



SOCCER AUSTRALIA

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The Effects of Temperature on Performance

Following publication of the Soccer Australia advice on drinking liquids during the course of play (see circular No. 13 dated 17 May 2000) we have been requested to provide information on the effects of temperature on performance. We have researched this subject and provide the following information as a guide only.

We would be grateful if you could circulate this information to coaching personnel within your structure.

Introduction

A human being can only tolerate a variation of around 4°C in internal body temperature without physical and mental performances being impaired. It is well known that soccer players like in many other sports are at some time or other subjected to extreme weather conditions. The temperature of the climate the game is played in is all important and will affect body temperature and thus the ability to perform.

Temperature Regulation

The control of body temperatures depends on the balance between overcooling and overheating. The normal temperature of the body is 37°C. When playing football heat production is increased and has to be removed or else performance will be affected. Temperature must stay within a range of 37°C to 40°C. Body and the outside air temperature/humidity can be measured relatively accurately through the use of thermometers.

Most of the heat is conducted in the blood stream to the skin where it is released into the environment in four different ways:

Conduction: excess heat is transferred through direct contact with an object (e.g. when swimming in cold water).

Convection: circulating air allows heat to be transferred to air passing over the skin (depends on the air temperature).

Radiation: Involves heat being lost from the body through radiation (eg. Loss of heat within a cold environment).

Evaporation: excess heat is transferred to sweat which then evaporated. Sweating is the most important means of dissipating heat when exercising under hot conditions.



However, even with the large heat loss through sweat evaporation, body temperature does rise during a match as not all of the heat produced can be released. Evidence also shows that due to the intermittent nature of soccer, the general increase in temperature is greater than for continuous exercise and also the higher the exercise intensity the greater is the heat production.

Cold Weather

The harmful effects of cold exposure are mediated by the balance between heat production and heat loss. There is a close relationship between muscle performance and muscle temperature - as temperature decreases, so does performance. For example, muscle strength is impaired and a decrease in reaction time has been shown under cold conditions. *Vasoconstriction* where the blood flow to muscles or the outer parts of the body is reduced, occurs.

Under normal conditions, body fluid loss can be around 2 litres resulting in a negative effect on soccer performance (a loss of only 2% in body mass affects performance). Even in winter conditions, there is still a danger of dehydration if correct fluid replacement is not implemented. **Studies under cold conditions have shown that if players do not drink sufficiently, then significant dehydration can still take place.**

The risk of injury is also increased when exercising in the cold. Whether this be due to a poor playing surface or incorrect warm-up procedures, athletes should take the necessary precautions to reduce their chances of injury. To reduce the effects of cold weather, players should be correctly hydrated, undertake a good warm-up session and wear warm appropriate clothing. The coach must play a major part by making sure that players are correctly prepared and checking if the climatic conditions are suitable.

Hot Weather

When playing football in hot weather, the heat lost through convection and radiation is minimal thus requiring heat to be dissipated through the evaporation of sweat. In humid conditions the bodies ability to reduce its temperature is further reduced as sweat evaporation is inhibited. The active muscles and the skin are in direct competition for the limited blood supply as the muscles need blood to provide the necessary oxygen and the skin needs blood to facilitate heat loss. Thus, exercising in hot and humid conditions can be dangerous or at least lead to poor performance.

The distances run by players has been shown to be markedly reduced when playing in hot conditions. Evidence also shows that the loss in body water can be more than 3.5 litres (compared to 2 litres in normal conditions). As mentioned earlier a loss of 2% in body mass affects match performance levels and a 5% loss will decrease the ability to exercise by as much as 30%.



Players can help reduce the effects of a hot climate through:

Fluid intake: adequate fluid intake before, during and after the game/training will help to avoid dehydration. Players should be correctly rehydrated before competition and take additional drinks when possible. Before exercise, the player's weight should be at it's norm. Drink absorption is at its best when mixed to a weak solution of 2.5 % carbohydrate and rehydration drinks should contain sodium. Thirst is a poor indicator of hydration levels and probably indicates that the player is already dehydrated.

Judging their efforts: Many tournaments are played in hot and humid temperatures which is likely to affect playing performance. Players should try to judge carefully their efforts over the whole match without exhausting themselves from too much high-intensity exercise too soon in the game.

Planning: The coach can judge or measure whether the temperature is too hot for training. Training should not take place in temperatures above 40°C and can be moved to cooler periods (morning/early evening). Plenty of drinks must be made available and exercise intensity levels adjusted accordingly. Training should as well include regular rest periods. Special attention to the conditions must be taken with children when training or playing matches.

Acclimatisation: Players can be acclimatised to hot conditions by spending a defined period of time in the designated place beforehand (10-14 days is recommended as a good adaptation period). However, training sessions should be shorter and easier at the beginning in hot weather. It seems as well that the higher the training level of individuals, the quicker their adaptation to hot conditions with one of the reasons being a greater ability to sweat.

Clothing/Skin Protection: Clothing should be light coloured if possible and made of a lightweight, breathable material so that sweat can evaporate. Football kit soaked in sweat prevents heat loss so should be frequently changed. Sun-block can be used to prevent sunburn.

Conclusion

The above information has described the effects of temperature on playing performance. Both the coach and player must take the necessary measures to prevent problems arising when playing soccer in adverse weather conditions. Correct clothing, fluid intake, hydration levels, adaptation, planning and rest periods all play a part in maintaining playing performance. If temperature related illness is suspected, consult a qualified doctor.

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