BORN TO SWEAT

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INTRODUCTION

Sweat can be a sloppy nuisance, a sign of hard work, a stinky indication of poor hygiene, and a body-cooling lifesaver. In fact, it's likely that sweat has been and will continue to be all of those things for anyone who is physically active, especially during warm weather. Sweating helps us survive in jungles and deserts, on athletic fields and gymnasium courts, on farms and construction sites, and in fitness centers and saunas. Most people know very little about sweating, yet sweating is one of our body's most indispensable responses to physical activity.

We're born to sweat

Most of us are born with roughly 2 – 4 million sweat glands and although even new-born babies are able to sweat, the glands don't kick into high gear until after puberty. Even then there are wide differences in people's capacity to sweat; some people do little more than glisten their way through workouts, while others doing the same exercise are drenched in sweat. Our capacity for sweating is primarily determined by three factors: genetics, fitness, and acclimation. Heavy sweaters have a genetic predisposition for high sweat rates and are often very fit and well acclimated to the heat. Light sweaters are genetically predisposed to secrete sweat efficiently, covering the skin with just enough moisture to aid cooling. Some people mistakenly believe that sweating decreases as we become more fit when just the opposite is true: as our fitness improves and as we become more accustomed to exercising in the heat, we sweat more. That's a good thing, because more sweat generally means more cooling.

In the days of Aristotle, it was thought that sweat might be caused by the formation of dew on the skin, a theory that persisted until the 1800s.[3] Now it's well understood that sweat glands spurt out small droplets of sweat when stimulated by nerves from the brain's thermostat.

Sweating is so important to survival that it is automatically triggered whenever body and skin temperature rise above what scientists refer to as "the sweat threshold" – a few tenths of a degree above normal resting body temperature (98.6°F or 37°C). Although increased body temperature certainly prompts the nerve outflow that provokes sweating, sweating can

begin during vigorous exercise even before core temperature rises as the body anticipates the need for heat loss. Of course, sweating is not restricted to exercise; whenever it's hot enough to cause body temperature to creep upwards, our sweat glands start to work. Sweating can begin within seconds after the start of exercise and the hotter we get, the more we sweat. Although that response may be a nuisance, it's also vital to our survival. Without sweating, our body temperature would climb so rapidly that we would suffer from heat illness within the first ten minutes of exercise.

Evaporation is key

Sweat itself does not keep us cool; it's the *evaporation* of sweat from our skin that does the job. For example, sweat that drips to the ground or is wiped from the skin does nothing to keep us cool. Sweat must evaporate from the skin for cooling to occur, which is the main reason why it's so important to wear workout clothing that does not restrict the evaporation of sweat. Every liter (quart) of sweat that evaporates from the skin releases about 600 kcal of heat to the environment, making sweating the most effective avenue for heat loss during exercise. We also rely on convective cooling (air movement caused by wind, fans, body movement), radiative cooling (heat lost to cooler surroundings), and to a much lesser extent, conductive cooling (heat transfer to a cooler object in contact with the body), but none of those avenues for heat loss can match the cooling power that occurs when water molecules evaporate from the skin.

The amazing cooling power of evaporation is well illustrated by this observation: "One morning, toward the end of the eighteenth century, the Secretary of the Royal Society of London, one Mr. Blagden, ventured into a room heated to 105°C (221°F), taking with him some eggs, a piece of raw steak, and a dog. A quarter of an hour later, the eggs were baked hard, the steak cooked to a crisp, but Blagden and his dog walked out unharmed."[1] Blagden sweated, his dog panted, and both survived because evaporative cooling slowed the inevitable rise in body temperature that occurs in such extreme heat.

Put it back

Contrary to popular belief, sweat doesn't contain toxins, unless you consider body heat a toxin. Ridding the body of toxins is the job of the liver and kidneys, not the sweat glands. Sweat is more than 99% water but does contain dozens of different minerals, metabolites, and amino acids, with sodium and chloride far in front, as reflected by sweat's salty taste. Potassium is lost in sweat, but in very small amounts. For that reason, rehydrating after exercise requires the replacement of water, sodium, and chloride, with potassium at a far lesser consideration — no offense meant to oranges and bananas. Next time after a race or workout, if you want to rehydrate rapidly, reach for a sports drink or salty snacks and leave the fruit for later.[2]

Sweat is our friend when it works to keep us cool and our enemy when we don't replace it. Drinking during exercise is important because dehydration erases many of the benefits associated with improved fitness and acclimation, causing over-heating and premature fatigue. Staying well hydrated helps you get the most out of your body during a workout by maintaining your sweating response and promoting heat loss. When faced with a sweaty workout, the goal is to drink enough during exercise to minimize weight loss, but avoid over-drinking (weight gain during exercise.)

Know your sweat

Think back to the last time you exercised with a group of people. Although you were all doing the same exercise, some were sweating a lot and others just a little. That's normal variation in human physiology. Light sweating rates can range from under 100 ml per hour to 500 ml per hour (16 oz./H.). Average sweating rates can vary from 500 ml/H. to 1,500 ml/H. (48 oz./H.), while heavy sweaters can pump out more than 2,000 ml/H. (64+ oz./H.). Your sweat rate will vary each time you work out because exercise intensity, clothing, and environmental conditions will vary.

Improved fitness enables us to stay cooler longer, a response that helps us exercise longer and harder. Fit, acclimated individuals have larger sweat glands, lower resting body temperatures, and sweat sooner, sweat more, and sweat over a greater surface area of the body, just a few of the many benefits associated with getting into better shape. But more sweating means a greater risk of dehydration and premature fatigue, so as fitness improves, drinking during exercise must increase to keep pace with greater fluid loss.

Drink it up

There is no one-size-fits-all recommendation for replacing sweat loss during exercise because there is such a large variation in sweat response among people. The best way to gauge your fluid needs is simply to weigh yourself periodically before and after exercise. Here's how to make those weigh-ins work for you, starting first with an obvious point: If you work up a sweat and don't drink anything during exercise, your weight will drop due to dehydration. (Sorry, fat loss is a tiny fraction of weight lost during exercise.) The goal is to drink enough during exercise to minimize that weight loss. (Don't worry, you'll still lose fat weight if you burn more calories than you ingest over the course of each day.) Try to drink enough during your workouts to keep weight loss less than 2% of your body weight. For example, if you begin the workout weighing 126 lb., you should try to complete the workout weighing at least 123.5 lb. (a 2.5-lb. loss, roughly 2% of body weight). Replacing sweat loss during exercise will help keep you cooler, feeling better, working harder, and will speed your recovery.

References

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