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Accumulated Oxygen Deficit During Arm Cranking: Effects Of Hypoxia And Methodological Considerations

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(No relationships reported)

Under normobaric hypoxia, aerobic capacity is inherently limited, possibly leading to changes in energy system contribution. While most of the research has focused on lower body cycling or full-body exercise, upper body differences in muscle fiber type distribution and diffusion distance may require greater anaerobic energy provisions as reflected by accumulated oxygen deficit (AOD).

PURPOSE: To observe the effects of normobaric hypoxia on AOD and energy system contribution during different intensities of upper-body arm cranking exercise.

METHODS: Twenty-one recreationally active men (21.4 ± 1.4 yr.; 175.5 ± 5.7 cm; 84.8 ± 11.7 kg) performed a graded exercise test (GXT) in normobaric normoxia (N; FiO2~20%) and normobaric hypoxia (H; FiO2~14%) to determine peak power output (PPO). Time to exhaustion (TTE) trials were later conducted at 110% and 120% PPO under both N and H. AOD (in L-min⁻¹) was calculated as the difference between predicted O2 consumption (extrapolated from a regression equation calculated from GXT) and measured O2 consumption during the TTEs, standardized to time. Anaerobic energy system contribution (%AN) was calculated as [1-(actual O2 consumed/predicted O2)] × 100. AOD and %AN were calculated in three conditions: N, H, and H using the N regression equation (H). Two-way (condition × intensity) repeated measures ANOVAs were conducted for AOD and %AN.

RESULTS: There was a significant condition × intensity interaction for AOD (p=0.009) and AOD (p=0.007). At 110% PPO, %AN was significantly greater (p=0.013) in H compared to N (14% vs. 6.8%, respectively), but not H compared to N. At 120% PPO there were no differences in %AN between conditions. At 110% PPO, AOD was significantly greater (p=0.029) in H compared to N (0.33 vs. 0.19 L·min⁻¹, respectively) but not H compared to N. At 120% PPO there were no differences in AOD between conditions.

CONCLUSION: Calculating AOD for hypoxic exercise using a regression equation derived from normoxic conditions reveals a greater anaerobic contribution relative to normoxic exercise. The greater AOD and %AN in hypoxia compared to normoxia that was present at 110% PPO was not reproduced at 120% PPO. This may suggest a possible threshold at which hypoxia has no further effect on energy system contribution in this exercise modality.

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The Effects of Altitude Training Masks Worn During Low-Intensity Bouts on Performance


(No relationships reported)

Altitude training masks (ATMs) are frequently used during exercise to enhance physiologic adaptations, yet few studies have examined the effects of ATMs when used during recovery periods.

PURPOSE: To examine the effects of ATMs used only during low-intensity recovery intervals in a high-intensity interval training (HIIT) program in healthy young adults.

METHODS: Participants engaged in 18 HIIT over a 6-week period using a treadmill. HIIT sessions comprised of 6-8, 60-second high-intensity bouts at a relative work rate corresponding to 95% of participants’ maximal heart rates, alternating with 90-second low-intensity recovery bouts at a relative work rate corresponding to 20% VO2max. Participants were randomly assigned to an experimental group (EXP) which wore an ATM only during the low-intensity bouts or to a control group (CON) which did not use an ATM. Cardiopulmonary exercise tests (CPET) were performed before and after the HIIT.

RESULTS: 10 participants completed the study in the EXP group (6 females; 26±6.1 years; BMI: 24.2±1.6 kg/m²) and 10 in the CON group (7 females; 21±3.5 years; BMI: 22.8±2.1 kg/m²). Both groups experienced improvements in VO2max (EXP: 39.9±8.0 vs. 42.8±6.0 ml/kg/min, p=0.02; CON: 39.7±6.1 vs. 43.9±8.3 ml/kg/min, p=0.01; baseline vs. follow-up, mean±SD). The EXP group alone saw improvements after training in time to anaerobic threshold (169±32.1 vs. 213±56sec, p=0.04), increased peak work rate during CPET (44±26.9 vs. 88±54.3 Watts, p=0.03), and increased minute ventilation during peak exercise (108±15.3 to 113.6±19.6 L/min, p=0.04). No other changes were observed in the CON group.

CONCLUSIONS: Using ATMs only during the low-intensity bouts of HIIT appears to have afforded participants with unique training adaptations not observed in standard HIIT. Conventional use of ATMs employs the masks during exertional portions of exercise training, not solely during recovery periods. These findings suggest that ATMs may serve as a valuable training adjunct even if used only during recovery periods in HIIT. Supported by: GWU SMHS Emerging Scholars Award 2016-2018

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Effect Of Intermittent Hypoxic Exercise Training On Improving Altitude Acclimatization

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PURPOSE: The purpose of this study was to evaluate the effect of hypoxic exercise training towards altitude acclimatization through systematic literature synthesis, and establish a potential strategy to improve altitude acclimatization.

METHODS: A selective PubMed, CNKI and Google Scholar search on intermittent hypoxic exercise training and altitude acclimatization was conducted. By search and screening, 11 articles of PubMed/Google Scholar and 4 articles of CNKI were included for final analysis and assessment.

RESULTS: Moderate-intensity intermittent hypoxic exercise training could blunt oxidative stress and decrease Acute Mountain Sickness (AMS) at elevations of ~ 3200m, but its little effect on physical performance compared to intermittent hypoxic exposure. Vigorous-intensity intermittent hypoxic exercise training can improve human endurance performance. None moderate exercise is performed to increase AMS or worsen AMS severity, while exceed health bearing can worse symptoms of AMS.

CONCLUSIONS: 1) intermittent hypoxic exercise training can improve altitude acclimatization to AMS and physical health status. 2) A proper hypoxic exercise training intensity may be a crucial factor to maintain and raise human physical performance at high altitude.

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