

# WCSS



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## World Conference on Science and Soccer

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MEASURED VERSUS ESTIMATED O<sub>2</sub> CONSUMPTION DURING INTERMITTENT RUNNING

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We have previously shown that, monitoring the players' speed by GPS in soccer, and on the bases of the biomechanical equivalence between accelerated/decelerated running on flat terrain and uphill/downhill running at constant speed, it is possible to estimate metabolic power (MP), as given by the product of energy cost of running (EC) and speed. Furthermore, assuming a mono-exponential VO<sub>2</sub> kinetics, it becomes possible to estimate the time course of actual VO<sub>2</sub> from that of MP, on the basis of the player's VO<sub>2</sub>max (Patent n. 0001425417). We implemented this approach into GPS devices monitoring the players' speed at 20 Hz (GPEXE ©), thus obtaining the time course of MP and VO<sub>2</sub>. However, several recently published studies have criticised the above mentioned approach mainly because the energetic parameters estimated from GPS data do not match those obtained by means of portable metabolic carts. This disagreement may be due, at least in part, to the fact that the approach described so far can be meaningfully applied to running; however during a soccer match several walking episodes are interspersed among running spells. Therefore, we have recently implemented into the system a set of algorithms to take into account also the energetics of the walking phases, based on similar assumptions as for running. On these bases we have determined the overall energy expenditure, as obtained by the time integral of: i) MP and of VO<sub>2</sub> ii) as estimated from MP or iii) directly determined by a portable metabolic cart. Data were collected during constant

speed walking at  $4.5 \text{ km}\cdot\text{h}^{-1}$  (W) followed by running at  $10 \text{ km}\cdot\text{h}^{-1}$  (R) and by 3 series of ten 50 metres runs in 10 seconds, each followed by a 20 s pause. Series 1 (S0): after every run the subjects continued running in the same sense; Series 2 (S90): after every run the subjects resumed running after a 90 deg turn to the right or left; Series 3 (S180): after every run the subject resumed running after a 180 deg turn. Five min pauses were interspersed between R, S0, S90 and S180. Preliminary results obtained on 4 subjects show that, if the progressive increase of resting  $\text{VO}_2$  due to exercise is duly considered, the overall energy expenditure difference between estimated and measured  $\text{VO}_2$ , at the end of the experimental period (47 min), ranges from + 3.7 to - 12.5 %. Part of this difference is probably due to individual differences in running technique and/or to changes in the  $\text{VO}_2$  kinetics, such as a progressively increasing role of the slow component, with the exercise time. In conclusion, the use of GPEXE © is a powerful tool for estimating the energetic characteristics of soccer and for selecting appropriate training strategies.

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