

Abstract

Swimming speed, intra-cycle variation and efficiency in young swimmers

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The purpose of this study was to understand the relationship between the swimming speed, intra-cycle variation of the horizontal speed of displacement (dv), and Froude efficiency (η_F) in front-crawl during the three consecutive stroke cycles. The study included a sample of 15 males (16.07 ± 0.77 years, 1.77 ± 0.06 m in height, 1.83 ± 0.08 m in arm span) and 15 females (15.05 ± 1.07 years, 1.63 ± 0.07 m in height, 1.68 ± 0.07 m in arm span). The participants performed a 25-meter front-crawl trial, during which their swimming speed, dv , and η_F were measured over three consecutive stroke cycles.

The results indicated that the stroke-by-stroke effect on swimming speed was not significant ($F = 2.55$, $p = 0.087$, $\eta^2 = 0.08$), but there was a significant difference between sexes ($F = 90.46$, $p < 0.001$, $\eta^2 = 0.76$), with males exhibiting higher swimming speeds. The trend observed for $d\bar{v}$ and η_F mirrored that of swimming speeds in terms of stroke-by-stroke effects, but there was no significant difference between sexes ($p > 0.05$). The Spearman correlation analysis revealed no significant correlations between swimming speed and either $d\bar{v}$ or η_F in all three stroke cycles for both sexes. However, it's important to note that the inverse relationship between swimming speed and $d\bar{v}$ was not consistently observed, and the direct relationship between swimming speed and η_F was not consistently observed either. Additionally, the analysis using hierarchical linear modelling showed that η_F had the ability to predict swimming speed, whereas the $d\bar{v}$ did not have a significant predictive effect. The findings of this study revealed a tendency for swimming speeds to decrease over time, with male swimmers achieving higher velocities in all stroke cycles compared to female swimmers. Although there were no significant correlations between swimming speed and $d\bar{v}$ or η_F , Froude efficiency emerged as a stronger predictor, prompting a discussion about the importance and impact of intra-cycle velocity variation on swimming speed among young swimmers. Coaches and swimmers must be aware that lower $d\bar{v}$ may not always be related to faster swimming velocities and vice-versa, and that η_F is entered as a swimming speed predictor rather than $d\bar{v}$.

Keywords: swimming, maximal trials, efficiency, technique.