Stability and Prediction of 100-m Breaststroke Performance During The Careers of Elite Swimmers

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The aim of this study was to track and analyze the 100-m Breaststroke performance stability throughout elite swimmers' careers. 35 Portuguese male top-50 swimmers were analyzed for seven consecutive seasons between the ages of 12 and 18 years old. Best performances were collected from ranking tables. Longitudinal assessment was performed based on two approaches: (i) mean stability was analyzed by descriptive statistics and ANOVA repeated measures for each season followed by a post-hoc test (Bonferroni test), (ii) normative stability was analyzed with self-correlation (Malina, 2001) and the Cohen's Kappa tracking index (Landis and Koch, 1977). There was a 100-m Breaststroke performance enhancement from child to adult age. The overall career performance prediction was low. The change from 13 to 14 years can be a milestone, where the ability to predict the final swimmer's performance level strongly increases.

Keywords: stability, prediction, tracking, breaststroke

INTRODUCTION

Swimming seems to be one of the most studied sports in the Sport Sciences community. Researchers are constantly trying to identify and understand the factors that can better predict swimming performance. However, the majority of the studies in swimming "science" have a cross-sectional character. Indeed, they do not consider the performance stability and change as the result of individual development, new training methods and/or technological sophistication.

The longitudinal approaches regarding competitive swimming are few. Even so, most of the papers published have a strong focus on physiological and/or biomechanical issues and less on the swimming performance itself. Swimming performance is expressed by the time spent to cover the event distance. The longitudinal performance assessment is important to help coaches to define realistic goals and training methods. These longitudinal assessments can be developed tracking the performance of elite swimmers, analyzing its progression between competitions and/or seasons. The main advantages are that it is possible to: (i) describe and estimate the progression and the variability of performance during and between seasons; (ii) find hypothetical chronological point determinants to predict swimmer's performance throughout his/her career or a given time frame and; (iii) determine swimmer's chance to reach finals or win medals in important competitions. Pyne et al. (2004), in a 12 month study, made an attempt to understand the performance behaviour leading up to the 2000 Olympic Games by analyzing the 50-m, 100-m, 200-m, 400-m, 800-m (females only) and 1500-m (males only) freestyle events; two backstroke, breaststroke and butterfly events over 100-m and 200-m, and the 200-m and 400-m individual medley events. They reported that to stay in contention for a medal, a Sydney 2000 Olympic swimmer should improve his/her performance by approximately 1 % within a competition and by approximately 1 % within the year leading up to the Olympics. The authors also stated that presumably an additional enhancement of approximately 0.4 % would substantially increase the swimmer's chances of a medal.

So far, any research analyzing the change and stability of swimmer's breaststroke performance during his/her career using the tracking approach does not appear to exist. Therefore, the purpose of this study was to track and analyze the 100-m male breaststroke performance stability throughout the elite swimmer's career, from childhood to adult age.

METHODS

An overall of 35 Portuguese male swimmers and 905 race times were analyzed for seven consecutive seasons between 12 and 18 years old. The Portuguese male top-50 rankings in the 100-m Breaststroke event, in the 2007-2008 season was consulted to identify the swimmers included. Exclusion criteria were defined as: (i) authors do not have access to the season best performance in seven consecutive seasons and (ii) swimmer did not swim the 100-m breaststroke event at least once per season for some reason. Best performances from official competitions, in a short course pool (regional, national or international level), during the career seasons, were collected from ranking tables. The rankings tables were provided by the Portuguese National Swimming Federation, and when suitable or appropriate were also consulted from a public swimming database (www.swimrankings.net, November 2009).

Longitudinal assessment was performed based on two approaches: (i) mean stability; (ii) normative stability. For mean stability, quartiles, means plus standard deviations were computed for each chronological age. Data variation was analyzed with ANOVA repeated measures followed by a post-hoc test (Bonferroni test). Normative stability was analyzed with Pearson Correlation Coefficient between paired performances throughout the seven seasons. Qualitatively stability was considered to be: (i) high if $r \geq 0.60$; (ii) moderate if $0.30 \leq r < 0.60$ and; (iii) low if $r < 0.30$, as suggested by Malina (2001). The Cohen's Kappa tracking index (K) plus one standard deviation, with a confidence interval of 95 % was also calculated. The qualitative interpretation of K was made according to Landis and Koch (1977) suggestion, where the stability is: (i) excellent if $K \geq 0.75$; (ii) moderate if $0.40 \leq K < 0.75$ and; (iii) low if $K < 0.40$.

All statistical procedures were computed with SPSS software (v. 13.0, Apache Software Foundation, Chicago, IL, USA). However, the K value was computed with the Longitudinal Data Analysis software (v. 3.2, Dallas, USA). The level of statistical significance was set at $P \leq 0.05$.

RESULTS

Figure 1 presents the variation of swimming performance throughout swimmer's career. ANOVA repeated measures revealed significant variations in the 100-m Breaststroke swimming performance [$F(1.34) = 353.57$; $P < 0.01$, power = 1.00]. Bonferroni post-hoc tests verified significant differences ($P < 0.01$) between all seasons analyzed. The only exception was for the pair wise comparison between the sixth and the seventh seasons that was not significant. From the age of 12 to the age of 18, median values ranged between 80.70 s (12 years) and 66.55 s (18 years). So, there was an obvious performance enhancement during the swimmer's career.

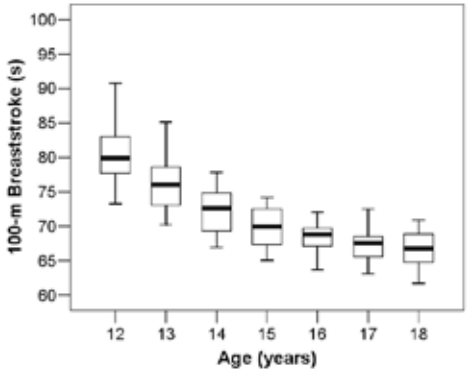

Figure 1: Diagram of 100-m Breaststroke swimming performance, median extremes and quartiles from childhood to adult age.