Fueling for endurance events

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For events longer than about 90 minutes, extra carbohydrate in the days before and during the race improves performance.

Why it matters: "Hitting the wall" in a marathon is largely running low on stored carbohydrate. Good fueling can delay it; untested fueling on race day can upset your stomach.

The big picture: For shorter races, a normal diet and a pre-race meal are enough. Practice your race fueling in training.

What to do with this

Event length	Day or two before	Before the start	During
Under about 60 minutes (5K, 10K)	Normal diet	A normal meal 2 to 4 hours before	Water if you want it
About 60 to 90 minutes	Normal, carbohydrate-rich diet	A carbohydrate-rich meal 1 to 4 hours before	Optional; small amounts can help
Over about 90 minutes (half marathon for many, marathon, long rides)	Carbohydrate loading	A carbohydrate-rich meal 1 to 4 hours before	About 30 to 60 grams of carbohydrate an hour; up to 90 for very long events

Amounts come from the sports nutrition guidelines [1]; see the conversions below.

Go deeper

The terms:

- **Glycogen:** the stored form of carbohydrate in your muscles and liver. It's a key fuel for hard endurance exercise.
- **Carbohydrate loading:** eating more carbohydrate than usual for one to two days before a long event to fill glycogen stores.
- **Hitting the wall:** the sudden fatigue when glycogen runs low late in a long event.
- **Gels and chews:** small packs of easy-to-digest carbohydrate made for eating during exercise.

What people believe: Carb loading means a giant pasta dinner the night before, or that you should eat nothing during a race to avoid stomach trouble. Lately, from pro cycling: the more carbohydrate an hour, the better. None of these is the best approach.

Carbohydrate loading:

- A review found that higher starting glycogen can delay fatigue by up to 20% in exercise lasting more than 90 minutes, and improve performance over a set distance by about 2 to 3% [2].
- For efforts of 60 to 90 minutes, extra glycogen made little or no difference, because muscles still had glycogen left at the end [2].
- Sports nutrition guidelines advise about 4.5 to 5.5 grams of carbohydrate per pound of body weight a day (10 to 12 grams per kilogram) for the 36 to 48 hours before an event longer than 90 minutes [1]. For a 154-lb (70-kg) person, that's about 700 to 840 grams a day.

During the race:

- A meta-analysis of 50 placebo-controlled studies found that taking in carbohydrate during exercise lasting an hour or more improved performance. In time trials, the gain was about 2% [3].
- The benefits came from intakes of about 30 to 80 grams an hour [3].
- Guidelines advise 30 to 60 grams an hour for most long events, and up to about 90 grams an hour for events longer than about 2½ hours, using products that combine glucose and fructose [1].
- Pro cyclists now often take 100 grams an hour or more. A 2025 review found no direct evidence that this beats 60 to 90 grams an hour for performance, and it can make stomach problems worse [5].
- Gels, chews and sports drinks list their grams of carbohydrate on the label, so you can plan your hourly total.

Training your gut:

- A review concluded that the gut can adapt to handle more carbohydrate during exercise when athletes practice eating and drinking in training, which reduces stomach problems on race day [4].

Between the lines: Fueling matters most in long events. In a 5K or 10K, your normal diet already covers you.

Reality check: Most fueling trials are in trained, mostly male cyclists and runners in the lab. Individual tolerance varies, especially for high hourly amounts.

How sure are we: Strong that carbohydrate during exercise over an hour improves performance. Moderate that carbohydrate loading helps events over 90 minutes. Early on gut training.

Plan your race fueling

1. **Two days out (long events):** make carbohydrate the bulk of each meal and snack: rice, pasta, bread, potatoes, cereal, fruit, juice. Cut back on fiber and fat if your stomach is sensitive.
2. **Race morning:** eat a familiar, carbohydrate-rich breakfast 1 to 4 hours before [1], such as a bagel with jam, oatmeal with banana, or toast with honey.
3. **During:** start fueling in the first 30 to 45 minutes and take small amounts regularly. For example, a gel with about 25 grams every 30 minutes adds up to about 50 grams an hour.
4. **Practice:** use your race-day foods and timing on long training runs.
5. **Nothing new on race day.**

Sources

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2. Hawley JA, Schabort EJ, Noakes TD, Dennis SC. Carbohydrate-loading and exercise performance: an update. *Sports Medicine*. 1997;24:73–81.
3. Temesi J, Johnson NA, Raymond J, Burdon CA, O'Connor HT. Carbohydrate ingestion during endurance exercise improves performance in adults. *Journal of Nutrition*. 2011;141(5):890–897. doi:10.3945/jn.110.137075
4. Jeukendrup AE. Training the gut for athletes. *Sports Medicine*. 2017;47(Suppl 1):101–110. doi:10.1007/s40279-017-0690-6
5. Wilson PB. A narrative review of the high-carbohydrate fueling revolution (≥100 g/h) in the professional peloton. *Sports Medicine*. 2026;56(2):295–313. doi:10.1007/s40279-025-02372-6