COMPETING IN HOT & HUMID CONDITIONS

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PREPARATION for competitions in hot and/or humid environments has attracted increased attention and much research in recent years as many of the recent Olympic Games have or will be held in extreme environmental conditions (Atlanta 1996, Athens 2004 and Beijing 2008). When competing in the hot or humid conditions, the combination of exercise and heat stress increases the cardiovascular and thermoregulatory strain on the body, which increases the amount of blood sent to the skin. The increase in thermal stress, that leads to an increase in the cardiovascular and thermoregulatory load, is thought to be the primary reason for the decrease in exercise performance observed in hot environments [3]. In order to optimise performance when competing in the heat, adequate preparation is required in the weeks leading up to the race and also on the day of the race. This preparation includes heat acclimatisation, adequate recovery, specific competition warm up and adequate dietary and fluid intake.

HEAT ACCLIMATISATION AND ACCLIMATION

The negative effects of exercising in heat and humidity can be attenuated to a large degree by a period of heat acclimatisation, a process that involves training under similar conditions to allow the body to adapt and allow better performance. Much of the acclimatisation adaptation occurs within the first 10 to14 days. Endurance-trained individuals (whose body temperatures are usually raised during the course of their training, even in moderate climates) already show some of the adaptations that accompany acclimatisation, but further adaptation occurs with training in the heat. However, it does seem that for most athletes a longer period of preparation for racing in the heat may well be needed.

As testimony to this premise, in championship marathon races in the heat and/or humidity (where conditions are likely to affect performances most), athletes who have lived and trained regularly in hot and humid conditions for varying lengths of time (sometimes interspersed by periods of cooler weather training such as altitude work) have typically performed better than their rankings would suggest. There are also similar examples of athletes in events lasting 15 to 30 minutes such as 5 km and 10 km, where increased core temperature associated with high energy output can adversely affect performance. While the "textbook" may indicate that acclimatisation may occur in 14 days, somewhat longer periods are recommended for elite athletes in hot races, especially those competing over the longer distances. There is likely to be an optimal period of time required for acclimatisation, and longer may not be better – in fact longer can be worse, especially if there is no respite to the heat in between training sessions. Training in similar climates to the competition for 4 to 8 weeks, ensuring that recovery and general living occurs in cooler conditions to get respite from heat stress (eg. air-conditioned living quarters) is probably optimal to get adaptations from heat acclimatisation.

Athletes can use acclimation techniques if they are living in cooler climates but will be competing interstate or overseas in hotter conditions. Heat acclimation refers to the use of heated rooms or climate chambers as a means for preparing for competition in the heat. Acclimation can be used for longer periods, as there is constant respite from the heat and athletes are not consequently exposed to oppressive conditions. It is recommended that the use of heat acclimation is supplemented with a shorter (2 to 3 weeks) of acclimatisation in a similar climate to that of competition to allow the body full adaptation for competing in the heat.

Brett Cartwright shows the strain of competing in hot conditions at the 2005 Zatopek Classic. Getty Images

Spending time between training sessions in cool conditions is considered important for acclimatising athletes who are unused to the hotter conditions, and assists in the adaptation process by allowing optimal recovery following training. Should the coach and athlete detect symptoms of unusual tiredness or problems associated with insufficient recovery between quality sessions or long runs, then steps should be taken to ensure that training be carried out in the coolest part of the day before resuming more stressful training in expected race conditions. This becomes increasingly important the closer it gets to the final taper period. Access to air-conditioned living quarters is essential between training to obtain respite from the heat and facilitate recovery. On the other hand, it is advisable to assist acclimatisation by spending a certain amount of time in the natural environment. It is a good idea, perhaps for psychological as well as physical reasons, to train, at least on some occasions, at the same time of day as the competition. Of course, coaches and athletes must be very careful to avoid over-exposure to any harsh conditions. It is important to avoid direct solar radiation when possible using head protection as well as appropriate clothing and sunscreen.

COMPETITION WARM-UP

In general, the competition warm-up will not need to be as long as a warm-up in cool weather. Clearly, one of the aims of a warm-up is to increase the muscle temperature to that corresponding to the optimal for power production. This process is attenuated in the heat and means that a warm up of shorter duration can be employed. However, the other benefits of a warm-up related to technique and neural activation (eg. race pace run-throughs) should be addressed as usual.

The use of pre-competition cooling, by way of cooling vests, plunge pools and cold showers have been used during and/or after the warm-up, and can optimise performance when competing in a hot/humid environment. Pre-cooling the body can be an effective means of improving athletic performance in the heat as it allows athletes to start a competition with a lower body temperature. This enables them to increase their heat storage and perform more work prior to reaching a limiting core body temperature, and delays fatigue in endurance events [4]. Coaches and athletes intending to employ this technique should practice the routine on several occasions before major competitions. An example of the benefits of pre-cooling on running performance was investigated using a cooling vest during active warm-up (38 min) by track athletes (9 males, VO_{2max} 67 ml/min/kg; 8 females, VO_{2max} 58 ml/min/kg). The pre-cooling in this study enhanced 5km running performance in the heat (32ºC, 50% relative humidity) by 13 seconds compared to a control group who did not wear the vest. Reduced thermal and cardiovascular strain, as well as a lower perception of thermal discomfort resulting from the pre-cooling in the early portion of the run appeared to permit a faster pace later in the run [1].

HYDRATION

Hydration in hot/humid conditions is critical to maximise performance during training and competition. The following strategies should be used:

1. Hydrate well prior to the workout, drink as much as is comfortable and practical during the session, and re-hydrate aggressively afterwards in preparation for future exercise.
2. Recovery of significant fluid loss after exercise is assisted by the simultaneous replacement of electrolyte loss. Sports drinks (flavoured drinks consisting of water, some salt and sugar) allow more complete hydration than drinking plain water or soft drinks because they have optimal sugar concentrations to maximise the uptake of water by the body.
3. Use the principle of variety by drinking sports drinks, water, dilute fruit juice, cordial and an occasional soft drink. Alcoholic and caffeine-containing drinks are not advised given their diuretic effect. However, in the name of common sense and everyday practicality, there is no damage done by a glass of wine with a meal if that suits an individual or a cup of coffee or tea during the course of the day. This assumes plenty of the preferred means of fluid intake throughout the day as mentioned above.

DIETARY ADJUSTMENTS IN THE HEAT

Carbohydrate requirements for exercise are increased in the heat due to a shift in substrate utilization towards carbohydrate oxidation [3]. However, in the real world of track and field, this is not a huge issue, given that most successful endurance athletes will consume large amounts of carbohydrate as a matter of routine. As usual, daily food patterns should focus on replacing glycogen stores after exercise. Competition strategies should include activities to enhance carbohydrate availability, such as building up glycogen stores in preparation for endurance events, pre-event carbohydrate intake, and intake of glucose/electrolytes in events lasting longer than 60 minutes. This can be done using water and the carbohydrate gel preparations, or using sports drinks. It has been reported that intake of carbohydrates prior to and during prolonged exercise in the heat provide benefits to exercise performance [2].

References

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SUMMARY

- **Performance in endurance sports such as distance running is compromised when training in hot and/or humid conditions due to a suppressed cardiovascular and thermoregulatory system.**
- **This decrease in performance can be attenuated by a period of acclimatisation, where the athlete trains for 4 to 8 weeks in the conditions in which they will be competing. A shorter acclimatisation period is required if heat acclimation is utilised in the preparatory period.**
- **The use of pre-cooling can be used in the warm up to start exercise with a lower body temperature and delay the thermal stress.**
- **Athletes should ensure appropriate hydration before and after training in hot conditions.**
- **Adequate carbohydrate intake is required to meet the increased energy demands associated with exercise in the heat.**