ANALYSIS OF EXTERNAL LOAD DURING SSG 5VS5 WITH AND WITHOUT EXTERNAL WILDCARD (JOLLY) SOCCER PLAYERS

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Abstract
5vs5 with external jolly shows higher and very significant (p<0.0005) values in the parameter of maximum speed, maximum power, sprint distance; however, 5vs5 without external jolly shows higher and very significant (p <0.0005) values in walking/jogging distance covered, average power in recovery time between power session, the time spent and the distance covered at low intensity power (< 20.00 W/kg). In conclusion, the 5vs5 format with the use of goalkeepers is recommended for those who have been used for at least 60 minutes during the match; however, the 5vs5 format with goalkeepers and external jolly is recommended for those who did not take part in the game or did not play 60 minutes.

Key words: *small-sided games, football, GPS, external load, soccer players.*

Introduction

Trainings with ball on reduced football field and with a reduced number of football players are known as Small- Sided Games (SSG).

These trainings may be carried out in various formats (Owen et al., 2004; Da Silva et al., 2011; Dellal et al., 2011a; Aguiar et al., 2013; Castellano et al., 2013; Halouani et al., 2017; Póvoas et al., 2018; Randers et al., 2018) and with different rules (Hill-Haas et al., 2010; Dellal et al., 2011b; Ngo et al., 2012; Casamichana et al., 2014; Chamorro &Rodríguez Marroyo, 2016; Gómez-Carmona et al., 2018; Aasgaard & Kilding, 2019 in press); with or without goalkeeper (Castellano et al., 2013; Köklüet al., 2015; Chamorro & RodríguezMarroyo, 2016; Sanchez-Sanchez et al., 2017) and encouragement of the technical staff (Rampinini et al., 2007a; Sampaio et al., 2007; Sanchez-Sanchez et al., 2014; Brandes & Elvers, 2017); with a variation of field size (Owen et al., 2004; Casamichana & Castellano, 2010; Aslan, 2013; Castellano et al., 2015; Martone et al., 2017; Casamichana et al., 2018; Pantelic et al., 2019), in continuous or intermittent time (Köklü, 2012; Casamichana et al., 2013; Christopher et al., 2016; Köklüet al., 2017; Clemente, 2018).

SSG are so much used by the technical staff during trainings, because they can train both technical-tactical and physical aspects simultaneously, and for these reasons they are used in young and adult football players both professional and amateur teams (Hill-Hass et al., 2011; Halouani et al., 2014; Sannicandro & Cofano, 2015, 2019) and for the identification of talents (Hill-Hass et al., 2011; Halouani et al., 2014; Sannicandro & Cofano, 2015, 2019).

The SSG can be performed in traditional fields or in fields with barriers best known as "cage" (Sannicandro et al., 2016; Randers et al., 2019 in press).

Several studies published during these years tried to analyse and understand through Global Positioning System instruments best known as GPS (Hill-Hass et al., 2011; Halouani et al., 2014; Sannicandro & Cofano, 2015,2019), internal and external workload aspects. During last years, in fact, these instruments have been validated (Jennings et al., 2010; Johnston et al., 2012; Scott et al., 2016; Hoppe et al., 2018; Linke et al., 2018) and they also have been improved, passing from 1 Hz to the current 18Hz. The most used formats are the one that use from 2 players (1 vs 1) up to 12 players (6 vs 6). As well as being used in numerical equality (Hill-Hass et al., 2011; Halouani et al., 2014; Sannicandro & Cofano, 2015,2019), in many cases, SSG are also used in numerical superiority or inferiority (Hill-Haas et al., 2010; de Siqueira Montalvão et al., 2017) with the use of "*jolly*" players, usually placed within the play area, that support the team with ball possession (Hill-Haas et al., 2010; Campos-Vazquez et al., 2017; Práca et al., 2017; Sanchez-Sanchez et al., 2017; Lacome et al., 2018; Práca et al., 2018; Sanchez-Sanchez et al., 2019), but also with external wildcard players or "external jolly", limited to some formats (Bach Padilha et al., 2017; Castellano et al., 2016; Clemente et al., 2014; Cofano & Traficante, 2018; Sanchez-Sanchez et al., 2017,2018,2019; Sannicandro & Cofano, 2018a,b,c; Sannicandro et al., 2019 in press) . The most used formats are the 10-12 players one, so 5vs5 or 6vs6.

5vs5 is very popular among technical staff trainings, it have been widely analyzed (Barnabé et al., 2016; Casamichana et al., 2018; Christopher et al., 2016; Clemente, 2018; Clemente et al., 2019; Gaudino et al., 2014; Martone et al., 2017; Nevado-Garrosa& Suàrez-Arrones, 2015; Pantelic et al., 2019; Randers et al., 2014,2018; Sannicandro & Cofano, 2017a,b; Sannicandro et al., 2019 in press) by the scientific literature, however we do not know the changed variable of the format when there are external wildcard players or "external jolly".

Literature is questioning about what happens during trainings with external wildcard players in order to have useful information for the placement of this format in SSG weekly or monthly planning.
The purpose of this study is to identify, to analyze and compare the external load produced by 5vs5 format with two goalkeepers and with or without external jolly.

Methods

Participants
18 football players: 10 of them playing in SSG format, 2 goalkeepers (GK) and 6 external jolly players (EJ).

The subject tested through GPS is composed of 10 professional adults players (24,7 ± 3,9 years, 78,4 ± 4,2 kg and 182,9 ± 4,5 cm) that have never had injuries or they have never suspended trainings for at least 6 months. All players were aware of the different formats of SSG, and GPS instruments .

This study was conducted in compliance with the ethical and institutional standards and for human experimentation in accordance with Helsinki Declaration.

Procedure
Football players carried out 5vs5 format with and without external wildcard players (Table 1), in two different sessions, at the same time (4:00 p.m.) and with the same temperature (22°C).

Before starting, players have warmed up for about 15 minutes, they slowly ran at the 60% of FCmax, they also did a mix of running gaits, exercises for joint mobility, and dynamic stretching. After the warm up, players have started SSG trainings in 6 repetition of 3 minutes with a passive recovery period of 1 minute between different repetitions.

During SSG formats, players have been supervised with GPS up to the end of trainings. All trainings have been conducted without the encouragement of the technical staff and public. The GPS was positioned only on the players who performed the 5vs5 and not on the external jolly.

Small-sided games
SSG characteristic's are summarized in table 1. Both trainings of the study have been carried out on a natural grass football field with a dimension of 60x35 metres with two reduced goal (5x2 metres) and the support of n=2 goalkeepers (GK). In 5vs5 with external jolly (5vs5S) have been placed n=6 EJ along the perimeter of the field: n=2 football players near each goal and n=1 player on the side line and balls outside playground (Figure 1,2). SSG lasted 23 minutes (6 repetition of 3 minutes with 1 minute of passive recovery).

SSG have been carried out with the presence of GK and with free touch, with all rules of football except offside. During the execution of SSG there have not been any support and encouragement of technical staff (Rampinini et al., 2007a).

Table 1. Description of different SSG formats used in the survey.

	5vs5	5vs5S
Number of repetitions	6	6
Duration of repetitions (min)	3	3
Duration of recovery (min)	1	1
Field size (m x m)	60 x 35	60 x 35
Relative fieldsize (m2)	1:210	1:210
Goalkeeper	YES	YES
External jolly	NO	YES
Number of external jolly	0	6
Specificplayingrules	NO	NO
Encouragement of technical staff	NO	NO

Measurement parameters

The study has been conducted with GPS instruments at 18,8 Hz (GPEXE® SYSTEM, EXELIO srl, Udine, Italia) recently validated (Hoppe et al., 2018) and it has been supervised the following parameters: total distance covered (m), maximum speed (peak in km/h), maximum power (peak in W/k), maximum acceleration (m/sec2), maximum deceleration (m/sec2), number of high acceleration and high deceleration (≥ 2,50 m/sec2; ≤ - 2,50 m/sec2), the average power during power session (W/kg), the power during recovery between different power session, the total amount of energy consumption (J/Kg) and the equivalent distance covered (m) that it is the distance that the athlete would have traveled with constant speed using the total amount of energy consumption during a training session or in an interval of time.

Furthermore the distance covered in different speed has been analyzed: walking/jogging (speed< 7.30 km/h), low intensity running (speed between 7.3 and 14.50 km/h), moderate intensity running(speed between 14.50 and 19.90 km/h), high intensity running (19.90 and 25.20 km/h) and very high speed running≥ 25.20 km/h best known as "sprint" (Rampinini et al., 2007b; Di Salvo et al., 2013). Also power expressed in different intensity has been analysed. Time spent and distance covered in low intensity power (< 20.00 W/Kg), at high intensity power (20.00 – 55.00 W/Kg) and maximal power (> 55.00 W/Kg) in according to parameter used in literature (Osgnach et al., 2010).

The time spent ≥ 20W/Kg was definited as high metabolic power running (Osgnach et al., 2010).

Data analysis

The data of the study are interpreted with medium values and standard deviation (M±SD). To find out the statistical significance for the different parameters analysed , we used ANOVA for repeated measure.

The statistical analysis was conducted using SPSS 15.0 and significance level fixed at < 0.05.

Results

In table 2 summarizes the data that emerged from the 5vs5 SSG with and without external jolly.

Table 2. Summary of results of the study

	5vs5	**5vs5S**
Total distance covered (m)	2733,7 ± 405 *	2449,7 ± 123,7
Maximum speed (km/h)	24,4 ± 1,4	26,5 ± 0,8 ***
Maximum acceleration (m/s²)	4,14 ± 0,2	4,06 ± 0,2
Maximum deceleration (m/s²)	- 4,55 ± 0,3	- 4,77 ± 0,3
Maximum power (W/kg)	78,4 ± 1,6	90,1 ± 12,4 ***
Acceleration (n°)	12,8 ± 2,7	13 ± 2,9
Deceleration (n°)	17 ± 7,3	14,4 ± 5,3
Total energy (J/Kg)	12723,6 ± 2591,9	11465,8 ± 729,6
Equivalent distance covered (m)	3196,3 ± 503,3 *	2876,5 ± 150,3
Walking/jogging distance (m)	1084,1 ± 114,7 ***	939,2 ± 74,5
Distance covered at low intensity running (m)	1157,2 ± 276,7 *	957,3 ± 81,7
Distance covered at moderate intensity running (m)	401 ± 200,2	414,9 ± 96,9
Distance covered at high intensity running (m)	90,2 ± 64,9	126,5 ± 25,7

Sprint distance (m)	1,2 ± 2,5	11,7 ± 10,8 ***
Average power in power session (W/Kg)	20,1 ± 0,6	20,7 ± 1,3
Average power in recovery time between power session (W/Kg)	5,3 ± 0,8 ***	4,5 ± 0,3
Time spent at low intensity power< 20.00 W/Kg (s)	1300,2 ± 57,8 ***	1170,6 ± 18,7
Distance covered at low intensity power< 20.00 W/Kg (m)	2080,4 ± 182,2 ***	1797,3 ± 57,9
Time spent at high intensity power 20.00-55.00 W/Kg (s)	168,4 ± 55,2	155,2 ± 16,1
Distance covered at high intensity power 20.00-55.00 W/Kg (m)	620 ± 237	600,5 ± 77,3
Time spent at maximal intensity power> 55.00 W/Kg (s)	7 ± 2,9	10,6 ± 3,2 *
Distance covered at maximal intensity power> 55.00 W/Kg (m)	33,4 ± 14	51,9 ± 14,9 **

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.0005$

Discussion

The study had the purpose of comparing the different variables of external load of 5vs5 format that has been studied in two different procedures: with and without external jolly players.

5vs5 format, in the traditional procedures (without EJ) shows higher values statistically significant in the parameter of total distance covered ($p < 0.05$), in equivalent distance ($p < 0.05$), in walking/jogging distance covered ($p < 0.0005$) and in the distance covered at low intensity running ($p < 0.05$). It is possible to say that 5vs5 without EJ mainly produces activity at low intensity, it is also confirmed by the time spent and distance covered at low power intensity. These values are significantly higher ($p < 0.0005$) than 5vs5 with EJ.

About the total distance covered, the values of the two formats of 5vs5 are higher than other study conducted with 5vs5 format with the same working time but different procedure of execution: use of mini goal (Clemente, 2018) rather than goalkeepers and EJ; if we compare it with another study that used 5vs5 with mini goal, we can notice that they are lower: nevertheless the higher total working time has for sure influenced results (Randers et al., 2018).

Significant differences have emerged between the distance covered at moderate and high intensity of running, but both values compared in literature (Randers et al., 2018) are lower than the distance covered at speed between 13 and 19,9 km/h but higher if we observe the distance covered at > 20km/h. In 5vs5 format with EJ, the distance covered in sprint is higher and significant statistically than the traditional variable.

It is highly, probable, that the support of EJ determines a condition of numerical superiority for the team with ball possession and it display the need of sprint actions and high intensity running, even if this last variable does not satisfy the statistical significance. This value is supported by the difference observed in peak speed ($p < 0.0005$) in 5vs5 with EJ.

Values resulted in the two SSG are different from each other. They are higher than what emerged during the other study conducted with young soccer players and without EJ and goalkeepers, in which the peak speed was 18,1 ± 1,4 km/h (Nevado-Garrosa & Suarez-Arrones, 2015) also with adult players that played in 5vs5 format (with 4 different dimensions), with goalkeepers and without EJ (Casamichana et al., 2018).

Peak speed, as well as being higher than studies mentioned above, is also higher in according to a study that analyses the 5vs5 format with ball possession, with goalkeepers and without EJ, and with mini goal without EJ.

We can find these differences in all roles, except for data related to central defenders (24,4 ± 4,68 km/h), in 5vs5 format with goalkeepers and without EJ (Djaoui et al., 2017).

The difference between distance covered in different intensity is confirmed by the power peak parameter ($p < 0.0005$), by the time of exercise ($p < 0.05$) and by the distance covered at maximum power ($p < 0.01$) that are always higher and significant in the format with EJ. As regards high accelerations and high decelerations, the two formats are not so much different for number and peak of acceleration and deceleration.

For this analysis, it could be necessary an additional study that uses higher amount of exercises.

Conclusion

In conclusion, even if the two exercises are to be considered similar, different and significant values have emerged from the study that allow us to recommend the use of the two exercises in the first post-match training session. If the 5vs5 format with the use of goalkeepers is recommended for those who have been used for at least 60 minutes during the match due to the higher and more significant values in terms of low intensity; the 5vs5 format with goalkeepers and external players, in virtue of the higher values in terms of high intensity detected, is recommended for those who did not take part in the game or did not play 60 minutes.

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