

## **Coping with Heat**

*Article taken from the British Triathlon website: [www.britishtriathlon.org](http://www.britishtriathlon.org)*

If you are training or competing in triathlon in hot conditions, you need to be aware of the potential problems that can occur, which can range from a reduction in your endurance capacity through to potentially harmful conditions such as heat stroke. Triathletes training and competing in high temperatures need to prepare properly and take precautions if they are to maintain their normal performance standards and are to remain safe.

If you live in Great Britain weather conditions are normally temperate although in recent years we seem to have been experiencing periods of high temperature. This article provides some background on how to prepare for training and competition in hot climatic conditions. It is of particular importance to those triathletes who train normally in temperate conditions.

## **Understanding Heat**

When you undertake physical activity, such as when you are in triathlon training or competition, your body produces heat. Increases in body core temperature due to exercise can rise from 37C to above 40C. Your body needs to lose heat whilst exercising and does so by:

transferring heat to the surrounding air (Radiation) - this can only happen when the surrounding air is cooler than the body temperature,

transferring heat to air which is passing over the body (Convection), - this might be the effect of a cool breeze or a result of the body passing through the air quickly as in cycling,

transferring heat through contact with something that is cooler (Conduction) - this might occur if the water temperature in a swim is cooler than body temperature,

Heat lost from the body through sweating (Evaporation) - this can be effective in hot dry conditions but may be more difficult if the sweat is unable to evaporate as in humid conditions.

In hot conditions cooling through radiation, convection and conduction becomes more difficult and as a result the body tends to sweat more as it attempts to cool itself. The effect of increased sweating is fluid loss. Fluid loss can be measured by taking your body weight before and after exercise. Athletes can lose 2-3 litres of fluid per hour whilst exercising in hot conditions, which represents a body weight loss of 5-10% and a body water loss of 13-14%.

Losses in body weight of 2% during exercise can result in a reduction in endurance performance raising heart rates. The need to sweat profusely whilst exercising in hot climates places a load on the circulation, which has to send blood to the muscles to maintain work rate and to the skin for cooling.

As the body dehydrates, the circulation is further compromised and heat storage can exceed heat removal. This results in increased heart rate, sweat rate, and core and skin temperatures, which in turn can lead to collapse if the person continues to exercise.

## **Climate**

There are three climatic factors that need to be considered when training or competing in hot conditions. These are:

Temperature

Humidity

Radiant Heat

The most commonly used index of heat in sport is the WBGT index which includes measurements of air temperature (dry bulb), humidity (wet bulb), and radiant temperature. It is usually recommended that when using this index if it is above 25C, and you are exercising intensely, that you should exercise care. Above 28C, individuals who are poorly conditioned, unacclimatised, or have low heat tolerance, should desist from exercise.

Hot, humid conditions cause more problems than hot, dry climates as the air is saturated with moisture making it difficult for sweat to be evaporated off the body. In hot climates, training is best scheduled in the early morning or in the evening when the triathlete can avoid the worst heat which tends to occur from noon to mid-afternoon.

### **Individual Differences**

Not all individuals cope with exercising in heat in the same way. Some have a naturally higher tolerance to heat than others. Those individuals with a low tolerance to heat need to take extra care when exercising in hot climates.

Individuals with heavier builds possess a lower ratio between their skin surface area and body mass than those with linear builds. This can be a disadvantage for heat removal. High levels of body fat also encourage heat storage and adipose tissue absorbs heat more readily. Individuals with a high level of endurance fitness tend to tolerate hot conditions much better than those who are unfit.

In the general population young adults tend to cope with heat better than older adults. Men tend to tolerate heat better than women. Pre-pubertal children have poorly developed sweating mechanisms and can overheat quickly. In hot conditions care needs to be taken when working with pre-pubertal children and other more vulnerable groups.

### **Heat Acclimatization**

Triathletes wishing to compete in hot climates are recommended to prepare for the conditions by undertaking periods of heat acclimatization. It has been shown that training in cool conditions does improve tolerance to hot conditions. However, full adaptation to heat can only be achieved by actually working out in hot conditions. Heat acclimatization is a relatively quick process and is achievable in about 8 to 12 days if regular daily exercise of about 90 minutes is undertaken.

**If you have access to a heat chamber such as that at Leeds University then 9 x 60-90 minute sessions over a 2 week period have proven effective if you will be arriving into hot conditions one week before your target race.**

Adaptation to training in heat leads to expansion of blood volume, which supports both increased endurance capacity and the sweating process. An acclimatized triathlete would commence sweating sooner, sweats more evenly across the skin surface and loses less salt. The acclimatized individual is able to exercise in hot conditions with a lower heart rate and lower core and skin temperatures.

Acclimatization to heat will not be as effective if the individual undertaking acclimatization training is not fully hydrated. For adaptation to heat to take place, the triathlete needs to keep themselves fully hydrated by drinking regularly both during and between training sessions.

Pre-pubertal children acclimatize more slowly than adults. Children are also not good at assessing whether they are overheating or are dehydrated. During physical activity they need recovery breaks for cooling and fluid replacement. They may also need to be encouraged to drink water or rehydration drinks to rehydrate.

### **Clothing**

Triathletes training and competing in hot conditions should give some thought to their choice of clothing. Light coloured clothing made from open-weave natural fibres (e.g., cotton, wool) are best for general training. In choosing triathlon specific clothing considers light colours and features which enable ventilation. A lot of triathlon clothing made from synthetic fibres which offers more resistance to heat removal and can become uncomfortable during training and competition.

### **Fluid Replacement**

A loss of more than 2% body weight due to fluid loss can lead to a reduction in a triathlete's endurance capacity leading to poor performance. Triathletes need to be well hydrated before they compete and to take measures to rehydrate whilst competing. Although it is unlikely that a triathlete will be able to take on board enough fluid to balance fluid loss during an event, it will substantially reduce the risk of overheating.

Triathletes need to have clear rehydration strategies as simply waiting until you feel thirsty is too late. The sensation of thirst lags behind dehydration and should not be used as the signal to drink.

During exercise the body loses more water than electrolytes leading to body fluids becoming concentrated. The priority during exercise is therefore to replace water.

Triathletes should carry water on their bikes to drink and should utilize the feed stages during the run. You may also want to have a drink available in transition.

In hot conditions, it is essential to consume fluids before, during, and after training. This maintains the stability of circulation that is so important for endurance efforts. Water is the primary requirement and, in most circumstances, is the ideal replacement fluid. Fluids with high carbohydrate and electrolyte concentrations empty slowly from the stomach for absorption into the blood via the small intestine. That slow emptying will actually delay the replacement of needed water. Drinks specifically for rehydration will contain low levels of carbohydrate which encourages adsorption of the fluid. It is only when excessive sweat losses occur on successive days that small amounts of electrolyte may be necessary in a replacement fluid.

### **Tips on Rehydration Drinks**

Drinks should be cool (8-10C).

Drinks should be low in or lack sugar (carbohydrate) to enhance absorption of the water. The highest concentration of carbohydrate should be 2-5 g per 100 ml of water.

Drink no more than 0.5 litres per hour in doses of 100-200 ml every 15 minutes during exercise.

Drink at least 0.5 litres of water prior to exercise.

The loss of electrolytes in most activities is minimal in sweat and can be adequately replaced in the diet after exercise. The need for replacement during exercise is generally non-existent.

Keeping a record of body weight after waking in the morning is an easy method of monitoring hydration.

Do not rely on the feeling of thirst to determine when you need to drink, stick to your rehydration plan.

### **Tips for Training in the Heat**

The body appears to adapt to heat after about 8-12 days of training in a hot environment by making adjustments to the blood flow and sweating processes. During this period the athlete will probably feel low on energy as a result of the effect heat has on the utilisation of glycogen stores. You should certainly train during this period in order to encourage adaptation, however care should be taken to avoid heat related problems.

It will be necessary to reduce both the extent and intensity of training during the period of adaptation.

Care needs to be taken if training during the hotter times of the day. It may be better to train early in the morning or in the evening when it is cooler.

You should avoid wearing too much clothing, wear loose clothing which allows air to circulate, and light colours which reflect the sun's rays.

Light coloured headgear which gives protection to the head and neck should be worn on runs.

Sufficient fluids should be drunk before, during and after training. Sprinkling water over your head, neck and thighs will also help reduce heat.

Triathletes should get used to sweating.

Avoid training immediately after eating as this attracts blood flow to the gut and makes you less efficient at transferring heat to the body surface.

Warm-ups and warm downs should be shorter than usual but stretching should not be reduced.

Warm downs are important, to ensure that the runner does not cool down too quickly.

Avoid hot showers and saunas until after you have fully warmed down.

## **Tips for Competing in the Heat**

When warming up, stretching, or relaxing prior to the race seek out shaded areas, keep out of direct sunlight.

A shorter warm up may suffice but do not forget to stretch.

Keep covered up prior to the race in light airy clothing, a hat and sunglasses.

Avoid standing out in the heat and sun with your wetsuit fully zipped for too long prior to being called up to the start.

Wet your head prior to the start.

Remember to keep consuming fluids up to being called up to the race start.

If the water is cooler than your body temperature it will help cool you.

Have water or rehydration drinks on your bike and remember to drink from them.

Have a drink in your transition box which you can consume as you leave transition. Keep it covered in the box.

On the bike the air passing over your body will help cool you. Do not let this fool you as you need to keep drinking if you are to survive on the run.

Use a hat and sunglasses on the run.

If there are showers on the course run under them.

Take the drinks from the feed stations sip some water and empty the rest over your head or thighs.

When you finish seek a rehydration drink and the shade.

## **When Things Go Wrong - The Warning Signs**

Be aware of heat related problems, which can occur when triathletes are training or competing in the heat and are not properly adapted to the conditions. These problems can include heat exhaustion, sunstroke, and heat stroke. The symptoms of heat exhaustion are normal skin temperature, cold sweaty skin, drowsiness, weakness, vomiting, an elevated pulse, and hypertension.

Avoid heat exhaustion by regular drinking of water prior to and during training or competition. A triathlete who is forced to stop due to heat exhaustion, should rest in a cool airy place, and should sip water in order to rehydrate.

The symptoms of sunstroke include red skin, swollen face, buzzing in the ears, dizziness, headache, nausea, sleepiness, elevated pulse, weakness and rapid respiration. A triathlete suffering from sunstroke will probably be unable to continue competing or training and may have collapsed. If despite sunstroke the triathlete manages to continue he/she may develop heat stroke.

A triathlete with sunstroke should cease all activity and be removed to a cool, well ventilated area, his clothes should be removed and an ice bag or cold compress should be applied to the forehead and back of the neck.

Heat stroke is the end result of overheating and marks a total breakdown in heat regulation, This rare condition is marked by high temperature, hot dry skin, signs of confusion, loss of control, or even collapse. The treatment is to remove the athlete to a cool airy place, undress him, and wrap him in a blanket soaked in cold water, and seek immediate medical attention.