The Science Behind Why Hot Days Make It Harder To Exercise

Philip Mok, B.A.
Exercise Biology

Cardiovascular Drift isn't a term you'll hear athletes sitting around chatting about at the local coffee shop after a hard workout. What you might hear them say is "#@!* it was hot today. That heat really slowed me down." It's a phenomenon we have all experienced; a hot environment is harder to perform well in.

Stroke volume (volume of blood per heart beat) is determined by venous return (volume of blood returning to the heart). Essentially, the more blood that returns to your heart, the more blood your heart can pump out. When venous return and stroke volume are reduced, your heart beats faster to keep up with demand. This effect is called cardiovascular drift, and is caused by a build-up of factors that stem from your bodies demand to cool off.

To understand the concept of cardiovascular drift, we need to do a review of the anatomy and physiology of the cardiovascular system. I promise to keep it simple. Blood transports nutrients, water, oxygen, and waste products such as carbon dioxide around your body. There are five types of blood vessels: Arteries, veins, arterioles, venules, and capillaries. Blood that is traveling away from the heart is carried in arteries and arterioles. Blood returning to the heart is carried in veins and venules. The smallest blood vessels, which are located in between, are called capillaries. Arteries and veins are like rivers that carry large amounts of blood very fast. Arterioles and venules are more like small streams and capillaries are like swamps. As humans we have a closed circulatory system. This means that our blood never leaves the blood vessels. Every cell in your body (except for those in the lenses of your eyes) is fed by a capillary. Nutrients leave our blood and enter our cells through small openings called fenestrae. These openings are too small for blood cells to fit through.

As your body heats up during exercise, the blood vessels leading to your skin become dilated. This allows more of your blood to be transported to the capillaries in your skin to give off heat and to transport water for sweat. While it is important to give off heat, other problems arise that negatively affect performance.

The capillaries in your skin truly are akin to a swamp. Your skin is densely populated with capillaries which gives it a large capacity to hold blood. When blood reaches your skin it moves extremely slowly. Furthermore, blood volume is decreased because of water loss due to sweat.

The combination of your blood being trapped in the skin and its volume being reduced means that less is returning to your heart. To compensate for the loss in stroke volume, your heart will beat faster. But it's a losing battle. There is only so much blood in your body and with larger amounts than necessary caught up in your skin, not as much blood can be transported to deliver oxygen to your muscles. Your muscles start screaming "We need more oxygen!" which causes your heart to beat even faster.

Combating Cardiovascular Drift

The most obvious way to combat cardiovascular drift: Workout when it is cool outside. For example, plan to exercise in the morning rather than the afternoon. If running on a treadmill, use a fan. This will allow you to exercise more intensely for a longer amount of time. Aside from the temperature of your

workout environment, the second most important factor is proper hydration. Being fully hydrated before exercising on a hot day is crucial to performance.

Your body also has the ability to acclimate to hot environments. This is done by increasing blood plasma volume (more water in your blood) and by sweating more efficiently. A trained, acclimated person will start to sweat almost immediately after internal body temperature begins to rise to take control of the situation quickly. A person who is untrained and not acclimated to heat will take longer to start sweating and then begin sweating profusely in attempt catch up. Most of that sweat goes to waste as it drops to the floor.

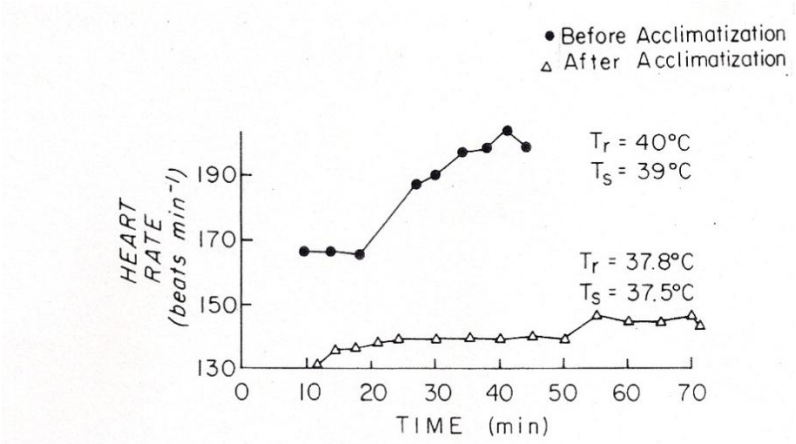

Figure 13-20. Circulatory responses to heat acclimatization from one subject during mild upright exercise in a hot (48° C), dry environment. Comparison is with his initial exposure, shown in Figure 13-9, and final exposure to identical conditions 14 days later. Cardiac output, aortic blood pressure, and central blood volume were unaltered by acclimatization, but heart rate was reduced and stroke volume rose proportionally. Note the reduction in T_c (rectal) and T_s after acclimatization. This was the most dramatic adjustment in this study. (Adapted from Rowell et al., 1967.)

In the end, there is only so much that one can do to keep his or her heart rate from going up. Cardiovascular drift is not the only thing that contributes to an elevated heart rate. After all, we're only human. Everybody has a maximum heart rate that will eventually be reached with the proper amount of exertion, no matter what the temperature is in the room, unless it is so cold or hot that you die, in which case your heart rate will be zero.