vestigated on reliability and checked on validity. For the XC skiing sprint a competition simulation was performed to get information on physiological loading and relationships between physiological and biomechanical variables to performance. Additionally, biomechanical analysis on single XC skiing techniques, current and maybe future technical and technological developments using kinematic, kinetic and electromyopgraphic methods were performed. Finally, the most stable and strongest performance related variables were extracted. In total these test concepts and achieved results should provide a scientific basis for reasonable testing and training for XC skiing.

Keywords: Testing, Physiology of Exercise, Biomechanics

Running, swimming, cycling and skiing-3
PERFORMANCE DIAGNOSIS IN SWIMMING

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INTRODUCTION
Energy expenditure as a function of swimming velocity is one of the major topics of interest in swimming science. Understanding the mechanisms behind swimming performance and training need new scientific approaches, while most of the existing knowledge on the bioenergetics of the four swimming strokes has already a number of years. The purpose of this presentation is to synthesize the most recent contributions of our research group in the domain of bioenergetic evaluation of the swimming strokes.
METHODS
Assessment of physiological and biomechanical variables was conducted over different samples of low level swimmers, high level swimmers, and elite swimmers. The parameters used were: (i) $\dot{V}O2$ kinetics (COSMED K4 b^2), including $\dot{V}O2max$, slow component (SC), and time limit at $\dot{V}O2max$. (TLimv$\dot{V}O2max$); (ii) capillary blood lactate concentrations ([La-]) (Yellow Springs); (iii) heart rate (POLAR); (iv) mean velocity (v) (paced by a GBK Pacer); (v) energy cost of swimming ($\dot{C}$); (vi) (intra-cyclic horizontal speed fluctuations (dv) (dual-media videogrametry through APAS); (vii) stroke parameters such as stroke length (SL), rate (SR), and stroke index (SI). The experimental protocol contained two phases (24h rest): (i) an intermittent incremental test for v$\dot{V}O2max$ assessment and; (ii) an all-out test at v$\dot{V}O2max$ to assess TLim-v$\dot{V}O2max$.
RESULTS AND FINDINGS
We compared the actual relative economy profile of the four competitive strokes with one published in the seventies. A reduction in $\dot{C}$; was noted, especially in butterfly. Probably due to rules restrictions, a breaststroke bioenergetic evolution was not so noticeable. $\dot{C}$ was compared between swimming strokes. Front and back crawl where more economic than simultaneous techniques, due to the association of this parameter with the dv: $0.38<R<0.79$. An overall positive linear relationship was observed between total energy expenditure and v, as well as a tendency to a polynomial relationship between v and dv ($0.47<R<0.65$). The relationships between stroke parameters and $\dot{C}$ showed that SR was the major determinant of $\dot{C}$ in all swimming strokes ($0.14<R^2<0.25$), and that increases in SL tended to reduce $\dot{C}$, especially in breaststroke ($R^2=0.24$, $P=0.02$) and butterfly.
Results also pointed out that TLim-v$\dot{V}O2max$ values ranged from 215 to 260 s (elite swimmers), 230 to 260 s (trained – high level swimmers) and 310 to 325 s (low level – university swimmers). No differences were observed between genders. TLim-v$\dot{V}O2max$ main determinants were swimming economy, oxygen slow component, SL and SI (direct relationship) and v$\dot{V}O2max$, velocity corresponding to anaerobic threshold, lactate production and SR (inverse relationship). In general, TLim-v$\dot{V}O2max$ was not related to $\dot{V}O2max$. It seems that the higher v$\dot{V}O2max$ values achieved by elite and high level swimmers impose also higher $\dot{C}$ for this exercise, and higher recruitment of the anaerobic energy system, which leads to earlier fatigue stages and consequently lower TLim-v$\dot{V}O2max$.

Keywords: Swimming, VO2 Kinetics, Energy Expenditure

Running, swimming, cycling and skiing-4
PERFORMANCE PREDICTION IN RUNNING

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The international standardization for long distance running provides an exemplary "gold standard" for the verification of performance diagnostics. Taken this opportunity, the quality of experimental running test procedures can be generally judged by their ability to predict race results. This applies not only for high performance athletes but for recreational runners, too. Furthermore, comparison between race and experimental results can achieve more clarity about the factors that limit endurance performance.
To illustrate the principle of performance prediction, we used a database of 561 runners (401 male, 160 female) at each performance level. These runners participated in competitions between 800 m and Marathon and all underwent a treadmill test not more than 4 weeks before or after the race. On the treadmill, a multistage exercise test protocol was applied with 6 km/h at start, 2 km/h increment for all 3 minutes. From capillary blood, lactate was measured at the end of each stage. From the results, all available measures of endurance capacity were compared regarding their predictive power for race results: Performance at 4.0 mmol/l blood lactate, at a net increase of blood lactate of 1.5 mmol/l, maximum performance, VO2max, etc
Best single predictor for Marathon running was the performance at a blood lactate net increase of 1.5 mmol/l ($r=0.88$). Best single predictor for 1.500 m was maximum