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TRACKING THE 2004-2008 OLYMPIC CYCLE PERFORMANCE IN LONG DISTANCE FREESTYLE EVENTS

INTRODUCTION

Swimming seems to be one of the most studied sport among Sport Sciences community. Researchers are constantly attempting to identify and understand the factors that can predict swimming performance with a higher accuracy (e.g., Silva et al., 2007). Although the majority of the studies with that purpose have a cross-sectional character. Moreover, the longitudinal approaches regarding competitive swimming are reduced. Some papers aimed to obtain comprehensive knowledge about the role of bioenergetics (e.g., Pyne et al., 2001) and biomechanics (e.g., Huot-Marchand et al., 2005) issues in the performance enhancement. Others tried to establish relationships between these two domains and swimming performance (e.g. Latt et al., 2009). However, fewer authors focused their attention in the performance itself (e.g., Stewart & Hopkins, 2000; Pyne et al., 2004).

The longitudinal performance assessment is important to help coaches to define realistic goals and training methods (Pyne et al., 2004). Longitudinal assessment can be developed tracking the swimmers performance for a given time period, analyzing its progression between competitions and/or seasons. This information can be used to: (i) describe and estimate the progression and the variability of performance during and between seasons; (ii) find hypothetical chronological points determinant to predict swimmer's performance throughout his/her career or a given time frame and; (iii) determine swimmer's probability to reach finals or win medals in important competitions.

Swimming was experiencing a very quick development in all events, as the world records were broken so often. Moreover, its maximal expression was achieved in the time frame between the Athens 2004 and Beijing 2008 Olympic Games. However, no scientific study until now attempted to quantify and/or systematically describe these performance enhancements over the last few seasons.

So, the aim of the present study was to track the long distance freestyle events performance during the 2004-2008 Olympic Cycle.

METHODS

SUBJECTS: For the 400-m and 1500-m, an overall of 181 swimmers and a total of 905 race times were analyzed. It was considered as inclusion criteria to be a FINA's male top-150 world-ranked swimmer for long course during the 2007-2008 season, in any of the freestyle events presented . It was defined as exclusion criteria: (i) not be a swimmer from the FINA's top-150; (ii) to be a swimmer from the FINA's top-150, but authors did not have access to season best performance in the five consecutive seasons (iii) be a swimmer from the FINA's top-150 but have not swum the event at least one time per season from 2003-2004 to 2007-2008 for some reason.

DATA COLLECTION: For each freestyle event, FINA's male top-150 ranking for long course in the October 2007/September 2008 season was obtained, to identify the swimmers that were included in it. After that, ranking tables provided by the National Swimming Federation of each swimmer identified in the top-150 were used to collect the season best performance, between 2003-2004 (Athens's Olympic Games season) and 2007-2008 (Beijing's Olympic Games season). Only race times from official competitions at local, regional, state, national or international levels were considered. When suitable or appropriate, race times were also collected from a public internet swimming database (www.swimrankins.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 Landis and Koch (1977) 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 five consecutive seasons in the freestyle events analyzed. Figure 2 presents the swimming performance extremes and quartiles throughout the five consecutive seasons. ANOVA revealed significant variations in the swimming performance for the 400-m event [$F(1,91) = 67.89$; $P < 0.01$] and 1500-m event [$F(1,90) = 91.81$; $P < 0.01$] throughout the Olympic Cycle. Bonferroni post-hoc tests confirmed significant performance enhancement ($P < 0.01$). The K values expressing the stability throughout the Olympic Cycle were moderate [400-m event ($K = 0.43 \pm 0.05$) and

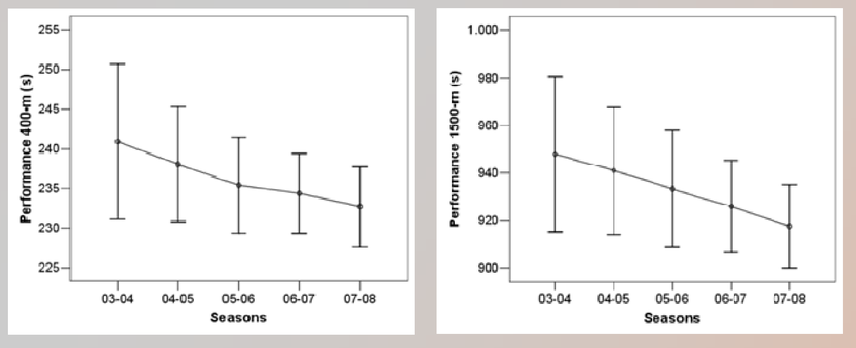

Figure 1. Mean (+1 SD) variation of swimming performance throughout five consecutive seasons in the freestyle events.

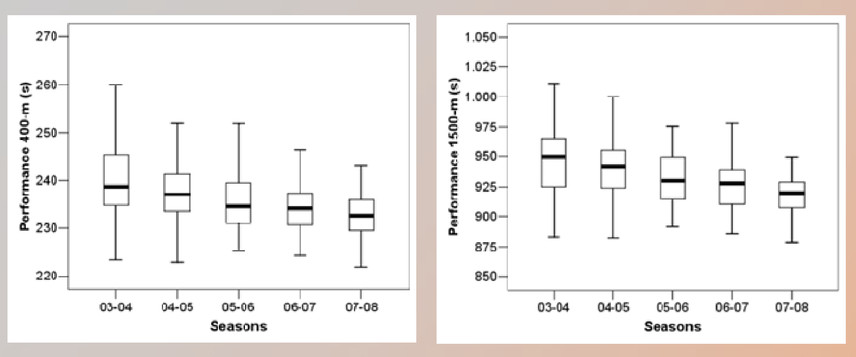

Figure 2. Diagram of swimming performance extremes and quartiles throughout five consecutive seasons.

Table 2. Pearson Correlation Coefficients throughout all season's analyzed

400-m	03-04	04-05	05-06	06-07	07-08
03-04	1				
04-05	0.90*	1			
05-06	0.71*	0.86*	1		
06-07	0.49*	0.68*	0.76*	1	
07-08	0.35*	0.46*	0.58*	0.73*	1
1500-m	03-04	04-05	05-06	06-07	07-08
03-04	1				
04-05	0.91*	1			
05-06	0.72*	0.84*	1		
06-07	0.44*	0.61*	0.69*	1	
07-08	0.49*	0.58*	0.61*	0.75*	1

RESULTS AND DISCUSSION

1500-m event ($K = 0.44 \pm 0.05$)]. So, based on overall tracking values of the five consecutive seasons, a moderate swimming performance stability and prediction can be considered.

Table 1 presents the Pearson Correlation Coefficient values for pair wised seasons between 2003-2004 and 2007-2008. Doing an analysis based on the peak performance season (i.e., 2007-2008 season, Beijing Olympic Games), there is a trend to stability increase from 2003-2004 season to 2007-2008 season. Self-correlations (table 1) revealed that high stability is achieved at the third season in the 1500-m event ($r = 0.61$) and at the fourth season in the 400-m event ($r = 0.73$).

CONCLUSION

World-ranked swimmers performance went through a great improvement during the 2004-2008 Olympic Cycle. Stability and prediction based on overall Olympic Cycle period was moderate. When more strict time frames are used, swimming performance stability and prediction increases, starting at the third season in the 1500-m and at the fourth season in the 400-m.

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