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The influence of stroke mechanics into energy cost of elite swimmers

Abstract

The purpose of this study was to analyze the relationships between energy cost (C), swimming velocity (v), stroke frequency (SF) and stroke length (SL) in top-level swimmers. Eighteen elite swimmers (four freestylers, five backstrokers, five breaststrokers and four butterflyers) performed an intermittent set of $n \times 200$ m swims ($n \leq 8$) with increasing velocity. The oxygen consumption was measured breath-by-breath by a portable metabolic cart (K4 b2, Cosmed, Rome, Italy). A respiratory snorkel and valve system with low hydrodynamic resistance was used to measure pulmonary ventilation and collect expiratory gases. Blood samples were taken from the ear lobe before and after each swim to analyze the blood lactate concentration (YSI 1500L, Yellow Springs, OH, USA). At Backstroke, Breaststroke and Butterfly strokes, increases of SF were associated to increases of C, even when controlling the v. The increases in SL only promoted significant decreases in the C in Breaststroke. There was a significant and polynomial relationship between v and SF for all competitive swimming techniques. The polynomial relationship between v and SL was significant only in Freestyle and Butterfly stroke. Partial correlations between v and SF controlling the effect of SL and between v and SL controlling the effect of SF, were positive and significant for all techniques. It is concluded that manipulation of stroke mechanics variables (SF and SL) may be one of the factors through which C in competitive swimming can be altered for a given v.

Within this Article

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- Stroke length

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