dicting competition success from different anthropometrical and physiological values in children are important in swimming. Accordingly, the aims of the present investigation were to: 1) assess the use of recovery oxygen consumption values for determining oxygen cost during front crawl swimming; and 2) determine the factors that best predict maximal oxygen consumption and the ability to perform a 400-m front crawl swim.

METHODS

Twenty nine prepubertal (Tanner stages 1 and 2) and pubertal (Tanner stages 3 and 4) boys (13.0±1.8 yrs; 163.6±11.9 cm; 51.6±13.0 kg; %body fat: 12.1±5.3 %) underwent different anthropometrical and physiological measurements. Swimmers also performed 400-m front crawl swimming to determine the validity of calculating exercise oxygen consumption from expired gas samples taken during the first 20 seconds of recovery after the activity. During the 400-m front crawl swimming, the average speed (v), stroke frequency (SF), stroke length (SL), stroke rate (SR) and stroke index (SI) were computed. In addition, energy cost of swimming (Cs) from the measured parameters was calculated. Dual energy X-ray absorptiometry was used to measure different body composition parameters and maximal oxygen consumption was determined on a bicycle.

RESULTS

Prepubertal children had smaller values for measured body composition and maximal oxygen consumption values except for body fat and oxygen consumption per kg body mass values compared to pubertal children. Similarly, mean v (0.99±0.12 vs 1.12±0.13 m/s), SL (0.87±0.11 vs 0.99±0.10 m/cylce), SI (0.87±0.20 vs 1.11±0.22 m^2/s/cycles), Cs (2.38±0.41 vs 3.29±0.67 kJ/min) and oxygen consumption (2.53±0.50 vs 3.92±0.90 l/min) during 400-m front crawl swimming were significantly lower in prepubertal boys compared to pubertal swimmers. Relationship between directly determined maximal oxygen consumption and oxygen consumption determined after 400-m front crawl swimming was highly significant ($r=0.850$; $p<0.001$). Swimming performance at 400-m front crawl distance was best determined by specific anthropometric and body composition (height, arm span, fat free mass, bone mineral mass and density), physiological (maximal oxygen consumption) and swimming technique (v, SL and SI) parameters in boys.

DISCUSSION

It is possible to accurately determine oxygen consumption during maximal swimming using a single, 20-s expired gas collection taken immediately after 5-7 min maximal front crawl swim in prepubertal and pubertal boys. In addition, specific stroke technique parameters are important determinants of the energy cost and variations in performance during swimming in prepubertal and pubertal boys.

ENERGY COST AND INTRA-CYCLIC VARIATION OF THE VELOCITY OF THE CENTRE OF MASS IN BREASTSTROKE.

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INTRODUCTION

The purpose of the present study was to analyse the relationship between energy cost (C) and intra-cyclic speed fluctuations (dv) in breaststroke.

METHODS

Four elite breaststroke swimmers (2 males of 17.0±0.0 yy, 172.5±3.5 cm and 69.4±2.0 kg, and 2 females of 17.5±2.1 yy, 167.0±7.1 cm and 64.2±4.2 kg) performed an incremental intermittent protocol (n x 200m) for maximal oxygen consumption assessment (Fernandes et al., 2003), during which biomechanical and bioenergetical parameters were measured. The test was videotaped in sagittal plane with two SVHS cameras, providing, after mixing and editing, a dual-media image of the swimmer. The APAS software (Ariel Dynamics Inc, USA) was used to calculate the variation coefficient (dv) of the v(t) function of the centre of mass (CM) for each 200m step. Oxygen consumption was measured through a portable gas analyser (K4 b^2, Cosmed, Italy) connected to the swimmers by a respiratory snorkel and valve system. Capillary blood samples were collected from the ear lobe, before and after each set, to analyse blood lactate concentrations (YSI 1500L Sport, USA). The energy expenditure ($\dot{E}$) and C ($\dot{E}.v^{-1}$) were calculated for each 200m using net values of VO_2 and blood [La-], converted with a 2.7 $mlO_2.kg^{-1}.mmol^{-1}$ constant.

RESULTS

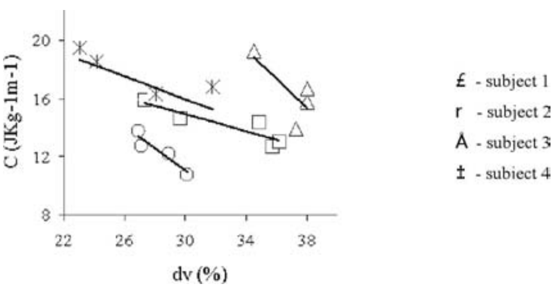

Figure 1. Relation between C and dv.

Intra-cyclic speed fluctuations (dv) decreased with mean swimming velocity ($r=-0.63$, $p\leq 0.01$). $\dot{E}$ increased with v^3, and, as it is possible to observe in Figure 1 for each swimmer, C decreased with increasing dv.

DISCUSSION

As it was expected, a cubic relationship between $\dot{E}$ and dv was found, once energy output is a function of mechanical power, and the latter is expected to be a function of v^3. The relationship obtained between C and dv do not confirm previous literature (Vilas-Boas, 1996). This finding may be due to differences in methodological procedures, or more obviously due to the higher influence of v, than dv, in $\dot{E}$.