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Abstract

Validating Physiological and Biomechanical Parameters during Continuous Swimming at Speed Corresponding to Lactate Threshold †

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Abstract: AIM: The purpose of this study was to validate the physiological responses and biomechanical parameters during continuous swimming at intensity corresponding to lactate threshold previously calculated by an intermittent, progressively increasing speed test (7 × 200-m). **MATERIAL & METHOD:** Nine competitive male and female swimmers (age, 19.2 ± 2.3 years; height, 175.3 ± 7.5 cm; body mass, 67.6 ± 8.7 kg; VO_2max, 46.5 ± 15.6 mL/kg/min) performed a 7 × 200-m front crawl test reaching maximum speed in the last effort. Blood lactate concentration (BL) and oxygen uptake (VO_2) were determined after each repetition, while heart rate (HR) was recorded continuously. Stroke rate (SR) and stroke length (SL) were measured in each 200-m effort. The speed at lactate threshold (sLT) was calculated using the individual speed vs. BL, and subsequently BL, VO_2, HR, SR, and SL corresponding to sLT were calculated (BL-sLT, VO_2-sLT, HR-sLT, SR-sLT, and SL-sLT). On a subsequent day, swimmers performed 30-min continuous swimming (T30) with a constant speed corresponding to sLT. BL, $V0_2$, HR, SR, and SL (BL-T30, $V0_2$-T30, HR-T30, SR-T30, and SL-T30) were measured in the 10th and 30th minutes of the T30 test, and the mean values were used for the statistical analysis. **RESULTS:** The speed corresponding to sLT was not different from the speed at T30 (1.33 ± 0.08 vs. 1.32 ± 0.09 m/s, $p > 0.05$). There was no difference between tests in VO_2 (VO_2-sLT, 34.9 ± 13.3 vs. VO_2-T30, 32.1 ± 11.4 ml/kg/min, $p = 0.47$). However, not all swimmers were able to complete T30 at sLT, and BL, HR, and SR were higher, while SL was lower at the end of T30 compared to sLT (BL-sLT, 3.47 ± 0.60 mmol/L vs. BL-T30, 5.28 ± 3.15 mmol/L, $p = 0.05$; HR-sLT, 163 ± 10 vs. HR-T30, 171 ± 11 b/min, $p = 0.03$; SR-sLT, 28.0 ± 4.0 vs. SR-T30, 33.8 ± 3.2 strokes/min, $p < 0.001$; SL-sLT, 2.6 ± 0.4 vs. SL-T30, 2.4 ± 0.3 m/cycles, $p < 0.001$). A Bland-and-Altman plot indicated agreement between 7 × 200 and T30 in BL (bias 1.8 ± 2.4 mmol/L), VO_2 (bias −2.9 ± 11.4 ml/kg/min), HR (bias 10.3 ± 12 b/min), SR (bias 5.3 ± 3.4 strokes/min), and SL (bias −0.3 ± 0.2 m/cycle), but the range of physiological and biomechanical data variations was large. **CONCLUSIONS:** Continuous swimming at speed corresponding to lactate threshold may not show the same physiological and biomechanical responses as those predicted by a progressively increasing speed test of 7 × 200-m.

Keywords: blood lactate; heart rate; swimming