

Abstract of Doctoral Thesis

Title : Effects of repeated-sprint training in a combined hot and hypoxic condition

Doctoral Program in Sport and Health Science
Graduate School of Sport and Health Science
Ritsumeikan University

ヤマグチ ケイイチ
YAMAGUCHI Keiichi

The present thesis investigated acute systemic and local responses, and training adaptations induced by repeated-sprint training in a combined hot and hypoxic condition.

[Study 1] Ten male athletes performed a repeated-sprint exercise in four different conditions (control, hypoxic, hot, and combined hot and hypoxic conditions). Acute performance, energy metabolism, endocrine response, and acid-base balance were evaluated during the exercise. As a result, muscle temperature, sprint performance, and muscle blood volume were significantly higher in the combined hot and hypoxic condition compared with the hypoxic condition. However, no difference was observed among conditions for blood lactate, plasma adrenaline, noradrenaline concentration, and acid-base balance.

[Study 2] Eleven male athletes performed a repeated-sprint exercise in three different conditions (control, hypoxic, and combined hot and hypoxic conditions). Muscle oxygenation and muscle metabolism were evaluated during the exercise. The results showed that muscle blood flow at the initial phase of the exercise was significantly higher in the combined hot and hypoxic condition than in the control condition, while muscle oxygen consumption was similar between conditions.

[Study 3] Sixteen canoe/kayak sprinters were randomly assigned into two groups (hypoxic or combined hot and hypoxic training groups). They conducted two weeks of repeated-sprint training in each condition. Exercise performance, muscle oxygenation, and muscle metabolism were evaluated before and after the training period. The training in the combined hot and hypoxic condition did not show additional benefits in performance improvement and partially attenuated muscular adaptations compared with the training in the hypoxic condition.

These findings suggest that adding a hot condition to repeated-sprint training in hypoxia does not enhance training adaptations. However, several specific responses (increased muscle temperature, power output, and muscle blood flow) observed during acute exercise in a combined hot and hypoxic condition potentially induce positive impacts on training adaptations.