

## Abstract

In swimming different measures are known to determine performance and economy including lactate tests for the assessment of aerobic and anaerobic metabolic capacity as well as spirometric tests for maximum oxygen consumption and technical skill. The current study aims to identify reliable parameters which describe the economy of swimming and can be used for performance evaluation and tracking on an individual level.

23 competitive swimmers ( $16.7 \pm 3.5$  years; 15 female, 8 male) performed two identical exercise protocols in a swimming flume on separate days within one week swimming freestyle (front crawl). 3 minute exercise periods were followed by 1 minute of rest, starting at 1.01 m/s and escalating in steps of 0.09 m/s until exhaustion. Oxygen consumption and blood lactate levels for each velocity step were converted to metabolic power output according to  $P_{O_2} = (4.940 * RQ + 16.040) * VO_{2-netto} / 60$  respectively  $P_{lac} = ([Lac_{exerc}] - [Lac_{rest}]) * 60 * M_{mass} / t_{exerc}$ .

The resulting function  $P = A_{LBM} * v^{b+1}$  ( $p < 0.001$ ) was highly significant. The factors 'A<sub>LBM</sub>' and 'b', which characterize the individual change in economy with swimming speed, were combined to a 'technique index' ( $Z_T$ ) which explains 47% of the variance of the best performance in the 200m freestyle event. The Index ( $Z_T$ ) showed significant differences for the better swimmers of the group compared to average ( $p < 0.05$ ) and below average swimmers ( $p < 0.001$ ).

The index ( $Z_T$ ) proved a reliable parameter to evaluate and track the economy of individual swimming motions. The results demonstrate the outstanding importance of swimming economy (technique) for race performance and the individual change of economy with swimming speed. In conclusion training objectives should focus more on high quality execution of technical requirements at high swimming speeds as opposed to volume and distance.