

## **Hydration for the Distance Runner** **by John Steitz, MCP Coach**

Without proper hydration, you have no hope of completing a marathon. You need to watch your hydration before, during and after every training run (and on race day!)

If you remember nothing else from this <article>, remember that Hydration is a BALANCE, that even a “little” dehydration can cause a lot of problems, and that hydration begins at home!

Both dehydration and hyponatremia are serious problems for distance runners, caused by the body’s hydration being seriously out of balance.

Dehydration (not enough water in your system) is a medical condition with serious or fatal consequences: reduced physical capacity and heat tolerance, deterioration in cognitive function, failure of thermoregulation, physical incapacity, and ultimately, organ failure. Even mild dehydration, if repeated over and over again, can lead to renal stones, urinary infections, severe constipation, rectal afflictions, and cutaneous membrane drying.

Progressive symptoms of dehydration include increased thirst, decreased urine output, concentrated urine and/or urine that is deeply yellow or amber in color, dry mouth and swollen tongue, the inability to sweat, weakness, confusion, dizziness, sluggishness, fainting, and palpitations (feeling that the heart is jumping or pounding). If you ever notice a runner with two or more of these latter symptoms, please summon assistance for that runner from a coach or race official.

Mild dehydration can be treated on the scene, with shade, rest, and having the victim drink small, but frequent small amounts of fluids. Moderate to severe dehydration requires medical attention, because treatment may require IV fluids and/or hospitalization. Moderate to severe dehydration may be combined with other conditions requiring medical attention, e.g., heat stroke. When in doubt, get the runner off the trail and onto the ground, and call for medical assistance.

The opposite of dehydration is hyponatremia (too much water in your system), a medical condition with serious or fatal consequences. Hyponatremia (or “water intoxication”) comes from ingesting water (only) for a period of time, but sweating out both water and electrolytes [sodium (Na<sup>+</sup>), potassium (K<sup>+</sup>), chloride (Cl<sup>-</sup>), calcium (Ca<sup>2+</sup>), magnesium (Mg<sup>2+</sup>), bicarbonate (HCO<sub>3</sub><sup>-</sup>), phosphate (PO<sub>4</sub><sup>2-</sup>) and sulfate (SO<sub>4</sub><sup>2-</sup>)]. Full-blown hyponatremia is very rare, but it has been seen in slower runners, who take several 4+ hours to complete a marathon, and who ingest nothing but water during their run. The Marine Corps Marathon has had one fatality from hyponatremia.

Progressive symptoms of hyponatremia include fatigue, lightheadedness, weakness, cramping, weight gain, nausea, bloating and/or swelling, dizziness, headache, confusion, fainting, disorientation, seizures (severe cases) and coma (severe cases). Notice how some of these symptoms appear the same as those for Dehydration! Unless a runner can “clearly” communicate symptoms, hyponatremia can look like dehydration, and vice versa. When a runner is confused or disoriented (or worse), seek professional medical attention – do not attempt treatment unless you are a medical or first aid provider.

The medical assistance required to treat hyponatremia can include fluid restriction and/or diuretic therapy.

Mild hyponatremia (e.g. cramps) is often miss-diagnosed. If you, yourself, ever have “severe” cramps, seek medical assistance immediately.

Hyponeutremia is better prevented than treated. To avoid it, replace the fluids you lose through sweat while running – and no more. Drink small amounts frequently, rather than large amounts all at once. Consume salty foods and beverages before, during and after the run. And determine your <personal> fluid needs during a run through body weight monitoring.

Thirst is a highly INACCURATE indicator of how much fluids you body needs at any given time. Lack of thirst does NOT mean that you are fully hydrated or properly hydrated.

To find the actual amount of water you need each day – without running, just your body’s normal requirement for living - , divide your weight by 16. (You actually take half your weight and divide it by eight—the number of ounces in a glass.) So, a 115-pound person needs to drink 7.2 8-ounce glasses of water a day, 180-pounder needs 11.25, and a 225-pounder needs 14.

To this base number, consider the effects of: heat, humidity, diet, medications, and bleeding/menstruation. Each of these may increase your daily fluid requirements – on top of what your body needs for vigorous exercise over extended periods of time.

[Humidity is an especially nasty factor in hydration. The cooling effect you gain from sweating comes not from the release of sweat, but by from the evaporation of that sweat off of your skin. That is why technical shirts with wicking fabric spread out your sweat all over the place, to increase the surface area of that sweat, and increase the amount that evaporates.

But with high humidity in the air around you, <and non wicking fabrics on your body> there is no place for the evaporation to go – the air is already saturated with vaporized water molecules. You sweat, and sweat, and sweat, and sweat and nothing happens! You remain overheated and covered with sweat, but now you’re dehydrated, too!

To figure out how much water you lose while running, one easy way is to measure your weight both before and after the run. Subtract your end weight from your starting weight, to determine your net loss of weight, in pounds. Most, if not all, of this weight loss is loss of fluids during the run.

Each 8.35 pounds of lost weight corresponds to loss of a gallon of fluid during the run. If you drank fluids during your run, you need to add that amount to your loss, as your real loss was even greater, modified only by the fluids you consumed.

Say, you started out with 180 lbs before the run, and were 3 pounds lighter at the end:

Starting weight in lbs. 180  
- Ending weight in lbs. 177  
Net weight loss: 3 lbs.

Pounds/8.35 = gallons of fluid .35 gal.  
+ Fluid consumed .25 gal  
= Gross fluid loss: .60 gal!

The consequences of fluid loss are often expressed as a percentage of one’s total fluid content, which is a function of one’s gender and body weight. Water makes up about 60 percent of a man’s weight and 50 percent of a woman’s. So a 180 lb man might have a base on 108 lbs of water, while a 150 lb woman might have a base of 75 lbs. of water. In doing the math, convert all fluid quantities to pounds, to make the arithmetic easier.

In the case above, the gross fluid loss during the run was .60 gallons, but the net loss was only .35 gallons, because the runner drank .25 gallons (a quart, or, roughly, a liter) during the run. .60 gallons of fluid corresponds to 5.01 pounds lost, while .35 gallons equates to only 2.92 lbs.

For runners of varying weights, a loss of 5 pounds corresponds to a percentage of body weight as follows:

100 lbs – 5%  
120 lbs – 4.2%  
150 lbs – 3.4%  
180 lbs - 2.8%

Compare this to a loss of only 2.92 pounds of fluids during the run:

100 lbs – 2.9%  
120 lbs – 2.4%  
150 lbs – 1.9%  
180 lbs - 1.6%

In the example above, only the 150 and 180 pound runners kept their fluid loss below 2%, and even then, only when they consumed a quart of fluids (32 ounces) during the run.

And that's significant, because as little as 2% dehydration can have measurable effects on performance, like a 7% decrease in endurance. Lack of water in the system thickens blood in arteries and veins. Thicker blood doesn't move as fast, so its ability to transport oxygen and glycogen (carbohydrate fuel) to working muscles is compromised. So too, is the bloodstream's ability to remove lactic acid and CO<sub>2</sub> from those muscles. A dehydrated bloodstream provides less lubrication to muscles, making them more prone to injury. And the collapse of good form from muscles prematurely fatigued from dehydration can compound chances for injury in the latter stages of the run.

To avoid these consequences, you need to ingest some fluids during your run – not too much (as we'll discuss below), but up to 33 ounces an hour.

The best way to ingest fluids (and food) during a run is in small quantities spread throughout that run. For those practicing the walk/run ("Galloway") method, taking a sip – or even a gulp – of fluid during every walk break, or every other walk break, is a good way of spreading out your fluid intake to something your stomach can handle. Absent a walk break, practice taking fluids at regular intervals: at every mile/kilometer marker, or at every curve in the course, or at whatever marker you can remember and follow.

On race day, take a half-cup of fluids at every aid station, preferably the sport beverage that is adding some sodium and potassium that plain water just doesn't have.

But slower runners may not be able to wait to drink at water stations. If water stations are 2 miles apart (as at MCM), they are encountered every 14 minutes for 7 minute per mile pace, every 20 minutes for 10 minute per mile pace, and only every 28 minutes for 14 minute per mile pace. Assuming each runner gets about 5 ounces of fluid at each water station, the seven-minute-miler gets 20 ounces an hour, the ten-minute-miler gets about 15 ounces, and the fourteen-minute-miler gets only 10 ounces per hour –far short of their theoretical 33 ounces per hour that their digestion can handle, and perhaps far short of the fluids that are losing each hour.

And whatever your pace, you have to practice taking fluids during your training runs, if you're going to be able to do it without screwing up your digestion on race day.

There are many popular bottle-holders and belts that let you carry extra fluids and spread the weight out evenly around your waist.

And don't forget – you need to replace electrolytes as well as water during your run. For sports beverages – READ the LABEL. The products vary widely in the amount of sodium and other electrolytes, as well as simple carbs, they provide.

For example 8 ounce servings of the following beverage provide:

	Carbs (gram)	Calories (kcal)	Sodium (mg)	Potassium (mg)
Water	0	0	0	0
Orange Juice	26	112	3	496
Gatorade	14	50	110	30
Gatorade Endurance	14	50	200	30
Powerade	19	70	55	30
Capri Sport Sun23	83	59	36	

Electrolytes can also be replaced with salty foods or sodium pills marketed at running stores.

As with anything else in your training, first try a new hydration device, or a fluid-ingestion plan, on your mid-week short runs. If it works there, try it on a few long runs. If it works on the long runs, then, and only then, should you use it on race day.

Ingesting fluids during a race or a long run is a very, very good idea. But can you ingest enough fluids during a run to compensate for all the fluids you lose? Probably not.

No matter how much you drink, your stomach and digestive tract can only absorb about 1 liter – 33 or 34 ounces – per hour – and that's under the best of conditions. Unabsorbed fluids will either slosh around in your stomach, or worse, they will go straight to your bowels, where they will pull salt from the body and dilute the mineral balance in the tissues...which is the very definition of hyponatremia. Even if you escape the more serious symptoms of that condition, you may still be greeted with some really nasty cramps.

For that reason, you really shouldn't drink more fluids than you lose through sweat during a run and UNDER NO CONDITIONS should you drink more than 33 ounces per hour, no matter HOW much fluid you lose during a race or training run.

And even drinking 33 ounces an hour is a difficult trick for anybody running at more than 75% of their maximum heart rate. Furthermore, during your run, your body will be less able to absorb water, electrolytes and nutrients than normal, because of blood flow away from the stomach toward working muscles.

So no matter how great your personal system for hydration-during-the-run, assume as a matter of caution, that you will almost always lose more fluids during a long training run or race in the heat and humidity of DC than you can replace by drinking during that run. What to do?

Well, that's my final point: **Hydration Begins at Home!** If you come to the race or training run well-hydrated, you can still lose more fluids than you replenish during that run, but not be in physical distress from dehydration. And if you come in well-hydrated, you need not worry about over-hydrating during the run (more than 33 ounces per hour), because you can back off drinking a little during the race, with fewer ill effects.

Yes, being well-hydrated going into a race has its drawbacks. But you should rejoice every time you have to urinate before or during a race or a training run, because that is a sign that your hydration balance is at least middle-of-the-road, if not well-saturated.

Before a marathon or long training run, I would counsel you to hydro-load the way you would carbo-load. 2-3 days before the long run, drink more fluids in small amounts throughout the day. 66% of what you ingest will be urinated away, but 33% will remain in your body for the run.

For example, to gain 1/2 gallon (4.175 pounds) of extra fluids in your system prior to a long run, you would need to ingest a total of 1.5 gallons in the two to three days prior to the long run. Over three days, 1.5 gallon equals 1/2 gallon, or 64 ounces, per day. Because your body absorbs only about 1 liter (33.81 ounces) per hour, you must drink small amounts over a period of time to absorb extra fluids (over and above what you would drink normally). 64 ounces over 12 hours is 5.33 extra ounces per hour – a little more than a half glass of fluid, or 1/4 of a 20 ounce bottle of a sports beverage.

Don't take large quantities of fluids at any one time, even if you're not exercising. Large fluid quantities will slosh around in your stomach or worse yet, bypass your digestion and go straight to your bowels. (Hyponatremia!) Large quantities of fluids without food solids may also cause gastric distress.

And as you would during the run, don't just drink extra water before the run, lest you dilute your electrolytes! Make sure your electrolytes are topped off too, not just your H<sub>2</sub>O or carbs! Eat salty pretzels, or your favorite salty snack, as you hydro-load before a marathon or long run. Or, depending on your normal diet, just eat normally (or carbo load!) - the average American diet contains plenty of sodium! Some runners drink sports beverages (Gatorade, et al.) while wandering the expo or sitting in clinics the day before a race. And bananas contain Potassium, an electrolyte that helps the body retain sodium.

With a little extra fluid each hour over the course of 2 to 3 days, you can build a good fluid reserve prior to the race or long run. Like all other aspects of marathon training, this is something you would have to try, and perfect, prior to your Saturday training runs, before you ever tried it prior to a race.

Make proper hydration before, during, and after your long runs a habit. You will perform better, and will "feel" better, with less risk of injury.