Climate control: acclimatising to the heat

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Exercising in hot, humid conditions when the body is not accustomed to it can place the body under great stress. The demand for circulation to working muscles, which are producing heat, overtakes the need for blood flow to the skin to transport heat away from the body. As a result, body temperature rises. Couple this with dehydration and the risks of heat illness, and poor performance increases. Athletes travelling overseas or to different climates should consider heat acclimatisation an important preparation strategy.

What is heat acclimatisation?

The benefits of heat acclimatisation have been known for many years (Robinson 1967). Early reports describe heat acclimatisation as the body's ability to adapt to repeated daily exposure (four to eight days) of exercise in the heat to reduce the impact of heat on physiological function and exercise performance.

What are the benefits of being heat acclimatised?

Acclimatisation produces:

- a lower heart rate at a given heat and exercise stress level
- better maintenance of core body temperature
- reduction in the sweating threshold
- increased distribution of active sweat glands
- increased sweat rate
- an increased sweating sensitivity to increasing core body temperature
- a reduction in the loss of water and electrolytes from the kidneys (Robinson 1967).

Sweat sodium concentration is often lower after heat acclimatisation, producing a more dilute sweat (Nielsen et al. 1997) and perceived exertion during exercise in the heat is reduced (Cheung, McLellan and Teneglia 2000). Studies have shown acclimatisation over 6 to 12 days can increase tolerance time in the heat, for example, by 15 per cent (from 100 minutes to 115 minutes) (Cheung, McLellan and Teneglia 2000).
How can coaches ‘climate control’ their athletes?

There is a variety of heat exposure protocols that can achieve heat acclimatisation. Coaches need to consider the frequency of exercise, duration, intensity and the environmental conditions that produce heat strain to elevate core body temperature and invoke a sweating response. The choices are:

- live and train in the hot environment where the sporting event will be held — the advantages are clear, but the weather could be unpredictable and hence affect quality training
- live and train in another location, but with an environment similar to the host location
- stay at home, but create a hot training environment, for example, laboratory conditions, internal heating, and warm, heavy clothing. This offers a more controlled environment with little disruption to training and less time away from home.

Frequency of exercise

Major adaptations can occur within the first few days of repeated heat exposure. The process of adaptation is largely complete for most people within seven to ten days. Heat acclimatisation should occur daily or at intervals of no more than three days apart for 10 to 12 sessions, otherwise deacclimatisation starts to occur (Maughan 1997). Heat acclimatisation may be transient, requiring repeated exposure to maintain the adaptations. Once heat acclimatisation has been achieved, the rate of decline in benefits is slow and reinduction can be achieved rapidly (Cheung, McLellan and Teneglia 2000).

Exercise duration

Exercise sessions should last between 60 to 90 minutes either in hot conditions (Maughan 1997) or wearing heavy clothing (Dawson 1994). Some suggest quality training in the morning with heat acclimatisation training in the afternoon (Maughan 1997).

Exercise intensity

Athletes should exercise at intensities between 50 to 70 per cent VO2 max (the athlete’s maximum aerobic power) (Cheung, McLellan and Teneglia 2000; Armstrong and Maresh 1991).

Environmental conditions

Generally temperatures ranging from 25 to 30°C are appropriate; any hotter and the exercise intensity should be reduced. Are hot, dry conditions or hot, humid conditions better? Generally humidity should match the conditions of the environment the athletes will be competing in. Research studies have shown that for hot, wet conditions there was a greater slowing of body temperature and a greater increase in tolerance time compared with hot, dry acclimatisation conditions. Tolerance times increased 27 per cent from 104 to 130 minutes as a result of the hot, wet heat acclimatisation program, compared to an 11 per cent increase from 109 to 120 minutes that followed 12 days of hot, dry heat acclimatisation (Cheung, McLellan and Teneglia 2000).

Wearing heavy clothing in cool conditions may cause the same increased sweating response as with heat exposure (Dawson 1994). It has also been found that wearing clothing that does not allow evaporative cooling is a strong stimulus for sweat production and is a major factor in heat acclimatisation (Cheung, McLellan and Teneglia 2000). Heat acclimatisation with heavy clothing may also condition athletes to tolerate the psychological discomfort associated with a high level of wetted skin (Cheung, McLellan and Teneglia 2000).
What effect does dehydration have on heat acclimatisation?

Acclimatisation improves performance in the heat but increases fluid needs because of increased sweat loss. As a result, dehydration abolishes the advantages of acclimatisation.

Coaches should weigh all athletes before and after all training and heat acclimatisation sessions. The aim is to prevent weight loss, as every one kilogram of weight loss is equivalent to at least one litre of fluids to be replaced. If there has been no weight loss then the athletes have successfully maintained their hydration status during sessions by drinking appropriate amounts of fluid. Alternatively, coaches can encourage athletes to monitor urine colour. Well-hydrated athletes will produce plenty of pale-coloured urine.

To prevent dehydration during the acclimatisation process, a sports drink such as Gatorade is an appropriate choice since:

- it contains 6 per cent carbohydrates (6g per 100mL) the optimal amount for fast absorption to provide a readily available source of energy for working muscles (Ryan et al. 1998)
- it contains electrolytes such as sodium (41mg per 100mL) to replace those lost in sweat. Sodium also ensures thirst continues so athletes fully rehydrate, as water turns the thirst mechanism off too soon before rehydration is complete (Wemple et al. 1997)
- Sports drinks are flavoured so athletes will tend to drink more during and after exercise (Gonzalez–Alonso et al. 1992)
- Sports drinks help the body maintain acceptable body temperatures, preventing heat-related illness and ensure the heat acclimatisation adaptations are maintained by preventing dehydration (Dawson 1994).

Practical tips

- Plan for acclimatisation especially if competing in hotter environments than athletes are used to. Either arrive earlier to allow two weeks for acclimatisation or commence the process before they leave home by exercising in a hot environment or wearing heavy clothes in a cooler environment.
- Consider the frequency of exercise, duration, intensity and the environmental conditions needed to sufficiently elevate core body temperature and invoke a sweating response necessary for heat acclimatisation.
- Monitor athletes’ hydration status by body weight or urine colour and volume.
- Ensure athletes drink sports drinks to maintain hydration and replace sodium lost in sweat.
- Encourage carrying drink bottles at all times so that drinking regularly becomes a habit in hot climates.

References


