Cardiovascular effort in different head-out aquatic exercise routines: influence of limbs action and floating equipment.

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Head-out aquatic exercise classes comprise limbs action with or without equipment to diversity and change the intensity of the session. Instructors use arms only, legs only action or full mode of exercise to induce different forms of effort. Although acute physiological response can be dependent from the number of limbs in action or by the inclusion of floating material (Costa et al., 2008), there is a need to stagger those routines for health and conditioning purposes. Ten young and healthy women (22.2±2.6 years, 59.3±12.5 kg of body mass and 1.63±0.08 m of height) were recruited to perform five head-out aquatic exercises: (i) horizontal arms abduction (Ab); (ii) horizontal arms abduction with dumbbells (AbDum); (iii) frontal kick (Fk); (iv) frontal kick with leggings (FkLeg), and; (v) aquatic skiing (Ski). Subjects were randomly assigned to each routine that was performed for three minutes at the cadence of 132 bpm. Cardiovascular response was assessed by heart rate, systolic blood pressure, double product and rating of perceived exertion. There were significant and strong variations in all variables according to the routine performed ($p < 0.01$, partial $\eta^2 > 0.64$ for all). The heart rate was higher in FkLeg (140.40±25.50 bpm) compared to Ab (110.30±23.75 bpm, $p = 0.03$) and AbDum (110.00±22.70 bpm, $p = 0.04$). The systolic blood pressure showed higher values in Fk (120.60±15.20 mmHg) when compared to Ab (104.50±10.80 mmHg, $p = 0.05$). The double product also showed higher values in Fk (15962.80) and FkLeg (16990.40) when compared to Ab (11608, $p < 0.01$ and $p = 0.01$, respectively). Interestingly, the rating of perceived exertion showed lower values in Ski (10.40) than AbDum (13.60, $p = 0.01$) and FkLeg (15.80, $p < 0.01$). It can be concluded that different head-out aquatic exercise routines, encompassing different limbs or with the aid of floating devices, induce different cardiovascular responses. Actions by the lower limbs are the most intense, while upper limbs elicit a lower exertion. Exercising the four limbs (e.g. aquatic skiing) seems to be less demanding than eliciting only two limbs with the aid of a floating device.

References:

Costa, G., Afonso, S., Bragada, J. A., Reis, V. M., & Barbosa, T. M. (2008). Comparison of acute physiological adaptations between three variants of a basic head-out water exercise. *Brazilian Journal of Kinanthropometry and Human Performance*, *10*(4), 323–329. https://doi.org/10.5007/1980-0037.2008v10n4p323

Artificial neural networks and performance prediction from low to severe swimming intensities

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The non-linear modelling method is promising in the area of competitive swimming [1], being artificial neural networks considered potentially superior than linear approach for modelling, pattern recognition and time series forecasting with errors lower than 0.50 s for middle-distance events (Leondes, 2002; Pfeiffer & Hohmann, 2012). We aimed to apply two artificial neural networks types (i.e. Multilayer Perceptron and Radial Basis Function) for horizontal center of mass swimming velocity (CM) prediction at low-moderate, heavy and severe training intensities during an incremental protocol using physiological and biomechanical data. We hypothesized that a satisfactory model-fit could be achieved with both artificial neural networks types implemented for performance prediction of different swimming training intensities. Ten well-trained front crawl male swimmers (mean ± s: age 19.78 ± 5.36 yrs, stature 1.78 ± 0.06 m, body mass 71.40 ± 5.72 kg) volunteered to participate. Swimmers completed an intermittent incremental protocol of 7 x 200 m crawl swims to exhaustion (0.05 m.s-1 increments and 30 s intervals), being measured expiratory gases and blood lactate concentrations. Two surface and four underwater digital cameras recorded independent