Strength training for endurance athletes

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Heavy and explosive strength training make runners and cyclists more efficient without blunting endurance.

Why it matters: Many runners and cyclists still skip the weight room, worried about bulking up or getting tired legs. The research says lifting is one of the few things that improves both performance and durability.

The big picture: Two short sessions a week are enough to benefit. Across many sports, strength training also cut injuries; in runners alone, the evidence is weaker (see "Running injuries").

What to do with this

- **Lift twice a week** in the off-season and base phase. Dropping to once a week in race season is common practice.
- **Include heavy lifts:** loads you can lift about 3 to 6 times per set, once you've learned the movements.
- **Add jumps or hops** for runners (see "Plyometrics: jumps and throws").

- **Keep sets short of failure** and the number of exercises small: squats or leg press, deadlifts or hip hinges, lunges, calf raises.
- **Schedule heavy leg days away from hard runs or rides** where you can (see "Does cardio blunt strength gains?").

Go deeper

The terms:

- **Running (or cycling) economy:** how much oxygen you use at a given speed or power. Better economy means less effort at the same pace.
- **Heavy strength training:** lifting loads at about 80% or more of your one-rep max.
- **Plyometric training:** quick jumps and hops that train the muscles and tendons to store and release energy.
- **One-rep max (1RM):** the most weight you can lift once.

What people believe: Lifting makes endurance athletes heavy and slow, and light weights with high reps are the right kind of strength training for them.

Economy:

- A 2024 meta-analysis of studies in middle- and long-distance runners found that heavy strength training (80% of one-rep max or more) improved running economy, more so at faster speeds [1].
- The 2024 analysis pooled 31 studies of 652 runners. Heavy lifting gave a small improvement. Programs combining heavy lifting with jumps gave the largest one [1].
- Jump training alone helped only at slower speeds, about 7.5 mph (12 km/h) or less. Moderate loads (40 to 79% of one-rep max) and isometric holds didn't clearly help [1].
- A review found heavy strength training also improved cycling economy [2].

Performance:

- Adding heavy or explosive strength training to endurance training improved running performance; for cycling, the strongest evidence was for heavy strength training [2].
- Proposed reasons include stronger, stiffer tendons that return energy better, and fatigue-resistant muscle fibers being used more [2].

Doesn't it slow you down? A 2022 meta-analysis found that combining cardio and strength didn't blunt strength gains, and the endurance studies above found performance improved, not worsened [1, 2, 3].

Injury: Strength training cut sports injuries to under a third of the rate in comparison groups in a meta-analysis of trials across many sports [4]. In runners alone, prevention programs worked mainly when supervised; see "Running injuries."

Between the lines: Light, high-rep "endurance" lifting is the type with the least evidence for runners. Heavy loads, ideally combined with jumps, are what moved the needle.

Reality check: Most studies were 6 to 24 weeks long and in trained but not elite runners and cyclists. Effects on race times were smaller and less studied than effects on economy.

How sure are we: Moderate that heavy strength training improves running economy; low certainty that combining it with jumps works best. Moderate that strength training improves endurance performance. Strong that strength training lowers injury risk across sports; Early for runners on their own.

A simple program for endurance athletes

Exercise	Sets × reps	Notes
Squat or leg press	3 × 4 to 6	Heavy, with good form
Romanian deadlift or hip hinge	3 × 4 to 6	Heavy
Split squat or lunge	2 × 6 to 8 each leg	
Single-leg calf raise	3 × 8 to 12	Add weight over time
Jumps (runners)	3 × 5	Box jumps, bounds or hops; full rest

1. **Start lighter for 3 to 4 weeks** to learn the movements (see "Your first 12 weeks").
2. **Build to heavy loads** you can lift 4 to 6 times with a rep or two to spare.
3. **Twice a week** in base training; **once a week** in race season and the taper is common practice.

Sources

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2. Rønnestad BR, Mujika I. Optimizing strength training for running and cycling endurance performance: a review. *Scandinavian Journal of Medicine & Science in Sports*. 2014;24(4):603–612. doi:10.1111/sms.12104
3. Schumann M, Feuerbacher JF, Sünkeler M, et al. Compatibility of concurrent aerobic and strength training for skeletal muscle size and function: an updated systematic review and meta-analysis. *Sports Medicine*. 2022;52(3):601–612. doi:10.1007/s40279-021-01587-7
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