DETERMINANTS OF REPEAT SPRINT ABILITY

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Presentation Outline

- This presentation will use the most current, peer-reviewed research to discuss the following:

- What is it RSA and its significance to performance
- Determinants:
  - Aerobic capacity
  - Lactate buffering
  - Speed, strength and power

- *Here, sprint refers to efforts of ≤10s, whereby peak power could be maintained throughout*
First, Establish the Physiological Demands

• What are the work to rest ratios (W/R) for Fencing:
  – Eppe
  – Foil
  – Sabre

  – 1:1 in Epee
  – 1:3 in foil
Energy Systems

• Sprints rely on the muscle’s stores of
  – Adenosine triphosphate (ATP)
  – Phosphocreatine (PCr)

• Both are replenished via the aerobic system

• Many coaches assume \( \uparrow \) aerobic capacity (\( \text{VO}_2\text{max} \)) = \( \uparrow \) recovery and \( \uparrow \) RSA
• Conflicting findings due to the RSA test used
• For example:
  – moderate correlation \((r = -0.35)\) using 8 X 40m sprints
    with 30s of recovery between sprints (Aziz et al., 2000)
  – But not 6 X 20m sprints with 20s of recovery
    between sprints (Aziz et al., 2007)
• Length of the sprint alters contribution of the
  aerobic system (Balsom et al., 1992)
VO$_2$max Summary

- VO$_2$max unrelated to RSA with sprints $\leq 40$m (or 6s) (Da Silva et al., 2010)

- Also, recovery between sprints affects RSA (Bogdanis et al., 1996)

- If recovery is long enough, ATP and PCr can be resynthesized during recovery phases via the aerobic system (Glaister, 2005)

- If recovery is too short, thus inhibiting PCr repletion, the contribution of anaerobic glycolysis is increased as reflected by higher lactate levels (Glaister et al., 2005)
But...

- VO$_2$max may be important only after certain number of sprints (Thebault et al., 2011)

- Researchers skeptical to conclude VO$_2$max is not important until protocols of match duration performed (Castagna et al., 2007)

- But they are referring to team sports like football and rugby
Lactate Threshold

• Da Silva et al., (2010): RSA test of 7 X 35m sprints (involving a change of direction) and 25s recovery, produced high lactate ($15.4 \pm 2.2\text{mmol/L}$)

• Inability to maintain RSA subsequent due to lactate, hydrogen ($H^+$) and depletion of PCr (Spencer et al., 2005)

• Velocity at onset of blood lactate accumulation ($vOBLA$) better correlated with RSA ($r = -0.49$)

• $vOBLA$ reflects peripheral adaptations = ↑ capillary density and capacity to transport lactate and $H^+$ ions (Bilat et al., 2003; Thomas et al., 2004)
Speed, Strength and Power

• Da Silva et al., (2010) (protocol aforementioned) and Pyne et al., (2008) (using 6 X 30m sprints with 20s rest):

• Strongest predictor of RSA was anaerobic power i.e., fastest individual sprint time

• Explained 78% of variance and relationship \( (r) \) of 0.66 respectively

• Training should also ➤ sprint speed, strength and power
Conclusion Part I

• ↑ anaerobic qualities such as strength, power and speed

• ↑ vOBLA

• These are regardless sport’s W/R
Conclusion Part II

• Sports that require:
• repeated high intensity efforts over a prolonged period of time (e.g., >15min),
• in which athletes are required to cover >40m per interval
• and regularly produce efforts ≥10s,
• would benefit ↑ VO₂max
References