TTIPS VOL. 28/22 – INSIGHTS
Heat Exhaustion, Heat Stroke, and Keeping Cool on Your Rides

Introduction

It is hot in the Low Country, seriously hot….and humid, of course. And we choose to ride in it. Such is our OCD (Obsessive Cycling Disorder) affliction. In this heat, we need to be careful, and we need to look out for each other during our rides.

Every year, there are more than 67,000 emergency room visits due to heat. The two most common diagnoses are HEAT EXHAUSTION and HEAT STROKE. Do you remember the difference between the two? Do you know how to recognize and treat them? Here's a refresher from Men's Health magazine, July-August 2022:

HEAT EXHAUSTION SYMPTOMS

- Heavy sweating plus:
- Cold, pale, clammy skin

- Fast, weak pulse
- Muscle cramps, tiredness, or weakness
- Nausea or vomiting
- Dizziness or headache
- Fainting

WHAT TO DO FOR HEAT EXHAUSTION

- Move to a cool place
- Loosen clothing
- Drink cool liquids
- Cool down with cool cloths, or douse with cool water
- When possible, take a cool bath
- Get immediate help if vomiting or symptoms last longer than an hour

---

HEAT STROKE SYMPTOMS

(These symptoms are extremely serious. A person can die or be permanently disabled if these are not treated quickly)

- Body temperature of 103 degrees or higher
- Hot, red, dry, or damp skin
- Fast, strong pulse
- Confusion
- Headache, dizziness, or passing out.

WHAT TO DO FOR HEAT STROKE

- Call 911 without delay
- Get the person to a cool location
- Use cool cloths or a cool bath to lower their body temperature
- Do not give them something to drink

Okay, that's a great review. Here's a recent article from a runner's magazine on how to keep cool in the first place. Enjoy.

The Great Cooling Revolution in Endurance Sports

Studies show that reducing body temperature may improve performance even in relatively temperate conditions. We've known that physiology for a long time, but it wasn't until recently that athletes started making cooling techniques a top priority. All around the world, in all different sports, there is something big happening. We are witnessing a cooling revolution.

AUGUST 2, 2022
DAVID ROCHE

TRAIL RUNNER

Hi everyone, this is David, and I have a confession to make. I just watched Unbreakable, the documentary about the 2010 edition of the Western States 100 Miler, for the very first time.

After many years of coaching.

After coaching multiple winners of the race.

In the year of our Lord (Anton Krupicka), 2022.

When I first confessed to my sins on social media, I got tons of comments from people who were shocked, as if I told them I just discovered toilet paper.

In my defense, I wasn't coaching back in 2010, and by the time I figured out that I missed this essential piece of trail running culture, it felt too late to catch up. I feel the same way about Harry Potter, missing it as a kid who thought it was a children's book, and by the time I realized it was a seminal piece of modern literature, J.K. Rowling had already made a Twitter account.

So I watched Unbreakable on the edge of my seat. I wanted to see everything. How has the sport changed? Why does 2010 look like 1950? Would I feel comfortable wearing Anton's shorts when running past an elementary school?

There were countless little differences between then and now. Geoff Roes said he consumed 800 calories just 30 minutes before the race started, which is a gut protocol that I wouldn't suggest at home. Kilian Jornet wore white spandex shorts, which is one of history's greatest power moves. But my co-coach Megan and I kept finding ourselves screaming at the TV, asking the same question with increasing frustration: *Where are the cooling techniques?!*

We saw one guy put his head directly into a cooler full of ice. Perhaps that was an early step in the evolutionary timeline of cooling techniques, similar to how the early mammalian ancestors of whales lived on land and looked like oversized gerbils. The four champions that the movie followed would put some water on their heads at aid stations, but that was mostly it. Somehow, they ran blisteringly fast races. But how fast would they have gone with modern approaches to cooling?

It's scary to think about just how good they were.

Changes In Cooling Techniques

At some point, between 2010 and 2022, there was a seismic shift in how athletes approach cooling at Western States, with tens of thousands of pounds of ice, changes in clothing and gear, and other techniques we'll get into later. Times are improving by leaps and bounds every year. Cooling improves speed, reduces DNF rates, and likely reduces the incidence of negative health outcomes.

But watching that amazing movie and knowing the science of how temperature influences performance, Megan and I had another realization. Advanced cooling techniques are going to take the entire endurance world by storm, from the top to the bottom, sooner rather than later.

You can already see the cooling revolution across other sports. At this year's Tour de France, male and female athletes were constantly spraying themselves with cold water, even on days

that weren't sweltering. If you tuned in and saw little lumps under their shoulders, that was usually an ice pack from the team car. Soccer players can sometimes be seen in ice vests pre-match. At the World Track Championships, ice vests were the fashion must-have of the starting corral. Mid-race in the 5,000 meters, eventual winner Jakob Ingebrigsten even dumped water on himself from a table alongside the track.

Cooling techniques are the frontier of applied exercise science. Yes, athletes have been doing versions of these practices for decades, and studies have been out there on PubMed for longer than that. The difference is that now, it's not just athletes at the cutting edge, like Galen Rupp in his pre-marathon ice vest at the 2016 Olympic Trials, or athletes competing in sweltering races like Western States. Cooling is for everyone, in all different conditions.

The frontier is getting crowded.

If you look closely at endurance events all over the world, you can see the future. And the future is looking cool as hell.

COOLING SCIENCE

Let's take a step back. What motivates these shifting approaches to cooling? The most clear way to see the impact of temperature on performance comes from a suite of studies on major marathons. Each study takes a similar approach, using participant datasets of race results, controlling for different variables, and seeing what has the biggest impact on times. The overwhelming conclusion: rising temperatures begin to hurt performance outcomes much earlier than you might think.

A 2012 analysis in *PLoS One* examined around 2 million results from 6 major marathons and found that times began to get slower and DNFs increased around 10 degrees C/50 degrees F. By 20 C/68 F, average times would decrease by almost 30 seconds per mile for an athlete running a 3:15 marathon! A 2019 study in the *International Journal of Environmental Research and Public Health* scoured Boston Marathon results for male athletes from 1897 to 2018 and found a similar relationship. In road marathons, performance starts to decrease well before you'd even take off your jacket to go to the store.

A 2012 review in *Sports Medicine* looked at some of the mechanisms. While the exact reason for reduced performance varies, it has to do with some combination of high brain temperatures when core temperature is very high, anticipatory downregulation of performance prior to that point, fluid balance offsets, and thermal strain/hyperthermia reducing metabolic efficiency, causing peripheral/central fatigue, and stressing the cardiovascular system.

Whether in the lab or in the field, the impacts of cooling strategies on performance can be massive. A wonderful 2013 review study in the *British Journal of Sports Medicine* found that precooling and during-event cooling both have positive, moderate effect sizes on performance. A 2015 review in BJSM solidified those findings, finding a 5.7% performance improvement from pre-cooling and a 9.9% improvement from cooling during events. Important factors include the temperature and exercise protocol, elevated skin temperature to core temperature gradients (2014 study), and heat acclimation status, among many other things.

The science is clear: heat hurts endurance performance, *even when it's not that hot*.

4 COOLING GUIDELINES

Where the science is less clear is on what exact protocols are most beneficial for improving performance in real-world settings. For example, the reviews indicate that ice vest cooling is the best option for mid-event performance, but that may be unrealistic or even against race rules outside of aid stations. There are countless articles talking about all sorts of cooling interventions that have success, so experiment and find what works for you.

Here are the 4 interventions that Megan and I have started asking athletes to use when possible, starting with the most important.

ONE : Keep your body wet, ideally with generous applications of cold water.

If you watched the Tour de France this year, you probably saw riders spraying themselves down constantly. They'd even do it during hard attacks–launching up the road, grabbing a cold bottle from a team employee or a spectator, and dousing themselves vigorously before tossing the bottle aside. It was a wet t-shirt contest at 30 miles per hour.

The evaporative cooling mechanism has the dual benefits of lowering skin/core temperatures while being as refreshing as an ice-cold Zima. In your races, douse yourself like it's your job, focusing on high-yield zones like the head, neck, and core. Just make sure you practice chafe protection with lubrication and strategic taping to prevent your nipples from becoming distant memories. Try to avoid spraying your shoes directly, and if you're planning a #StayWet approach, don't wear compression socks, which can pool water on your feet over the course of longer races.

TWO: Try to keep your skin surface temperature cool with light, reflective clothing in extreme heat, or with water in more temperate conditions.

In Unbreakable, 2nd placer Anton Krupicka was wearing nearly nothing, while winner Geoff Roes was wearing a white shirt that was constantly wet. I wonder if the difference that day was just a wardrobe choice. A light, reflective layer has two benefits: protecting the skin from direct sunlight and keeping the skin surface wet for longer. In temperate conditions, a normal singlet or shirt will be fine, but consider more when temperatures get above 85 or 90 degrees F.

THREE: Apply ice to your body whenever possible using your hat in temperate conditions, or a mix of a hat, vest, sleeves, and other options in very hot conditions.

A little ice goes a long way, and any approach to keep some on your skin works. It's highly dependent on options at races and your clothing choices, so make individual decisions that make the most sense for you. I love hats in almost all conditions as a chance to put cold water or ice on the head. As it gets hotter, stuff ice wherever possible. If I coached more triathletes, I'd have them wearing spandex with accessible ice pockets, and I wonder if more highly-tailored options may come to running soon.

FOUR: Pre-event, apply cold water to your skin after the warm-up, and consider an ice vest for warmer days.

Once core temperature rises, it can be difficult to bring it back down, so make sure your race isn't sabotaged before the start line. Pre-cooling techniques start simply, with making sure your skin and head are wet before getting to the start line. I am asking athletes I coach to get an ice vest to put on after their warm-ups, and that will be helpful for ultra aid stations too.

CONCLUSION

Of all the articles I have ever written, this one might provide the advice that gives you the biggest immediate advantage. Make small changes in an iterative fashion, testing them in training to avoid epic fails on race day. Try different things, and tune into signals from your body. Adjust approaches to prevent blisters and chafing. And dear Lord Anton, protect your nipples.

In this momentary offset between what we know in the scientific literature and what we see in practice in temperate races, there's an exciting opportunity to apply cooling techniques that may enhance performance with little downside.

If you look closely at endurance events all over the world, you can see the future. And the future is looking cool as hell.

Okay riders, see you next time. Until then,

Make Every Ride Epic,

Darryl