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*Abstract*

# Validating Physiological and Biomechanical Parameters During Intermittent Swimming at Speed Corresponding to Lactate Concentration of 4 mmol/L †

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**Abstract: AIM**: progressively increasing swimming speed test (5 × 200 m) is used to calculate the speed corresponding to blood lactate concentration of 4 mmol/L (V4) and related physiological and biomechanical parameters. The purpose of this study was to compare the calculated by a 5 × 200-m test parameters with those obtained during an intermittent swimming training set (5 × 400-m) performed at constant speed corresponding to V4. **MATERIAL & METHOD:** Twelve competitive male swimmers (age, 19 ± 2 years; height, 178 ± 8 cm; body mass, 74.4 ± 10.1 kg) performed a 5 × 200-m front crawl test reaching maximum speed in the last effort. Blood lactate concentration (BL) was measured after each 200 m, and heart rate (HR), stroke rate (SR), and stroke length (SL) were determined during each 200 m. V4 was calculated by interpolation using the individual speed vs. BL, and subsequently HR, SR, SL corresponding to V4 were calculated (HR-V4, SR-V4, SL-V4). One week later, swimmers performed 5 × 400-m at constant speed corresponding to V4. During the 5 × 400-m test, BL (BL-5 × 400) was measured after the 1st, 3rd and 5th repetitions, while HR (HR-5 × 400) was recorded continuously. SR and SL were measured in each 400-m repetition, and mean values were calculated (SR-5 × 400 and SL-5 × 400). **RESULTS:** V4 and HR-V4 were not different from speed and HR-5 × 400 during the 5 × 400-m test (1.30 ± 0.10 vs. 1.29 ± 0.10 m/s; 160 ± 14 vs. 166 ± 13 b/min, both $p > 0.05$). BL-5 × 400 was not different from 4 mmol/L (4.9 ± 2.6 mmol/L, $p > 0.05$). SR was increased and SL was decreased during 5 × 400 m compared to the values corresponding to V4 (SR-V4, 28.9 ± 3.8 vs. SR-5 × 400, 34.5 ± 3.4 strokes/min; SL-V4, 2.38 ± 0.33 vs. SL-5 × 400, 2.25 ± 0.30 m/cycle, both $p < 0.05$). A Bland-and-Altman plot indicated agreement between variables obtained by the 5 × 200-m and 5 × 400-m tests but with great range of variation (bias: BL, −1.0 ± 2.6 mmol/L; HR, −7 ± 12 b/min; SR, −5.6 ± 3.3 strokes/min; SL, 0.13 ± 0.09 m/cycle). **CONCLUSIONS:** An intermittent, with progressively increasing speed, swimming test provides physiological information to coaches to apply during an intermittent constant-speed swimming training set at intensity corresponding to BL of 4 mmol/L with large inter-individual variability. It seems that the 5 × 200-m test does not provide valid results for the biomechanical parameters.

**Keywords:** blood lactate; heart rate; swimming