

Invited Speaker Abstract

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Title of Presentation

Efficiency and metabolic flexibility in aerobic and strength sports: importance of substrate oxidation for performance/health

1. Abstract

In many sports, especially in the long-term, there are several factors that affect performance, but in particular, efficiency and/or race economy, understood as the amount of oxygen needed to develop a given power ($W \cdot L O_2^{-1} \cdot \text{min}^{-1}$). An increase in efficiency, depending on the sport (running, cycling, swimming) is associated with an improvement in performance, in addition to a better metabolism of fats to the carbohydrates, and the use of lactate as an energy substrate, which may reflect the concept of metabolic flexibility. However, this transition from fats to carbohydrates and lactate utilization has also been shown to be interesting in the performance of high intensity interval training (HIIT), whether for endurance or strength and health.

Thus, it has been proposed that the assessment of the influence of fat and carbohydrates oxidation, as well as, the measurement of lactacidaemia, in aerobic efforts (cycling/running) and strength (Crossfit®) in populations of different characteristics.

There are being used to address these evaluations: indirect calorimetry (gas exchange, cardiorespiratory capacity and energy/substrates consumed), measurement of capillary blood lactate (in endurance and strength) and muscle oxygen saturation and total haemoglobin by NIRS (near infrared spectroscopy, non-invasive; only in endurance).

Analysing the different groups of athletes, classified by sports, sex, health and performance level, the results show that fat oxidation is greater in those subjects of higher level. Similarly, the values of lactacidaemia, oxygen saturation and haemoglobin correlate inversely with fat oxidation.

Taking into account these findings, the accumulation of blood lactate correlates positively with the oxidation of carbohydrates and negatively with that of fats during efforts of different character, covering a wide range of capacities metabolic. These techniques may reflect a valid indirect measure to assess the metabolic flexibility, the oxidative capacity of the different substrates in a range of varying intensities and groups of people.

2. key references

- Jeukendrup AE, Martin J. Improving cycling performance: how should we spend our time and money. *Sports Med.* 2001;31(7):559-569.
- San-Millan I, Brooks GA. Assessment of metabolic flexibility by means of measuring blood lactate, fat, and carbohydrate oxidation responses to exercise in professional endurance athletes and less-fit individuals. *Sports Med.* 2018;48(2):467-479.
- Hetlelid KJ, Plews DJ, Herold E, Laursen PB, Seiler S. Rethinking the role of fat oxidation: substrate utilisation during high-intensity interval training in well-trained and recreationally trained runners. *BMJ Open Sport Exerc Med* 2015;0:e000047

3. key messages

- Although not routine, these techniques and technology are increasingly available to all

types of people and athletes.

- Dietitians could work with other health professionals to join possibilities of assessing muscle biopsies, substrates consumed or apps in their athletes/people, and transfer results to other interest groups.