

Heat Acclimation

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INTRODUCTION

Measurement of physiological responses to exercise under heat stress, including heart rate, core temperature, sweat rate, and perceived exertion, is a critical component of assessing heat acclimation in high-performance athletes. These measures serve three primary purposes:

- **Indicators of Heat Acclimation:** They help evaluate the athlete's adaptation to exercising in hot environments.
- **Correlation with Performance:** Physiological responses under heat stress are closely tied to endurance performance in hot conditions.
- **Guidance for Optimal Training Stimuli:** They provide insights into appropriate training intensities and strategies for heat acclimation.

INDICATOR OF TRAINING ADAPPTIONS

Heat acclimation studies have traditionally focused on changes in core temperature and sweat rate as markers of adaptation. However, recent research emphasizes the importance of monitoring heart rate responses, sweat sodium concentration, and perceptual measures such as RPE (Rate of Perceived Exertion) to assess the extent of heat adaptation. These metrics often show greater sensitivity to heat acclimation than traditional measures like VO2 MAX.

CORRELATION WITH ENDURANCE PERFORMANCE

Physiological adaptations to heat—such as improved thermoregulation, increased plasma volume, and enhanced sweat efficiency—are strongly correlated with endurance performance in hot environments. Studies suggest that these adaptations may be better predictors of performance during prolonged exercise in heat.

DEFINITION

Heat acclimation involves physiological changes that improve an athlete's ability to perform in hot conditions.

Key markers include:

- **Sweat Threshold:** The point at which sweating begins earlier and becomes more efficient.
- **Heart Rate Stabilisation:** A reduction in heart rate for a given workload under heat stress.
- **Core Temperature Management:** Lower peak core temperature during exercise due to improved thermoregulation.

These adaptations typically occur after consistent exposure to hot environments over 7–14 days.

PRACTICAL APPLICATION

Following a heat acclimation assessment practitioners provide insights into improvements such as:

- Lower heart rate at a given intensity (indicating improved cardiovascular efficiency).
- Reduced core temperature (suggesting enhanced thermoregulation).
- Increased sweat rate with reduced sweat sodium concentration (reflecting improved fluid balance).
- Increased plasma volume (indicating better cardiovascular stability during heat stress).
- Improved other factors such as total distance covered, RPE and thermal sensation (reflecting improved exercise capacity and tolerance in hot conditions and successful physiological and perceptual adaptations to heat stress).

These adaptations help athletes sustain higher intensities during prolonged exercise in hot conditions while mitigating risks like dehydration or overheating.



RECORDED DATA / RESULTS

Exercise Description:	Running	Start Date:	01/01/2021
Informed Consent:	Y	Time:	10:30
Body mass (kg):	72.35	Temp (°C):	35
Stature (cm):	182	Humidity (%):	50
Pre Hematocrit (%)	44	Post Hematocrit (mmol/L):	42
Pre Hemoglobin (mmol/L):	9.2	Post Hemoglobin (mmol/L):	8.9

Day	Total Distance (km)	Resting Core Temp (°)	HR at 60M (b/min)	RPE at 60M	Thermal Scale at 60M	Osmolality
1	10	37	150	15	+2	600
2	15	36.8	148	15	+2	500
3	20	36.7	145	14	+2	450
4	25	36.6	140	12	+1	400
5	30	36.5	135	11	+1	350

EQUIPMENT

- Stadiometer, Seca 287 Wireless Ultrasonic Measuring Station, Seca Medical, Birmingham, UK
- Blood Pressure Monitor, Omron 907 Professional Blood Pressure Monitor, Kyoto, Japan
- Seca mBCA 515. Seca Medical, Birmingham, UK
- Heart Rate Monitor, Polar FT1, Polar Electro, Kempele, Finland
- Squirrel Data Logger, Squirrel 2010, Grants Instruments Ltd, Cambridgeshire, UK (Squirrel View)
- Climatic Test Chamber 201003-1, T.I.S Services, Hampshire, UK
- Life Fitness 95Ti Treadmill, Somerset, UK
- WattBike Cycle Ergometer, WattBike Trainer, WattBike Ltd, Nottingham, UK,
- Concept 2 Rower, Model D, Concept 2 Inc., Morrisville, USA



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