doubled after the 200-mg dose, increased sixfold after the 400-mg dose, and rose roughly tenfold after the 800-mg dose.

Blood nitrite levels, another important step in the nitrate pathway, increased fourfold with the 400-mg dose and sixfold with the 800-mg dose. Think of this as filling a reservoir. The more nitrate available, the larger the supply your body has available for nitric oxide production. Because every study participant was a young man, it's not yet clear how closely these results apply to women or older adults.

- **The mechanism behind these benefits starts in your mouth** — After you consume nitrate-rich foods such as beets, specialized bacteria convert nitrate into nitrite. From there, your body converts nitrite into **nitric oxide**, a signaling molecule associated with blood vessels relaxing and widening. Wider vessels allow blood to move more easily, reduce resistance inside the circulatory system, and improve delivery of oxygen and nutrients throughout the body.

How Beetroot Juice Helped Preserve Performance After Fatigue Set In

For the Journal of the International Society of Sports Nutrition study, researchers investigated whether beetroot juice could enhance the benefits of **blood flow restriction** (BFR) training in 20 healthy male university students.⁴ BFR training, also known as **KAATSU**, uses a cuff to partially restrict blood flow during low-load exercise, creating a challenging environment for muscles without requiring heavy weights.*

Participants completed one week of beetroot juice supplementation followed by four weeks of BFR training three times per week. The goal was to determine whether beetroot juice could help muscles perform better when fatigue set in.

- **Strength improved in both groups, but beetroot juice offered a specific advantage** — After four weeks, both groups showed significant increases in knee extensor and knee flexor strength across multiple testing speeds and contraction types. In other words, the training itself worked. However, the researchers found that beetroot juice wasn't a universal performance booster.

Instead, its biggest contribution appeared during fatigue. The authors concluded that the effects of beetroot juice were "selective rather than broadly superior," meaning it didn't improve every measurement but did improve some of the most important ones for sustained performance.

- **The biggest gains appeared after muscles became tired** — This is where the findings become especially relevant for athletes and active adults. Before the intervention, fatigue caused large drops in jump height, force production, and explosive power. After four weeks, participants receiving both BFR training and beetroot juice showed significantly better preservation of performance under fatigued conditions.

Most notably, only the BFR-plus-beetroot group achieved a significant improvement in fatigued bilateral countermovement jump height after the intervention. A countermovement jump is the type of jump you perform when you quickly bend your knees and then explode upward. It's widely used to measure lower-body power and athletic readiness.

- **Explosive power became more resilient** — Researchers also measured rate of force development, often abbreviated as RFD. This reflects how quickly your muscles generate force. It influences sprinting, jumping, rapid changes of direction, and athletic explosiveness. Following the intervention, the absolute amount of force and RFD participants could produce while completely exhausted was significantly higher in the beetroot juice group.

- **The study revealed why beetroot juice shines during repeated efforts** – Unlike some supplements that produce noticeable effects only in fresh, rested conditions, beetroot juice demonstrated its value when participants were challenged. The researchers used a demanding 100-repetition knee extension protocol to create muscular fatigue.

Even after this exhaustive test, participants who combined beetroot juice with training showed better jump performance and less performance deterioration. If your goal involves repeated efforts – sports, recreational competition or physically demanding activities – preserving performance under fatigue often matters more than producing a single peak effort.

- **Several mechanisms help explain the results** – The researchers discussed evidence showing that chronic nitrate intake raises nitric oxide availability and enhances calcium release inside muscle cells. Calcium acts as the signal that tells muscle fibers to contract. Better calcium handling improves excitation-contraction coupling, which is simply the communication process between your nervous system and your muscles.

The authors also explained that under the low-oxygen conditions created by BFR training, stored nitrate inside skeletal muscle is converted more efficiently into nitric oxide. This appears to enhance oxygen delivery, improve energy production, support lactate clearance, and reduce neuromuscular fatigue.

Together, these adaptations help muscles continue producing force when they would normally begin to fade, which explains why beetroot juice delivered its greatest benefits after fatigue rather than before it.

Support Blood Flow and Strength Every Day

The studies point to a simple reality: healthy blood flow is only part of the equation. Your ability to maintain strength, power, and physical performance when fatigue sets in depends on how efficiently your body produces and uses nitric oxide.

Rather than chasing a quick fix, focus on the daily habits that help your body maintain healthy circulation, deliver oxygen efficiently, support muscle function and preserve performance when physical demands increase. Small improvements repeated consistently create results that last.

- **Make nitrate-rich vegetables a regular part of your meals** — If your goal is better circulation and stronger physical performance, start with the source. Beets are one of the richest dietary sources of nitrate, but they're not the only option. Arugula, spinach, lettuce, celery, and other leafy greens also contribute meaningful amounts.

I like to think of this as your daily nitric oxide challenge. Aim for a serving in the range the research used, roughly a cup of cooked beets, a concentrated beet "shot," or a generous portion of arugula. Vegetable nitrate content swings widely with soil and growing conditions, so think in servings, not exact milligrams. The benefits build over time as your body gains a more reliable supply of the raw materials needed to support circulation and muscle performance.

One caution: because nitrate-rich beets lower blood pressure, check with your doctor first if you take nitrate heart medications, erectile-dysfunction drugs, or blood pressure medication — the effects can stack. And if you have kidney disease or form calcium-oxalate stones, beets and leafy greens are high in oxalate and potassium, so run it by your doctor before making it a habit.

- **Protect the beneficial bacteria in your mouth** — Your body relies on [bacteria in your mouth](#) to convert dietary nitrate into forms that support nitric oxide production. If that first step is disrupted, the entire process becomes less efficient. Avoid antibacterial mouthwash unless it is absolutely necessary. Brush and floss normally, but remember that your mouth is not meant to be sterile. Those microbes play an important role in the pathway that supports healthy circulation and exercise performance.

- **Train for fatigue, not just fitness** — If you're new to exercise, start with a simple goal such as a daily walk. If you're already active, gradually add activities that challenge your muscles after they become tired. Hill walking, repeated stair climbs, interval training, and sport-specific drills help train your body to maintain performance under demanding conditions.

At the same time, avoid falling into the trap of thinking **more exercise is always better**. Your body adapts and grows stronger during recovery, not during the workout itself. Build in rest days, prioritize quality sleep, and pay attention to signs that you need more recovery, such as persistent soreness, declining performance, or unusual fatigue.

One of the most important findings from the research was that beetroot-supported training helped participants maintain more power after fatigue developed. Whether you play sports, hike, cycle, or simply want more stamina throughout the day, your ability to perform when tired often matters more than your performance when fully rested.

- **Build and maintain muscle mass** — Strong muscles help you use oxygen, nutrients and energy more effectively. If you're over 40, preserving muscle becomes even more important because muscle loss accelerates with age. Prioritize resistance training two times each week. Bodyweight exercises, resistance bands, carrying heavy objects, climbing stairs, and traditional strength training all count.

BFR training is another option because it allows you to build strength using lighter loads while creating a powerful training stimulus. For protein intake, aim for about 0.6 to 0.8 grams per pound (or 1.32 to 1.76 grams per kilogram) of ideal body weight, with one-third coming from **collagen-rich sources** like slow-cooked meats or bone broth, to support connective tissue as well as muscle.

- **Support the foundations of cellular energy** — Nitric oxide works best when the rest of your metabolism works well. Focus on habits that support cellular energy production: regular sunlight exposure, sufficient sleep, daily movement, and a

nutrient-dense diet built around whole foods.

If you're active, don't fear healthy carbohydrates. Most adults benefit from roughly 250 grams of carbohydrates daily, with higher amounts often appropriate for people who exercise regularly. Whole fruit, white rice, root vegetables, and other minimally processed carbohydrate sources help replenish energy stores, support recovery, and provide the fuel your muscles need to perform well and resist fatigue.

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

FAQs About Beets for Circulation and Strength

Q: How do beets support healthy circulation?

A: Beets are rich in dietary nitrate, which your body converts into nitric oxide. Nitric oxide helps blood vessels relax and widen, making it easier for blood, oxygen and nutrients to move throughout your body. Research found that beetroot supplementation improved blood vessel function, reduced arterial stiffness, and lowered aortic blood pressure in healthy young men.

Q: What is the most effective amount of beetroot nitrate for blood vessel health?

A: The Food & Function study found that different doses produced different benefits. A 400-mg nitrate dose produced the greatest improvement in blood vessel responsiveness, while an 800-mg dose produced the largest reduction in aortic systolic blood pressure.⁵ More was not always better, highlighting the importance of finding an effective range rather than simply increasing intake.

Q: Does beetroot juice improve exercise performance?

A: Research suggests it can. The Journal of the International Society of Sports Nutrition study found that beetroot juice helped preserve physical performance when fatigue developed.⁶ Participants who combined beetroot juice with BFR training maintained more jump height, force production, and explosive power after exhausting exercise than those who trained without beetroot juice.

Q: Why does beetroot juice seem to work better when muscles are tired?

A: The study showed that beetroot juice offered its greatest benefits under fatigued conditions rather than during fresh, rested performance. Researchers found that nitrate-derived nitric oxide helped support oxygen delivery, energy production and muscle function when physical demands increased, helping reduce fatigue-related declines in performance.

Q: What are the best ways to support nitric oxide production naturally?

A: Focus on nitrate-rich foods such as beets, arugula, spinach, lettuce, and celery. Protect the beneficial bacteria in your mouth by avoiding unnecessary antibacterial mouthwash, stay physically active, build and maintain muscle mass through resistance training, prioritize recovery and consume enough healthy carbohydrates to support energy production and exercise performance.

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

Sources and References

- ^{1, 3, 5} [Food & Function February 13, 2026](#)
- ^{2, 4, 6} [Journal of the International Society of Sports Nutrition February 24, 2026](#)