

ORIGINAL RESEARCH

## Comparison of high-intensity patterns between possession games and small-sided games in professional soccer

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### Abstract

**Background:** Many specific games are practiced with the aim of maintaining the possession of the ball by the team. Among them, possession games (POG) are similar to small-sided games (SSG), and as such, have a few different characteristics. **Objective:** The aim of this study was to compare high-intensity patterns of professional soccer players in relation to the positional role between POG and SSG in professional soccer. **Methods:** A descriptive analysis was conducted over one season, during typical training sessions with 5 vs. 5 designs and 10 official matches. Twenty-six male professional players (age  $24.7 \pm 5$  years, body mass  $73.6 \pm 7$  kg, body height  $178.4 \pm 6.2$  cm) were classified into five positional roles: central defender, wide defender, midfielder, wing and forward. Players' locomotor activity was recorded using GPS (Openfield-Catapult™). Data on total distance, player-load, work rates (distance covered at speed  $> 14.9$  km/h per min and distance covered at speed  $> 19.9$  km/h per min), the number of runs in work rates, very high-intensity accelerations-decelerations ( $> 3.5 / < -3.5$  m/s<sup>2</sup>) and maximal speed were measured. **Results:** The analysis of the data showed higher performance for POG in seven of the nine study variables ( $p < .01$ ), except in accelerations where the SSG were higher than POG ( $p < .01$ ), while no significant difference was obtained in decelerations. When comparing performance among playing positions, significantly higher values were observed in POG ( $p < .05$ ) in the same variables (no differences for the wingers in total distance and player-load; wide defenders and forwards in distance covered at speed  $> 19.9$  km/h per min). Regarding accelerations, SSG outperformed POG in almost all game positions ( $p < .05$ , except for wide defenders). No significant differences were found in decelerations for all positions. **Conclusions:** The findings suggest that POG could be used to stimulate the physical demands to which players are exposed to competitions. Moreover, SSG could be used as an exercise with greater intentionality when it comes to stimulating a significant number of accelerations per unit time.

**Keywords:** professional soccer players, specific games, physical demands analysis, high-intensity activity, positional roles

### Introduction

Small-sided games (SSG) represent one of the most common training elements in soccer at any level and age, as they allow the simultaneous development of technical-tactical contents together with physical goals (Halouani et al., 2014). In particular, the player's responses during the performance of SSGs have been extensively studied by different authors (Casamichana & Castellano, 2015; Casamichana, Castellano, Calleja-González, et al., 2013; Hill-Haas et al., 2011). In this sense, the advantage of carrying out these games is to replicate real competition situations as closely as possible in regard to the physical, physiological, technical, and tactical demands of the match (Dellal et al., 2011; Dellal, Owen, et al., 2012; Gonçalves et al., 2017). However, it should be considered that it is necessary to have a good command and knowledge of this type of task, in order to be able to perform them accurately. This is the main reason why they are adapted to the objectives pursued by the coach, relative to

the imposed load determined by the exercise (Casamichana et al., 2018; Lacombe et al., 2017).

Nevertheless, not only is the *SSG traditional approach* commonly used in the soccer world (Casamichana, Castellano, & Dellal, 2013; Hill-Haas, Dawson, et al., 2009; Hill-Haas, Rowsell, et al., 2009), but other games are also practiced with the main goal of maintaining possession of the ball by the team. Among them, possession games (POG) are similar to traditional SSG, yet nonetheless, have a number of different characteristics. In SSG the aim of the task is to maintain ball possession, but the disposition of the players is not preset, and the occupation of the spaces is not predetermined (Casamichana, Castellano, et al., 2013), while in POG the same spaces are intelligently covered. In the latter, the players who maintain possession of the ball are positioned in such a way that the interrelation among them and the space are as efficient as possible (Vilamitjana et al., 2020). Effectively, the fundamental objective of this type of exercise is to generate free spaces by means of individual and collective movements, which make the game

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progress with greater fluidity (Vilamitjana et al., 2020). This, in turn, promotes factors inherent to strategy and tactics, which have a greater transfer capacity towards specific game situations (Vilamitjana et al., 2020).

In elite soccer there are many teams that apply these two types of activities in their training sessions, striving to simulate competition situations. However, there is some debate about the usefulness of their application (Dellal, Owen, et al., 2012; Lacombe et al., 2017). In this context, Gaudino et al. (2014) made a comparison between SSG and POG, with 5, 7 and 10 players a side, where they could not progress with more than 2 touches in both games. Moreover, in POG they had to maintain ball possession as long as possible. The designs of each format were not detailed, as the only difference described was that the SSGs were played with goalkeepers and goalposts. In other instances, in a study by Asian-Clemente et al. (2021), the authors compared two POG designs (5 vs. 5 + 5 with 2 floaters, with identical area per player, but with a different playing task) with official games. The analysis revealed that designing these kinds of games with an extra zone in which the players have to move to recover the ball, was a more suitable way to increase running at high-speeds during these drills, except for peak speeds. The same could be said for distances covered with a sprint. Other authors such as Lacombe et al. (2017) compared three SSG formats (4 vs. 4, 6 vs. 6 and 8 vs. 8) with official matches, and then differentiated the final performance according to the positions occupied by the players on the field. On the one hand, they concluded that central defenders accumulated more distance in high intensity than the other positions, during the 6 vs. 6. On the other hand, Vilamitjana et al. (2020) performed a similar comparison, but with three POG formats (6 vs. 6, 7 vs. 7 and 8 vs. 8). The main conclusions refer to the fact that the cardiovascular response in 6 vs. 6 and 7 vs. 7 was match-compatible, while the positions as central defenders and midfielders accumulated more distance in high-intensity running, revealed a similar level to that obtained in competition.

To the best of the author's knowledge, comparisons between SSG and POG have been limited with a greater understanding of these demands and their application to soccer match performance needed. Keeping this context in mind, the study's first and foremost objective was to compare the physical demands between SSG and POG within the competitive function profile, considering, as a hypothesis, that POG would demand more physical performance patterns. A secondary objective of this research was to examine these demands relative to the position of the players during official matches.

## Methods

### Participants

Twenty-six professional soccer players (age  $24.7 \pm 5$  years, body mass  $73.6 \pm 7$  kg, body height  $178.4 \pm 6.2$  cm, the sum of ten skinfolds sites  $60.5 \pm 8.6$  mm, professional playing experience:  $6.6 \pm 5$  years) participated in this study; all of them were playing for an elite Argentinean

team, competing in the First League (LPF) during 2019 season. The players were grouped according to their position on the pitch: central defenders ( $n = 7$ ), wide defenders ( $n = 5$ ), midfielders ( $n = 6$ ), wingers ( $n = 5$ ), and forwards ( $n = 3$ ). Goalkeepers were excluded from the study, as they did not participate in the same physical training program as the rest of the squad (Clemente et al., 2013).

Before starting the season, the players were evaluated using FIFA's medical protocol. None of them presented any ailments, pathologies or injuries and no medical prescriptions were issued. All the participants were informed about the objectives of this research and volunteered to participate in the study, which in no way disrupted their scheduled training. The study protocol was approved by the local Institutional Review Board and drafted in accordance with the Declaration of Helsinki 2008, updated in Fortaleza, October 2013.

### Procedure

During the 2019 season, each player's GPS data were recorded ten times during training sessions and ten times during official games. The official games used either 1-3-4-3 or 1-4-2-1-3 playing formation and were played on natural grass soccer pitches with standard dimensions. Five observations of each playing formation were selected in each semester of the season (March–July, August–December). The only players who were taken into consideration were those who had completed the first half of each game under normal conditions and with the same role on the pitch, in order to rule out any possible effects of under-performance due to mental fatigue or incidents related to match strategies (Lacombe et al., 2017; Paul et al., 2015).

In each competitive micro-cycle, the players performed five sessions with the ball (one day of possession games, three days of tactical-position games and two days of complimentary "set pieces"), each of which lasted on average, 31 min net. There were 1–2 weekly strength and conditioning sessions plus the official match (the average total distance covered for all activities per micro-cycle was 28.1 km). There existed no differences in weekly methodological structure when the team played with a variety of tactical systems.

### Instruments and measurements

The totality of physical parameters was assessed using portable 10-Hz GPS devices (Optimeye S5, Catapult Sports, Melbourne, Australia) previously validated by Johnston et al. (2014) and Nicolella et al. (2018); and analyzed using the Openfield Analytics platform (Version 1.22.0, Catapult Sports, Melbourne, Australia). To limit inter-unit error, each player wore the same device throughout the course of the season. The GPS devices were activated 15 min prior to the start of the match, in accordance with the manufacturer's instructions (GPS accuracy:  $< 1$  m circular error probability [50%] without selective availability [horizontal], typical differential GPS [Wide Area Augmentation System, Euro Geostationary Navigation Overlay Service, Satellite Augmentation System]: 2.5).

The following speed intensities were used to categorize motion: moderate-intensity running (14.9–19.8 km/h),

high-speed running (19.9–25.2 km/h), and sprint running (above 25.2 km/h). The number of runs and the distance covered at each speed intensity were measured. The peak speed was also recorded. The speed thresholds were equal to those reported previously by Di Salvo et al. (2009, 2013). The accelerations and decelerations thresholds ( $> 3.5 \text{ m/s}^2$  and  $< -3.5 \text{ m/s}^2$ , respectively) and definitions have been used previously by Harper et al. (2019). The nine study variables were obtained from these parameters (Table 1).

The HILR and HSSL load rates were previously reported by Vilamitjana et al. (2020, 2021; Table 1).

### Possession games and small-sided games

As a proposal, three different specific 5 vs. 5 POG options were designed by the authors, each one with well-defined

objectives for the attack and defense system (oriented area), see Figure 1. The games were played *with no limit on the number of touches*, except at the time of shooting. The SSGs were considered a *traditional format* (Casamichana, Castellano, & Dellal, 2013; Hill-Haas, Dawson, et al., 2009; Hill-Haas, Rowsell, et al., 2009), with a task aimed at scoring as many goals as possible against the opposite team's goal (polarized area), with no limitations in the number of touches and pitch areas where to shoot (Figure 1). Both, SSG and POG, were designed with the same relative area per player ( $70 \text{ m}^2$ ) and played on natural grass soccer pitches with standard measurements. The dimensions of each design were selected based on the observations described in the article by Fradua et al. (2013): the relative playing area  $65\text{--}110 \text{ m}^2$ , and by Casamichana et al. (2015):  $50\text{--}100 \text{ m}^2$ .

Table 1 Definitions of study variables

| Variable                                    | Definition   |
|---|--|
| Total distance (TD)                         | The total distance covered for the time determined for each activity in meters per minute.   |
| Player-load (PL)                            | The sum of the accelerations across all axes of the internal tri-axial accelerometer during movement. It considers instantaneous rate of change of acceleration and divides it by a scaling factor (in number per minute). |
| High-intensity load rate (HILR)             | Quotient between distances covered at moderate intensity, high-speed running, and sprint by the amount of time of each activity in meters per minute.  |
| High speed running-sprints load rate (HSSL) | Quotient between distances covered at high-speed running and sprint by the amount of time of each activity in meters per minute.   |
| Runs in HILR (#HILR)                        | The number of runs performed at moderate intensity, high-speed running, and sprint, in number per minute.  |
| Runs in HSSL (#HSSL)                        | The number of runs performed at high-speed running and sprinting, in number per minute.  |
| Very high-intensity accelerations (VHIA)    | The number of accelerations performed above $3.5 \text{ m/s}^2$ , in number per minute.  |
| Very high-intensity decelerations (VHID)    | The number of decelerations performed below $-3.5 \text{ m/s}^2$ , in number per minute.   |
| Maximal speed (MS)                          | The absolute maximal speed reached, in km/h.   |

Figure 1 Possession games (POG) and small-side games (SSG) designs and graphic representation for 5 vs. 5 formats

| Game   | Design  | Diagram |
|--------|---|---------|
| POG #1 | <p><b>Setting up:</b> A hexagonal shape made up of a rectangle of <math>20 \times 15</math> meters, with 4 triangles inside (15 and 20 meters of base by 10 meters of height), plus two strips on each side; an official goal is located 5 meters from the top points of the triangles (with goalkeepers).</p> <p><b>Objective:</b> To reach the goal, the ball must travel through to the two inner triangles and one strip (the goal cannot be scored from the strips). Attackers can shoot the ball from inside of the end triangles, with only one touch. The defenders can press in any sector, except inside from the strips, trying to recover the ball as soon as possible.</p> |         |
| POG #2 | <p><b>Setting up:</b> Two rectangles (<math>18 \times 20</math> meters), with two internal shapes (<math>4 \times 5</math> meters); one official goal on one side (with goalkeeper) and two mini goals on the other side (without goalkeepers), each is 5 meters from the end line.</p> <p><b>Objective:</b> Possession of the ball making at least 6 passes to score. The defenders can press in any sector, except in the internal shapes. Once the ball is recovered, they must make a through pass to the inner figure in the opposite square.</p>  |         |
| POG #3 | <p><b>Setting up:</b> Octagonal shape (<math>30 \times 30</math> meters, subtracting 4 triangles of <math>10 \times 10</math> meters), with five mini goals inside (without crossbar) and four mini goals outside (five meters from one side of the figure).</p> <p><b>Objective:</b> Possession of the ball, trying to make a pass through the mini goals located inside the figure. At least three passes are necessary, to be able to score. The defenders must press, trying to get the ball back as soon as possible. The players can score in any of the four mini goals that are placed on the outside of the octagonal figure.</p>  |         |
| SSG    | <p><b>Setting up:</b> A rectangle shape (<math>18 \times 38</math> meters) and an official goal located two meters from the end line, with one goalkeeper in each.</p> <p><b>Objective:</b> Score as many goals as possible against the opposite team's goal. The defenders must press, trying to get the ball back as soon as possible.</p>  |         |

The same monitoring procedure was performed for each POG-SSG design and in official matches. Altogether, five training sessions were recorded for analysis: three sessions for POG and two sessions for SSG (same weekday). All these sessions started with a similar 23-min standardized warm-up (8 min of general movements patterns plus active stretching, core, and prevention drills; 6 min of specific movement patterns with the ball; 6 min of specific game to perform; 3 min of stretching-recovery) and were performed on a natural pitch, at the same time (10:00–12:00 am).

The POG and SSG were performed using an *intermittent format* of 2 reps  $\times$  6 min. In between these sets, 2 min of passive recovery was carried out, to promote a more optimal recovery (longer work-to-rest ratio time than the 4:1 relation used by Casamichana, Castellano, & Dellal, 2013; Hill-Haas, Rowsell, et al., 2009; Vilamitjana et al., 2020). During rest periods, ad libitum, water was provided to players. All participants were advised to maintain their usual diet, with special emphasis being placed on a high intake of water, carbohydrates and sports beverages. In addition, there were two assistant coaches outside the playing area to ensure the continuity of the game. The latter was also assigned as timers and referees (i.e., to enforce the rules, for each ball involvement, etc.).

### Statistical analysis

Descriptive statistical variables such as mean and standard deviation were calculated for each position and formation. A preliminary exploratory analysis was carried out followed by a normality (Shapiro-Wilk) and homogeneity test (Levene). A linear mixed-effects model was used to determine position and condition effects. For each response variable, the fixed effects were the condition (POG or SSG) and the position (positional roles). The player was considered to be a random effect. This model makes it possible to calculate the condition and position effect separately, considering an autocorrelation among observations made about the same players (Gelman & Hill, 2007). The model was adjusted using the restricted maximum likelihood method (McGilchrist & Yau, 2007). The results include the table with the estimation of the model's parameters, standard errors and p-values (significant differences were reported at a level of 5%). The processing was performed by R statistical software (Version 4.0.2, R Foundation for Statistical Computing; <https://www.R-project.org>). The report was prepared with the KNITR statistical package (R package version 1.30, <https://yihui.org/knitr/>).

### Results

When both exercises were compared, it could be observed that in seven of the nine studied variables the average values of POG were significantly higher than those of SSG (Table 2). With respect to TD, the POG values were similar to those of match status (96.3 vs. 87.2%), and 10.6% higher than SSG ( $p = .0011$ ; Table 2). The averages of POG in the PL were 7.1% higher than those of SSG (107.5 vs. 100.2%,  $p = .0014$ ; Table 2). With respect to the load rates, those pertaining to HILR as those in HSSL,

the average values in POG were significantly higher than those obtained in SSG ( $p = .0012$ ,  $p = .001$ ), although in both cases they differ notably from the levels belonging to competition (58.8 vs. 37.2% and 20.0 vs. 12.2%, respectively; Table 2). The same occurs in #HILR variable (75.5 vs. 44.3%,  $p = .0011$ ), in #HSSL (116 vs. 14.7%,  $p < .01$ ) and MS (71.6 vs. 64.4%,  $p < .01$ ; Table 2). In contrast, the VHIA variable registered a greater frequency in SSG in comparison to POG (30%,  $p < .01$ ), with percentages relevant to those which were determined in matches (159.5 vs. 131.7%; Table 2). No statistical difference between the two games was determined in the VHID variable (Table 2).

When performances are compared (mean  $\pm$  SD) in relation to the game positions, POG were significantly higher than SSG in almost all the variables and positions ( $p < .05$ ), except the wingers for TD and PL ( $p = \text{NS}$ ; Table 3). This is likewise applied for wide defenders and forwards for the HSSL variable: in these cases, the differences are not of significance (Table 3). The only exception in the variables was VHIA, where the highest values in SSG were determined in comparison to POG ( $p < .05$ ) in almost all game positions, with the exception of the wide defenders ( $p = \text{NS}$ ; Table 3). Yet another exception was the VHID variable, in which no statistical differences were determined for any game position (Table 3).

### Discussion

The foremost aim pertaining to this study was to compare the physical demands between POG and SSG, in order to subsequently describe demands in relation to the player's position during official matches. The analysis of the data obtained in POG showed a higher performance to SSG in seven of the nine studied variables, which are related to the average intensity during activity, such as TD and PL. The performances obtained during POG significantly outstripped those of SSG, arriving at similar levels during the competition and even surpassing it by 7.5%, as in the case of PL. To the best of the author's knowledge, there are only two scientific references which have delved into

**Table 2** Performance values of POG and SSG compared with matches ( $M \pm SD$ )

| Variable     | POG                | SSG             | Match           |
|--------------|--------------------|-----------------|-----------------|
| TD (m/min)   | 105.8 $\pm$ 11.8** | 97.7 $\pm$ 9.4  | 109.8 $\pm$ 8.6 |
| PL (n/min)   | 12.1 $\pm$ 1.3**   | 11.3 $\pm$ 1.6  | 11.3 $\pm$ 1.4  |
| HILR (m/min) | 13.0 $\pm$ 6.0**   | 8.2 $\pm$ 4.5   | 22.1 $\pm$ 5.4  |
| HSSL (m/min) | 1.4 $\pm$ 1.0**    | 0.8 $\pm$ 0.8   | 6.8 $\pm$ 2.3   |
| #HILR (runs) | 1.2 $\pm$ 0.5**    | 0.7 $\pm$ 0.4   | 1.6 $\pm$ 0.3   |
| #HSSL (runs) | 0.5 $\pm$ 0.4**    | 0.1 $\pm$ 0.1   | 0.4 $\pm$ 0.1   |
| VHIA (n/min) | 1.0 $\pm$ 0.3      | 1.3 $\pm$ 0.4## | 0.8 $\pm$ 0.2   |
| VHID (n/min) | 2.4 $\pm$ 0.7      | 2.5 $\pm$ 0.9   | 1.0 $\pm$ 0.3   |
| MS (km/h)    | 20.9 $\pm$ 1.2**   | 18.8 $\pm$ 2.6  | 29.2 $\pm$ 1.3  |

*Note.* POG = possession games; SSG = small-sided games; TD = total distance covered; PL = player-load; HILR = high-intensity load rate; HSSL = high-speed running-sprints load rate; #HILR = number of runs performed in HILR; #HSSL = number of runs performed in HSSL; VHIA = very high-intensity accelerations; VHID = very high-intensity decelerations; MS = maximal speed. \*\* $p < .01$  from POG vs. SSG. ## $p < .01$  from SSG vs. POG.



Table 3 Performance values of POG and SSG compared with matches in relation to the game positions (M ± SD)

| Variable     | Central defenders |          |           |  | Midfielders |          |           |  | Wingers    |            |           |  | Forwards    |          |           |  |
|--------------|-------------------|----------|-----------|--|-------------|----------|-----------|--|------------|------------|-----------|--|-------------|----------|-----------|--|
|              | POG               | SSG      | Match     |  | POG         | SSG      | Match     |  | POG        | SSG        | Match     |  | POG         | SSG      | Match     |  |
| TD (m/min)   | 107.4±6.4*        | 95.4±9.8 | 102.3±4.6 |  | 102.7±6.7*  | 91.1±8.3 | 119.7±5.8 |  | 107.5±16.6 | 102.3±12.3 | 109.8±8.2 |  | 107.0±11.1* | 97.1±8.0 | 101.1±3.3 |  |
| PL (n/min)   | 11.6±1.0*         | 10.5±0.8 | 10.2±0.8  |  | 12.2±1.0*   | 11.4±1.5 | 12.5±0.9  |  | 12.8±1.9   | 13.0±1.7   | 11.4±1.3  |  | 10.7±1.8*   | 9.6±1.0  | 9.2±0.7   |  |
| HILR (m/min) | 11.7±6.0*         | 7.7±3.0  | 15.6±1.5  |  | 12.4±4.9*   | 7.4±4.8  | 26.1±5.0  |  | 16.7±9.8*  | 10.1±6.3   | 25.4±5.4  |  | 13.3±2.7*   | 7.8±5.0  | 20.5±1.6  |  |
| HSSL (m/min) | 1.1±1.1*          | 0.5±0.7  | 3.8±0.5   |  | 1.5±1.0*    | 0.8±0.5  | 7.1±1.4   |  | 2.1±1.5*   | 1.0±0.9    | 9.4±2.2   |  | 1.4±0.4     | 1.3±1.4  | 6.6±1.0   |  |
| #HILR (runs) | 1.1±0.5*          | 0.6±0.4  | 1.2±0.1   |  | 1.2±0.4*    | 0.7±0.4  | 1.9±0.3   |  | 1.6±0.9*   | 0.9±0.5    | 1.9±0.4   |  | 1.2±0.3*    | 0.8±0.6  | 1.6±0.1   |  |
| #HSSL (runs) | 0.4±0.3*          | 0.04±0.1 | 0.3±0.03  |  | 0.7±0.5*    | 0.1±0.04 | 0.5±0.1   |  | 0.4±0.3*   | 0.1±0.1    | 0.6±0.1   |  | 0.4±0.4*    | 0.1±0.1  | 0.4±0.1   |  |
| VHIA (n/min) | 0.9±0.1           | 1.1±0.4† | 0.8±0.1   |  | 1.1±0.2     | 1.4±0.4† | 0.8±0.1   |  | 1.2±0.3    | 1.4±0.1†   | 0.8±0.1   |  | 0.9±0.3     | 1.3±0.9† | 0.6±0.1   |  |
| VHID (n/min) | 2.2±0.7           | 2.3±1.2  | 1.0±0.2   |  | 2.2±0.6     | 2.2±0.9  | 1.0±0.2   |  | 2.6±0.8    | 2.6±0.6    | 1.3±0.2   |  | 2.2±0.1     | 2.5±0.9  | 0.8±0.02  |  |
| MS (km/h)    | 20.2±1.3*         | 18.5±2.5 | 27.9±1.2  |  | 21.0±1.1*   | 18.1±2.0 | 28.7±1.0  |  | 21.6±1.7*  | 19.4±3.1   | 30.7±0.7  |  | 21.5±0.2*   | 19.9±3.8 | 29.5±0.6  |  |

Note. POG = possession games; SSG = small-sided games; TD = total distance covered; PL = player-load; HILR = high-intensity load rate; HSSL = high-speed running-sprints load rate; #HILR = number of runs performed in HILR; #HSSL = number of runs performed in HSSL; VHIA = very high-intensity accelerations; VHID = very high-intensity decelerations; MS = maximal speed. \* $p < .05$  from POG vs. SSG. † $p < .05$  from SSG vs. POG.

the quantification of the mentioned indicators. One of them was developed by Casamichana et al. (2012), where the activity of the players during 3 vs. 3, 5 vs. 5 and 7 vs. 7 was closely monitored, so it could be compared to the values obtained in friendly matches. The value of PL was higher during the SSG, as occurred with other variables like TD (taking into account that the relative area for the three formations was 210 m<sup>2</sup>, 300% larger than the one employed in the present study). In the reference conducted by Gaudino et al. (2014), the authors compared three different POG and SSG formats (one of them being 5 vs. 5, 73–90 m<sup>2</sup> per player), concluding that TD was 4.1% higher in POG than in SSG.

Concerning high-intensity and high-speed/sprint distances covered, the load rates of HILR and HSSL were higher in POG, to a lesser extent for the HSSL. As opposed to this, Gaudino et al. (2014) determined that very high-intensity distance (19.8–25.2 km/h) covered was higher in SSG in relation to POG (no significant difference was found at > 14.4 km/h). This might occur due to a methodological conception when the exercises were developed (Casamichana et al., 2018). With respect to the percentages obtained in relation to the competition, Vilamitjana et al. (2020) compared three POG formats (6 vs. 6, 7 vs. 7, 8 vs. 8) with two match tactics (1-4-2-1-3 and 1-3-4-3) arriving at the following conclusion: in the case of HILR, the values represented a percentage of ~70-75%, while in HSSL the previously mentioned values reached ~38 to 50%. We must take into consideration that the concept used for the building of the POG designs employed for the present study, was similar to the work mentioned earlier (Vilamitjana et al., 2020). Thus, if we compare both results, it is possible to infer that when the number of players on each side is reduced, the high-intensity actions performed decrease in a progressive manner. It should be noted that in studies where SSG formats (5 vs. 5) have been compared in relation to the demands of the competition, significant differences have been determined. This is especially true in regard to actions performed at high-speed patterns (Allen et al., 1998). The mentioned differences were not observed when the SSG were performed with a higher number of players. This might be influenced, in part, by the absolute dimensions of the playing field (Casamichana et al., 2015). In the same way, previous studies have found that the main objective of the task (maintaining ball possession) and the dimensions of the area (< 75 m<sup>2</sup> per player in every case) are variables that reduce the accumulated distance in high-speed (> 19.8 km/h; Casamichana & Castellano, 2010; Castellano et al., 2013). Indeed, one of the main findings of the Gaudino et al. (2014) study was that the distance covered at high-speed was greater in both games (POG and SSG) when the surface per player was increased (10 vs. 10 > 7 vs. 7 > 5 vs. 5).

In regard to the high-intensity accelerations and decelerations, the values in SSG were significantly higher than POG, while in VHID, no statistical difference has been found when comparing both activities. Likewise, other authors have observed a larger number of high-intensity accelerations (> 3.0 m/s<sup>2</sup>) and decelerations (< -3.0 m/s<sup>2</sup>)

in favor of SSG when compared to the POG for the format 5 vs. 5 (Gaudino et al., 2014). In the present study, these variables showed a higher differentiation from matches: 40% more in VHIA and 60% more in VHID. The analysis obtained from a number of studies using POG formats (5 vs. 5 + 2; ~102–135 m<sup>2</sup> per player) ratified the fact that when soccer is played in smaller relative areas than those used for official games, the accelerations and decelerations will be increased significantly (Asian-Clemente et al., 2021).

Maximal speed was another variable with higher levels in POG (7% more than SSG), reaching more than 70% of competition peak values. A different trend was observed by Gaudino et al. (2014) when SSG was higher than POG in every format, being more pronounced in 10 vs. 10 and 7 vs. 7 than in the 5 vs. 5 format (5% different in 5 vs. 5). They concluded that the number of times that players could develop a peak velocity was only 34% of the sprints during matches. Additionally, Asian-Clemente et al. (2021) compared 5 vs. 5 POG formats with matches, obtaining higher MS values (26.2 vs. 19 km/h) as reported by Gaudino et al. (2014), representing the 85.6% with respect to the competition.

When performances relative to game positions were analyzed, significant differences were obtained which favored POG in almost every variable and position, with the exception of the VHIA, where the SSG was higher in almost all positional roles. Likewise, differences in the VHID variable were not significant in all game positions. To the best of our knowledge, there are no previous scientific references which have examined performances in both formations in relation to specific game positions. Nonetheless, there are studies where outcomes have been compared in terms of speeds that exceed 14.4 km/h with different formations of SSG relative to the competition. Although higher values for 6 vs. 6 and 8 vs. 8 have been registered, no significant differences were determined in the format 4 vs. 4 for any position (Lacome et al., 2017).

The main limitation of this study concerns the sample size. In contrast, its strongest aspect was that all the players were from the same team. It remains unclear whether the results obtained would be generalizable to other teams and competitive levels. Additionally, it would be essential that performances in other POG formats such as 6 vs. 6, 7 vs. 7 and 8 vs. 8 be evaluated at a future time which would allow the possibility to compare these with the same SSG formats.

## Conclusions

The most salient finding resulting from this study was that players displayed a higher performance during POG in seven of the nine study variables (TD, PL, HILR, HSSL, #HILR, #HSSL and MS), while SSG showed higher levels in VHIA (no significant difference was obtained in VHID). When comparing performance among playing positions, significantly higher values were observed in POG in the same variables (with some exceptions in some positional roles). Based on the foregoing, POG could be used to

stimulate the physical demands that players are subjected to during competition. Moreover, the conventional SSG could be an exercise which could be practiced with greater intentionality, especially when it comes to stimulating the accelerations that the players perform during a specific execution time. It would be essential to inform coaches and fitness trainers on how POG should be designed in order to increase training specificity by providing them with information for training prescription, according to high-intensity competition demands.

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## Conflict of interest

The authors report no conflict of interest.

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