Meta-analysis on the efficacy of heat mitigation measures and optimisation of hydration

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5 Heat Management Strategies

AEROBIC FITNESS CONDITIONING

HEAT ACCLIMATISATION

PRE-ACTIVITY COOLING

WORK REST CYCLES

HYDRATION
Heat Management

Heat Strain

Work Tolerance

Lengthening work tolerance

Max. limit

Start state

Attenuation

Extension

Reduction

Expanding heat capacity
5 Heat Management Strategies

AEROBIC FITNESS CONDITIONING

HEAT ACCLIMATISATION

PRE-ACTIVITY COOLING

WORK REST CYCLES

HYDRATION
Drink temperature and form

- Extensive research on fluid replacement, but limited data on the physiological responses to drinks at different temperatures
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- Drink temperature and form can influence body heat storage capacity.
Amount of energy required to warm or cool the ingested fluids to body temperature

\[ E = M \cdot h_c \cdot \Delta T \]

- \( M \) = Mass of the fluids ingested
- \( h_c \) = Specific heat of ingested fluids
- \( \Delta T \) = Difference in temperature between the ingested fluids and body core temperature
Cold fluids was effective in reducing Tc at rest leading to an improved endurance capacity

- Exercise 65% VO₂ peak to exhaustion
- T_{db}: 35°C; RH: 60%
- Water at 4 or 37°C
Cold fluids was effective in reducing Tc at rest leading to an improved endurance capacity by 23%.

Lee, Shirreffs, Maughan (2008) MSSE
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From bench to **bedside** work site?

Focus on Core Temperature as a Heat Disorder Countermeasure

ICE SLURRY “Cools from the Core” -

NUS team finds new purpose for old clothes
Summary

- While employing a combination of various heat mitigation will be most ideal, the meta-analysis allows prioritization based on resources at hand

- Ingestion of ice slurry is an effective and practical precooling method
  - Lesser volume required to attenuate body temperature
  - Efficacy achieved without affecting drink constituents
THANK YOU

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Climatic conditions – just one of several factors

(1) Physical fitness and heat acclimation status

(2) Amount and type of clothing worn

(3) Exercise intensity

(4) Climatic conditions

Lee et al. (2010). EJAP
Dehydration following races in the tropics (n=2206)

- Acute dehydration (>2% body mass loss) may not compromise health

Tan et al. (2016). Sports Med
Definition

EAH is the occurrence of hyponatremia during or up to 24 hours after prolonged activity and is defined by a serum/plasma Na+ concentration below the $< 135 \text{ mmol/L}$.

EAH is primarily a *dilutional hyponatremia*.
Prevalence of Exercise Associated Hyponatremia at Onsite Endurance Medical Tents: 2009 to 2011 (n=48)

Tan et al. (2016) Sports Med