



# **Innovations in Hydration Science – Research and Technology Come Together to Illuminate New Advances**

*How new tech is poised to help athletes and clinicians accurately measure fluid levels in the body.*

# Innovations in Hydration Science – Research and Technology Come Together to Illuminate New Advances

In August 2001, the importance of hydration in professional sports became a focal point when Korey Stringer, a Pro Bowl offensive tackle for the NFL's Minnesota Vikings, collapsed and died of heat stroke during the team's training camp. After the incident, it was discovered he was significantly dehydrated at the time of his collapse.

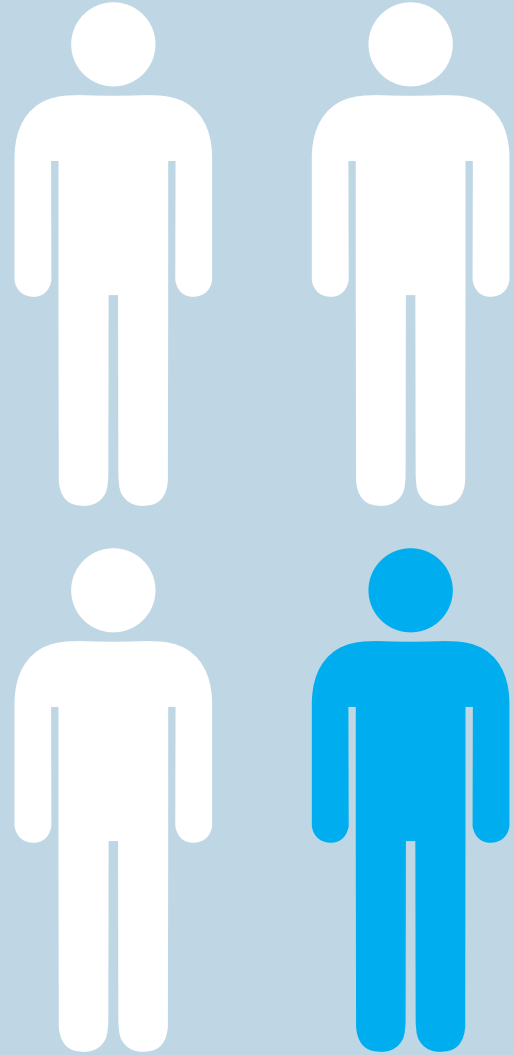
Today, athletes at all levels are more focused than ever on keeping their bodies properly hydrated to enhance performance and mitigate safety risks. The Korey Stringer Institute (KSI), a non-profit organization housed at the University of Connecticut, born from Kelci Stringer's efforts to honor her husband's legacy, focuses on providing first-rate information, resources, assistance and advocacy for the prevention of sudden death in sports via health and safety initiatives.

"Hydration is a complex and fluid science," said William Adams, Director of Sport Safety Policies for KSI. "Getting more information about hydration available to athletes and people in high-intensity jobs is imperative to making sure they stay safe while training and working."

## Tackling the Issue

Adams has worked with KSI since it opened in 2010, where his responsibilities focus on assisting state high school athletics associations develop and implement safety policies, including heat acclimatization, emergency action plans, defibrillator use and more. He is also very active in research in hydration, thermal physiology, exertional heat illnesses, and preventing sudden death in sport and physical activity.

About **1 in 4** Americans are properly hydrated.



Infographic created with information provided in endnote <sup>1</sup>

The biggest challenge he sees to ensuring all athletes maintain appropriate levels of hydration is the relative lack of non-invasive, real-time methods available to easily track and assess it during exercise or physical activity.



“Clinically, there are three primary options,” he said. “Urine assessment, in which you look at the concentration of the urine, its specific gravity and its color. The darker the yellow color, the more dehydrated a person is. Then there’s blood assessment, in which you look at plasma volume changes and the concentration of plasma. The most real-world application, however, is body weight changes before and after exercise.”

None of these options are without their challenges. With urine and blood analysis, there needs to be urine and blood samples available. These assessments are costly because of the types of equipment needed for the testing process. Also, measuring body mass changes before and after activity are difficult in some situations making these clinical measures not applicable in all situations.<sup>2</sup>

“If you are a soldier in a remote setting for training or a mission, for example, there’s no way you’re going to be able to get a blood or urine sample and analyze it within a reasonable amount of time,” said Adams. “Also, it is not feasible to obtain a nude body mass before and after physical activity, making it difficult to assess fluid losses and subsequent fluid needs.”

Another difficulty in managing hydration in athletes, soldiers and laborers, is the fact that fluid needs are very individualized.

“Each person’s fluid needs are individualized and are based on sweat rate, exercise intensity, fitness status, acclimatization status, and other factors,” Adams says. “Based on this complexity, it is difficult to prescribe a general hydration strategy due to the fact that any two people could have very different needs during exercise. One athlete might have a sweat rate of 2.7 liters per hour and his teammate a sweat rate of 1.0 liters per hour. Prescribing a hydration plan based on anyone’s needs could be detrimental to the other; too much water could cause the low sweater to risk hyponatremia and too little water could cause

the high sweater severe dehydration during prolonged exercise,” explains Adams.

Adams also acknowledges the challenges of other side of the spectrum; hyperhydration, or a greater than normal volume of body water.

“It’s not uncommon for endurance athletes (i.e., marathoners or Ironman triathletes) to experience the other side of the hydration equation – hyponatremia – which is essentially a result of too much water and too little salt in the body, and without proper management can lead to poor patient outcomes. Both dehydration and hyponatremia are dangerous to athletes, and being able to manage fluid needs during activity is important,” he concluded. “We need to look at the development of tools that allow athletic trainers, athletes coaches and strength and conditioning coaches to measure and analyze the overall picture of hydration status – in real time.”

## **New Technology on the Playing Field – Nobo’s B60 Hydration Measurement Tool**

One digital health company in Milwaukee, Nobo, has developed a new product that could serve as a more realistic option for measuring and assessing hydration. Russ Rymut, founder and CEO, is introducing B60, a device that has the potential to change the way athletes and clinical professionals measure hydration.

“The idea of measuring hydration actually came from my mother,” said Rymut. “She was working with an older couple that weren’t eating or drinking enough. When their friends went into the hospital, they had horrible outcomes, and my mother suspected those problems were results of dehydration and the physicians didn’t know. With a background in healthcare technology and devices, I realized that she might be right - and that there really was no good way of assessing hydration.”



So Rymut began researching hydration and testing potential methods to monitor it. He eventually found a dehydration signal that correlated with weight loss. But rather than creating another solution involving stepping on and off a scale, Rymut's new tool measures how light is absorbed by water in the body.



“B60 continuously measures the absorption of several different wavelengths of light,” he said. “By shining light into tissues in the body, you receive a signal that allows you to measure the complete state of hydration – and assess if you need more water or if there is too much in your body.”

## The Science of Hydration

B60's ability to measure hydration in real time is extremely important for athletes, especially those engaged in high-intensity training, because weight loss from loss of water can occur quickly.

Adams outlines the effects of water loss in the following way: “With dehydration, if you're just looking at a pure performance perspective, after two percent body mass loss as a result of fluid losses you start to have performance problems, especially in endurance exercise,” he said.

“When you get to three or four percent, that's

when anaerobic performance begins to kick in, and you lose power and strength at a more rapid pace. Other issues that can happen with dehydration include cognitive impairment (around the 2 percent mark), changes in mood, impaired reaction times, impaired high motor skills and thinking.”<sup>3</sup>

The effects can quickly manifest themselves in other areas of the body. For every one percent a person loses of body weight in water, their temperature increases by approximately half a degree,<sup>4,5</sup> and their heart beat increases by about three beats per minute.<sup>6</sup>

If someone is three percent dehydrated, their body temperature would, in theory, increase approximately 1.5 degrees and their heart beat would increase about 10 beats per minute over what they would be when the person is correctly hydrated.

“From a performance perspective, with an increased heart rate your performance is reduced because you have less leeway in terms of the max heart rate you want to achieve while competing,” said Adams. “Your max heart rate is occurring at a lower intensity.”

On the other end of the spectrum, being over-hydrated is especially problematic for people who engage in long periods of exercise, like marathoners or Ironman competitors.

“For marathon runners, hydration is tricky,” said Rymut. “For many people, they will be training and drinking completely different amounts of water than what they drink during the actual race. You actually get to the point where people are drinking way too much water, because they feel like they shouldn't pass up any of the hydration stations.” In fact, a 2005 study of several hundred participants in the Boston Marathon found that 13% had hyponatremia, and 0.6% had critical hyponatremia.<sup>7</sup>

other wearable fitness items, so people can easily incorporate it into their routines.”

The device also has plenty of clinical applications. There are many challenges, for example, of ensuring proper fluid levels in low birth-weight infants in hospitals.

“The fluid balance in a three- or four-pound premature baby can change very quickly,” said Rymut. “Maintaining the proper balance is a huge challenge for those low birth weight infants, and using traditional tests on such young patients is quite difficult. This solution would make it much easier for clinicians to make sure babies are getting no more and no less fluid than they need.”

For hospitals and trainers, B60 is a more affordable means of providing the people they care for with an accurate and reliable means of assessing hydration. For individuals, it is a simple, comfortable and useful means of getting that testing done.

## Constantly Working for Better Results

Adams and the Korey Stringer Institute continue to work with a variety of companies and organizations testing various theories about hydration products and learning more about how to more easily assess hydration in the body. He believes the technology options that are coming to the forefront have the potential to address the challenges of hydration – and the sign a better future for prevention of hydration-related health problems.

“All of us at the Korey Stringer Institute want to see much more awareness and prevention of hydration-related health risks,” he said. “Having a device that is wearable that can accurately assess hydration status during rest and physical activity is a huge step forward. I’m looking to see what the future has in store for this technology.”



To complicate matters even further, many of the same symptoms occur for both dehydration and over-hydration, meaning people who do not have the means of analyzing their hydration levels in real-time could assume they are dehydrated and begin drinking water to compensate, when in reality they actually already have too much water in their system.

B60 would effectively solve this problem for people such as athletes, soldiers and workers of high-intensity jobs like construction, because it is a wearable, non-intrusive device that gives real-time readings of hydration levels.

“For most athletes and workers in harsh environs, laying down in a lab somewhere really is not a practical way of measuring hydration,” said Rymut. “This device can be worn during athletics, out on the battlefield, basically anywhere. It’s comfortable and barely noticeable. It’s even compatible with

## Endnotes (Works Cited)

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