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Title: HOT & FAST: Temperature regulation and heat illness

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This integral presentation will focus on (i) advanced heat transfer between a human and the environment, (ii) direct thermal physiological responses and acclimatization, (iii) pathologies/heat illness, and (iv) recommendations for safe and enhanced physical performance. The presentation is trailer for medical professionals with specializations in sports, military, inetrenal, tropics, geriatrics, among others.

Summary

A core temperature in a narrow band around 37 °C is essential for optimal human functioning. This thermal balance can be acquired if heat gain is equal to heat loss. The thermal balance can be summarized as: $S = M - W \pm E \pm K \pm C \pm R$ (Blatteis et al., 2001). Were S is heat storage, M is the metabolic rate, W is the external work, E is evaporative heat transfer, K is conductive heat transfer, C is convective heat transfer, and R is radiant heat transfer, all typically given in W or W/m^2. The human thermal regulative center is located in the preoptic-anterior hypothalamus, where afferent information from the whole body is integrated. The effector mechanisms include thermogenesis, vasomotor activity, and sweating. In addition, behavior temperature regulation is present. The reciprocal inhibition model (Bligh, 2006) is most widely used for the functioning of the temperature regulatory system. Under optimal conditions (nude and resting in an ambient temperature of 28 °C) this equilibrium is maintained under control of minor fluctuations in skin blood flow (vasomotor activity). However, if the conditions are not optimal, such as during exercise in a hot environment, the heat strain can be enormous, resulting in increased skin blood flow, increased sweat rate, increased heart rate, several behavioral mechanisms and eventually an increased body core temperature (hyperthermia).

The acute effects of heat strain on the physiological system are evident, and results in reduced performance. This increased strain, with or without hyperthermia, results in an increased incidence of mortality and morbidity under the elderly and sick (e.g., Kunst et al., 1993; Dematte et al., 1998). If heat strain results in hyperthermia it can even cause mortality and morbidity under healthy, well trained individuals (Coris et al., 2004). Since sweat production plays a crucial role in heat loss in a warm environment also factors associated with dehydration need to be considered, e.g., hyponatremia.

Several guidelines and products are available aimed at reducing heat illness risks. An example of the former is the position stand on exercise and fluid replacement of the American Collage on Sports Sciences (Sawka et al., 2007). An example of the latter is an ice-vest which can be used to cool a person before exposure to heat stress conditions (Bogerd et al., 2010). Finally, recommendations for further readings will be given.

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