HYDRATING THE ELITE

BY EMILY BEERS

Olympic gold medalist Simon Whitfield reveals how elite triathletes figured out widely held hydration guidelines are wrong.

Michael Brian/CrossFit Journal

Richwell Correa/CrossFit Journal

In endurance events, top athletes often use aid stations to cool themselves off rather than to stay hydrated.

When Simon Whitfield competed in the 2000 Sydney Olympic Games—the first to include the sport of triathlon—the information he had been fed about hydration was confusing at best.

"Lots of things were haphazard. Lots of different information contradicted each other," Whitfield said.

When Whitfield first got involved in triathlons as a teenager in the early 1990s—in a time he refers to as "the infancy of the sport"—he said North American athletes' beliefs about hydration were just plain wrong.

"I came in in a generation where we had no idea what we were doing," said Whitfield, now 39. "We were told to hydrate, so we'd hydrate like crazy people. … You'd see people everywhere guzzling giant 2-liter bottles before a race."

In the book "Waterlogged: The Serious Problem of Overhydration in Endurance Sports," Dr. Tim Noakes examines the rise of the commonly given advice to drink as much and as often as possible before engaging in endurance exercise—advice many recreational triathletes take even today.

The philosophy that suggests drinking more is always better started to take hold in the 1970s, Noakes explained in his book. By 1996, the American College of Sports Medicine (ACSM) was recommending people "Consume the maximal amount that can be tolerated" in the "American College of Sports Medicine Position Stand. Exercise and Fluid Replacement."

Similarly, in 2002, magazines such as Runner's World—North America's most widely read running publication—were publishing advertisements that instructed athletes to, "Drink early and often," "Always drink sports drinks on long runs" and "Don't wait until you feel thirsty." Institutions such as the Gatorade Sports Science Institute (GSSI) often paid for these advertisements.

Ads—as well as articles written by mainstream media outlets such as The New York Times—have played a role in shaping people's ideas about how much they should drink during exercise, said Dr. Mitchell Rosner, a nephrologist and professor of medicine at the University of Virginia. The ads often seem like they're based on science; Rosner said they're not.

"Bottled-water companies, too, are pretty vocal at pushing their product," he noted. "The mainstream advertising tells you you need to avoid dehydration, and if you wait until you're thirsty, it's too late."This is a lie, Rosner explained. Instead of blindly fearing dehydration, athletes should listen to their body's natural thirst mechanism.

"Use your thirst to guide behavior. Don't just drink because you're drinking to prevent a condition that may or may not occur, and understand the consequences of overdrinking," Rosner warned.

Worst-case scenario: Overdrinking while exercising can cause exercise-associated hyponatremia (EAH), a condition that leaves an athlete with a dangerously low sodium concentration in the blood. The effect can be life threatening, as explained in the CrossFit Journal article "Water Wise."

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Dr. Tamara Hew-Butler—an exercise physiologist who teaches exercise science at Oakland University in Rochester, Michigan—has dedicated the last 15 years to studying EAH. She explained that normal blood-sodium levels fall between the range of 135 and 145 millimoles per liter (mmol/L). Drinking too much dilutes these levels.

"When there isn't (enough) sodium in the blood, water flows in (to the cells) and you can get swelling," Hew-Butler explained.

When this swelling occurs in the brain and causes increased pressure in the skull, it's called hyponatremic encephalopathy and it can be deadly.

In the 2002 Boston Marathon alone, 13 percent of 488 runners studied were found to be hyponatremic, while other studies have found some endurance events to report percentages as high as 29 percent, according to Rosner and Justin Kirven's 2006 article "Exercise-Associated Hyponatremia," published in the Clinical Journal of the American Society of Nephrology.

In "Waterlogged," Noakes documented 12 deaths from EAH or exercise-associated hyponatremic encephalopathy (EAHE) between 1981 and 2009. And just last year, two otherwise healthy 17-year-old high-school football players died from EAHE after drinking too much water and Gatorade.

Even though EAH was first described in 1981 in Durban, South Africa, information about it still hasn't sunk in with the masses of endurance athletes today, both Hew-Butler and Rosner said.

Whitfield, though, explained that the elite-triathlon community rejects the ACSM's drinking advice, which was updated in 2007 but still doesn't solve the problem. Instead, elite triathletes follow hydration guidelines that are in line with what Hew-Butler, Noakes and Rosner advise: Drink when you're thirsty.

"From my generation, we had to figure out by trial and error (to learn that) chugging water before a race doesn't work," Whitfield said.

The more he drank, "the more I cramped," he said. "(My) body just wasn't used to that much fluid."

He added, laughing: "That idea that if you wait until you're thirsty, then it's too late, you're already dehydrated—that's crazy."

A Personal Hydration Plan

In 2011—just one year before his fourth and final Olympic Games, in London—Whitfield started working with Trent Stellingwerff.

Stellingwerff, of the Canadian Sport Institute, studied at Cornell University in Ithaca, New York, before earning his doctorate in exercise physiology from Guelph University in Guelph, Ontario. In addition to working with triathletes, he also has experience with rowers and track-and-field athletes.

Leading up the 2012 Olympic Games, Stellingwerff spent time with Whitfield doing what he described as "nutrition interventions."

This meant "doing some things outside the box," Stellingwerff explained.

These experiments involved having Whitfield complete workouts with nothing more than caffeine in his system, for example.

"Or in another session, we would withhold carbohydrates and then go for a cycle. Other times, he'd take lots of carbohydrates to see how his body would react," Stellingwerff said.

The idea was to experiment to discover what helped Whitfield perform best. Part of this trial and error was figuring out a hydration plan.

When helping athletes with hydration, Stellingwerff tests for two major indicators: salt loss and sweat rate. Some athletes sweat more—or lose more salt—than others. Knowing how much salt and water each athlete loses while training or racing provides valuable data to help determine his hydration plan, he said.


Courtesy of Trent Stellingwerff

Exercise physiologist Trent Stellingwerff, Ph.D., helped Simon Whitfield prepare for the 2012 Olympics.


Adam Pretty/Getty Images

After winning a gold medal at the 2000 Sydney Olympics, triathlete Simon Whitfield won silver at the 2008 Beijing Olympics.

To test for salt loss, athletes wear one or multiple patches while training. The patches collect sweat, which then gets spun down in a centrifuge to be analyzed by a Sweat-Chek Analyzer. The Sweat-Chek Analyzer then measures the sodium and salt content of the sweat, Stellingwerff explained.

While Stellingwerff said this test provides an incredibly accurate measurement of salt loss, there's a less sophisticated way of essentially doing the same thing.

"The poor-man's sodium test is to go out on a hot day wearing a black T-shirt, and if you have salt crusts all over the T-shirt, then you're a heavy sweater," Stellingwerff said.

Stellingwerff has found that some people lose as much as 6-8 g of salt during a training session or race. The American Heart Association recommends an athlete consume up to 2.4 g of sodium a day, so these athletes would be losing three or four days' worth of salt, according to those guidelines.

This means an athlete would need to drink up to 24 L of a typical sports drink to replenish their salt, Stellingwerff explained.

"It's impossible," he said.

Rosner reiterated a similar point.

"Sodium concentration (in Gatorade) is not high. The salt in Gatorade isn't in high enough concentrations to prevent hyponatremia," he said.

Instead, Rosner added, drinking Gatorade is equivalent to drinking sugar water.

In fact, the sodium in Gatorade is "irrelevant" in maintaining blood-sodium levels, hydration expert Sandra Fowkes Godek, Ph.D., said in the CrossFit Journal article "Confronting the Drinking Problem." That means overdrinking Gatorade or other sports beverages is just as dangerous as consuming too much water.

Rather than guzzling Gatorade, Stellingwerff recommended his athletes be liberal with salting their food.

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Some endurance athletes add salt and electrolytes to their water to replenish their sodium, but Rosner was adamant that scientists aren't sure whether salt supplementation is useful.

"It's controversial. It's not completely clear whether salt supplementation improves this condition," he said.

The second most important piece of the puzzle for determining a person's hydration needs, Stellingwerff said, is to determine his or her sweat rate. This is done by measuring the athlete's body weight before and after a race: 1 kg of lost body weight while training or racing is equal to 1 L of sweat.

Courtesy of Valerie Hunt

Dave Re/CrossFit Journal

It's common for athletes to lose weight during long events such as Ironman triathlons (left), according to Dr. Tamara Hew-Butler (right). If athletes do not, they're probably overdrinking.

"Anyone can do this," Stellingwerff said. "If you're coming out (of a training session or a race) weighing more or the same, then you're drinking too much."

Hew-Butler also said losing weight during a long endurance session is expected.

"You should always lose a little bit of weight," she said.

If not, you're probably overdrinking, she added.

Both Hew-Butler and Stellingwerff said an athlete should expect to lose between 2 and 4 percent of his body weight during an endurance event.

"That is normal," Stellingwerff added. "I worked with a race walker who lost 6 percent of his body weight. … It's normal to get dehydrated during a race."

An athlete is considered to be dehydrated if his blood-sodium levels are above 145 mmol/L. Only a blood test will reveal the exact dehydration level of an athlete, but the body's natural thirst mechanism is nearly foolproof, Hew-Butler said.

"That's the best fluid guideline that you can have. Your body has sensors that sense blood sodium in your brain and your heart," she said.

Even when thirst does kick in during training or a race, an athlete doesn't need to panic, she said.

"When you start to feel thirsty, you're still in the normal range of blood sodium," she said.

When dehydration becomes dangerous, Hew-Butler said the athlete would be forced to seek out water.

"(When you're dangerously dehydrated), your body dominates every thought you have, so when you get to that point you'd stop and have to drink something. You would actually stop. You would stop performing and look for water," she said.

Getting to that point is unlikely today, Hew-Butler added.

"In today's modern world, there's always water. There's so much water that people … don't actually know what thirst is," she said.

The challenge in getting hydration just right comes because sweat rates vary based on outside temperature and workout intensity. To account for this, Stellingwerff tests his athletes at specific temperatures and intensities defined by an athlete's heart rate. A heart-rate monitor is used to measure intensity, while his athletes train in a heat chamber that allows them to set temperatures and humidities to mimic what they might see in an upcoming race.

Heat acclimation is another variable when it comes to sweat, Stellingwerff explained.

"When you first get into heat you feel horrible, but you can adapt. Within five to 10 days you have an increase of blood volume when you train in the heat, and that allows you within two weeks or so to get an increase in sweat rate," Stellingwerff said.

Once an athlete is acclimated and starts sweating more, it allows him to dissipate heat, which ultimately enables him to perform better.

Because an athlete's sweat rate can change so much, Stellingwerff tests his endurance athletes between two and four weeks before the race, he said. This allows him to be as accurate as possible with hydration advice.

A final important component in determining hydration needs involves the gastrointestinal (GI) tract. The more fit you are, the faster you're going, the hotter it is, the more your blood will go to your muscles during exercise, as opposed to your GI tract, a phenomenon known as blood shunting, Stellingwerff explained.

"So the GI tract of an elite athlete almost shuts down (during a race)," he said.

This means it can be easily aggravated by certain foods or too much water, which can also cause unwanted diarrhea, Stellingwerff noted.

"Four weeks out from a race, we're testing the gut (to see what it can tolerate), especially during workouts that are at race speed, workouts that target heat and humidity at race paces," he said.

Even with careful salt and sweat testing, things such as race-day anxiety can upset the GI tract. Because of this inevitable anxiety, Stellingwerff said he often suggests his athletes drink slightly less on race day than they know their bodies can tolerate in training.

It's a delicate process, but the details are important. They can make all the difference to an elite triathlete.

"It's not just showing up on race day," Stellingwerff said.

The approach is much different than that recommended by big-soda ads that tell you to "drink, drink, drink," he added.

Dialed In

By 2012, Whitfield had his game-day hydration down pat.

He used solid foods to hydrate before a race, often eating chia seeds, which are thought to help absorb and retain water. He also turned to fruits, such as watermelons, and vegetables with a high water content, such as cucumbers.

"I would find hydration in fruits and vegetables instead of drinking water," Whitfield said, adding that this worked better for him than drinking 2 L of water alone.

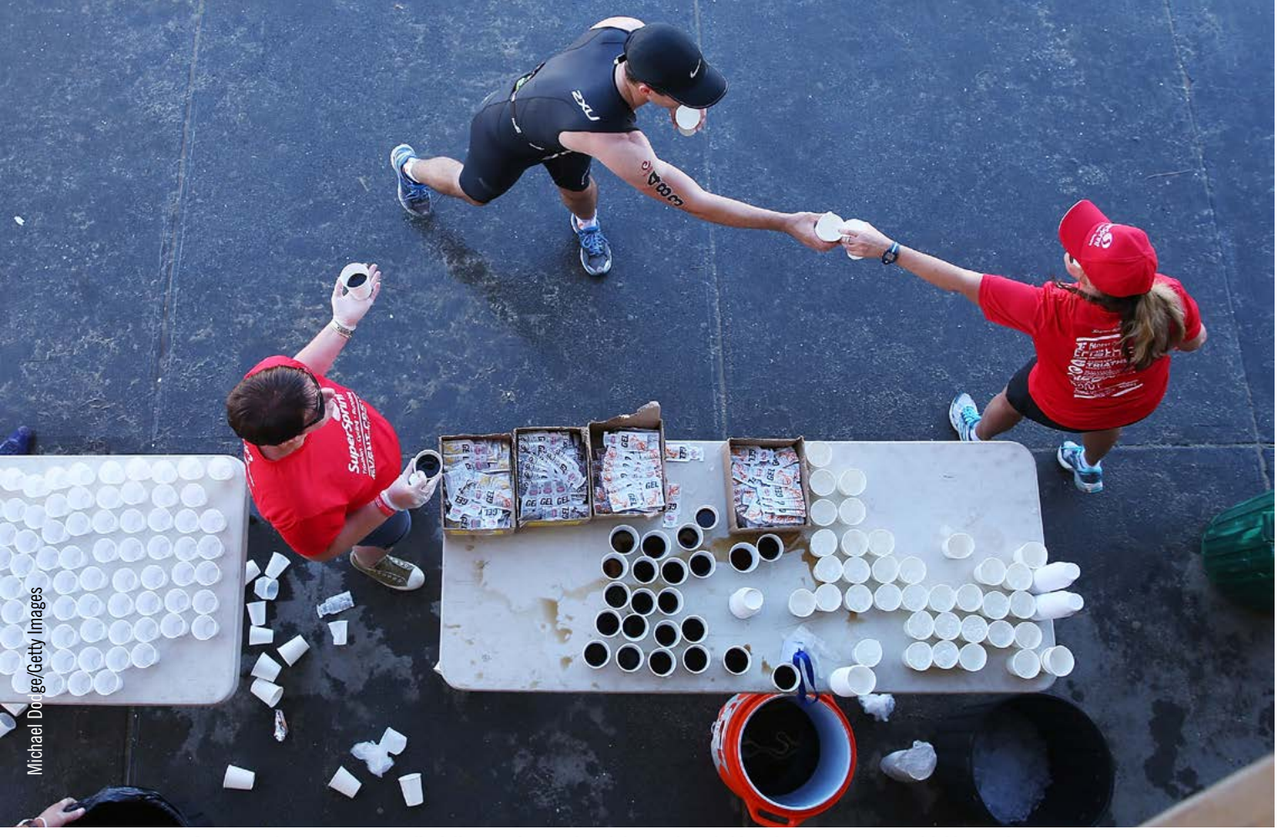
He would eat his last big meal four hours before a race, often a four-egg-and-yam omelette, and salt water.

"I'd use Himalayan rock salt," Whitfield said.

Himalayan salt contains 95 to 96 percent sodium chloride. Many endurance athletes consume it today because it is believed to help with electrolyte balance, although, as Rosner explained, science has yet to prove this claim.

Like Whitfield, Stellingwerff promotes what he calls a "food-first" approach.

"The more solutes you have in your drink or your food, the more fluid will be absorbed. So water is great, but it's the least absorbed of everything," he said.



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At some endurance events, medical directors have reduced the number of aid stations to prevent overdrinking on the course.

Dave Re/CrossFit Journal

Dr. Mitchell Rosner believes athletes should place their trust not in advertising but their body's thirst mechanism.

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He suggested adding sodium and potassium into pre-race fluids, and even drinking milk or baby formula as they contain both protein and carbohydrates.

"Because any time you're absorbing (any macronutrient) across your intestine, it's going to pull water with it," he said.

Stellingwerff specifically remembered encouraging Whitfield to eat chia seeds, bananas and dates.

Whitfield took the advice. Two hours before a race, he would eat a banana to stay satiated. He'd also ingest a pre-race endurance gel full of electrolytes and maybe almond butter on toast. Then, 45 minutes before the race, he would take a 400-mg caffeine tablet.

After this, his decision to drink any water before the race simply depended on whether he was thirsty. Minutes before the race, he might take a final sip or two of water with a bit of flavoring if he felt he needed it.

Then it was go time.

Once the race was on, hydration decisions were largely based on feel, as well as race circumstance. Sometimes drinking was unrealistic.

"It's really easy for me to say 'drink to thirst,' but when an athlete gets thirsty they may not have an opportunity to drink," Stellingwerff said.

Maybe an athlete just can't get his hands on water. Or maybe the moment the athlete gets thirsty it's time to make a move on a competitor. Or sometimes the bike course has a lot of turns. And often the sheer intensity of the race makes drinking difficult.

"They're running well under the 5-minute-mile pace. Try to do that and drink at the same time," Stellingwerff said.

Intensity and race logistics aside, sometimes elite triathletes choose not to drink—even when they're thirsty—especially if they're susceptible to GI-tract reactions that can be brought on by drinking.

Whitfield said he tried to drink when he was thirsty and when circumstances permitted, but he also knew it wasn't going to kill him if he held off and went just a couple more miles without water. When he arrived at a mid-race water station, sometimes he used it just to rinse off.

Looking back on his career, Whitfield said he believes many of his mid-race hydration decisions came down to doing what his body was used to. Eating more gel or drinking more water during a race than he had practiced in training wouldn't have been a good idea, as his body wouldn't have been ready for it.

He also knew that getting a bit dehydrated and losing 2 to 4 percent of his body weight was something from which he'd easily recover. It was just part of his sport.

Today's Challenge

Whitfield learned long ago that following hydration guidelines suggested by the ACSM and GSSI doesn't help performance.

Elite triathletes like Whitfield have the luxury of learning the science from top experts in the field. They race at such high speeds that drinking—let alone overdrinking—is almost impossible. And they usually lose more water than the average person because their sweat rates are so high. Because of all of these factors, Stellingwerff calls drinking too much "a non-factor in elite endurance sports."

Such is not the case in the recreational triathlon community. The average triathlete has ample time to chug water during the race. Often, he doesn't sweat as much. And he likely doesn't have access to expert scientists or the latest technology to help him with hydration planning

Instead, the recreational triathlete turns to mainstream media—to advertisements created by Gatorade or bottled-water companies—for advice, Hew-Butler said. Whether conscious or not of how he's internalizing information, he becomes terrified of getting dehydrated and thinks he must drink as much as his body can tolerate.

"With advertising there's no real regulation," Hew-Butler said. "When (scientists) put studies out (about hyponatremia), it takes us a couple years, but ads can tell you you need water, and they can put it out tomorrow."

And the consequences of listening to these ads can be dire for too many endurance athletes.

"The scary thing is it kills people," Hew-Butler said. "And it kills healthy people." ■

About the Author

Emily Beers is a CrossFit Journal contributor and coach at CrossFit Vancouver. She finished 37th at the 2014 Reebok CrossFit Games.