SPACE EARTH
September 16-19, 2014 Berlin, Germany
6th International Congress of Medicine in Space and Extreme Environments (ICMS)

Abstract Status 26.06.2014

SOCCER PERFORMANCE: A CLOSE LOOK

Author:
Prof. Pietro Enrico di Prampero University of Udine, Italy
Dr. Cristian Osgnach EXELIO, Udine, Italy
Dr. Alberto Botter University of Udine
Dr. Valerio Roberti EXELIO, Udine, Italy
Mr Valerio Vettor EXELIO, Udine, Italy
Prof. Emanuele Paolini EXELIO, Udine, Italy

Introduction:
Soccer is characterised by frequent episodes of accelerated/decelerated running, the energy cost (EC) of which is “uncharted territory”, thus making it difficult to estimate its energetic load. We show here that, monitoring the players’ speed by GPS, it is possible to estimate EC, metabolic power requirement (MPr) and actual O2 consumption (VO2).

Material & Methods:
Accelerated/decelerated running on flat terrain is biomechanically equivalent to uphill/downhill running at constant speed, the slope being dictated by the forward acceleration. Hence, if the time course of speed and hence of acceleration is determined, since the EC of uphill/downhill running is know, it is possible to estimate: i) EC of accelerated/decelerated running, and ii) MPr, i.e. the instantaneous product of EC and speed. At the beginning of a 100 m dash, peak values of EC and MPr attained ≈ 50 J/(kg m), as compared to ≈ 4 for constant speed level running, and ≈ 90 W/kg (≈ 260 ml /(kg min) in terms of O2 requirement) (1). This approach applied to video analysis data showed that, whereas during official soccer games, the time spent by the players at speeds > 16 km/h amounted to ≈ 6 % of the total, the energy spent at MPr above that required to run at 16 km/h was ≈ 40 % of the total (2).

Results:
We implemented this same approach into GPS devices monitoring the players’ speed at 20 Hz (GPEXE ©), thus obtaining: acceleration, EC, MPr and overall energy expenditure. Furthermore, assuming a monoexponential VO2 kinetics with a time constant of ≈ 20 s we estimated the time course of actual VO2 from that of MPr (Patent Pending). The amount of energy derived from anaerobic sources during any given time interval was also estimated from the difference between the time integrals of these two functions, on the basis of the player’s VO2max. Actual VO2, as determined by portable devices (K4, Cosmed, Rome, Italy) during repetitive shuttle runs over 25 metres in 5 s, with 20 s pause between any two bouts, closely matches the time course of VO2, as estimated by GPEXE ©.

Discussion & Conclusions:
The use of GPEXE ©, whenever these devices are allowed, is a powerful tool for estimating the energetic characteristics of soccer and for selecting appropriate training strategies.

References:

1 - di Prampero P.E. et al. (2005). J. Exp. Biol. 208: 2809.
2 - Osgnach C. et al. (2010). Med. Sci. Sports Exerc. 42: 170.