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Transitioning Athletes to the Next Level

Heart Rate Response and the Heat

There are some trainers who do not believe in monitoring heart rate (HR) during exercise, as they say it does not tell the whole story. This is true; levels of sleep, hydration and nutrition status, fatigue, and heat can all affect one's HR response. However, when modified with input about breathing rate and the rate of perceived exertion (RPE), HR response can be very telling.

This is never more true than when training in severe heat. I believe that the heart rate gives us very valuable information that should not be overlooked.

Without going into too much detail, I want to explain a little about how the cardio vascular system works, so that it makes more sense about how the human body responds to exercise in the heat.

The cardio vascular system responds very specifically to exercise, and one of the ways in which we measure the rate of exertion is through oxygen uptake (VO_2). This is a combination of cardiac output and oxygen extraction at the muscles. Cardiac output itself is a function of stroke volume (how much blood the heart pumps with each beat) x heart rate (how many times it beats/minute). Stroke volume is a direct result of how much blood makes it back to the heart from the venous side (de oxygenated blood returning from the body).

Under everyday conditions, body temperature will increase with exercise, but when the same exercise is conducted in heat and humidity, body temperature increases even more. In an attempt to cool the body and keep core temperature within normal and healthy limits, the vascular system will increase blood flow to the skin where it can dissipate heat more easily. When more blood goes out to the skin, less is available to return to the heart. When less blood gets to the heart, stroke volume decreases. However, since you have not stopped exercising the oxygen demand stays constant, and to keep blood flowing to the working muscles, the heart rate must increase to make up for the decrease in stroke volume.

Now add to the mix dehydration, which further decreases total blood volume, stroke volume is decreased even more: there is a serious possibility of you over heating! Your heart rate can only get so high, and your body can only get rid of so much heat—exercise beyond that point and you jeopardize your health.

So—what to do? The good news is that with regular training, athletes increase blood volume by as much as 10 %, and with heat acclimation training, blood volume can increase even more. In addition to the increased blood volume

(which helps maintain stroke volume), we also get some other useful adaptations. Athletes who train in the heat will begin to sweat more and sooner (which aids in cooling), their sweat will evaporate more efficiently as its composition changes, and they increase their blood plasma (which helps retain more water.)

What does all this mean to you?

- Don't plan a spring race in the heat when you live in Boston without doing some heat acclimation training first! It takes the body 10-14 days to gain the benefits listed above, so if you live in the frozen north you better bundle up and train specifically to get these benefits pre-race. So, get on your treadmill wearing entirely too much clothing: scarf, hat, gloves and full sweat suit and don't put the fan on. You are attempting to simulate hot conditions.
- You must pay careful attention to hydration. Weigh yourself naked before and after one of these sessions, and the difference in pounds + what you drank while working out is your sweat rate. If you did not lose any weight, you may have OVER hydrated. Be sure not to just drink water for any event over 30 minutes, or else you risk messing with your electrolyte levels. So, drink a mix of sports drink and water leading up to and during workouts and your races. You should be consuming about 24-40oz liquid/hour. Note: this varies for everyone, and it will depend on your sweat rate, your effort, and your belly.
- Pay attention to your HR in the heat. If you normally run an 8 minute mile with your HR in Z3, don't try to run that same 8 min mile in big heat. Cardiac drift (the tendency of HR to increase in the heat and over a long workout as our metabolic processes and fatigue increase our core temperature) will occur sooner and you are VERY likely to overheat, even with all the acclimation training. Accommodate your effort and pace and run in Z3 (or whatever zone you have trained for) at whatever pace that gives you. You will still be getting the training benefits, but the not the training risks.
- You HAVE to SLOW down in the heat—there is no way around it, as we simply cannot keep core temperature down. Additionally, our glycogen usage increases in the heat, so if you do not slow down, you are highly likely to bonk sooner than you normally would as you run through the available glycogen stores. For long races, this means you need to take in additional calories (gels, sports drinks, bars, etc. whatever has worked for you in practice).
- When you begin the acclimation training, start slow and short, and gradually build effort and duration.