Longitudinal Interventions in Elite Swimming: A Systematic Review Based on Energetics, Biomechanics, and Performance

Mário J. Costa,[1–3] José A. Bragada,[1,3] Daniel A. Marinho,[3,4] António J. Silva,[2,3] and Tiago M. Barbosa[1,3]

[1]Department of Sport Sciences, Polytechnic Institute of Bragança, Bragança, Portugal; [2]Department of Sport Sciences, Exercise and Health, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal; [3]Research Centre in Sports Science, Health and Human Development, Vila Real, Portugal; and [4]Department of Sport Sciences, University of Beira-Interior, Covilhã, Portugal

Abstract

Costa, MJ, Bragada, JA, Marinho, DA, Silva, AJ, and Barbosa, TM. Longitudinal interventions in elite swimming: A systematic review based on energetics, biomechanics, and performance. *J Strength Cond Res* 26(7): 2006–2016, 2012—Longitudinal information requires the notion of repeated measurements throughout time. Such data is important because it allows the determination of the effectiveness of an intervention program. Research in competitive swimming has given special emphasis to energetics and biomechanics as determinant domains to improve performance. The purpose of this systematic review was to summarize longitudinal evidences on the energetic, biomechanical, and performance status of elite swimmers. A computerized search was made in 6 databases, conference proceedings, and department files. The 28 studies that satisfied the inclusion criteria were selected for analysis. Studies' qualitative evaluation was made by 2 independent reviewers using the Quality Index. These studies were then gathered into 3 main categories according to their reported data: energetics ($n = 18$), biomechanics ($n = 9$), and performance ($n = 8$). The conclusions were as follows: (a) elite swimmers are able to demonstrate from slight to substantial changes in their performance and energetic and biomechanical profiles within and between seasons; (b) the magnitude of change is dependent on the characteristics of the training programs, the duration of the intervention, and subject's gender; and (c) future research should emphasize the use of more complex procedures to improve the quality of the interventions.

Key words elite swimmers, seasonal variation, kinematics, training

Introduction

Research in competitive swimming has given special emphasis to energetic and biomechanical assessments. The performance is strongly linked to energetic variables, as those are dependent on biomechanical profile and motor strategies adopted by the swimmers (5). At the moment, most of the recent reviews conducted about this topic (5,42,43) report evidences exclusively based on cross-sectional studies. The defining feature of a cross-sectional study is that it can compare different population groups (i.e., cohort groups) and different variables at a single time moment. Such interventions are less comprehensive and informative about the cause-and-effect relationships in a long-term perspective. On the other hand, the longitudinal assessment implies the notions of repeated measures, that is, the observations are collected at a certain number of occasions. Extending its measurements beyond a single time moment, a sequence of events can easily be established (45). Thus, it seems that longitudinal interventions can bring more benefits than cross-sectional studies.

There are a few longitudinal studies on competitive swimming when compared to other sports (e.g., running). Most of those articles were published in peer-reviewed and indexed journals showing the strong effect of their findings. Indeed, the consolidation of those evidences retrieving some major guidelines is an important tool for coaches' daily intervention. However, to the best of our knowledge, it does not seem to exit any review about longitudinal interventions on competitive swimming.

Longitudinal data play a major contribution in helping coaches defining realistic goals and training procedures between competitions or between seasons (30). This kind of information on energetic and biomechanical terms is a useful tool to determine the effectiveness of the previous load, helping enhanced performance (40). Moreover, the longitudinal performance judgment by itself can be a useful adjunct for the prediction phenomena. Chronological points can be used to predict performance levels (6) or even to determine the probability of winning a medal in a specific event (30,44).

Address correspondence to Mário J. Costa, mario.costa@ipb.pt.

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