

Topic 6 Adaptation to Anaerobic Training

Adaptations to anaerobic training

Gold standard for measuring anaerobic power and capacity is Wingate anaerobic test

- Anaerobic power and capacity increases with training
- Adaptations in muscles
 - Increase in all muscle fibre cross-sectional area, mostly for type IIa, IIx
 - Type I fibre% decrease, type II fibre % increase
- ATP-PCr system
 - Little enzymatic change with training
 - Increased strength with ATP-PCr system-specific training
- Glycolytic system
 - Increase in key glycolytic enzyme activity (phosphorylase, PFK, LDH, Hexokinase)
 - Performance mostly gain from increase in strength
 - Enzyme activity only in 30s (strength and enzymes) exercise not in 6s (only strength), while power doesn't differ much

Adaptations to High-Intensity Interval training

HIIT – time-efficient way to induce many adaptations normally associated with endurance training

- Mitochondrial enzyme cytochrome oxidase (COX) increases the same after HIIT vs. traditional moderate-intensity endurance training

Specificity of training and Cross-Training

Specificity of training

- VO₂max is higher in the athlete's sport-specific activity
- Due to the individual muscle group adaptation

Cross-training

- Training for more than one sport or fitness components at once
- Strength benefits blunted by endurance training
- Endurance benefits not blunted by strength training

Topic 7 Environmental Influences on Performance

Body temperature regulation

Humans are homeothermic where internal body temperature is regulated

- Thermoregulation – regulation of body temperature around a physiological set point
- **Acclimation**: short-term adaptation to environmental stressor (days/weeks)
- **Acclimatization**: long-term adaptation to environmental stressor (months/years)

Metabolic heat production (M)

- <25% ATP breakdown is cellular work (W)
- >75% ATP breakdown is metabolic heat

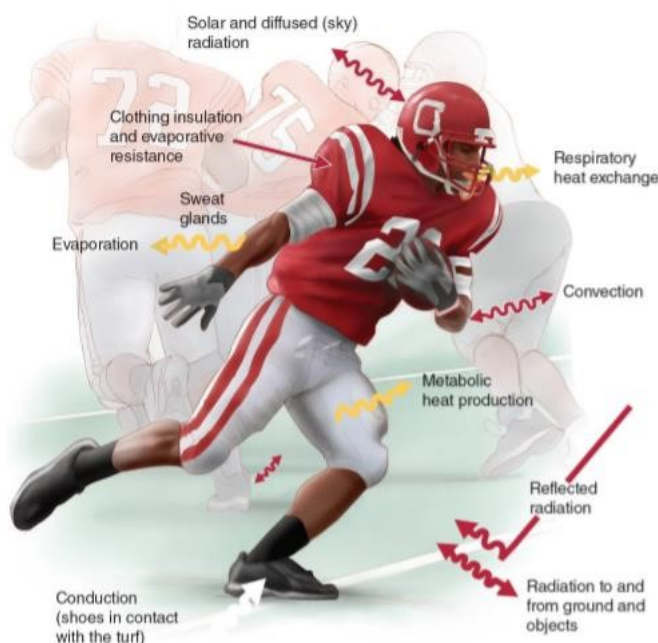
Transfer of heat between body and environment from body core to periphery via blood then dissipate from skin. Insulation (I) is resistance to dry heat exchange, C C R are dry heat exchange. Still layer of air is ideal insulator

- Conduction (C) - Heat transfer from one solid material to another through direct contact
 - Not efficient for human
- Convection (C) – heat transfer by movement of gas or liquid across a surface
 - Increased movement across skin more heat transfer
 - Major daily thermoregulatory factor
- Radiation (R) – heat loss in form of infrared rays
 - Body can give off or receive radiant heat
 - Major daily thermoregulatory factor
- Evaporation (E) – heat loss via phase change from liquid to gas
 - Primary heat loss during exercise (~80%)
 - Clothing adds resistance to E
- Heat balance equation

$M - W \pm R \pm C \pm E = 0$ (Heat balance)

If $M - W \pm R \pm C \pm E < 0$ (Heat loss)

If $M - W \pm R \pm C \pm E > 0$ (Heat gain)
- Humidity and heat loss
 - Water vapor pressure (humidity) adds resistance to Evaporation
- Cooling capacity of sweat – 1.5L sweat evaporated cools 400W
 - Air temperature can become \geq skin temperature



Thermoregulatory Control - $<35^{\circ}\text{C}$, $>41^{\circ}\text{C}$ (Hypo/Hyper)thermia

- For normal range, thermoregulatory responses very effective
 - Core temperature $\sim 37^{\circ}\text{C}$; $>40^{\circ}\text{C}$ inhibits physiological function
 - Thermoregulatory function controlled by POAH (preoptic anterior hypothalamus)
- Preoptic-anterior hypothalamus (POAH) signals sympathetic nervous system (SNS) effectors
 - Receive input from sensory thermo-receptors activate thermoregulatory mechanism
 - Sensory receptors located peripheral in skin, central in brain, spinal cord
 - Skin arteriole effectors
 - SNS vasoconstriction (VC) minimizes heat loss