Heart Rate Variability and Performance at Two Different Altitudes in Well-Trained Swimmers

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Abstract

The aim of this study was to compare the effects of training at two different altitudes on heart rate variability (HRV) and performance in well-trained swimmers. Eight national-level male swimmers (age = 17.0 ± 1.8 yrs, weight = 67.0 ± 6.6 kg, height = 180.4 ± 7.2 cm, V·O₂max = 60.4 ± 4.0 ml · min⁻¹ · kg⁻¹) trained 17 days at 1200 m altitude (T₁₂₀₀), then, after 6 weeks of moderate training at sea level, reproduced the same training plan at 1850 m (T₁₈₅₀). The training was mainly aerobic with 86 % and 84 % ≤ anaerobic threshold for T₁₂₀₀ and T₁₈₅₀, respectively. Four HRV analysis tests were performed during T₁₂₀₀ and T₁₈₅₀, respectively (pre-test = day 0, test 2 = day 5, test 3 = day 11, post-test = day 17), in supine and standing position. Performance was measured over a 2000-m freestyle test at the altitude of 1200 m. A difference in HRV changes was observed between the two altitudes: during T₁₂₀₀, addition of parasympathetic and sympathetic activity in supine (TPSU) (p < 0.05) and standing (TPST) (p < 0.05) position, supine parasympathetic activity (HFSU) (p < 0.05), and standing sympathetic activity (LFST) (p < 0.05) were increased and the 2000-m performance was improved (p < 0.05) whereas none of these parameters was changed during T₁₈₅₀. Change in performance was correlated with increase in HFSU (r = 0.73; p < 0.05) and tended towards correlation with increase in LFST (r = 0.73; p = 0.06). Conclusion: the same training loads induced a positive effect on HRV and performance at 1200 m but not at 1850 m. This may be the consequence of greater stress due to an interaction between greater hypoxic stimulus and the same training loads. These results highlight two opposing effects: aerobic training increases, whereas hypoxia decreases HFSU, due to the correlation between HRV and changes in performance during altitude training.