



Mid Atlantic Regional Chapter of the American College of Sports Medicine

Annual Scientific Meeting, November 1st – 2nd, 2019
Conference Proceedings

International Journal of Exercise Science, Volume 9, Issue 8



Evaluation of VO₂max Criteria in High-Active Trail Runners

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PURPOSE: To compare the achievement of classic versus contemporary maximal oxygen consumption (VO₂max) criteria using the Bruce treadmill protocol in high-active adult trail runners. **METHODS:** Nineteen (12 men, 7 women; 36.1 ± 6.4 yr) high-active trail runners (376 ± 137 min of running per week) performed the Bruce treadmill protocol to volitional exhaustion. Pulmonary ventilation, VO₂, and VCO₂ were collected continuously using a metabolic measurement system. Heart rate (HR) was monitored and recorded each minute using an electrocardiogram. Individual exercise test data was analyzed for achievement of the following classic VO₂max criteria: 1) VO₂ plateau, < 2.1 ml·kg⁻¹·min⁻¹ increase with increasing workload, (2) HR within 10 beats·min⁻¹ of age-predicted maximal HR (APMHR: 220 – age), and (3) respiratory exchange ratio (RER) ≥ 1.15. Data was also analyzed for the following contemporary criteria: 1) VO₂ plateau, < 2.1 ml·kg⁻¹·min⁻¹ increase during the final minute of exercise, (2) HR within 10 beats·min⁻¹ of APMHR (208 – 0.7*age), and (3) RER ≥ 1.10. The proportion of subjects achieving classic versus contemporary criteria was compared using the Chi-Square Test of Independence, completed separately for each criteria type (plateau, HR, RER) and overall (achieving 2 of 3 criteria for accepted VO₂max achievement). **RESULTS:** Mean time until test termination was 13.6 ± 1.7 minutes. The highest 30-second average VO₂ for the overall sample was 53.8 ± 8.6 ml·kg⁻¹·min⁻¹, ranging from 38.6 – 52.6 ml·kg⁻¹·min⁻¹ in the women and 43.6 – 72.7 ml·kg⁻¹·min⁻¹ in the men. A significantly lower proportion of subjects achieved the classic compared to the contemporary criteria for VO₂ plateau (1/19 vs 15/19; Chi-Square = 21.16, *p* < 0.001), RER (7/19 vs 16/19; Chi-Square = 8.92, *p* = 0.003), and overall (4/19 vs 17/19; Chi-Square = 17.99, *p* < 0.001). A similar proportion of subjects achieved the classic and contemporary HR criteria (11/19 vs 13/19; Chi-Square = 0.45, *p* = 0.501). **CONCLUSION:** In this sample of high-active adult trail runners, the less conservative contemporary VO₂max criteria resulted in a greater proportion of subjects achieving VO₂max using the Bruce treadmill protocol.