

“Healthy Running”

Hyponatremia and the Risks of Overhydrating

Key points:

- Exercise-associated hyponatremia is a potentially life-threatening condition associated with excessive fluid intake during endurance running events.
- The risks for EAH include marathon race times longer than 4 hours, excessive drinking during the race, and weight gain during the race.
- EAH can be prevented by drinking fluids according to thirst. Sports drink or salty snacks do not prevent EAH if fluids are over-consumed.

With the Shamrock Marathon just 3 weeks away, this is a good time to review an important but avoidable complication of marathon running – exercise-associated hyponatremia. This is a potentially life-threatening condition which is completely preventable by following simple guidelines for fluid intake during your race.

Under usual conditions, our body systems control fluid balance and blood electrolyte concentrations in narrow ranges, and serum sodium stays between 135-145 (mmoles/L). Two key players in this balance are the kidneys and a pituitary gland hormone ADH (anti-diuretic hormone). If we are over-hydrated, ADH levels should fall and the kidneys will release more water into urine. However, for reasons that are not well understood, this feedback balance is disrupted in prolonged endurance efforts and ADH levels remain inappropriately high even in the face of excess fluid intake. The kidneys, as a result, keep water in our system instead of releasing it. This retained water causes a diluting effect in our blood, and levels of serum sodium drop below 135, the condition called exercise-associated hyponatremia (EAH).

A marathon runner with EAH will have nausea, vomiting, headache, weakness, confusion, and disorientation, and may appear socially withdrawn or apathetic. He/she may complain of tight rings and swollen fingers as well as feeling of full in the stomach. The hallmarks of this situation are weight gain during the race and not being thirsty. If this is not recognized and fluid intake continues, symptoms can progress to altered level of consciousness, seizures, wheezing due to fluid in the lungs (pulmonary edema), coma, and death.

EAH was first recognized in 1981 and in subsequent years of the Comrades Marathon in South Africa, with runners gaining 4 to 12 pounds, sodium levels as low as 115, and 4-5 day hospital stays for recovery. Sadly, EAH claimed its first casualty with the death of a participant in the 2002 Boston Marathon. During these years, fluid guidelines for races followed the dictum, “during exercise, athletes should start drinking early and at regular intervals in an attempt to consume fluids at a rate sufficient to replace all the water lost through sweating...or consume the maximal amount that can be tolerated” (ACSM, 1996).

Subsequent research reports, including a study of runners in the 2002 Boston Marathon (NEJM, 2005), clarified the role of excessive fluid intake in causing EAH. These reports showed that the risks for EAH are: weight gain during the race, longer race times (over 4 hours), and small body size (body-mass index under 20). Women appear to be at greater risk due to race times and body size, not due to gender per se. Importantly, over-consumption of any fluids is

associated with EAH, and the intake of sports drink does not protect against EAH. Up to 13% of the 2002 Boston Marathon participants in the study were found to have hyponatremia at the finish line.

Although you may still read, “consume 4 to 8 ounces of fluids every 15 to 20 minutes,” these recommendations are now questioned. Instead, runners are advised to keep fluid intake in the range of 400-800 ml per hour (13-26 oz. per hour). Smaller runners, slower runners, and those less well trained are encouraged to keep intakes in the lower end of this range. In general, runners are advised to drink *ad libitum*, meaning according to thirst only and not more. The best way to know the fluid intake most appropriate for you is to develop your own individual hydration plan by determining your own sweat rate. Weigh yourself without clothing before a one hour run. After the run, remove your clothing, dry off any sweat, and weight yourself again. Subtract the post-run weight from the pre-run weight and add the amount of any fluids you drank during the run. The result is the pounds of sweat you lost. Each pound equates to 16 oz. of water. By the way, 1 oz. is roughly the amount of water in an average “gulp”. You now have a good estimate of how much you can drink per hour during your race and avoid over-hydration.

Following this guideline does not increase your risk of dehydration or hyperthermia. Laboratory research from the 1960’s suggested that exercise performance suffers when we lose more than 2% of our body weight during the race. More recent research on runners outdoors shows this is not the case, and drinking in response to thirst is sufficient to maintain running performance. The chances of hyperthermia increase as more body heat is generated with increasing exercise effort and has less to do with hydration status.

Medical tent treatment of EAH consists of providing the runner with limited amounts of highly concentrated salty fluids. Examples are concentrated broth with 4 bouillon cubes in 4 oz. of water, or 4 oz. of sports drink with several salt packets added. The runner can leave the medical tent when their symptoms clear. Instructions are given to eat salty snacks and to avoid water and dilute beverages until passing urine.

Exercise-associated hyponatremia can be prevented. Do not over-hydrate in the days before your race. Drink according to thirst before the race. Typically, an ounce of beverage for every 10 pounds of body weight taken 4 hours before start time is enough to produce urine flow that indicates you are adequately hydrated. Reduce this amount if you are drinking closer to start time. Drink according to thirst during the race. Water stations are in place for our convenience, but not because we necessarily have to drink from each of them. At Shamrock, there is a water stop about every 1.5 miles. Those of us completing 26.2 in over 4 hours can prevent EAH by hitting the water stops every 5K, i.e., every other water stop. Remember that eating salty snacks during your race or drinking sports drinks at the water stops will not prevent EAH. Avoiding over-drinking of all fluids will keep your sodium levels in balance and get you to the finish line safely.

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