

THE SCIENCE BEHIND HYDRATION

Featuring: Karyn Wulf, MD, MPH, Medical Director, Pediatrics, Abbott Nutrition

TRANSCRIPT

Maura Bowen: When I was researching for this podcast episode, I came across a story about a man in his athletic prime. He was running at a pace of seven minutes per mile, feeling great for the first 10 miles of the Daytona Beach Half Marathon, until he collapsed in mile 12. Brain fog, glassy eyes, elevated heart rate, all the signs pointed to significant dehydration and heat stroke. And that's scary, right? But first know that the runner fully recovered. Secondly, know that I didn't relay that story to worry you. The point is that dehydration really could happen to anyone. And not just in the scenario of extreme exertion, like the one I just described. You can become dehydrated when you've spent too much time in the heat, or when you've contracted the flu, or when you've been traveling all day. There are lots of other reasons too. So, let's talk about that today to help ensure you know when you, or a loved one is dehydrated to understand what dehydration can mean for your body, and then to know what to do to properly rehydrate.

Maura Bowen: I'm Maura Bowen and podcasting for Abbott Nutrition Health Institute. And with me today is our own Dr. Karyn Wulf, medical director of pediatrics here at Abbott, and frequent contributor to these podcasts. She's one of my favorite guests, if it's okay to have favorites, but you'll see why through the course of this discussion. So, Dr. Wulf, welcome.

Karyn Wulf: Thank you, Maura. And it's great to be here again today.

Maura Bowen: So, before we get started, I'll remind everyone that we are still in the middle of a pandemic and we're playing it safe by social distancing. By that, I mean, Dr. Wulf and I are both dialing in for this discussion. So, the sound quality of this recording may sound a little bit different from what you're used to hearing. I should also note that this recording is just the second in a three-episode series on hydration. The first episode was about hydration for you as an athlete, whether you're in that elite category or a recreational road warrior, like the rest of us. And then, there's this episode in which Dr. Wulf will discuss, as I mentioned, hydration basics, including how to know when you're dehydrated and what to do about it. And in the third episode, we'll talk about hydration across the lifespan. So, these are all episodes that are useful information. We hope you'll make it a point to listen to each one. So, Dr. Wulf, before we begin, do you mind telling our listeners a little bit about yourself and your background?

Karyn Wulf: Sure. Maura, as you mentioned, I joined Abbott about two years ago as medical director for pediatrics, but I'm also a general pediatrician and I've worked for the last 18 years as a generalist in pediatric emergency medicine. So, basically, my whole career has been taking care of acutely ill children in the urgent care or emergency room setting.

Maura Bowen: And I know we're going to spend some time today talking about water and electrolytes, and that's an obvious place to start for discussion on hydration. But, first, I'm hoping we can kind of set the stage by talking about electrolytes, what they do, why they're important and where can you find them?

Karyn Wulf: Certainly. So, electrolytes are minerals and they're minerals that the body needs to function properly. So, the most important minerals, when we talk about hydration, generally are the players you've probably heard of. So, sodium, chloride and potassium. Now, sodium and chloride together make up what we know as table salt. So, the salt that you put on your food is a combination of those two minerals together. Potassium, and sodium, and chloride are found in many of the foods that we eat. So, people often talk about how much potassium a banana would have in it, but you can see there are electrolytes, which are really these minerals, in foods and beverages that we consume.

Karyn Wulf: We also think about some other minerals like calcium, phosphorus and magnesium that are important for cellular function, especially our muscle cells. And these can be impacted by hydration. But, for today's discussion, sodium chloride and potassium are the key players.

Maura Bowen: And what is the interplay between electrolytes and water in the human body?

Karyn Wulf: So, if you think about the human body, it's really a very complex integration of systems. You've probably heard the statistic that our bodies are over 70% water and the regulation of that right balance of water and electrolytes involves several different systems. When we think about the human body, the more important something is, the more systems there are to regulate it and keep it pretty tightly regulated. And hydration is really important to the human body, so there's a lot of different systems that work together to make sure we have that right balance.

If you were to look inside of our body, you wouldn't find free water anywhere. It's all some degree of a salty water. So, there's some level of sodium water, potassium and chloride in the cells inside of ourselves, and also in the bloodstream itself.

Maura Bowen: Now, there's a relationship between salt and water too, right?

Karyn Wulf: That's correct, Maura. And a simple rule of thumb when we're thinking about salt and water, is that where salt goes, water follows. And that's true going into cells and also coming out of cells.

Maura Bowen: So, eventually, the fluids we take in are absorbed into our gastrointestinal tract or our guts. So, how does this work? And can you tell us why that's important?

Karyn Wulf: Sure. When everything's working the way it should, the main way we get water into our bodies is actually through our gastrointestinal tract. Our GI tract absorbs both water and electrolytes from the foods and beverages that we drink. When you look at this absorption process at the cellular level in the gut, so how does this actually happen? Some water can be directly absorbed but, most of the time, the most efficient absorption of water through the intestinal cells uses something called the sodium-glucose co-transporter. That's a fancy way to say that water in our intestinal tract can be absorbed more readily if there's a little bit of glucose around. That glucose can open the door for sodium to enter the cell. And then, water follows salt. So, water follows that salt into the cell.

Karyn Wulf: So, when we think about how our GI tract best absorbs water, that optimal absorption happens when we have a little bit of glucose and sodium around as well. Once that water and the electrolytes, as well as the other nutrients from our food, are absorbed from the GI tract they enter our bloodstream. And when they enter our bloodstream, they're carried to the different areas of our body. These electrolyte levels in the bloodstream are highly controlled to stay in a certain range, and no matter how much we take in by eating. And this controlled by several systems, including the kidneys. And these kidneys act as filters to help us eliminate excess sodium, potassium and water, if we're well-hydrated. Or to help us hold on to them, if we're not well-hydrated.

Maura Bowen: And water and electrolytes play a role in the volume of blood pumping through your blood vessels. Can you talk about that for a moment?

Karyn Wulf: Sure. When we think of the concept of blood pressure that, ultimately, is how much blood volume is there pumping through our blood vessels. And this is another part of our hydration system that's very tightly controlled. So, in extreme cases, when we don't have enough water around, and we're significantly dehydrated, our blood pressure can actually drop. And that volume of blood that circulates through our blood vessels is not high enough. And that's a condition our body does not like to be in.

And so, it gives us several warning symptoms to let us know that we need to get more volume into our bloodstream. If possible, we can do that through digesting more water and electrolytes through our GI tract. And, if that's not possible, sometimes we have to do that directly into the veins, through IV fluids.

Maura Bowen: Now, I know we talked about this briefly as we were preparing for this recording, but you were explaining to me that thirst isn't necessarily a tried and true way to tell that you're dehydrated. So, can you talk more about that? Because if thirst isn't our primary cue to take in more fluids, what are some more reliable cues that we can follow?

Karyn Wulf: You are right, Maura. While thirst is a cue, it can be a late sign that you're becoming dehydrated. So, by the time you're thirsty, you're probably already a little further behind on fluids than you should be. Probably, for the average person who is otherwise feeling well, your urine output is going to be your more sensitive indicator of how well or poorly hydrated you are. The frequency of your urination and the concentration of your urine are pretty accurate indicators of your hydration status on a daily basis.

Maura Bowen: And there are clinical ways to determine dehydration too, right?

Karyn Wulf: Sure. When you come into the emergency room, to see me or one of my colleagues, we look for many different symptoms to potentially tell us that someone might be dehydrated. In younger ones, like babies, we look for a decreased number of wet diapers, sunken fontanelle, which is the soft spot, dry mucus membranes, and decreased tear production. In older people, we do some of the same symptoms. Again, if they do say they're thirsty, if they've not been urinating as much. But there's some other medical things we can look at as well.

Karyn Wulf: One of the earliest indicators is, actually, your heart rate being elevated. This is an earlier sign of dehydration. So, I don't know if you've ever been out for a run early in the morning where maybe you didn't drink a glass of water first, and you just feel like your heart rate's going way faster than it usually does when you run. That's one of those symptoms of dehydration when your body's working a little harder, and your heart rate goes up.

Karyn Wulf: In some conditions, or sometimes when we have a pre-weight, you can look at weight loss. So, this is actually one way that athletes can measure how much fluids that they lose during a workout, if they weigh themselves before and after a workout. We look for, again, the concentration of your urine. So, we can actually do a dipstick test to look at, what's called, the specific gravity. And we also look for the presence of, something called, ketones in the urine. And those can both be symptoms of dehydration. And, finally, if your blood pressure is low this is a very late sign of dehydration and generally a symptom that we need to take very seriously. And sometimes we can even see the skin turgor, the sort of tightness of your skin, it gets looser and kind of like a tent. And those are also late signs of dehydration clinically.

Maura Bowen: So, there are lots of different ways to become dehydrated. As we noted in the introduction, dehydration isn't just for athletes. So, what are some of the other ways that dehydration can occur?

Karyn Wulf: So, one of the most common reasons for dehydration are our illnesses. So, as you can imagine especially GI illnesses where you're having significant vomiting or diarrhea, you're having increased loss of fluids through that type of illness. So, that's one of the more common reasons that we would see patients in the ER for dehydration. But other things, even like fevers can cause increased fluid loss, even if you're able to

eat and drink. Hot heat and excess sweating, and fevers are all ways that you can lose more fluids and become dehydrated.

Karyn Wulf: One of the things that we see not infrequently in an emergency setting is actually new onset diabetes, those patients are often at risk for severe dehydration. And if you think about it, children, especially during illnesses, can especially be at risk for dehydration because they have a relatively high body surface area. So, a lot of our normal daily loss of fluids occurs from just evaporation off of our skin, and off of our mucus membranes. So, anything that increases that puts you at a little higher risk for dehydration.

Maura Bowen: If you realize you're dehydrated, what are some ways to rehydrate?

Karyn Wulf: So, oral rehydration, or using your GI tract to rehydrate is the preferred method of rehydration. And there are many studies that suggest that oral rehydration with an appropriately balanced glucose, sodium chloride, potassium water solution, or an oral rehydration solution can successfully rehydrate patients. In fact, the World Health Organization has great guidance on the types of oral rehydration solutions that are appropriate for this. So, when possible, rehydrating orally through your gastrointestinal tract is the preferred method.

Karyn Wulf: But there are times in acute illness, or when oral rehydration solutions are not available that a direct infusion of a saline solution, so this is a mixture of sterile water, salt, and chloride, can be given directly into the veins. We call this IV fluids. And these fluids because they go directly into the patient's bloodstream, they don't need glucose because they don't need to unlock that glucose-sodium transporter that we talked about in the GI tract. So, the IV fluids are generally just the salt water. If someone's placed on IV fluids to maintain their hydration, once they've been rehydrated then small amounts of glucose are generally added back into those fluids in the IV, and the sodium levels are decreased a bit.

Maura Bowen: As we're all going about our daily lives, what are some of the key things we should know about the role staying hydrated can play in our overall health and our wellbeing?

Karyn Wulf: As I mentioned before, when your body has so many complex systems working together to maintain hydration and maintain very tight levels of sodium and chloride in your bloodstream, it's really important for your cellular and body's normal functioning. So, hydration is a critical part of health on a daily basis. And, in fact, if you think about it, we can live without food for several weeks, but you can only live without water for a few days. And that is because water is truly important to our lives. But not just water, as we mentioned, electrolytes as well.

Karyn Wulf: And so, our daily lives, we should be thinking about anytime we're having increased losses, whether it's through heat, or sweat, or exercise, we really need to make sure that we're not only replacing

what we need every day, but extra on top of that to replace the losses that we are incurring, even just during normal activities.

Maura Bowen: You've talked about some of the cues we should pay attention to in our bodies to let us know it's time to take in some extra fluid. But if you're mildly or moderately dehydrated, what are some of the symptoms you might expect to see?

Karyn Wulf: The symptoms of mild to moderate dehydration may include some mild nausea. It might include a headache. You may feel some decreased focus, or even notice a little bit of a delayed response time. You may notice, again, that decreased urine output. And you may notice that your skin or mucus membranes feel a little bit dry. Even further, when you have more significant dehydration, almost every system in your body can be impacted by not being well-hydrated.

Karyn Wulf: We didn't talk much about it, but our respiratory tract is really important to have good hydration. So, if we think about how our respiratory cells work in our nose and our throat and in our lungs, there are little hair cells in those tracts that are covered with a thin layer of mucus, and that helps to capture and sweep out any particles that we encounter, whether they're particulate matter in the air, or even bacteria and viruses. When we're not well hydrated, that mucus becomes thicker and it's more difficult for those hair cells to do their job.

Karyn Wulf: We didn't talk about it because nobody likes to talk about poop very much, but if we don't have... Well, doctors do, and a lot of parents do. But if we don't drink enough fluids and have enough electrolytes, we actually can get constipated and have difficulty moving our bowels normally. So, our normal gastrointestinal function requires a fair amount of fluids to do its job well.

Karyn Wulf: If you've ever heard of kidney, dehydration can be a cause of kidney stones as well, because we're not getting enough fluids to flush through our renal system. Our skin can become dry, and you can get increased skin breakdown and even cracks, which can be another site of entry for infections. And then, our musculoskeletal functions. We can get muscle cramps. Our muscles can be fatigued more easily. And neurologically, as I mentioned, you can get headaches, and have some decreased focus and decreased response time. So, our proper water and electrolyte balance is really critical for almost every immune and body system function that we have.

Maura Bowen: So, with all that said, do you have any parting advice for our listeners about staying hydrated and addressing dehydration when it occurs?

Karyn Wulf: I think the most important thing is to recognize that you not only need water and electrolytes every day to maintain your normal body function, but you also need to replace losses that you might not

even think are very significant. So, it really is a good rule of thumb to keep an eye on your urine output, keep an eye on how your body's feeling, and make sure you're taking enough water and enough electrolytes to replace what your body needs on a daily basis, as well as any small losses that might be ongoing.

Maura Bowen: Well, perfect. This was fun, Dr. Wulf. You are always full of helpful insight. So, thank you again for joining us. And you know we'll tap you on the shoulder again sometime to ask you to come back.

Karyn Wulf: It's always my pleasure to be here, Maura, thank you so much for inviting me.

Maura Bowen: Thank you. And for our listeners, I mentioned at the beginning of this recording that, we're developing two additional hydration related podcast episodes for your listening pleasure. So, you'll be able to find these and many other episodes on health and nutrition by typing anhi.org into your browser, clicking Resources, then Podcasts and Videos.

And if you become an anhi.org member today, which you can do by clicking Register at the top of our homepage, you'll receive regular nutrition science news updates from our team. And, of course, you can also follow the Abbott Nutrition Health Institute on LinkedIn. And then, finally, our website and anhi.org has a series of printable resources related to topics just like this one, including a series of hydration infographics. And you can find these resources on anhi.org, by clicking Resources and Printable Materials. In fact, we have a great infographic on hydration, and we hope you'll check that out.

Thanks everyone. Stay healthy and safe.