

MARATHON FUELING

Runners Need Proper Nutrition and Hydration for the 26.2-Mile Stretch

By Janice H. Dada, MPH, RD, CSSD, CDE, CHES

Don't let misperceptions about nutrient intake become athletes' stiffest competition. Teach both casual and experienced racers how to best prepare their body for the big day.



With an increasing number of casual runners going out for 26.2 miles, RDs stand to learn some basics about marathon fueling. According to MarathonGuide.com, in 2009, there were approximately 468,000 marathon finishes recorded in the United States—an increase of about 9.9% over 2008 finishes. Women made up 40.5% of finishers in 2009.

The modern marathon commemorates the run of the soldier Pheidippides from a battlefield in the town of Marathon to Athens, Greece, in 490 BC, bringing news of the Greeks' victory over the Persians, according to the Web site for the Athens Marathon. Legend has it that Pheidippides delivered the momentous message of their victory and then collapsed and died.

Completing a marathon is a feat of strength, endurance, and stamina, and proper hydration, nutrition, and training are vital to a runner's success and survival. Runners, especially novice runners, may need guidance from nutrition and sports professionals before attempting the 26.2-mile distance.

Physical Training Techniques

Logging miles is key to successful marathon completion. Runners can adequately train their body with as little as three to four days of running per week. New runners may wish to spend several weeks to months establishing a good running base by engaging in 2- to 5-mile training runs several times per week before adding additional mileage. Hal Higdon, a well-respected runner and author, even recommends a one-year running base of distances between 3 and 6 miles before a novice runner attempts to train for a marathon.¹

The weekly long run is the most important element of the physical training program. There are several Web sites and books that provide detailed running plans dictating how many miles an individual should run on each day of training. Many participants choose to join running groups (eg, Team In Training) that do weekly long runs and sometimes midweek training runs together. Most training groups charge a fee or have requirements for fund-raising for notable charitable causes. For someone who is new to the sport, participating in training runs, long runs, and fund-raising can mean taking on a lot of responsibility.

Table 1 highlights week one of Higdon's 18-week novice marathon training schedule. All marathon-training programs gradually increase the running distance and max out about four weeks prior to race day, with about 40 miles per week for a novice program. Higdon's novice program suggests the schedule noted in Table 2 four weeks before the big event.

A training program for experienced marathoners follows a similar progression. However, the weekend long run begins at about 10 miles and peaks with three 20-mile runs. Some programs have runners extend the longest run beyond 20 miles. Also, many experienced marathoners take only one full day of rest and the other rest days include an "easy" run.

Some running experts consider rest to be just as important as the training runs. Without proper rest, a runner will be prone to exhaustion and injury.

After the runner completes a peak long run, he or she initiates a taper, a gradual reduction in training miles to rest the body about a few weeks before the marathon. Proper tapering allows damaged muscles to heal and also promotes optimal glycogen storage. Both experienced and novice runners must taper their mileage in the two to three weeks prior to race day.^{1,2}

Fuel the Body Right

As runners' training mileage increases, so do their calorie needs, especially calories from carbohydrates. Runners need between 7 and 10 g of carbohydrate per kilogram of body weight during training and closer to the upper end of this range before long runs.²⁻³ They require high amounts of carbohydrates to saturate the muscles with glycogen, the storage form of carbohydrate that fuels endurance exercise. The training diet should be at least 55% carbohydrate during daily training and 55% to 65% before an endurance event or long training run.^{2,4} The "Endurance Athletes' Nutrition Needs" sidebar highlights an endurance athlete's nutrition needs.

Additionally, since running (and exercise in general) produces free radicals from the extra intake of oxygen, runners should pay attention to their antioxidant intake.² While the body's cells are equipped with enzymes that protect against free radical damage (such as superoxide dismutase), they do only part of the job. Antioxidants from food help provide the rest of the natural defense. Runners should consume at least eight daily servings of antioxidant-rich fruits and vegetables. Runners in training need plenty of minerals (eg, zinc, iron, manganese, copper) in addition to vitamins C and E to increase antioxidant defense.² They can achieve a proper intake of these nutrients by eating plenty of green leafy vegetables, citrus fruits, carrots, whole grains, meats, seafood, and fortified breakfast cereals. Runners should also consume at least two servings of fatty cold water fish each week due to the inflammation-fighting power of omega-3 fatty acids, which help alleviate muscle soreness and boost immunity.²

Snack Before You Start

Eating prior to exercise can be tricky. Runners should consume between 400 and 800 kcal worth of foods high in carbohydrate, low in fat, and with moderate protein content two to four hours before exercise.^{1,5} However, depending on the training run or event's start time, this may be difficult to do. The Honolulu marathon, for example, starts at 5 AM to avoid extreme temperatures during the event. Many runners have trouble waking up to eat at 2 AM or 3 AM. Runners participating in a race that begins very early in the day may do best to eat a late dinner and/or an evening snack and consume an easily digestible carbohydrate food before the race (eg, sports drink, sports bar, energy gel).

Table 1: Higdon's 18-Week Novice Marathon Training Schedule: Week One¹

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Rest	3 miles	3 miles	3 miles	Rest	6 miles	Cross-train

Table 2: Higdon's Novice Program Schedule: Four Weeks Before the Big Event¹

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Rest	5 miles	10 miles	5 miles	Rest	20 miles	Cross-train

For runners who can eat breakfast before the race or whose stomach tolerates a meal closer to the start of exercise, a breakfast cereal with fruit and 1% milk or soy milk or a whole grain bagel with tomato and low-fat cheese is a good option.

Runners should aim to consume at least 10 oz of water or a sports drink two hours before exercise.²

On Your Mark, Get Set, Eat

One of the biggest challenges some runners face when training for a marathon is teaching their belly to accept food during exercise. But for continuous endurance exercise lasting longer than 45 minutes, eating during exercise is a must. Carbohydrate, fluid, and electrolyte balance is vital to a successful run and survival. It is important for runners to experiment with various types of foods during exercise to determine which work best.

When eating during a training run or event, a runner should consume a food item that is high in easily digestible carbohydrate and low in fat and protein. Since fat, protein, and fiber slow down the digestive process, runners should avoid these nutrients to keep their stomach calm. Digestion during exercise is difficult enough since the blood supply is diverted to the working muscles at a time when it would normally be focused on the stomach and proper digestion.²

Some popular foods that athletes use to fuel continuous endurance exercise include sports bars (eg, PowerBar, Clif Bar), sports drinks (which serve a dual purpose of supplying carbohydrate and fluid), energy gels (eg, GU, Clif Shots), jelly beans, gummy bears, fig bars, bananas, and pretzels. Why a

person chooses to carry one of these food items over another may boil down to convenience. For example, it is much easier to stuff a couple of energy gel pouches into a pocket than a couple of bananas. Those who prefer bars should opt for ones without chocolate coating or chips to avoid a melted chocolate mess during the run.

Runners should drink at least 8 oz of water with any food consumed during exercise and aim to consume 30 to 60 g of carbohydrate per hour (120 to 240 kcal per hour) of exercise.²

Fluid intake during exercise should match losses. Runners can ensure they have taken in adequate fluid during training runs by weighing themselves before and after the run. Weight loss after a run is fluid loss and must be replaced to adequately rehydrate. For every pound of weight lost, runners should take in an extra 2 to 3 cups (12 to 24 oz) of fluid gradually over the course of the day.² Runners should consume between 5 and 12 oz of fluid every 15 minutes during exercise.^{2,3} Those who consume carbohydrate in the form of gels, bars, or other foods high in carbohydrates and electrolytes can consume water during training runs or the event. Some runners may opt to use sports drinks as their source of carbohydrate, electrolytes, and hydration. Sports beverages should contain 100 to 110 mg of sodium and 38 mg of potassium per 8 oz. However, runners do not have a choice as to which

company will provide the sports drink on race day. To minimize variables, individuals should train with the sports drink that will be provided at the event. This information is usually available on the marathon's Web site several months ahead of time.

It is possible to consume excessive amounts of water or

Endurance Athletes' Nutrition Needs²⁻⁵

- **Total calorie needs:** about 19 to 26 kcal per pound of body weight
- **Carbohydrate needs:** 7 to 10 g per kilogram of body weight
- **Protein needs:** 1.2 to 1.4 g per kilogram of body weight
- **Fat needs:** 20% to 35% of total calories

World's Most Popular Marathons⁶

1. Boston (www.bostonmarathon.org)
2. New York City (www.nycmarathon.org)
3. Chicago (www.chicagomarathon.com)
4. London (www.virginlondonmarathon.com)
5. Berlin (www.adventure-marathon.com/berlin-marathon.aspx)

For continuous endurance exercise lasting longer than 45 minutes, eating during exercise is a must.

sports drink. There have been many case reports of hyponatremia over the years in runners who consumed too much or only water during a marathon. Too much pure water will dilute sodium levels and cause hyponatremia, which can be fatal. In contrast, the runner who consumes too little fluid or too much sports gel or sports drink and no water may be at risk for hypernatremia. Hydration during a marathon is a delicate balance of fluid, carbohydrate, and electrolyte consumption.

Postexercise Needs

Individuals should consume calories and fluids immediately following the training run or event in the form of a 100- to 400-kcal snack (eg, sports drink, chocolate milk, orange juice). Eating a high-carbohydrate snack with a modest amount of protein in the immediate postexercise period has been shown to quickly stimulate the replacement of glycogen that was used up during the exercise bout. This aids recovery and will allow the runner to start stocking up on stored carbohydrate for the next run.^{2,3,5}

Runners should consume a real meal within two hours of run completion that contains carbohydrate and protein in a 3:1 ratio to adequately replenish glycogen stores and rebuild muscles. They should also consume plenty of liquids until urine is pale yellow or clear.²

Tips for the Taper

During the tapering period, it is important for the runner to cut back about 100 kcal for each mile removed from training, correlating to roughly 17 to 26 kcal per pound.² It is normal to expect some weight gain with a taper due to the increase in glycogen content. However, many runners feel ravenous during this time and some gain too much extra weight because they do not adjust their diet accordingly. Too much extra weight will make the marathon more difficult, so it is important to emphasize this point to runners. Counsel them to fill up on foods that will not add a lot of unnecessary calories, such as soups, fruits, and vegetables. The average runner needs at least 375 to 450 g of carbohydrate, 60 to 90 g of fat, and 80 to 110 g of protein daily in the weeks leading up to the event.²

The Day Before the Main Event

The day before a race should be one of minimal exertion. Most runners attend the marathon expo to pick up their running bib and chip timer and peruse the vendors. They should consume plenty of fluids, and carbohydrate should make up about 70% of the diet on that day. Runners should eat small amounts throughout the day and constantly sip on a water bottle. On this day, they should avoid alcohol, which can interfere with glycogen metabolism in the liver, and gas-producing foods (eg, cruciferous vegetables, prunes, beans) to prevent unwanted prerace gastrointestinal disturbances. Many race participants will opt for a large plate of pasta for the prerace dinner, but there are many other high-carbohydrate foods that can make up this meal, such as a baked potato or

rice with tofu or chicken. Depending on what time they eat dinner, they may do well to have a high-carbohydrate evening snack (eg, cereal with milk).²

After the Race

It's time to celebrate! A marathon is a feat that few even attempt, so the runner has earned his or her share of congratulatory celebration and gloating. Nutrition will likely take a back burner for several days, but runners still must ensure they have adequately refueled and rehydrated. As they would do on training days, they should consume snacks immediately following the race. Bananas and snacks are generally available after the race for participants. Some may not feel much like eating and may turn instead to a sports drink for hydrating and fueling. Once their appetite returns, they can enjoy a celebratory lunch of their favorite foods.

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References

1. Higdon H. *Marathon: The Ultimate Training Guide*. Rodale Books; 1999.
2. Applegate L. *Eat Smart, Play Hard: Customized Food Plans for All Your Sports and Fitness Pursuits*. Rodale Books; 2001.
3. Clark N. *Nancy Clark's Food Guide for Marathoners*, 2nd ed. Meyer & Meyer Fachverlag und Buchhandel GmbH; 2007.
4. Clark N. *Nancy Clark's Sports Nutrition Guidebook*, 3rd ed. Champaign, Ill.: Human Kinetics; 2003.
5. Dunford M. *Sports Nutrition: A Practice Manual for Professionals*, 4th ed. American Dietetic Association; 2006.
6. Rich M. A guide to the most popular marathons. Available at: <http://www.life123.com/sports/cycling-running/marathon/marathons.shtml>. Accessed January 6, 2010.

Running Resources

- Gatorade Sports Science Institute (www.gssiweb.com)
- *Marathon: The Ultimate Training Guide* by Hal Higdon
- Marathon Guide (www.marathonguide.com)
- *Nancy Clark's Food Guide for Marathoners*, 2nd edition
- *Nancy Clark's Food Guide for New Runners: Getting It Right From the Start!*
- *Runner's World* (www.runnersworld.com)
- Sports, Cardiovascular, and Wellness Nutrition Dietetic Practice Group (www.scandpg.org)
- Team In Training (www.teamintraining.org)