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SHORT REPORT

MONITORING SWIMMING SPRINT PERFORMANCE DURING A TRAINING CYCLE

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RUNNING HEAD: Monitoring swimming sprint performance

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Abstract

The preparation for a major competition is an important concern of coaches and athletes. Therefore, the aim of this study was to evaluate the evolution in sprint performance during a training macro cycle in age-group swimmers of both genders. The sample comprised twenty four age-group swimmers (12.0 ± 0.72 years old, 41.43 ± 6.88 kg, 1.51 ± 0.09 m). The evaluations occurred during nine weeks of swimming training in the first macro cycle. During this period the subjects performed 54 training units (6 units per week). In all weeks, the performance in two trials of a 25 m front crawl all out test, with 15 min of rest, was recorded. Only the best performance was used to assess the effects of training. Comparisons between the first week and the following weeks were conducted using pair-sample t-test. The significance level was set at 5%. The sprint performance did not change during the first 6 weeks of preparation. In the last three weeks the performance in the 25 m front crawl test was improved when compared with the first week, although the major changes occurred at the last week of preparation.

It seems that in age-group swimmers seven weeks of specific swimming training enables improving swimmer's sprint performance, although some differences exists between male and female swimmers. These data could be used by coaches to program the training season and the evolution of the load components.

Keywords:
Velocity, Training control, Evaluation, Training volume, Age-group swimmers

Introduction

Swimming is a cyclic sport activity developed in a particular environment, leading to spatial, temporal and energetic specific constrains. Hence, the performance is evaluated by the time required to accomplish a

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specific distance. This capacity to achieve and maintain maximum velocity during a swimming distance depends both on biomechanical and physiological parameters (Silva et al., 2008).
After a period in which the performance enhancement was mainly due to a great increase in training volume, the search for new recovery techniques and the improvement in training efficiency started to be the main strategies to enhance sports performance (Vilas-Boas, 1989). The efficiency of the training process seems to be deeply determined by the possibility to gather objective data of the capacities and needs of each swimmer. Thus, the efficiency of the training process can only be improved if one can also improve the methodology used to evaluate each component of the sport performance (Marinho et al., 2006).

Although the complexity and even the impossibility to accurately evaluate the swimmer's shape, one must find methods to obtain objective data to allow a scientific base to decision in sports preparation (Proença, 1985). Following this assumption, Keskinen et al. (1989) referred that the most important characteristic of the testing protocols is to be specific of the sport activity. In swimming, this characteristic means that the testing evaluation should be conducted in the water and, if possible, in real swimming conditions (Marinho et al., 2009a).

Another important matter related to this issue is the swimmer's preparation for a particular event. It is not always clear the effects of a specific training in the performance or the required temporal period to allow a training load to positively affect performance. Wakaysohi et al. (1993), Maclaren and Coulson (1999), and Marinho et al. (2009b) reported significant improvements on the aerobic capacity of age-group swimmers after twelve weeks of training and Reis and Alves (2006) verified the same effect after nine weeks of training. Nevertheless, the effect on the sprint performance has not been deeply analysed in young subjects (Mavridis et al., 2006).

The need to enhance performance leads the sport coaches to use different methods and approaches to control and monitor the training process. However, not always the available processes are easy to be applied in large groups of swimmers due to the complexity, cost and difficulty to apply the suggested procedures.

Therefore, the main goal of this study was to evaluate the evolution of sprint performance during a macro cycle of training in age-group swimmers, applying a simple protocol to evaluate the training process.

Methods

Sample

24 age-group swimmers of both genders (13 males and 11 females) volunteered to participate this study. All the swimmers belonged to the same sport club and they were trained by the same coach for two or more seasons.
Consent to take part in this research was obtained from the swimmers' parents and coach and this research was conducted according to Helsinki Declaration.
Table 1 presents the mean values of age, body mass, height and the personal best time in the 100 m Freestyle event (front crawl).

Table 1: Mean (± standard deviation) values of age, body mass, height and personal best time in the 100 m Freestyle event.

	Total (n=24)	**Females (n=11)**	**Males (n=13)**
Age (years) *	12.0 ± 0.72	11.45 ± 0.52	12.46 ± 0.52
Body mass (kg)	41.43 ± 6.88	39.81 ± 7.84	42.81 ± 5.93
Height (m)	1.51 ± 0.09	1.50 ± 0.08	1.53 ± 0.10
100 m Freestyle (s) *	72.75 ± 7.49	77.82 ± 4.50	68.46 ± 3.98

* Significant differences between males and females ($p<0.05$).

Procedures

The evaluations were conducted during nine weeks of training in the first macro cycle of training, between October and December. The end of this period coincided to the participation in the Age-Group Regional Swimming Championship. During this phase all swimmers performed a total training volume of 208.6 km, corresponding to a mean value of 23.18 km per week and 3.86 km per training unit.

Six training units per week were performed each week by all participants. Figure 1 presents the evolution of training volume during the nine weeks of the evaluation period (volume per training unit and volume per week).

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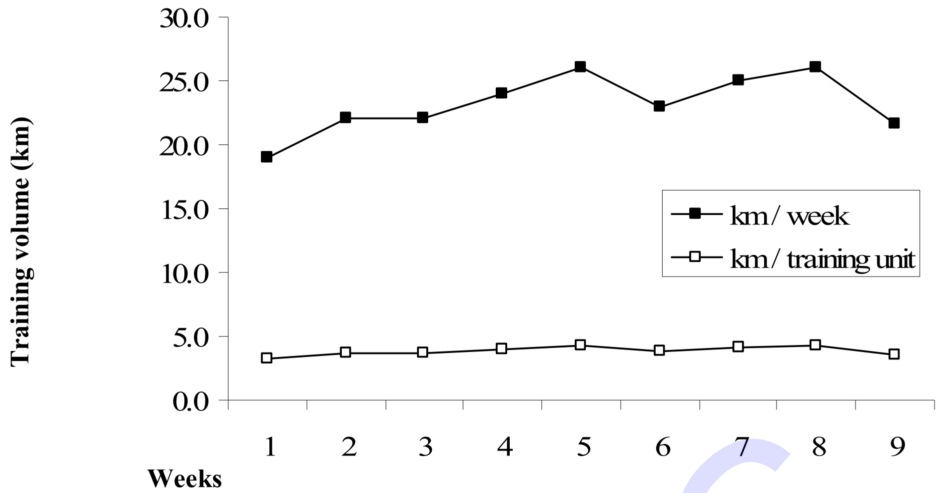

Figure 1: Evolution of the training volume during the nine weeks of the evaluation period (volume per training unit and volume per week).

In every week the 25 m front crawl performance was evaluated. All the swimmers performed two maximal tests, with a 15 min recovery period between the two trials. This evaluation occurred always at the same day of the week for each swimmer. To monitor the training process, only the best performance of each swimmer in the 25 m front crawl test was taken to analysis. The time was determined by two subjects trained for this measurement with a chronometer (Golfinho Sports MC 815, Aveiro, Portugal), and the mean value of both measurements was obtained in each trial.

Statistics

Normality of distribution was checked by Shapiro-Wilk tests (SPSS 12.0, Lead Tools, 2003). The values of each variable are presented as mean ± 1 standard deviation.

To analyse the evolution of the 25 m performance during the 9 weeks of training the pair-sample t-test was used. Comparisons between the first and the following trials were conducted. The statistical significance was set at $p \leq 0.05$.

Results and Discussion

Figure 2 presents the evolution of training volume (km per week) during the nine weeks of training and the sprint performance of the swimmers during the same period.

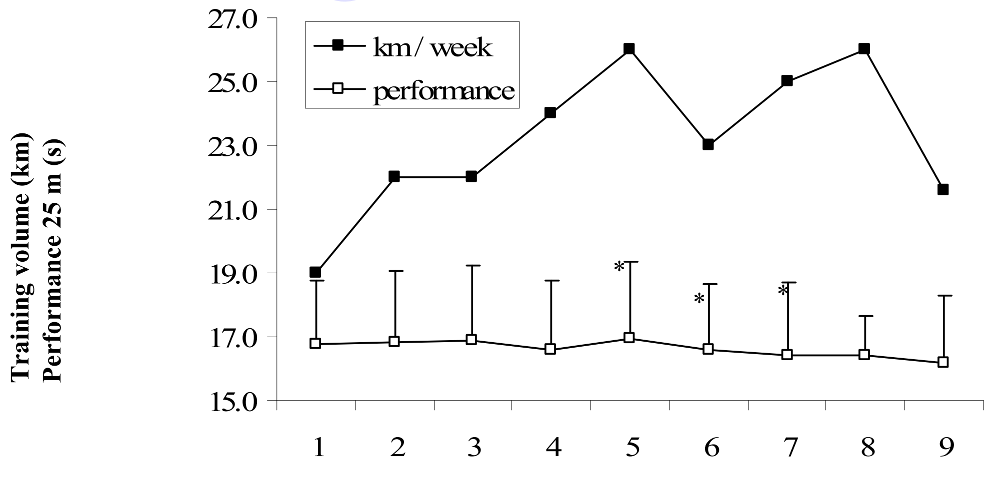

Figure 2: Evolution of training volume and performance (25 m front crawl) during the nine weeks of training evaluation.

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* Represent significant differences in the sprint performance between week 1 and the following weeks. Vertical lines represent the standard deviation.

As one can note in figure 2, sprint performance did not change during the first six weeks of preparation (week 1: 16.74 ± 2.04 s, week 2: 16.85 ± 2.23 s, week 3: 16.88 ± 2.38 s, week 4: 16.56 ± 2.14 s, week 5: 16.97 ± 2.40 s, week 6: 16.57 ± 2.05 s; $p > 0.05$). In the last three weeks the performance in 25 m front crawl was improved when compared to the first week (week 7: 16.41 ± 2.28 s, week 8: 16.41 ± 1.21 s, week 9: 16.18 ± 2.09 s; $p < 0.05$), although the major differences occurred in the last week of swimming preparation. Here, it was possible to observe a significant enhancement in swimming sprint performance. In fact, this last week corresponded to a large decrease in training volume, attempting to achieve the best sport results in the considered event (Regional Championship).

Nevertheless, when the sample is divided by gender, one can observe some differences between males and females. As expected, male swimmers presented always better performances than their female pairs during the nine weeks of specific training (Figure 3).

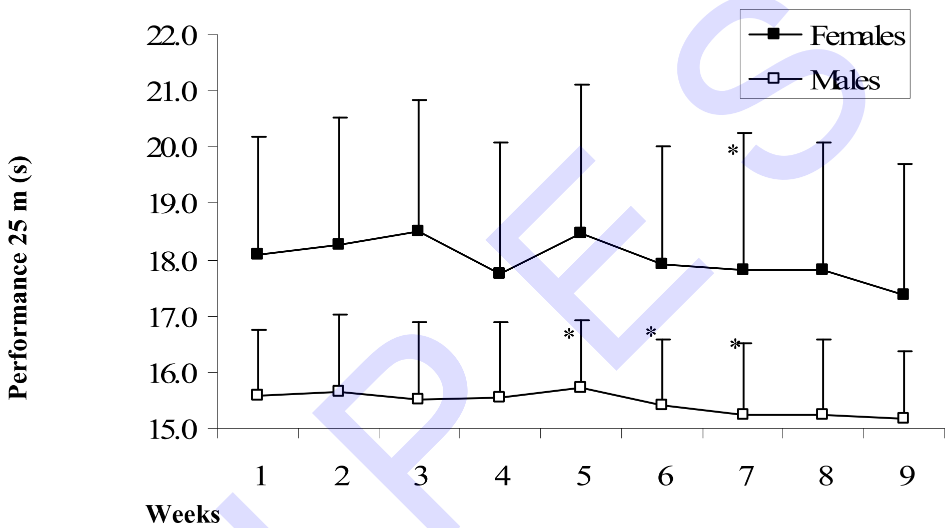

Figure 3: Evolution of training volume and performance (25 m front crawl) during the 9 weeks of training evaluation in male and female swimmers.
* Represent significant differences in the sprint performance between week 1 and the following weeks. Vertical lines represent the standard deviation.

Regarding the performance evolution, one can notice that females presented some irregularity in the 25 m front crawl performance during the preparation, which is not so noticeable in the male swimmers. However, the performance enhancement in females just became significant in the last week of preparation, in opposition to males, whom presented improvements in sprint performance in week 7 of preparation, as we observed when analysed the whole sample. The difference found in females can be due to a specific response to training (which can be different from males) but also to methodological issues. As one can note, the number of females in the sample (n=11) is lower than the number of males (n=13), which can influence the results. Moreover, the variation found in the 25 m performance in females is much higher than the values variation in males, which underlined the level difference in both genders.

This sample heterogeneity in females can be one of the causes of the differences in performance during the macro cycle. Hence, in the future, this issue should be considered to improve the quality of this research and to help coaches monitoring their training, although the main aim of this study was to apply a simple test in a real team of age-group swimmers. In this sense, the differences found in this study were expected and should be considered when monitoring the data.
As one can observe, throughout a simple and easy applied test it was possible to control and evaluate the training process in swimming. We believe that these data can be used by swimmers' coaches to control the training process in age-group swimmers and, at the some time, allowing some fine adjustments during sport preparation.

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In the current study we were able to notice a sprint performance improvement after seven weeks of swimming preparation, although differences were more visible in the last week of preparation, before the main competition. This week corresponded to a decrease in training volume, which can translate that in short distance performances, a reduction in training volume can improve performance in age-group swimmers, as reported before (e.g. Maglischo, 2003).

It was also interesting to observe that after a slight reduction in training volume in week 6 (after five weeks of continuous increment of training volume), an improvement in performance in the three following weeks was noticed, which can support the previous mention. Therefore, increasing training volume does not always provide a better stimulus for improving adaptations during specific period (Marques and González-Badillo, 2006).

The effect of different training loads in age-group swimmers performance has not been deeply studied by the scientific community. Wakayoshi et al. (1993), Maclaren and Coulson (1999), and Marinho et al. (2009b) reported significant improvements in aerobic capacity in age-group swimmers after twelve weeks of swimming training. Reis and Alves (2006) analysed 29 age-group swimmers of national and regional level and verified also a significant increase in aerobic capacity after nine weeks of mainly aerobic training. However, regarding sprint performance, the effects of different loads on performance during a period of time have been less studied. Mavridis et al. (2006) analysed the influence of twelve weeks of training in sprint performance. These authors concluded that these twelve weeks of specific training allowed significant improvements in sprint performance (10 m) and in short distance events (50, 100 and 200 m). Unfortunately, none of these authors controlled the sport performance during the specific training period between the two evaluation moments. Therefore, the current experiment represented an attempted to go forward and to address a practical concern of the swimming technical community, trying to understand the number of swimming preparation weeks required to allow improvements in sprint performance in age-group swimmers.

Conclusions

This study allowed verifying that in age-group swimmers seven weeks of a systematic training program seemed to be sufficient to improve sprint performance. Moreover, when the sample was divided by gender, seven weeks were sufficient to enhance sprint performance in males, whereas in females this enhancement in sprint performance was only observed in the last week of preparation (week 9).

Although this evaluation protocol was only applied in front crawl stroke, these data can be used by coaches to program and schedule the sport season and the evolution of the training loads. In the future, it seems interesting and challenging to apply this study in swimmers of different level and to evaluate and control the performance evolution in other swimming strokes, rather than only the front crawl stroke.

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