

Marathon

42.2 km. The cramp zone starts around 25 to 30 km, right where your legs run out of training.

Small numbers point to the sources on page 2.

1 Where cramps bite

- One in four marathoners cramp during or right after the race (24% in Valencia, men and women alike)¹.
- Crampers slowed from the 25 km mark onward. The cramp usually follows the fade, not the other way round¹.
- Crampers had much higher muscle-damage markers (CK roughly double at 24 h) but identical hydration and sodium to non-crampers¹.
- Prevalence in marathoners and cyclists ranges 18 to 70% depending on the race and the heat².

2 Cut your risk

- Strength train. Only 25% of crampers lifted regularly vs 48% of non-crampers¹.
- Do not race a pace you have not trained. Running faster than usual is the top predictor of cramp⁴.
- Long runs that finish at goal pace teach fatigued muscles to hold form at 30 km.
- Cramp history? Assume it will return and plan for it⁴.
- Stretch and neuromuscular drills are cheap insurance, though no single measure works for everyone².

3 When it hits

- Ease the pace before it locks. A twinge is your warning, not the cramp.
- Stretch the cramping muscle to full length and hold. Still the first-line response in every review².
- **Early, not late.** Take your GOAT Shot at the twinge. In the lab a small measured shot cut cramp duration to about 85 s against 134 s for water, through a mouth-to-nerve reflex rather than digestion³.
- Do not chug plain water to fix a cramp. Neither dehydration nor blood sodium separated crampers from non-crampers in field studies⁴.
- Once it releases, rebuild pace over 3 to 5 minutes. Straight back to race pace re-triggers it.
- The evidence behind this tactic is lab-based and mixed: Miller (2010) found a clear effect, later trials found a small or non-significant one⁹. What it is not: an electrolyte top-up. Test it in training, not on race day.

4 Fuel

- Carb load 10 to 12 g/kg/day for 36 to 48 h. For 70 kg that is 700 to 840 g a day⁵.
- Pre-race meal 1 to 4 g/kg carbohydrate, 1 to 4 h out⁵.
- Take 60 g/h, up to 90 g/h if over 2.5 h, from glucose plus fructose. Marathoners average only 35 g/h^{5,6}.
- Start fuelling by 30 min, not when you feel flat.
- Practise your exact race gels on every long run so your gut is trained⁶.

5 Fluid and salt

- Pre-load 5 to 7 ml/kg about 4 h before the start⁷.
- Drink to thirst if under 3 h; drink to a sweat-rate plan if slower or hot. Finish within 2% of start weight⁷.
- Sodium: about 1 g per litre of sweat. Add salt if you are out over 2 h or racing in heat⁷.
- Slow runners who drink at every station are the ones at hyponatraemia risk. Do not overdrink water⁷.

6 Race day

- Taper 8 to 14 days, volume down 41 to 60%, intensity and frequency held⁸.
- Kit: shoes with 50 to 100 km on them, race-tested socks, lube, gels pinned or in a belt.
- GOAT Shot: one in the belt, ready from 20 km.
- Morning: up 3 h out, eat, sip, toilet, arrive 60 min early, easy 10 min jog.
- Even splits win marathons. Bank nothing in the first 10 km.

Sources and the fine print

Every numbered claim on page 1 traces to one of these. Peer-reviewed studies and consensus statements only, no influencer opinion.

1. Martinez-Navarro I et al. Muscle cramping in the marathon: dehydration and electrolyte depletion vs muscle damage. J Strength Cond Res 2020 (Valencia Marathon, n=84).

2. Maughan RJ, Shirreffs SM. Muscle cramping during exercise: causes, solutions and questions remaining. Sports Med 2019;49(S2):115-124.

3. Miller KC et al. Reflex inhibition of electrically induced muscle cramps in hypohydrated humans. Med Sci Sports Exerc 2010;42(5):953-961.

4. Schwellnus MP et al. Increased running speed and previous cramps rather than dehydration or serum sodium changes predict EAMC: 210 Ironman triathletes. Br J Sports Med 2011;45:650-656.

5. Burke LM et al. Carbohydrates for training and competition (IOC consensus). J Sports Sci 2011;29(S1):S17-27.

6. Pfeiffer B et al. Nutritional intake and gastrointestinal problems during competitive endurance events. Med Sci Sports Exerc 2012;44(2):344-351.

7. Thomas DT, Erdman KA, Burke LM. Nutrition and athletic performance: ACSM / Academy of Nutrition and Dietetics / Dietitians of Canada position. Med Sci Sports Exerc 2016;48:543-568; Sawka MN et al. ACSM exercise and fluid replacement, 2007.

8. Wang Z et al. Effects of tapering on performance in endurance athletes: systematic review and meta-analysis. PLOS ONE 2023;18(3):e0282838.

9. Behringer M et al. Effects of TRPV1 and TRPA1 activators on the cramp threshold frequency: randomised placebo-controlled trial. Eur J Appl Physiol 2017;117:1641-1647; Lavender AP et al. Mouth rinsing vs ingesting pickle juice. Appl Sci 2021;11:12096.

GOAT Shot, plainly

A 10 mL single-serve shot of Australian organic apple cider vinegar with the mother, saltbush brine and native botanicals, in a small thin sachet that opens easily. A food, not a medicine.

The research above (Miller 2010; Behringer 2017; Lavender 2021) is what the twinge tactic on page 1 is built on. Read it and make your own call.

Test any race-day tactic in training first. That includes this one.

Pickled GOAT is a food under the Food Standards Australia New Zealand code. It is not a therapeutic good and is not intended to diagnose, treat, cure or prevent any condition. This guide is general information for healthy adults, not medical advice. If cramps are frequent, severe or happen at rest, see a sports doctor. Informed Sport and HASTA certification are stated goals and are not currently held.

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