

Performance modelling of butterfly swimmers: links between morphometric, kinematic and hydrodynamic variables

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Abstract: The aim of the study is to explain the performance of butterfly swimmers over 100 m butterfly using a set of selected morphometric, kinematic and hydrodynamic parameters. Parametric modelling and multivariate analysis are used in order to define synthetic variables (indices) describing kinematic and morphometric parameters. The possibility of predicting the performance V100 (mean velocity over 100 m butterfly) using morphology variables is tested. The results showed that the parametric model proposed describes well the performance. The selected kinematic parameter Xhip, (instantaneous hip displacement) varies little among the swimmers, whereas for the parameter k (describing the variation of the displacement patterns) highly different values have been obtained. Hip displacements vary essentially according to their shapes - high k values corresponding to swimmers acceleration at the end of the cycle, and low k values corresponding to swimmers with more regular displacements. Thus, k was selected as the only parameter to describe the hip displacement patterns. A negative relation between the performance and the hydrodynamic variables has been obtained confirming that every increase of flow resistance get worse performance. A positive relation between the performance and the individual morphological data has been found, i.e. light and sharp swimmers have in general higher performance. No relation between k and the morphology has been observed. On the contrary, a negative relation between the hydrodynamic variables and the morphology has been obtained.

Key words: sports biomechanics, swimming, modelling, multivariable analysis