

The fitness training in elite soccer- with special reference of high-intensity intermittent exercises and small-sided games

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Resumo

O objetivo dessa trabalho é analisar qual a posição que tomou o treinamento físico em relação ao moderno futebol de alto nível. A análise da atividade permitiu mostrar a natureza intermitente do jogo e da importância da habilidade para atividades repetidas em alta intensidade, especialmente com jogadores de elite cobrindo uma distância de 10496-11779 m incluindo 3-7% de ações em alta intensidade. Portanto, os exercícios intermitentes em alta intensidade foram usados a fim de melhorar a capacidade física de jogadores e de parâmetros diferentes, permitido proporcionar diferentes implicações fisiológicas e físicas: a intensidade (% de uma velocidade máxima aeróbia), o número de repetição e blocos, a duração e o tipo de recuperação (ativo ou passivo), ou o formato (em linha ou com mudanças de direção ou com a inclusão de competências físico-técnicas específicas). Além disso, o futebol moderno se caracteriza também pela alta intensidade em ações técnicas ilustradas por jogadores que cobriram $\sim 191 \pm 38$ m com a posse de bola, representando 43-61 passes que corresponde a uma duração total de posse de bola individual em torno de 43-84s, e com um número de contato com a bola por passe individual variando entre 1,76-2,26. Neste contexto, parece que o crescente interesse dos jogos em campos reduzidos (JCR) é um método consistente para recriar a intensidade encontrada durante um jogo e para melhorar o desempenho físico de jogadores de futebol, independentemente do nível de jogo e, concomitantemente por proporcionar solicitação tática e técnica. No entanto, um maior coeficiente de variação é apresentado durante o JCR, em comparação com o exercício intermitente, provavelmente devido às exigências táticas e técnicas que induzem um controle limitado destas variáveis. Consequentemente, de acordo com os objetivos e período do treinamento, os técnicos devem fazer uma escolha entre um treinamento controlado fisicamente (alta intensidade de exercícios intermitentes) e formação física integrada (JCR), com maior variação.

Palavras chave: futebol, ações técnicas, treinamento; atividades de alta intensidade; jogos em campos reduzidos

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Abstract

The aim of the present short presentation is to examine which position took the fitness training with a special reference to the modern top-level soccer. The analyze of the activity has allowed to show the intermittent nature of the game and the importance of the repeated high-intensity activities ability with especially elite players covering a distance ranging from 10496 to 11779 m including 3-7% of high-intensity actions. Therefore, the high-intermittent exercises were commonly used in order to improve the physical capacity of players and different parameter allowed to provide different physiological and physical implications: the intensity (% of a maximal aerobic speed), the number of repetition and blocks, the duration and the type of recovery (active or passive), or the format (in line or with directional changes or with the inclusion of specific technical or physical skills). Moreover, the modern soccer is also characterized by the high-intensity of the technical actions illustrated by players who covered $\sim 191 \pm 38$ m with the ball possession, presenting 43-61 individual ball possession which corresponding to a total duration of individual ball possession ranged from 43 to 84 s, and with a numbers of ball contact per individual possession ranged from 1.76 to 2.26. In this context, it appears that the growing interest of small-sided games (SSG) is a consistent method to recreate the intensity found during a game and to improve the physical performance of soccer players, independently of the playing level and concomitantly of a tactical and technical solicitation. However, a greater coefficient of variation is presented during the SSG as compared to intermittent exercise, probably due to the tactical and technical demands inducing a limited control of these variables. Consequently, according to the objectives and the period of the training, coaches should make a choice between a controlled physical training (high-intensity intermittent exercises) and physically integrated training (SSG) with greater variation.

Keywords: Association football, Technical actions, Soccer training; High-intensity activities; Small-sided games

Introdução

Soccer is characterized as a high intensity intermittent team sport with several actions and recovery period randomly distributed within a game. During competitive soccer match-play, previous studies have reported that elite players cover a distance ranging from 10496 to 11779 m including 3-7% of high-intensity actions (Dellal et al., 2011a; Dellal et al., 2010a), corresponding to an average of 80-90% of maximal heart rate (HRmax) and close to 75-80% of maximal oxygen uptake (VO₂max) (Stølen et al., 2005).

Thus, the intermittent nature of the game induce that soccer coaches used intermittent exercises in the fitness training sessions in order to optimize the specific physical ability of their players. This form of training involves alternating work and recovery periods (using active or passive recovery intervals) with the principal aim

of optimizing the players' VO₂max. Additionally, this type of exercise allows to delay fatigue compared to a continuous running method, to limit the blood lactate accumulation (metabolized during the recovery period) and to increase the creatine phosphate metabolism. At a physiological level, intermittent exercise provides a simultaneous and a mixed solicitation of the aerobic and anaerobic metabolisms and has been shown to improve the oxidative capacity of enzymes, reaction time while impacting on the peripheral component of performance (Dellal et al., 2010b; Dellal et al., 2008).

Traditionally, high-intensity intermittent exercises are performed in an intensity superior or equal to 100% of the maximal aerobic speed (MAS) determined as the highest speed reached at the end of a continuous test (Vameval, Léger-Boucher) or an intermittent fitness test

(IFT30-15) (Cazorla et al. 1993; Léger and Boucher, 1980; Buchheit et al., 2009; Buchheit, 2008). The different characteristics of the most used intermittent exercise in soccer were presented in Table 1, knowing that players commonly performed intermittent exercise bouts like 30-30-sec, 15-15-sec, 10-10-sec, 10-20-sec and/or 5-25-sec. Furthermore, intermittent exercises can be apply in-line (highest solicitation of aerobic capacity), with 180° directional changes or turn (greater anaerobic solicitations) or in including specific soccer skills as tapering, plyometric or technical actions (Dellal et al., 2010b), but this choice depends of the seasonal period. For example, during the in-season period, fitness coaches could favour intermittent exercises with 180° directional changes inducing an increase in the anaerobic metabolism solicitation and consequently create different responses compared to traditional in-line intermittent exercises (greater values of blood lactate concentration and RPE). Usually, intermittent exercises are in-line in pre-season or mid-season whereas during in-season coaches could used intermittent exercises with 180° turn or with specific actions. Moreover, several fitness coaches have mixed the different intermittent exercises characteristics in the same session as a 5-25/10-20 (Figure 1) in order to create a mixical solicitation of anaerobic and aerobic component. Thus, all these recent findings demonstrate that this method of training is a very interesting and indispensable tool in the elite soccer fitness training and justify their utilisation in pre-season, in-season or mid season period to recreate the physical demand of a soccer game. However, technical and tactical are also key factors in soccer.

In this context, previous studies have examined the technical actions of players in elite games. It was showed that players covered $\sim 191 \pm 38$ m with the ball possession (Carling, 2010), presented between 43 and 61 individual ball possession corresponding to a total

duration of individual ball possession ranged from 43 to 84 s (Dellal et al., 2011a). Moreover, Dellal et al. (2011a) revealed that the numbers of ball contact per individual possession were ranged from 1.76 to 2.26 both in Spanish Liga and English Premier League, and therefore, players have to play quickly when they received the ball. Therefore, coaches need to find several integrated training exercise recreating the specific physical and technical demands of players within an official match-play. In this context, small-sided games (SSG) are introduced as soccer specific training (Hill-Haas et al., 2011; Dellal et al., 2011b and 2011c). SSG were considered to simultaneously solicit the tactical, technical, and physical parameters of soccer performance and could correspond to the coaches' challenge of scheduling of training sessions especially in both in adult, youth or non-professional teams. The Table 2 presents the characteristics of SSG recommended and validated by soccer scientists. Dellal et al. (in press) revealed that the high-intensity players' activities within SSG were greater than those found in match-play while players had a greater difficulty to perform technical actions (number of ball lost and % of successful passes). The comparison between SSG and mixed generic training are also equally effective in order to improve the performance in Yo-Yo intermittent recovery test and to reach similar heart rate responses (HR) than those found in classic intermittent exercise sessions used in soccer practice (Dellal et al., 2008).

However, the physiological responses, technical and physical demands during SSG are influenced by the rules changes and game format such as the pitch size, the number of players, the presence of goalkeepers, the numbers and duration of bouts, or the number of ball contact authorized per possession (Hill-Haas et al., 2011; Dellal et al., 2011b; Dellal et al., 2011c). For example, the modification of the number of ball contact authorized per

individual possession affect the soccer player activity from the first to the last bout of SSG. Indeed, Dellal et al. (2011c) showed that free play rule presented greater number of duels, induced the lowest decreases of the sprint and high-intensity performances, and affected less the technical actions (successful passes and number of ball lost) from the first to the last bouts as compared to 1 or 2 ball contact authorized within SSG. Moreover, SSG played in 1 ball contact authorized per individual possession form lead to reach higher solicitation of the high-intensity actions while players presented more difficulty to perform a correct technical action. These last findings indicate that the determination of the rule and game format have to be precisely planned by the coach according to the objectives of the training.

In conclusion, knowing the physical and technical demands within a soccer game, the present manuscript have revealed that high-intensity intermittent exercises

and small-sided games (SSG) are two consistent methods to recreate the intensity found during a game and to improve the physical performance of soccer players, independently of the playing level. However, the difference of these two types of training is to control the activity of the players within the SSG, presenting especially a greater coefficient of variation as compared to intermittent exercise. This difference is due to the different rule changes and game format, but also because players could manage their effort and recovery period during SSG even if coaches provide encouragement to maintain motivation and high intensity implications. Consequently, according to the objectives and the period of the training, coaches should make a choice between a controlled physical training (high-intensity intermittent exercises) and physically integrated training (SSG) with greater variation.

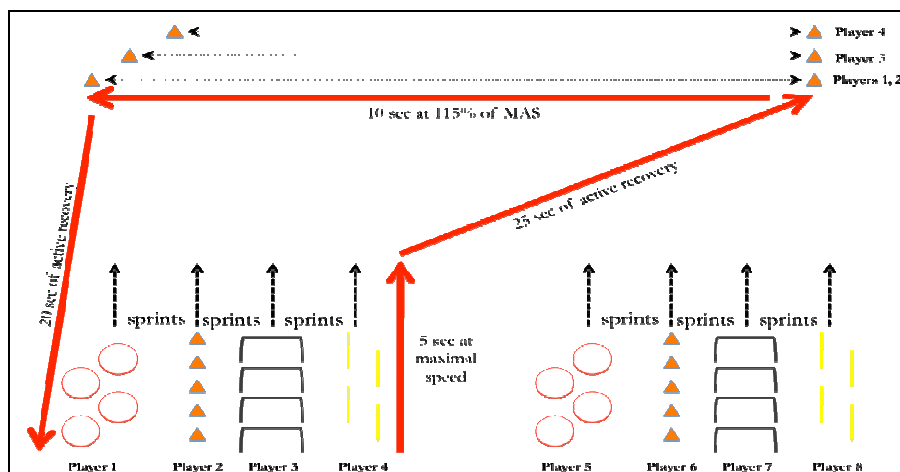
Table 1- Characteristics of intermittent exercises commonly used in fitness soccer training.

Type of intermittent exercise	Intensity in work period □ (% of MAS)	Type of recovery	Number of block (min)	Number of work period bout	Number of recovery period bout	Distance of go-back run in intermittent exercise with 180° directional changes
30''-30''	100, 105, 110 %	Active (40% of MAS)	2 x 10'-14'	10-14	9-13	42 m / 3 turns
20''-20''	105, 110, 115 %	Passive/Active	2 x 10'-12'	15-18	14-17	36 m / 2-3 turns
15''-45''	105, 110, 115, 120 %	Passive/Active	2 x 10'-12'	10-12	9-11	30 m / 2 turns
15''-15''	105, 110, 115, 120 %	Passive	2 x 8'-10'	16-20	15-19	30 m / 2 turns
10''-20''	110, 115, 120, 125 %	Passive/Active	1-2 x 7'-10'	14-20	13-19	21 m / 2 turns
10''-10''	110, 115, 120, 125 %	Passive	1-2 x 5'-8'	15-24	14-23	21 m / 2 turns
5''-25''	140 % or maximal speed	Passive	1-2 x 4'-7'	8-14	7-13	10-15 m / 1 turn
5''-5''	140 % or maximal speed	Passive	1-2 x 1'-2'	10-19	9-18	10 m / 1 turn

Table 2- Characteristics of small-sided games (SSG) commonly used in soccer training.

	Duration of bouts	Number of bouts	Recovery between bouts	Pitch size	Physical interests	Technical and tactical interests
1 vs 1	30" - 1'30	2 - 4	30" - 3'30	5m ² -25m ²	Anaerobic + strength	Duel + dribble
2 vs 2	45" - 2'	2 - 5	45" - 3'30	12m ² -30m ²	Anaerobic + strength	Duel + dribble
3 vs 3	2' - 4'	2 - 5	1' - 3'30	100m ² -225m ²	Mainly anaerobic + aerobic + vivacity	Duel + dribble + combination of play
4 vs 4	3' - 6'	2 - 6	1' - 4'	300m ² -1200m ²	Mixical anaerobic/aerobic/ + vivacity	Duel + dribble + combination of play + defensive attitude
5 vs 5	4' - 7'	2 - 6	1' - 4'	600m ² -1400m ²	Mixical anaerobic/aerobic/ + vivacity	Duel + dribble + combination of play + defensive attitude + tactical collective movement
6 vs 6	5' - 8'	1 - 4	1' - 4'	900m ² -2000m ²	Mixical anaerobic/aerobic/ + vivacity	Duel + dribble + combination of play + defensive attitude + tactical collective movement
7 vs 7	At least 8'	1 - 3	1' - 4'	1600m ² -2500m ²	Mainly aerobic + anaerobic	Duel + dribble + combination of play + defensive attitude + tactical collective movement
8 vs 8 and higher	At least 8'	1 - 3	1' - 4'	Since 1600m ²	Mainly aerobic + anaerobic	Duel + dribble + combination of play + defensive attitude + tactical collective movement

Figure 1- Combined 5-25/10-20 intermittent exercise repeated from 5 to 8 min with active recovery according to the period of the season.



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