

Training in the Heat

Why you're slower in the summer and what to do about it

By

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As year-round runners facing myriad conditions, we all recognize that it's harder to run well when it's hot. Perceived effort is greater and race times typically suffer accordingly. Why does this happen? What happens to the body at a physiological level? And most important, how should we adjust workouts and race expectations to best weather the weather?

It's generally recognized that for every 10-degree increase in air temperature above 55 degrees, there's a 1.5 percent to 3 percent increase in average finishing time for a marathon. (Translation: An extra 3 to 6 minutes for a 3:30 marathon with every 10-degree increase.) This slow-down occurs because heat impacts runners at a physiological level through various means, including dehydration, increased heart rate and reduced blood flow (and subsequently oxygen) to the muscles used for running.

SWEAT: THE DETAILS

Thermoregulation is how your body maintains a consistent internal temperature. When exposed to external heat, your body cools itself and maintains equilibrium via perspiration. Perspiration has a cooling effect on the body because it removes excess heat through evaporation. The rate of evaporation--and subsequently how well the body is cooled--changes depending upon humidity. When humidity is low, evaporation increases; when humidity is high, the rate of evaporation decreases and less cooling occurs.

Sweating, while critical to cooling the body, leads to fluid loss. [Dehydration from fluid loss](#) has a profound effect on running performance--a loss of even 2 percent of body weight leads to about a 4-to 6-percent drop in performance. Furthermore, both temperature and humidity increase heart rate and amplify these effects. At 60 to 75 degrees, heart rate increases by two to four beats per minute. From 75 to 90 degrees, heart rate increases up to 10 beats per minute, and humidity increases it even more. Perceived effort is accordingly much greater as both the temperature and the humidity rise.

Compounding things, when you sweat your blood volume decreases, less blood returns to your heart, less oxygen-rich blood reaches your working muscles, you produce less energy aerobically and you run slower for a given effort level. As it gets hotter this effect is exaggerated because the greater the amount of heat that needs to be dissipated, the greater the proportion of blood diverted to the skin. While the red blood cells contained in plasma don't play a role in the cooling process, your body can't separate the red blood cells (which carry oxygen) from the plasma--all are brought to the skin to induce a cooling effect. When oxygen is redirected via blood flow to your skin instead of your muscles, you have less energy to use for running, and your heart and lungs must work harder to compensate for the loss in oxygen. As you've experienced, this results in a higher heart rate at a set pace and the inability to maintain the same pace as on a cool day.

WHAT TO DO?

How can you minimize the negative impact of heat on performance? Because of blood plasma's important role in the cooling process, training alone provides a bit of adaptation, because a side effect of running is an increase in total plasma volume. This helps to explain why the fittest athletes (and likely those with the highest plasma volume) typically adapt more easily to heat.

In addition to regular training, running in hot conditions results in changes that make it easier to maintain a faster pace and cause perceived exertion to drop, including a higher blood plasma volume, increased

sweat rate, decrease in salt in sweat, reduced heart rate at a given pace and temperature, and a quicker onset of sweating. These changes make it easier to perform in the heat and are noticeable after only a week or two of heat exposure.

Still, heat acclimatization can take you only so far during weeks-long stretches of sultry weather. Steve Sisson, assistant coach of women's cross country and track at the University of Texas, knows well the impact that prolonged, inescapable heat has on distance runners. On particularly hot days, he encourages his athletes to adjust expectations and change their attitudes. He explains, "Heat really affects intensity. It is really hard to get up and excited in high heat environments. One of the things that I try to get my athletes to do is to approach any workout in the heat as a progression. Adjusting the level of effort or intensity based on what the body is signaling is a key lesson for any athlete to learn."

While Sisson doesn't change the number or length of repetitions in a workout, he does modify the workout by shifting the focus away from a certain time goal to running an equivalent effort. "If we are trying to hit mile repeats in 5:20 for a 10K workout, I will give my runners a time range of 5:20 to 5:30 and let them adjust based on how they feel," Sisson says.

"Living in a hot part of the country means that we are never going to get away from the heat. If we adjust volume we won't be competitive."

Sisson encourages his runners to look for internal cues instead of fixating on split times. To make the adjustment easier if you're particularly split-focused, on horrific heat days move your interval sessions off the track. Working out on an uncalibrated course is a sure way to ensure a shift to effort over time and this makes it easier to pay attention to internal feedback and perceived exertion and avoid being distracted or discouraged by slower-than-hoped-for splits.

RACING IN THE HEAT

Racing is uniquely taxing in any weather. Adding heat into the equation creates a competing interest and struggle within the body between powering such a strenuous effort and the need to cool the body. This means that you have to work even harder to cool yourself and is why a race will feel much worse than a workout in similar conditions.

Alan Culpepper, a two-time Olympian, is familiar with this tug of war. He faced gruesome conditions in the 2004 Olympic Marathon in Athens, with a starting temperature of 80 degrees. Thanks to smart preparation for and patience during the race, Culpepper placed 12th in a field full of faster runners. Here's what helped him succeed.

1) ADJUST YOUR PREPARATION.

If you're fortunate enough to anticipate less-than-favorable conditions for an event, preparation is key. Culpepper says, "Get your body used to losing heat more efficiently." The summer before the Olympics, Culpepper wore a baseball cap and long-sleeved shirt on runs to help acclimatize. He also advises taking in more electrolytes two to three days before a goal race, staying as cool as possible before the race (cold sponges can be helpful) and running a shorter warm-up before a hot event to prevent loss of electrolytes, particularly if you're running a longer event.

2) ADJUST YOUR EXPECTATIONS.

Says Culpepper, "You have to pay attention to perceived effort. It is important to recognize you will be slower than you hoped but effort is the determining factor." He advises that you pay less attention to traditional feedback like splits and instead, "Listen to the feedback your body is giving you: Is your breathing heavier? How uncomfortable are you?"

3) ADJUST YOUR MINDSET.

Attitude is critical. Culpepper recommends, "Instead of getting discouraged, recognize that everyone is dealing with the same conditions and have faith in your preparations."

It's Not the Heat, Nor the Humidity

It's the dew point. That's the meteorological measure that best predicts how tough your summer running is going to be.

Simply put, the dew point is the temperature at which water condenses. The closer the dew point is to the air temperature, the more saturated the air is and the less perspiration can evaporate and help the body cool itself, resulting in extra stress on the heart and lungs as the body attempts unsuccessfully to cool itself. Accordingly, the dew point provides a strong indicator of how you'll feel running and a useful tool in predicting how much performance will be impacted.

DEW POINT (°F)	RUNNER'S PERCEPTION	HOW TO HANDLE
50–54	Very comfortable	PR conditions
55–59	Comfortable	Hard efforts likely not affected
60–64	Uncomfortable for some people	Expect race times to be slower than in optimal conditions
65–69	Uncomfortable for most people	Easy training runs might feel OK but difficult to race well or do hard efforts
70–74	Very humid and uncomfortable	Expect pace to suffer greatly
75 or greater	Extremely oppressive	Skip it or dramatically alter goal

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