The Right Way to Hydrate for Marathons (Q&A sheet)

1. How important is hydration to marathon runner safety and performance?

Staying properly hydrated is important during marathon racing for both safety and performance. Hydration status in marathon runners depends on the balance between sweat losses and fluid replacement. Dehydration occurs when fluid losses are not adequately replaced. Sweat rates are influenced by weather conditions and running pace (i.e., pace per mile). Warm, humid weather usually increases sweat rates and accelerates the onset of dehydration, increasing the risk of early fatigue and heat-related illnesses in runners. Keeping the body properly hydrated improves marathon safety and performance by maintaining sweating, blood volume, and cardiovascular function. Dehydration decreases blood volume, increases heart rate, and impedes heat loss, all of which cause marathoners to slow their pace or drop out of the race.

It is possible for runners to drink too much fluid, which can result in a potentially fatal condition called ***hyponatremia***. Hyponatremia occurs in slower marathon runners who have the greatest opportunity to drink more fluid than they lose in sweat. Balancing fluid intake with sweat losses to avoid **dehydration and hyponatremia** is the fluid replacement goal for a safe a marathon experience and faster runners (< 4 hrs) should be more concerned with avoiding dehydration than developing hyponatremia. It's important to determine your fluid needs because there is no single recommendation that applies to everyone.

2. What is hyponatremia and why is it dangerous?

Exercise-associated hyponatremia (EAH) is defined as a blood sodium concentration less than 135 mmol/liter (135-145 is considered normal). This usually occurs in slower runners who are on the course for more than 4 hours; most commonly from drinking too much water or sports drink before, during, or after the marathon race. Drinking too much fluid dilutes the blood sodium level if the kidneys do not properly clear the extra body water and becomes dangerous if it causes the brain to swell. Too much brain swelling can lead to death. Some other factors associated with EAH are small stature, NSAID (ibuprofen or naproxen) use, and female gender. The sodium in a sports drink may delay the onset of hyponatremia, but drinking too much can still result in hyponatremia.

3. What are signs or symptoms of exercise-associated hyponatremia?

Symptoms begin to appear when serum sodium levels fall below 135 mmol/L and water begins to flow into the body cells. Early symptoms of hyponatremia include weight gain, puffiness (e.g., swollen fingers, tight-fitting watch), nausea, progressively worsening headache, weight gain, and a sense of "just not feeling right." More serious symptoms include vomiting, confusion, irritability, agitation, and seizures. Left untreated, hyponatremia can progress to serious brain and lung swelling, coma, and death.

It can take time for hyponatremia symptoms to appear, so keep an eye out for these symptoms **even a few hours after the race**. During or after exercise, if you are not sweating heavily and/or feel that you may have gained weight (see symptoms above), it is important not to drink large amounts of fluids until you are urinating normally.

4. What are the signs of dehydration?

Signs and symptoms of dehydration include headache, thirst, dizziness, nausea, muscle cramps, weakness, abnormal chills, thick saliva (i.e., difficult to spit), irritability, and fatigue.

5. What is the best way to avoid dehydration?

The best way to avoid dehydration is to drink enough fluid to minimize loss of body weight during the race, but avoid over-drinking and weight gain. In fast runners, thirst often lags behind and may be a late indication of dehydration and faster runners need to know how much fluid to replace each hour of running. However, in slower runners thirst indicates that you are becoming dehydrated and should begin to replace your sweat losses.

6. How do I know how much to drink?

To determine your unique fluid needs, estimate your sweat rate by weighing yourself nude and run for 1 hour in the conditions and at the pace you expect to race. Do not drink during this run. At the end of the run, strip down, towel off, and reweigh yourself nude. The difference in weight (ounces) is about your hourly sweat rate. No more than that amount should be replaced in each hour of your race. If you have determined that you need to drink 4 oz every 20 minutes (12 oz an hour), then stick with that plan for longer runs. You should also weigh yourself periodically before and after training runs. During training and racing, drink at regular 15 to 20 minute intervals to minimize loss of body weight to less than 2% of your starting body weight. For example, if you begin the run weighing 140 lb and end the run weighing 137 lb, you have kept your weight at 2% body water loss. If your weight drops below 137 lb this may begin to impair your performance. If your weight is above 140 lb, it is a clear indication that you drank too much. Drinking too much of any fluid (over hydrating) can lead to hyponatremia. If you are running at a slow pace (longer than 4 hours for the marathon) and you do not know your sweat rate, you can probably drink when you first notice the feeling of thirst and stay safe from both hyponatremia and dehydration. On those occasions when you know that you'll be losing a lot of sweat, drink 10-20 ounces of fluid about an hour before the race to help you start with adequate fluid in your system.

7. How can I avoid both dehydration and hyponatremia?

Develop your own hydration program using these tips:

- **You're unique, so don't copy other runners.** Some runners need less fluid than you, while others will need more. Learn your individual hydration needs. Fluid needs vary widely and slower runners need to be very cautious with their fluid intake while faster runners may need to drink more to replace higher volume sweat losses.
- **Try to match fluid intake to just below weight loss.** For example, if you lost 2 lbs (32 oz) during a run, you should try to drink close to 32 oz but not more during that long run.
- **Do not over drink.** Weight gain during a run is a sure sign of overdrinking.
- **If you are a slow runner,** determine the fluid intake that keeps your weight balanced with a slight 1% loss during a long run or drink when you are thirsty. The rate of sweat and weight loss for the same distance varies according to weather conditions and running speed.
- **Keep your urine a pale yellow color** like lemonade, neither dark like apple juice (dehydration) nor clear like water (over hydration)
- **Recognize the warning signs of dehydration** like feeling faint or light headed with standing, rapid heart rate, sunken eyes, dry mouth, feeling very thirsty, or dull headache. Try some fluids to see if you improve.
- **Recognize the warning signs of hyponatremia** like water sloshing in your stomach, severe and worsening headache, or feeling puffy or bloated in the hands and feet, nausea, upset stomach, or wheezy breathing. Stop drinking until you begin to urinate and the symptoms resolve.
- If you are **not feeling well** during or after the race and simple changes do not make you feel better, seek medical attention.

Information provided by

references:

1. Almond SD, Shin AY, Fortescue EB, et al. Hyponatremia among Runners in the Boston Marathon. NEJM 352(15), 2005.
2. Convertino VA, Armstrong LE, Coyle EF, et al.: ACSM Position Stand: Exercise and Fluid Replacement. Medicine Science Sports and Exercise 28(1): I-vii, 1996.
3. Hew-Butler T, Almond C, Ayus JC, Dugas J, Meeuwisse W, Noakes T, Reid S, Siegel A, Speedy D, Stuempfle K, Verbalis J, Weschler L. Consensus Statement of the 1st International Exercise-Associated Hyponatremia Consensus Development Conference. Clin J Sport Med 15(4):208-213, 2005.
4. Montain SJ, Sawka MN, Wenger CB. Hyponatremia associated with exercise: risk factors and pathogenesis. Exerc Sport Sci Rev 2001;29:113–117.