EDITORIAL

Can Cardiopulmonary Exercise Test Contribute to Train Soccer Players?

Miguel Mendes

Hospital de Santa Cruz/Centro Hospitalar de Lisboa Ocidental, Lisbon - Portugal

Soccer, which draws crowds and moves huge sums of money, has not been dissociated from science, being frequently approached in studies conducted by the academy or upon request of technical teams, aimed at optimizing the sports outcomes.

A training plan is used to prepare for the soccer competition and comprises purely physical, psychological, technical (p. ex.: pass, dribble, feint, leaps) and tactical components. In the preseason and during the competitive season, coaches measure and monitor different variables of the training.

The players of a soccer team, although having the same baseline physical fitness, face different physical challenges depending on their field position in the game. From the goalkeeper, exceptional capacity of instantaneous reaction, impulsion, flexibility and motor coordination, particularly of the upper limbs, are required. Field soccer players, however, must have good baseline aerobic conditioning associated with the capacity to repeatedly sprint during 2 to 4 seconds, every 90 seconds, covering distances that can range from 5 m to 40 m, in the case of lateral defenders and attackers, or be shorter, in the case of central-defenders and midfielders. During the 90 minutes of the game, elite soccer players walk or run approximately 10 km at a mean intensity similar to that achieved at the anaerobic threshold, with multiple explosive efforts, namely sprints, corresponding to as much as 11% of the distance covered during the game.[1]

The intermittent nature of soccer games requires the use of three types of energy substrates. The aerobic pathway supports the periods of walking or slow running (90% of game duration), while phosphocreatine and the anaerobic pathway are the sources of energy used in repeated explosive efforts, frequently carried out at a velocity superior to that achieved at the maximal effort of exercise testing and that the athlete will be able to repeat only after properly restoring the different energy substrates to the muscles.

The study by Souza e Silva et al.,[2] published in this IJCS issue, assessed, for the first time in athletes, the cardiorespiratory optimal point (COP) determined in a maximal cardiopulmonary exercise test (CPX), performed on a treadmill according to the ramp protocol in 198 soccer players of a major team of a Carioca club, between January 2005 and December 2016. They concluded that COP values do not differ according to the soccer players' field positions.

The COP is the minimum value of the ventilatory equivalent for oxygen (ratio between ventilation per minute and oxygen consumption: VE/VO_2) during a CPX. It represents the effort with the lowest ventilation per liter of oxygen consumed, considered the best integration point between respiration and circulation.

The COP occurs at the initial phase of the CPX, at 30 - 50% of maximal oxygen consumption, correlated with neither maximal oxygen consumption nor anaerobic threshold. It is easily determined in incremental tests, independently of the observer or the athlete's motivation, seeming useful for the assessment of healthy or ill individuals unable to achieve their maximum effort because of physical, psychological or other limitations.

This new parameter has shown an inverse relationship with all-cause mortality of healthy and ill individuals aged 40 to 85 years, as well as an ability to estimate mortality.[3]

In the discussion of their article, Souza e Silva et al.[2] hypothesized that the low COP values of those elite soccer players could represent a physiological advantage for sports practice, which, although logical, lacks confirmation.

Keywords

Exercise; Football / trends; Spirometry / methods; Athletic Performance.

Mailing Address: Miguel Mendes
Hospital de Santa Cruz - Av. Prof. Reynaldo dos Santos, s/n. 2790-134 - Carnaxide, Portugal.
E-mail: miguel.mendes.md@gmail.com

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The consideration of COP, a parameter that occurs before the anaerobic threshold, to assess or guide the training of athletes, namely soccer players, raises doubts because the most intense and eventually discriminative efforts of soccer players occur at intensities close to the maximal effort.

Psotta et al.,[4] studying young soccer players, have reported that the ability to perform sets of 10 repeated sprints can be predicted based on the mean velocity obtained in a 20-m sprint and in a 2-km race, suggesting the need for high-level anaerobic and aerobic abilities to properly respond to the demands of the game.

Edwards et al.[5] have reported that training brings the values of oxygen consumption at the anaerobic threshold and at the ventilatory threshold close to the values of oxygen consumption at peak effort, but it does not change the latter, as if the maximal oxygen consumption had already been optimized. The values of oxygen consumption at the anaerobic threshold and at maximal effort specifically reflect the ability to perform aerobic efforts. The COP should be studied in the context of sports training to assess whether it identifies athletes with excellent aerobic capacity at submaximal level or whether it can assess and monitor training during the competitive season.

Regarding the possibility of parameters provided by an incremental and maximal CPX being capable of identifying the ability to sustain and repeat sudden and intense efforts in anaerobiosis and to recover rapidly, it seems more useful to focus on the parameters present close to the end of the exercise test, after overcoming the 2nd ventilatory threshold, which precedes the phase of exhaustion and defines the intensity of the effort the individual will be able to maintain during a few minutes, being useful to consider the load at which it occurs (e. g., the treadmill velocity).

In addition, it might be useful to study how long an individual can sustain exercise at high lactatemia levels (e.g. > 6 - 8 mmol) or high respiratory quotient (> 1.10), considering the training of soccer players or other sports practitioners with similar physical requirements.

This is a very interesting and challenging field of work and study for the scientific community, which continues committed to produce knowledge that might contribute to enhance the performance of athletes with access to new technologies.

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