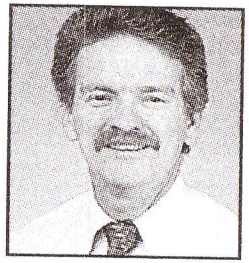
Sports Medicine Corner

Pay Attention To Fluids When Training!

By Dr. Don Kirkendall

It's early April as I write this and many areas of the southeast just kind of jumped straight from late winter weather into early summer. In North Carolina, we've had a few 90 degree days already.

The typical April daytime highs for where I live (Raleigh area) should be from 70-75 degrees. We shouldn't be seeing 90's until later May into June.



Dr. Don Kirkendall

A rapid shift of temperature can play havoc with sport on a number of levels. The big problem is that the body takes some time to adjust to the new higher temperatures.

Humans run pretty close to their boiling point. The typical normal body temperature is 99 degrees Fahrenheit and we can start to have real problems if our temperature gets above around 104F. As a result, our body works quite hard at keeping itself cool.

The body has four methods of cooling. Radiation is the radiant loss of heat to the atmosphere. That's why snow melts on a sufficiently cold, but sunny day.

Conduction is the loss of heat from direct contact with a cool surface. This would be like placing a cold towel over one's head.

Convection is the loss of heat to a cool breeze, like standing in front of a fan or an air conditioner.

While those three are very effective methods of losing heat, during exercise they pale in comparison to the fourth method, evaporation, which is when water molecules are driven from a liquid to a gaseous state. To understand evaporation, a little physiology is necessary.

Energy is needed to perform muscular work (and a whole lot of other bodily tasks). This energy is bound up is the chemical bonds of a high-energy molecule called ATP. When the bond is broken, the energy is released, but all that energy does not go for muscular work. About 40% of the energy is released as heat (all the normal energy requiring bodily process produce the heat that we see as our 99F body temperature).

When exercise is performed, the muscles are doing a whole lot more than they were at rest and that means a lot of ATP is being processed leading to a quick buildup of bodily heat that if not eliminated, would lead to drastic overheating and death.

Now the body needs to continually replenish spent ATP (we only have the equivalent of maybe 1-2 shot glasses). To do this, the body uses oxygen, so during exercise, the cardiovascular system opens up and sends much more oxygen to the muscles. The heat produced from ATP breakdown is transferred to the blood and all this extra blood flowing to the muscles can carry away the excess heat. But to where?

The body is smart and sends much of this warm blood to the skin where the heat is transferred to sweat glands in the skin that eventually is seen as sweat on the skin.

But producing sweat is not heat loss. Evaporation of the sweat is the actual heat loss and the faster sweat evaporates, the cooler the body and less likely to experience the potentially fatal cascade of events that can lead to heat stroke and even death.

Two main barriers to evaporation, of many, can slow evaporation. The typical cotton shirt is one such barrier. Cotton absorbs the sweat, but the body produces sweat faster than it evaporates from the shirt, so the body doesn't cool as efficiently. Modern moisture management fabrics, although a little pricey, are well worth the expense and found in most jerseys.

Humidity is another barrier to evaporation. Movement of the water in sweat from its liquid to a gaseous state goes 'downhill'. If the air's humidity is 25%, evaporation is pretty quick, but if the air's humidity is 75%, like we should soon experience, evaporation is much slower.

But the body is a wondrous machine. It can adapt its ability to cool with the change in temperature. One of the primary adaptations to heat is an earlier onset of a more dilute sweat – you sweat sooner at the start of exercise and that sweat is more water and less salt (to conserve sodium). As adaptations go, this one is pretty quick.

Most people will see adaptive changes occur in one to two weeks of exposure to rising temperatures. But if it was 60 yesterday and it's 85 for today's match, players can be at risk and precautions need to be made.

One of the ways to help the body is to drink water or a commercial fluid and electrolyte drink before, during, and after exercise. Drink 2-4 good mouthfuls in the 15-20 minutes before exercise, then every 15-20 minutes during exercise.

Smart players will weigh in before and after training. Multiply the difference in weight (in pounds) by 1.5 to get the number of pints needed to replace the fluids lost via sweating. And you can't drink this in one sitting. It will take nearly 24 hours to replace all the water lost.

A few final words from the research:

1. As many as 40% of soccer players are clinically dehydrated before they step on the field for training or a match because they failed to ingest enough water lost from the previous day's training. Drink more than you think you need.

2. As little as 1.5% dehydration will lead to reduced performance. Plan for water breaks during training and there are plenty of stoppages in a match to grab a drink. On really hot match days, both coaches and the ref should meet to agree on a water break during each half. The ref has that authority. FIFA approved a water break during the men's Olympic final in Bejing due to the oppressive heat.

3. If your urine is approaching the color of apple juice, you are dehydrated. It should look more like diluted lemonade.

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Editor's note: **Dr. Don Kirkendall** , ***Southern Soccer Scene***'s longtime Sports Medicine columnist, is "member of FIFA's Medical Assessment and Research Centre, F-MARC." He is also the author of the book ***The Complete Guide To Soccer Fitness and Injury Prevention*** from UNC Press.

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4. For unknown reasons, female players over drink and some actually weigh more after training than before.

5. People who are heavy salt sweaters will need to adopt strategies to increase salt ingestion. Who sweats a lot of salt? The player whose shirt neckline or armpits is crusted white after exercise.

This is easily seen on dark shirts.