



## Hypoxic Training and Team Sports

Accompanying video: <https://youtu.be/7RxhevwszDk>

Olivier Girard, The University of Western Australia

Brendan Scott, Murdoch University

### CONTENT

Historically, altitude training emerged in the 1960s and was limited to the “Live High Train High” method for the endurance athletes looking for increasing their oxygen transport. This “classical” method was completed in 1990s by the “Live High Train Low” method where athletes benefit from the higher intensity of training at low altitude. With minimal costs and travel constraints for athletes, the “living low-training high” (LLTH) approach is becoming popular in team sports. Active modalities that use either local [blood flow restricted (BFR) exercise] and/or systemic hypoxia [repeated-sprint training in hypoxia (RSH) and resistance training in hypoxia (RTH)] are increasingly used. This symposium aims to present recent updates on LLTH altitude/hypoxic training for team sports.

### Part 1 – Repeated sprint training in hypoxia

Repeated sprint training in hypoxia (RSH) is a recent training method that was introduced given some of the inherent limitations of intermittent hypoxic training (e.g., lower hypoxia-induced training stimulus). Briefly, RSH is the repetition of short (<30 s) “all-out” sprints with incomplete recoveries (<60s) in hypoxia, also including exercise-to-rest ratios typically lower than repeated-sprint ability tests/in-match scenarios to increase metabolic strain (Millet et al., 2019). The general consensus is that RSH leads to superior (1–5%) repeated-sprint ability in normoxic conditions than equivalent normoxic training, presumably with peripheral adaptations (i.e., mitochondrial biogenesis, phosphocreatine resynthesis) postponing muscle fatigue.

### Part 2 – Using hypoxia to improve muscular development

Using hypoxia during resistance exercise was explored by applying BFR cuffs to the top of the limbs during low-load training, which limits muscle blood flow and therefore oxygen delivery. Substantial evidence supports this as a way to enhance muscular development without requiring heavy training. More recent research has also shown that BFR can improve muscular adaptations to cardiovascular exercise, increase fitness characteristics when used during sports-specific training, and can reduce sensitivity to pain in injured participants. However, as BFR can only be applied to the limb, there is growing research interest in resistance training in systemic hypoxia to improve muscular development. There are conflicting findings regarding the benefits of RTH on muscular development, and a better understanding of the physiological mechanisms which drive adaptation to RTH is required.

### Part 3 – Practical implications.

Bearing in mind that “*there’s more than one way to skin the cat*” when prescribing altitude training, there is not one type of RSH, BFR or RTH exercise sessions that can be recommended to best improve physical performance in team sports. That said, the necessity to simultaneously increase the training stimulus and preserve the training quality represents a guiding principle. Real world scenarios are presented to offer practical recommendations for effective implementation of these innovative LLTH interventions. Considerations on how to potentially combine these methods with heat stress training, in professional rugby in particular, are also discussed.



# VIRTUAL ENVIRONMENTAL ERGONOMICS

## Questions

- 1. What are some of the non-haematological mechanisms underlying performance benefits following repeated sprint training in hypoxia?**
- 2. Despite mounting evidence of repeated sprint training in hypoxia safety and efficacy, some uncertainty still exists. Summarize some of the remaining challenges to maximize training adaptations.**
- 3. Explain how blood flow restriction may be a viable approach to speeding up the post-injury recovery process for a team sport athlete.**
- 4. While there is conflicting evidence on the efficacy of resistance training in (systemic) hypoxia, there is likely some benefit to this method. Explain a scenario where resistance training in hypoxia could benefit team sport athletes, and how you would implement this training.**