

## Stroke rate and stroke length in a typical swimming time limit test at VO<sub>2</sub>max

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### Introduction

One of the most recent topics of interest in swimming training and performance diagnosis is the concept of Time Limit, i.e., the time duration during which a certain intensity of exercise can be sustained until exhaustion (Billat and Koralsztein 1996). Time Limit in swimming has been studied mainly at intensities corresponding to maximal oxygen uptake (TLim-vVO<sub>2</sub>max), being firstly conducted in swimming-flume and after in free swimming in a conventional pool. The purpose of this study was to observe the behaviour of Stroke Rate (SR) and Stroke Length (SL) during a typical TLim-vVO<sub>2</sub>max freestyle effort. As TLim-vVO<sub>2</sub>max seems to be a kind of effort very well related to the 400 m freestyle performance (Fernandes et al. 2003), we think that SR and SL can bring new information about technical ability in such type of swimming efforts or events.

### Methods

Ten well-trained swimmers (6 male and 4 female) volunteered for this study. The mean ± SD values for their physical characteristics, weekly training frequency and physiological parameters are present in Table 1. Briefly, each subject performed an incremental protocol for freestyle vVO<sub>2</sub>max assessment, with increments of 0.05 m/s each 200 m stage and 30 s intervals until exhaustion (cf. Fernandes et al. 2003). Swimming velocity was controlled using a visual pacer (TAR. 1.1, GBK-electronics) with flashing lights in the bottom of the pool. Forty-eight hours later all subjects swam at their previously determined vVO<sub>2</sub>max to assess TLim-vVO<sub>2</sub>max. SR was determined as the number of cycles per min (registered with a cronofrequencymeter from 3 consecutive strokes) and SL was calculated by dividing velocity by SR. Both test sessions took place in a 25 m indoor swimming pool and in-water starts and open turns were used. Mean and SD computations for descriptive analysis were obtained for all variables (all data were checked for distribution normality). Paired samples Student's *t* test was also used. A significant level was set at 5%.

### Results

In Fig. 1 it is possible to observe a general tendency for an increase in SR and a decrease in SL during the freestyle TLim-vVO<sub>2</sub>max test. When we tested the differences in SR and SL between each 50 m of the TLim-vVO<sub>2</sub>max test, we verified a significant increase in SR and a decrease in SL between the values of the 100 and 150 m.

Parameters	Swimmers (n = 10)
Age (years)	17,10 ± 2,64
Body mass (kg)	63,10 ± 9,79
Height (cm)	174,10 ± 9,43
Training units (sessions/week)	8,25 ± 0,63
VO <sub>2</sub> max Inc (ml/kg/min)	68,70 ± 10,56
vVO <sub>2</sub> max (m/s)	1,41 ± 0,09

Table 1: Mean ± SD values for the physical characteristics, weekly frequency of training and physiological parameters of the subjects.

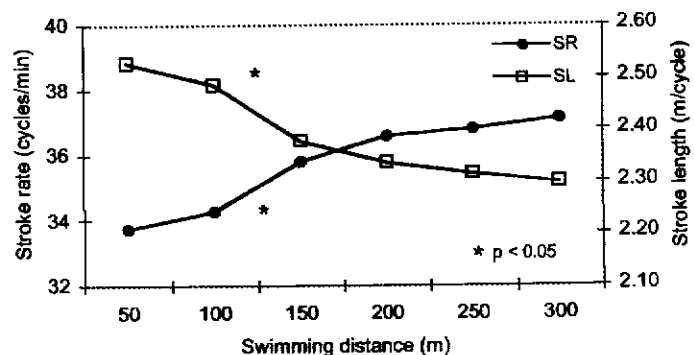


Fig. 1: Mean values for Stroke Rate and Stroke Length in relation to swimming distance during the TLim-vVO<sub>2</sub>max test.

### Discussion/Conclusion

The present results showed that there is a significant increase in SR and a decrease in SL after 100 m at a swimming intensity correspondent to aerobic power. After 150 m the slopes of the SR/distance and the SL/distance functions seems to be attenuated. The results seem to be in accordance with Keskinen and Komi (1993) and Wakayoshi et al. (1996) for other high intensity efforts, and indicate that swimming at high intensity rates seems to imply a deterioration of the technical ability during the event. This reduction in the quality of stroke technique is possibly due to the increasing local muscular fatigue, which traduces the swimmer's inability to maintain the "feel for the water" (Wakayoshi et al., 1996).

### References

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