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Performance analysis of professional U-23 portuguese players in small-sided games
Análisis del rendimiento de los jugadores portugueses profesionales sub-23 en juegos reducidos condicionados

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Abstract. The aim of this study was to examine the influence of different small-sided games (SSGs) format on external, internal load and technical actions of professional U-23 portuguese soccer players. Eight players (20.1±0.8 years, 180.4±7.2 cm, 75.9±4.9 kg) performed three different 4 vs. 4 ball possession SSGs (3x3 min play/rest) in different pitch dimensions, SSG1 16x24 m, SSG2 20x30 m and SSG3 24x36 m. All SSGs were video recorded for technical actions analysis**.** WIMU PRO™ (RealTrack Systems, Almeria, Spain) inertial devices were used for internal and external load data collection. The distribution normality was determined with the Shapiro-Wilk test. Parametric and nonparametric statistics were selected accordingly. *Statistical* Package for the Social Sciences (SPSS™ 25.0 version) was used for data analysis. No significant differences were observed comparing the different SSGs in total distance covered, acceleration/deceleration distance, as well as in maximal and mean heart rate. Regarding the technical actions, no significant differences were observed in successful passes, contrary to the observed from SSG1 to SSG3 in duels (7.00±2.13; 4.38±2.44; 4.25±1.98), number of balls lost (2.63±1.30; 1.00±0.53; 0.88±1.12) and in between SSGs in high-speed running ($p<0.05$, $ES=0.37$). In senior and professional soccer players, the modification of the pitch size between 16x24 m and 24x36 m during 4 vs. 4 ball possession SSGs with 3x3 min play/rest promotes modifications in the dynamic of technical actions and internal and external training load variables

Keywords: Small-sided games, Professional soccer, Technical actions, External and internal load, Performance.

Resumen.El objetivo de este estudio fue examinar la influencia de diferentes formatos de juegos reducidos (SSGs) en la carga externa, interna y las acciones técnicas de jugadores portugueses profesionales sub-23. Ocho jugadores de fútbol (20,1 ± 0,8 años, 180,4 ± 7,2 cm, 75,9 ± 4,9 kg) realizaron tres 4 vs.4 SSGs de posesión de balón diferentes (juego/pausa 3x3 min) en diferentes dimensiones del campo, SSG1 16x24 m, SSG2 20x30 m y SSG3 24x36 m. Todos los SSG fueron grabados en video para análisis de las acciones técnicas. Se utilizaron dispositivos inerciales WIMU PRO™ (RealTrack Systems, Almería, España) para recoger los datos de carga internos y externos. La normalidad de la distribución se determinó con el Shapiro-Wilk test. En consecuencia, se seleccionaron estadísticas paramétricas y no paramétricas. Para el análisis de datos se utilizó el *Statistical* Package for the Social Sciences (versión SPSS™ 25.0). No se observaron diferencias significativas al comparar los diferentes SSG en la distancia total recorrida, la distancia de aceleración/desaceleración, así como en la frecuencia cardiaca máxima y media. En cuanto a las acciones técnicas, no se observaron diferencias significativas en pases acertados, contrario a lo observado de SSG1 a SSG3 en duelos (7,00 ± 2,13; 4,38 ± 2,44; 4,25 ± 1,98), número de balones perdidos (2,63 ± 1,30; 1,00 ± 0,53; 0,88 ± 1,12) y entre los SSGs en marcha de alta velocidad ($p<0.05$, $ES=0.37$). En futbolistas senior y profesionales, la modificación de dimensiones del campo entre 16x24 m y 24x36 m durante 4 vs. 4 SSGs de posesión de balón con 3x3 min de juego/descanso promueve modificaciones en la dinámica de las acciones técnicas y variables internas y externas de carga de entrenamiento.

Palabras-clave: Juegos reducidos, Fútbol profesional, Acciones técnicas, Carga externa e interna, Rendimiento.

Introduction

The identification of training modalities that most closely replicate the physical demands of soccer match play is of great interest to coaches and exercise scientists who are concerned with optimizing training stimuli (Bourdon et al., 2017). Soccer is an intermittent sport which requires periods of high-intensity activity, interspersed with lower intensity actions, as well as technical and tactical components (Bangsbo, 1994; Dolci et al., 2020). Specifically in this sport, coaches manipulate training constraints on a daily basis, whether in the lab (e.g., isokinetic assessments), gym (e.g., rehabilitation) or at the pitch (e.g., small-sided and conditioned games, SSGs) (Ibáñez, Pérez-Goye, García-Rubio, & Courel-Ibáñez, 2020).

During a match, players typically cover a distance of 10-13 km, performing 150-250 intense actions (e.g., changes of direction, accelerations/decelerations [Acc/Dec]) interspersed with short recovery periods (Bangsbo, Mohr, & Krustrup, 2006). SSGs are widely practiced because they somehow replicate the physical, tactical and technical strain endured by players during a soccer match (Kelly & Drust, 2009; Michailidis, 2013), but also because they

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allow the players to have a high number of contacts with the ball (Capranica, Tessitore, Guidetti, & Figura, 2001; Rampinini et al., 2007). These games apply to training contexts mainly because they allow the perceptions of players to be augmented for specific behaviors (Davids, Araújo, Correia, & Vilar, 2013).

It is extensively documented that SSGs promote the development of physical aspects, technical qualities (e.g., passing, dribbling, kicking, tackling and heading), tactical and perceptual variables with greater enjoyment of players, contributing therefore to ensure more efficient use of the training time available (Dellal et al., 2012; Kelly & Drust, 2009; Los Arcos et al., 2015). As technical demands are a determining factor for soccer performance (Filipe Manuel Clemente, Figueiredo, Martins, Mendes, & Wong, 2016; Yang, Leicht, Lago, & Gómez, 2018), SSGs are specific exercises that can appeal to players' specific technical abilities (Dellal et al., 2012).

SSGs are often used during training to develop both the physical and technical performance of soccer players (Halouani, Chtourou, Gabbett, Chaouachi, & Chamari, 2014; Kalinowski, Bojkowski, & Śliwowski, 2019). These games are smaller, conditioned versions of the regular match, and they aim to prepare players for specific tactical contents and to increase intensity and individual participation (Clemente, Martins, & Mendes, 2015; Hill-Haas, Dawson, Impellizzeri, & Coutts, 2011). Cumulatively, are commonly used as a training drill by coaches to develop the physical fitness (Rebelo, Silva, Rago, Barreira, & Krustrup, 2016) or technical and tactical abilities (Jones & Drust, 2007; Olthof, Frencken, & Lemmink, 2018) of soccer players.

Likewise, SSGs have been introduced as a specific alternative to running based HIIT that simultaneously improves technical/tactical skills and fitness abilities of soccer players (Filipe M Clemente, Martins, & Mendes, 2014; Hill-Haas et al., 2011). Moreover, SSGs may offer additional advantages, improving essential neuro-muscular and cognitive skills such as reaction time, decision-making, and change-of-direction speed (Young & Rogers, 2014). Participants may also experience greater motivation (Buchheit et al., 2009) and enjoyment (Los Arcos et al., 2015) when performing SSG than HIIT protocols that are less sport specific.

So, one can argue that SSGs allow coaches to promote the development of players' technical and tactical skills, while at the same time improving physiological parameters such as strength, agility, and endurance in order to simulate the demands of competitive performance (Sgrò Francesco, Salvatore Bracco, Salvatore Pignato, & Mario Lipoma, 2018). By changing task constraints during SSGs coaches may directly amplify or inhibit the range of players' action possibilities within the context of practice (Chow et al., 2007), where the playing area manipulation represents the variable which most likely influence players' external workload and technical performance, and consequently, decision making (Sangnier, Cotte, Brachet, Coquart, & Tourny, 2019).

The proper SSG selection for training will allow a better training adaptation to the game requirements (Calderón Pellegrino, Paredes-Hernández, Sánchez-Sánchez, García-Unanue, & Gallardo, 2020). Correct handling of the training load thus reduces the risk of injury and improves players' physical condition, increasing their performance (Gabbett, 2016, 2020). Much research focuses on young top players whose findings could somehow differ from young sub-elite soccer players (Silva et al., 2014; Silva, Vilar, Davids, Araújo, & Garganta, 2016). In this sense, the relevance of our research since we focus on the under-23 soccer players.

Naturally, a greater amount of relative space could provide more time and space for players to execute passes and other soccer related technical actions. Nevertheless, it is expectable that players will execute more individual actions in smaller formats (2x2 to 4x4) compared to larger formats (5x5 to 11x11), specifically considering that players will have fewer teammates to rely on and that the need to be active and participate in all moments of the match will be higher (Filipe Manuel Clemente & Sarmento, 2020). Considering the training programs based on SSGs, it is expectable that low-skill level players will benefit more from these programs than players at advanced levels. However, it is also plausible that SSG-based programs will provide more benefits than running-based programs when exclusively considering technical skills (Filipe Manuel Clemente & Sarmento, 2020).

Many of the conducted studies focused on the evaluation of physical and physiological (Filipe Manuel Clemente, Afonso, & Sarmento, 2021), technical (Filipe Manuel Clemente & Sarmento, 2020) or tactical (Filipe Manuel Clemente, Ramirez-Campillo, et al., 2021; Ometto et al., 2018) variables in SSGs. The forms of play are an important training strategy that coaches can plan, correctly manipulating constraints to work on physical, physiological, technical and tactical aspects (Filipe Manuel Clemente, Afonso, et al., 2021), creating situations that are in accordance with the play internal logic, in which there is player-context relationship, practical variability and with various opportunities for action (Martín-Barrero & Camacho Lazarraga, 2020). According to this, it is pertinent to evaluate the SSGs considering the combination of several variables that are inherent to the practice of this type of training tasks. It is in this sense that we propose to analyze the effects of the practice of SSGs on physical, physiological and technical variables, thus contributing to enrich the knowledge about the effects of the game area manipulation.

Material and Methods

Participants

Eight U-23 professional players competing in the Portugal Revelation League participated in the study (age: 20.1 ± 0.8 years old; height: 1.80 ± 0.07 m; total body mass: 75.8 ± 4.9 kg). All players were part of the same team. This team is a member of a club certified by the Portuguese Football Federation and proposes a favorable competitive context for players to reach the professional leagues and national teams. The inclusion criteria for the players participating in the SSGs were: (1) players without injuries in the last two months; (2) players had participated in all training sessions in the six weeks prior to data collection; and (3) players had participated in the total playing time in the month of competition prior to data collection.

On average, the players practice 10-11 months per year with 5-6 weekly training sessions and one match per week by the time of data collection, but in some specific periods of the competitive season players were involved in two matches per week. Our study was conducted in accordance with the international ethical standards for sport and exercise science research (Harriss, Macsween, & Atkinson, 2019) and in accordance with the Declaration of Helsinki. *The study was approved by the Ethics Committee of the Polytechnic Institute of Leiria (CE/ IPLEIRIA/22/2021). The participation of the players was voluntary, having signed for this purpose the informed consent.*

Procedures

The research was conducted near the end of the competitive season 2020-2021, in a weekly microcycle with a competition. The training session took place in May, started at 10h00 and lasted approximately 1 hour. The tasks were performed on natural grass floor (in very good condition - 22 mm cut grass, with regular and compact surface - according to the natural lawns guide of Portugal League). Twenty-four hours prior to the experimental session, the players were instructed to refrain from intense activity and to maintain their usual habits, which included 8 hours of sleep the night before the data collection session and nutritional routine. Throughout the recovery time periods in the SSGs players could rehydrate. The training session started with a 25 min standardized warm-up, consisting of 5 min of slow jogging, and strolling locomotion followed by 12 min of specific soccer drills and finishing with 3 min of progressive sprints and Acc's and Dec's. Agility and speed drills were also conducted and 5 min of a ball possession game within a space of 20x20 m concluded the warm-up. Players have been familiarized with the 4 vs. 4 formats and regimes during the first period of the season. The SSGs were performed with the instructions to keep the ball as long as possible for a given team. Several balls were disposed all around these areas for immediate availability when balls leaved the playing areas. The total duration of the SSGs was thus an effective playing time. Figure 1 presents the description of the performed SSGs with different conditions.

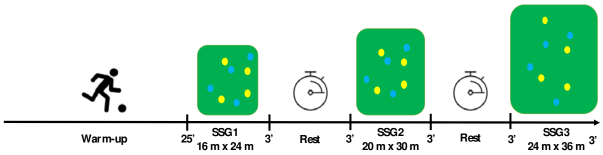

Figure 1. Schematic representation of the performed small-sided soccer games.

The formats of the SSGs, number of players and play space, were in accordance with the ones used by Rampinini et al. (2007). The SSGs were realized and interval training regimen, with a pause effort ratio of 1:1, lasting 3 minutes and 3 minutes active pause. The practice time used is each SSG was in accordance with the protocol used by Asçi (2016) and the pause time is in accordance with that used in several performed studies (Bujalance-Moreno, Latorre-Román, & García-Pinillos, 2019).

Players carried GPS devices (WIMU PRO™, RealTrack System, Almería, Spain) operating at a sampling frequency of 10 Hz. The technology used to collect the GPS data had been previously validated and was shown to be reliable for monitoring soccer players (Bastida-Castillo, Gómez-Carmona, De La Cruz Sánchez, & Pino-Ortega, 2019). Participants wore a fitted body vest, and the GPS device was inserted in a purpose-built harness prior to games. To download the tactical variables, the data were transformed into raw position data (x and y coordinates). Prior to being placed on the players, the GPS devices were calibrated and synchronized following the manufacturer's recommendations (Bastida-Castillo et al., 2019). Heart Rate (HR) data was collected through Garmin bands (Olathe, KS, USA) pasted into players, a system that emits data to WIMU PRO™ devices using ANT+ technology (Molina-Carmona, Gomez-Carmona, Bastida-Castillo, & Pino-Ortega, 2018). The procedure was as follows: (a) turn on the devices, (b) wait approximately 30 s after turning them on, (c) press the button to start recording once the device's operating system is initialized and (d) analyze the data obtained from the devices using SPRO™ software (RealTrack Systems, Almería, Spain).

WIMU devices allow you to collect internal (HR) and external load data (distance covered, accelerations, decelerations, and high-speed running).

HR responses were measured with 5 seconds recording intervals. HR expresses the beats per minute (bpm). The internal load variables HR_{max}, HR_{mean} and 6 HR_{max} zones (50-60%, 60-70%, 70-80%, 80-90%, 90-95%, and > 95%) (Gómez-Carmona, Gamonales, Pino-Ortega, & Ibáñez, 2018).

The external load variables analyzed were distance (m) - distance traveled; accelerations/decelerations (m) - distance of speed changes, calculated through high intensity accelerations/decelerations (>3m/s2) (Hauer, Störchle, Karsten, Tschan, & Baca, 2021); High-speed race (HSR, in m) - high-speed distance (>21km/h) (Lozano et al., 2020).

To examine the player technical activity, all SSGs were video recorded using four digital cameras positioned 15 m behind each corner of the SSG area (elevated at 1 m above the ground). A hand notational system combined with the video recordings, which were played back several times, was used to evaluate the duels (one player facing another player with the aim to keep or gain ball possession), individual percentage of successful passes, individual number of ball losses and individual total number of ball possessions in each bout within the SSG. This method has been described as reliable evaluation of movement in soccer (Drust, Atkinson, & Reilly, 2007).

Technical actions and physical performance during the SSGs were compared.

Data analysis

Study variables were characterized using descriptive analysis (mean, standard deviation and 95% confidence interval). The normality of the distributions was assessed with the Shapiro-Wilk test. Parametric and nonparametric statistics were selected accordingly. The existence of statistically significant differences between the SSGs was evaluated with *Anova* and the *Tukey* post-hoc analysis ($p<0.05$). Effect sizes were determined by calculating partial eta-squared (Levine & Hullett, 2002). Effect sizes are considered as small (<0.06), moderate (0.06<<0.15) or large (³0.15) (Cohen, 2013). The data analysis was carried out using the Statistical Package for Social Sciences (SPSS 25.0, SPSS. Inc., Chicago, IL, USA).

Results

The table 1 shows the results for the internal load (HR_{max} and HR_{Mean}) and external load (distance covered, HSR, accelerations and decelerations). Table 2 shows data for the different intensity zones considered the %HR. Table 3 presents the results related to the technical variables analyzed in the SSGs studied.

The distance covered concomitantly increased with the rise of playing area per player. Table 1 depicts the area of game per player, total covered distance, distance covered at HSR (>21km/h^{-1}), distance covered in Acc's and Dec's (>3m/s^2), maximum and mean HR (HR_{max} and HR_{mean}, respectively) during all the performed SSGs. No significant differences were observed throughout the SSGs in HR_{max} and HR_{mean}. Although, in HR_{max} and HR_{mean}, the lower values were observed in the SSGs with the smallest play area per player (16x24 m). We found significant differences between SSGs in the distance covered (SSG1-369.42±19.88, CI[346.03-392.81]; SSG2-384.43±29.33, CI[361.05-407.82]; SSG3-410.84±36.69, CI[387.45-434.23]; F=3.54, p=0.05, ES=0.28), particularly between SSG1 and SSG3 (MD=-41.42, p=0.04, CI[-74.93- -8.34]). Also, significant differences were observed considering the playing area increase in HSR (SSG1-0.00±0.00, CI[-3.82-3.82]; SSG2-0.00±0.00, CI[-3.82-3.82]; SSG3-7.29±8.34, CI[3.46-11.11]; F= 5.35; p=0.01, ES=0.37), with significant differences between SSG1 and SSG3 (MD=-7.29, p=0.02; CI[-13.86- -0.72]). Despite no significant differences were monitored between SSGs in distance covered in Acc's and Dec's, a large effect was visible considering the pitch size increasing Acc's > 3m/s^2 (ES=0.22).

Table 2 highlights the results related to the HR zones in different SSGs formats. Very small values of HR

Table 1.
Total covered distance, high speed running, accelerations, decelerations, maximum and mean heart rate during all performed small-sided games.

SSGs (m^2)	Total distance covered (m)	High Speed Running (>21Km/h) (m)	Accelerations (>3m/s^2) (m)	Decelerations (>3m/s^2) (m)	Max. heart rate (bpm)	Mean heart rate (bpm)
SSG1	369.42±19.88 ¥	0±0 ¥	21.74±14.09	14.95±5.48	184.85±5.33	169.85±9.42
SSG2	384.43±29.33	0±0	36.97±12.88	18.76±9.56	189.14±3.13	176.71±4.71
SSG3	410.84±36.69 *	7.29±8.34 *	22.08±16.13	8.68±10.41	188.57±5.15	176.85±7.53
F	3.54	5.35	2,54	0.39	1.75	2.00
p	0.05	0.01	0.10	0.67	0.20	0.16
η_p^2	0.28	0.37	0.22	0.04	0.16	0.18

Note. SSG1: 4 vs. 4, 16x24 m (48m^2); SSG2: 4 vs. 4, 20x30 m (75m^2); SSG3: 4 vs. 4, 24x36 m (108m^2). In all SSGs format the objective was ball possession with 3 min duration and 3 min rest (ratio 1:1). * for significant differences regarding SSG 1; # for significant differences regarding SSG 2; ¥ significant differences regarding SSG 3.

Table 2.
Percentage of heart rate in different forms of small-sided games.

SSGs	Relative heart rate (%) [50-60] Very low	[60-70] Low	[70-80] Moderate	[80-90] High	[90-95] Very high	[>95] Max.
SSG1	6.25±4.77 ¥ #	5.99±5.84	7.25±4.72	48.95±27.66	28.53±29.96	2.82±7.46
SSG2	0.81±2.14 *	8.40±5.01	7.55±3.17	20.77±11.09	54.12±10.78	8.33±14.78
SSG3	1.56±2.45 *	3.43±3.11	6.02±2.39	34.49±27.99	47.02±26.73	7.45±9.81
F	5.46	1.88	0.36	2.49	2.12	0.49
p	0.01	0.18	0.70	0.11	0.14	0.61
η_p^2	0.37	0.17	0.03	0.21	0.19	0.52

Note. SSG1: 4 vs. 4, 16x24 m (48m^2); SSG2: 4 vs. 4, 20x30 m (75m^2); SSG3: 4 vs. 4, 24x36 m (108m^2). In all SSGs format the objective was ball possession with 3 min duration and 3 min rest (ratio 1:1). * for significant differences regarding SSG 1; # for significant differences regarding SSG 2; ¥ significant differences regarding SSG 3.

percentages were observed in all the performed SSGs, namely in very low (50-60), low (60-70) and moderate (70-80) HR percentages. In this regard, the rise in pitch dimensions (from 16x24 m to 20x30) resulted in significant differences in HR_{50-60} (SSG1-6.25±4.77, CI[3.60-8.90]; SSG2-0.81±2.14, CI[-1.83-3.46]; SSG3-1.56±2.45, CI[-1.08-4.21]; *F*=5.46; *p*=0.01, *ES*=0.37). With exception of the very low HR%, in none of the other relative percentage HR significant differences were observed between the different SSGs, nevertheless, the higher HR percentage zone values occurred in HR_{80-90} and HR_{90-95}. It was possible to verify that the increase in the playing area promoted a great effect on HR variability in zones HR_{60-70} (*ES*=0.17), HR_{80-90} (*ES*=0.21), HR_{90-95} (*ES*=0.19) and $HR_{>95}$ (*ES*=0.52).

Table 3 presents the players technical actions during the performed SSGs.

Table 3 shows statistically significant differences in duels (SSG1-7.00±2,13, CI[5.38-8.61]; SSG2-4.38±2.44, CI[2.76-5.99]; SSG3-4.25±1.98, CI[2.63-5.86]; *F*=3.99; *p*=0.03: *ES*=0.27), and it is evident between SSG1 and SSG3 (*MD*=2.75, *p*=0.05, CI[-0.02-5.52]) The same was observed regarding the number of balls lost comparing SSG1 (2.63±1.30) and SSG2 (1.00±0.53) (*MD*=1.63, *p*=0.01, CI[0.31-2.94]) and SSG1 and SSG3 (0.88±1.12) (*MD*=1.75, *p*=0.00, CI[0.44-3.06]). Increasing pitch size had a big effect on duels (*ES*=0.27) and the number of balls lost (*ES*=0.40) and the number of balls lost (*ES*=0.40), noting that smaller field sizes promote more duels and ball losses.

Discussion

The aim of this study was to evaluate the effects of playing area manipulations in ball possession SSGs on internal and external load associated to technical actions in senior (U-23) and professional soccer players. The main results associated to the play of 4 vs. 4 ball possession SSGs with 16x24 m, 20x30 m and 24x36 m (all with 3 min duration and 3 min rest) were: i) The increase in distance covered was significative in the playing areas where there was an increase of 480 m2 (SSG1 vs. SSG3), a fact also evident to record HSR values (>21km/h) (Oliva-Lozano, Barbier, Fortes, & Muyor, 2021); ii) The rise in pitch size increases the distance. The predominantly HR percentage zones were «high» (80-90% HR_{max}) and «very high» (90-95 % HR_{max}); iv) The field size increase has a large effect size on the lower HR and HR_{max} zones (>95%). It has been found that in the smaller format (SSG1) there is a higher percentage in the HR zone (50-60%) compared to larger areas., and v) This SSGs format applied in senior and professional soccer players promotes differences in the technical actions performed by the players, namely a reduction of duels and balls lost and stabilization of number of successful passes and number of ball possession throughout the SSGs.

Regarding the physical response, an increase in distance was observed with the increase in field size, but only significant differences were recorded between SSG1 and SSG2. These results are in line with recent studies (Castillo, Raya-González, Manuel Clemente, & Yanci, 2020; López-Fernández, Sánchez-Sánchez, García-

Table 3.
Technical actions during the bouts of the 4 vs. 4 small-sided games.

SSG	Number of duels	Number of successful passes	Number of balls lost	Number of ball possession
SSG1	7.00±2,13 ¥	7.00±4.27	2.63±1.30 ¥ #	9.63±3.66
SSG2	4.38±2.44	7.00±3.29	1.00±0.53 *	10.50±3.74
SSG3	4.25±1.98 *	7.13±2.90	0.88±1.12 *	8.00±3.20
F	3.99	0.00	7.03	1.02
p	0.03	0.99	0.00	0.37
η_p^2	0.27	0.00	0.40	0.08

Note. SSG1: 4 vs. 4, 16x24 m (48m^2); SSG2: 4 vs. 4, 20x30 m (75m^2); SSG3: 4 vs. 4, 24x36 m (108m^2). In all SSGs format the objective was ball possession with 3 min duration and 3 min rest (ratio 1:1). * for significant differences regarding SSG 1; # for significant differences regarding SSG 2; ¥ significant differences regarding SSG 3.

Unanue, Hernando, & Gallardo, 2020; Martin-Garcia, Castellano, Diaz, Cos, & Casamichana, 2019; Nunes, Gonçalves, Davids, Esteves, & Travassos, 2021; Zurutuza, Castellano, Echeazarra, Guridi, & Casamichana, 2020). The values considered HSR (>21km/h) (Lozano et al., 2020) were only possible to check in SSG3, with higher areas of play, which is in line with Riboli et al. (2020), which verified a relationship between the increase in field size and the distance traveled in total distance of high intensity (>15 km/h). In this sense it is essential to note that in the game a large part of the high intensity actions are 75% maximum accelerations, compared to the displacements with speeds of 21km/h, a fact that should be taken into account, namely other key speed zones in the preparation of players for the competition (Martínez-Cabrera, Núñez-Sánchez, Muñoz-López, & de Hoyo, 2021). Acc's and Dec's are an important indicator of neuromuscular activity (Reche-Soto, Cardona, Díaz, Gómez-Carmona, & Pino-Ortega, 2020) and in soccer they are fundamental with intensity greater than $3m/s^2$ (Martínez-Cabrera et al., 2021). It was previously indicated that small playing areas in soccer promote braking, direction changes, Acc's and Dec's (Martin-Garcia et al., 2019; Zurutuza et al., 2020), however, in our study, these findings were only evident in SSG2 and SSG3. SSG1 had a smaller area compared to SSG2 and we could observe that in the latter an increase in high intensity Acc's ($>3m/S^2$) occurred. In our opinion this fact is related with the objective of the proposed exercise - ball possession game, stimulating a more positional game, without many displacements. With an intermediate playing area (SSG2) it was more evident a greater distance traveled with high intensity Acc's and Dec's.

Our study did not record significant differences in HR with the increase in field size since the used areas were lower (SGG1 and 2) and not much higher (SSG3) than $100m^2$. Sarmento et al. (2018) stressed that high physiological responses are expected with playing areas greater than $100m^2$, and this fact is evident in studies that used larger areas of play (Bujalance-Moreno et al., 2019; Filipe M Clemente et al., 2014; López-Fernández et al., 2020, 2018; Rampinini et al., 2007). It was possible to verify that the pitch size increase promotes a large effect on HR>80%, although, it is noteworthy that in our perspective if the aim of the task is the reach of HR_{max}, the methodology, or SSG format, should be carefully planned and evaluated, considering variables such as the pith size, time of play and rest and the number of players.

Considering the effects of SSGs in terms of technical actions, it has been consistently found that an increase in the number of technical actions performed individually by players occurs in smaller formats of the match (Almeida, Ferreira, & Volossovitch, 2013; Filipe Manuel Clemente & Sarmento, 2020; Gonzalez Villora, Garcia Lopez, Pastor Vicedo, & Contreras Jordan, 2011; Joo, Hwang-Bo, & Jee, 2016). Moreover, smaller pitch dimensions also promote an increase in the number of passes, shots, and tackles (Almeida et al., 2013; Clemente & Sarmento, 2020). In our study it was evident that SSG1, game with the smallest playing area, promoted a greater number of duels and losses of the ball, promoting confrontations of 1x1 and more alternation of offensive and defensive behaviors, determining aspects in the preparation of players, considering the characteristics of the soccer game. The playing spaces used in the study are not the best game situation to promote offensive actions, as is evident by the lack of significant differences in the number of successful passes and in the number of possessions. It will be important to equate play spaces above $300m^2$ to promote the goal of maintaining possession (Filipe Manuel Clemente & Sarmento, 2020). However, we risk suggesting that the SSGs used, because of the constancy in the number of passes and ball possession, are suitable for improving technical actions in senior U-23 professional players.

The present study has some limitations that are important to be indicated. Our study aimed to analyze training tasks with professional under-23 soccer players but considering the sample number the results should be carefully analyzed, referring only to the study participants. Another limitation of the study, although the training tasks were part of the training routine of the analyzed players, they were only repeated once. Future investigations should consider these limitations, as well as analyze more study variables related to tactical actions, different speed zones and accelerations. It can also be considered the use of the same SSGs format over an entire season to test the possible variations in player dynamics.

Conclusions

It was possible to verify that in the larger playing areas the players reached longer distances and HSR values (>21km/h). No significant differences were observed between the three SSGs formats in terms of Acc and Dec

At the level of internal load, no significant differences were recorded in HR_{max} and HR_{mean}, however, it was monitored a large effect size related to playing area and the HR zones >80%.

Regarding the technical actions, we found that the smaller format was promoter of more duels and loss of the ball. In the three formats there were no significant differences in the number of successful passes and ball procession.

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Conflicts of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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