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

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

TRACKING THE FREESTYLE PERFORMANCE FROM CHILDREN TO ADULT AGE

INTRODUCTION

Swimming researchers are, on regular basis, trying to identify and understand the factors that can predict swimming performance. For such aim most of the research designs adopted are cross sectional in nature. There are few longitudinal researches in swimming science. Moreover, most of these longitudinal studies dedicate their data analysis for a short time period, i.e., less than one season (e.g., Stewart & Hopkins, 2000) or, for a time period between one and five seasons (e.g., Pyne et al., 2004; Costa et al., 2010b). On the other hand, the number of longitudinal designs analysing swimming performance for a longer time period, e.g., more than five consecutive seasons still scarce. Some interesting conclusions were verified when adopting those longer time frames. Regarding the national level breaststrokers performances in the 100-m event for seven consecutive seasons, the age of 16 was considered a milestone, as the stability increased strongly starting in that age (Costa et al., 2010a). Analyzing the overall trends and individual trajectories of swimming performance for a decade, Hopkins et al. (2010) reported that the New Zealand swimmer's age for best performance was 18.9 ± 1.5 years and 18.7 ± 2.5 years for boys and girls respectively. So, it appears to exist a lack of consistent or massive knowledge from the stability and variation of the swimming performance during a long time period namely from children to adult age.

The purpose of this study was to track and analyze the freestyle performance stability throughout the elite swimmer's career from 12 to 18 years old.

METHODS

SUBJECTS: Portuguese elite male swimmers where chosen to be the main focus of our study. It was considered as inclusion criteria to be a Portuguese male top-50 swimmer, for short course during the 2006-2007 season in the 50-m, 100-m, 200-m freestyle events . On the contrary, an exclusion criteria was considered: (i) to be a swimmer from the Portuguese top-50, but authors did not have access to season best performance in some of the chronological ages; (ii) to be a swimmer from the Portuguese top-50 but not having swum the event at least one time per season from 12 to 18 years for some reason; (iii) to be a swimmer from the Portuguese top-50 but not being at least 18 years-old. So, an overall of 124 elite male swimmers and 868 race times were analyzed.

STUDY DESIGN: We made a retrospective performance data analysis of elite male swimmers during seven consecutive seasons. Portuguese male's Top-50 in the 2006-2007 season was consulted to verify the swimmers included in it. So, the Portuguese National Swimming Federation allowed us to collect the best official results between 12 and 18 years old from each swimmer identified in the Top-50. When suitable or appropriate performance times were also collected from public swimming database (www.swimrankings.net).

STATISTICAL PROCEDURES: The normality of the distributions was assessed with the Shapiro-Wilk test. Longitudinal assessment was made based on two approaches: (i) mean stability; (ii) normative stability. For mean stability, mean plus one standard deviation and quartiles were computed. Data variation was analyzed with ANOVA repeated measures followed by a post-hoc test (Bonferroni test). The normative stability was analyzed with the Cohen's Kappa (K) and the Pearson Correlation Coefficient. The qualitative interpretation K value was made according to Fleiss (1981) suggestion: (i) excellent if $K \geq 0.75$; (ii) moderate if $0.40 \leq K < 0.75$ and; (iii) low if $K < 0.40$. Qualitatively stability based on Pearson Correlation 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).

RESULTS AND DISCUSSION

Figure 1 presents the performance variation throughout the seven consecutive seasons in the freestyle events analyzed. ANOVA revealed significant variations in the swimming performance in the 50-m [$F_{1,35} = 769.88$; $P < 0.01$, power = 1.00], 100-m [$F_{1,43} = 3326.19$; $P < 0.01$, power = 1.00] and 200-m [$F_{1,43} = 16272.81$; $P < 0.01$, power = 1.00]. Bonferroni post-hoc tests verified significant differences ($P < 0.01$) between all ages for all events, except between the 17 and the 18 years. The overall stability based on K values was low in all events analyzed: 50-m (K = 0.22 ± 0.05), 100-m (K = 0.27 ± 0.05) and 200-m (0.23 ± 0.05). So, based on overall tracking

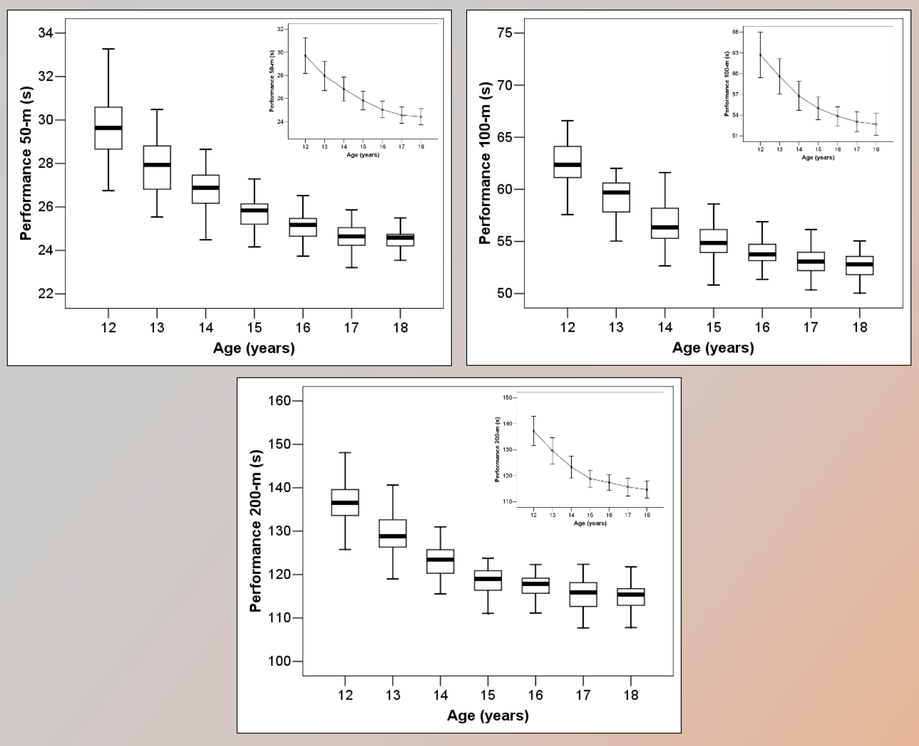

Figure 1. Mean (+1 SD) variation of swimming performance throughout seven consecutive seasons in the freestyle events analyzed.

Table 1. Pearson Correlation Coefficients throughout all season's analyzed

50-m	12	13	14	15	16	17
13	0.84**	1				
14	0.75**	0.90**	1			
15	0.62**	0.73**	0.81**	1		
16	0.48**	0.48**	0.58**	0.61**	1	
17	0.16	0.25	0.35*	0.33	0.74**	1
18	0.31	0.26	0.32	0.28	0.75**	0.87**
100-m	12	13	14	15	16	17
13	0.83**	1				
14	0.67**	0.87**	1			
15	0.34*	0.56**	0.83**	1		
16	0.13	0.36*	0.61**	0,80**	1	
17	0.08	0,10	0.33*	0.57**	0.81**	1
18	-0.62	-0.23	0.16	0.37*	0.68**	0.84**
200-m	12	13	14	15	16	17
13	0.83**	1				
14	0.51**	0.68**	1			
15	0.23	0.43**	0.75**	1		
16	-0.08	0.18	0.47**	0.71**	1	
17	-0.10	0.10	0.29	0.56**	0.56**	1
18	0.10	0.21	0.34*	0.54**	0.48**	0.78**

* P < 0.05; ** P < 0.01

RESULTS AND DISCUSSION

values of the seven consecutive seasons, a low swimming performance stability and prediction can be considered.

Table 1 presents the Pearson Correlation Coefficient values for pair wised seasons between 12 and 18 years old. Doing an analysis based on the adult performance season (i.e., 18 years old), there is a trend to stability become high from 15 to 16 years in the 50-m (r = 0.72) and 100-m (r = 0.68); from 16 to 17 in the 200-m (r = 0.78).

Several authors reported for world level swimmers, that the age interval between 15 and 16 is determinant to achieve the best individual performance in long distance events (Malina & Bouchard, 1991; Sokolovas, 1998).

CONCLUSION

The results pointed out a performance enhancement from children to adult age in all Freestyle events. The performance stability and prediction based on overall career period was low. However, coaches should set the age of 16 years-old as a determinant chronological point, were the ability to predict the adult performance level increases strongly.

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