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Manipulation of exercise to rest ratio within set duration on physical and technical outcomes during small-sided games in elite youth soccer players

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ABSTRACT

Training practices for elite soccer players should take into account specific technical, tactical and physical components. As a consequence of these demands small-sided games (SSGs) have become a popular conditioning tool that replicate the demands encountered during match play. The aim of this investigation was to examine how the manipulation of exercise to rest ratio, within the same overall duration, affected both physical and technical outcomes during SSGs in elite youth soccer. Twelve elite youth soccer players participated in three variations of eight minute 6v6 SSGs. The three variations included eight minutes continuous, 2×4 min and 4×2 min. Players perceived the continuous 8 min block as the hardest (4.5 ± 1.5 AU), followed by the 2×4 min (3.9 ± 1.4 AU) and the 4×2 min (3.3 ± 1.4 AU), although no difference in mean HR or physical measures via GPS analysis between SSGs was evident. From the technical perspective, only goals scored reached significance, with post hoc analysis identifying the number of goals scored were significantly higher during the 4×2 min and 2×4 min SSGs compared to 8 min continuous block. These results show that subjective ratings of exertion differed between conditions, but only minor technical manipulations were observed by adjusting work to rest ratios, with no significant effect on physical performance.

1. Introduction

Soccer is a physically demanding sport, where the aerobic and anaerobic systems are highly taxed (Mohr, Krustrup, & Bangsbo, 2003). Players will typically cover 10–13 km during a game, performing 150–250 intense activities such as accelerations/decelerations, changes of direction, all of which are interspersed with short recovery periods (Bangsbo, Mohr, & Krustrup, 2006), in addition to technical actions that include approximately 15 tackles, 10 headings, and 50 involvements with the ball (Stølen, Chamari, Castagna, & Wisløff, 2005). Therefore, physical conditioning in elite soccer is of upmost importance for coaches, practitioners and researchers alike.

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In recent years, much attention has focused on the use of small-sided games (SSGs) as a conditioning tool in elite soccer due to the similar demands to match play (Aguiar et al., 2008). Small sided games offer the opportunity to develop technical-tactical elements concurrently with specific fitness capacities as endurance (aerobic and anaerobic), strength and agility (Hill-Haas, Dawson, Impellizzeri, & Coutts, 2011). Small sided games are performed on smaller pitch areas, often under modified rules and with fewer players than traditional match-games (Hill-Haas et al., 2011). Impellizzeri et al. (2006) found SSGs to significantly improve aerobic fitness to the same degree as a generic fitness session, concluding that both were equally as effective in a sub elite youth population. These findings have been confirmed within an elite population (Hill-Haas, Coutts, Rowsell, and Dawson, 2009). Moreover, the authors also found players to perceive SSGs as less intense and physically easier. The use of perceived ratings of exertion has been commonly used within football and team sports, and is universally accepted as a valid measure (Robertson, Goss, & Metz, 1998). Further, Robertson et al. (1998) stated that rating of perceived exertion (RPE) is an easily applied measure for assessing functional aerobic power and prescribing intensity of exercise for use in a variety of sports. Recently, during a season-long period of field-based soccer training, Kelly, Strudwick, Atkinson, Drust, and Gregson (2016) found a high correlation between changes in RPE and heart rate (HR) within a sample of elite soccer players irrespective of playing position. Therefore, with application to training being vitally important, SSGs offer an interesting alternative to generic fitness sessions.

Over recent years, researchers have manipulated numerous organisational details of SSGs to investigate how this affects both physical and technical responses. Small sided game rule manipulations can change the physiological load, therefore SSGs characteristics should be adapted to suit the training aim. For instance, increasing pitch size so that the area per player is greater has been shown to increase the HR, lactate response and perceived effort (Hill-Haas, Rowsell, Dawson, & Coutts, 2009; Rampinini et al., 2007). Furthermore, decreasing the number of players appears to increase the HR response (Hill-Haas, Rowsell et al., 2009), as well as increasing the number of technical actions due to less players being involved (Jones & Drust, 2007). Manipulating rules by removing goalkeepers and making it a possession based game increases total distance but leads to decreases in high speed running as well as maximal velocities (Gaudino, Alberti, & Iaia, 2014). Dellal et al. (2008) suggested the increase in intensity observed with the inclusion of goalkeepers could be due to increased motivation as a result of the game becoming more realistic. Including training designs that are not synonymous with the training aims, which may for example use incorrect recovery times, protocol durations, pitch size dimensions and number of players could impair SSGs outcomes. Therefore to design relevant soccer protocols, it is paramount that the above parameters and rule manipulations are accounted for to ensure the correct technical outcomes and its association to external and internal load emerge (Beato, Bertinato, & Schena, 2014).

It is clear that SSGs have received a great deal of focus within the literature, although limited research has been conducted within elite youth soccer. Therefore, the rationale for the current investigation is to provide clarity on the impact of manipulating bout number and utilising an ecological duration within a session. The aim was to investigate the effect of manipulating the exercise to rest ratio within an equal session duration, with consistent player number and pitch dimension, on both physical and technical outcomes. The hypothesis states that decreasing bout duration, and therefore increasing set number will increase exercise intensity and lead to more high intensity exercise, potentially due to the rest periods providing an opportunity to assist in the removal of metabolic waste and resynthesis of phosphocreatine, as well as increasing technical proficiency due to the increased rest periods.

2. Method

2.1. Participants

Twelve elite youth soccer players took park in the investigation (Age 15.8 ± 0.6 years, Height 176.4 ± 9.6 cm, Weight: 67.1 ± 9.9 kg). The players comprised the U16 squad of an elite category one soccer academy in England (Chelsea FC). They all followed the same physical program of four on pitch training sessions per week, and one competitive match. All players and parents gave their informed, written consent after they were informed of the experimental procedures, the associated risks and their right to withdraw. The academy manager gave informed approval for the investigation to include their players. The investigation was approved by the Liverpool John Moores Ethics Committee.

2.2. Procedures

The players participated in 6v6 SSGs on a 50 × 32 m area (length × width), with full sized goals utilised. The games took place on an artificial surface, in an indoor facility (inflated dome). Teams were selected by the coach in an attempt to pick appropriately and were comprised of five outfield players and one goalkeeper. The teams were set up in a formation consisting of two defenders, two midfielders and an attacker. However they were given freedom to interchange freely within the game. Players were informed of the rules prior to the game, play restarted from the goalkeeper and the offside rule did not apply. The games took place without coach encouragement, although the scores were recorded by the coaching staff and the players were aware. All of the aforementioned was kept consistent throughout testing.

Upon arriving players were fitted with Polar T31 HR monitors and Global Position System (GPS) units. Players used gel on the HR straps to ensure optimal data collection. Prior to play all players took part in a standardised fifteen minutes warm up.