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ORIGINAL

SPORT PERFORMANCE EVOLUTION OF FOOTBALL 7-A-SIDE FOR PEOPLE WITH CEREBRAL PALSY: 2012-2016

EVOLUCIÓN DEL RENDIMIENTO DEPORTIVO EN FÚTBOL-7 PARA PERSONAS CON PARÁLISIS CEREBRAL: 2012-2016

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RESUMEN

El objetivo del presente estudio fue analizar los lanzamientos ejecutados durante la competición de Fútbol a 7 para personas con parálisis cerebral de los Juegos Paralímpicos de Londres 2012 y de Río de Janeiro 2016, además de conocer las diferencias entre ambas competiciones. Para ello, se realizó un análisis descriptivo de los 875 lanzamientos ejecutados durante la competición, así como de las diferencias entre las variables planteadas en el estudio entre ambas competiciones. Los resultados evidenciaron la importancia de los lanzamientos en el Fútbol a 7 para personas con Parálisis Cerebral. Se han obtenido diferencias significativas entre las competiciones analizadas en las siguientes variables: *Equipo*, *Partido*, *Clasificación Funcional*, *Zona de lanzamiento*, *Posición*, *Zona corporal*, *Tipo de golpeo*, *Oposición* y *Resultado del lanzamiento*. Se tuvo en cuenta el cambio de reglamento en torno a la clasificación funcional, que provocó cambios significativos en determinadas variables, concluyendo que la mayor implicación ofensiva la tienen los jugadores con menor afectación.

PALABRAS CLAVES: Fútbol-7, parálisis cerebral, competición, indicadores de rendimiento.

ABSTRACT

The aim of the present study was to analyse the shots performed during the football 7-a-side competition for people with cerebral palsy in London 2012 and Rio de Janeiro 2016 Paralympic Games, as well as to determine the differences between both competitions. A descriptive analysis of the 875 shots performed during the competition was carried out, as well as of the differences in the variables proposed in the study, between the two competitions. The results evidenced the importance of shots in football 7-a-side for people with cerebral palsy. Significant differences were detected between the competitions analysed in the following variables: *Team*, *Match*, *Functional class*, *Shooting area*, *Position*, *Body segment*, *Hitting type*, *Opposition* and *Shot outcome*. The rule modification regarding functional classification was considered, which caused significant changes in certain variables. It was concluded that the less severe the players' impairment, the greater their involvement in the offensive play.

KEYWORDS: football 7-a-side, cerebral palsy, competition, performance indicators.

1. INTRODUCTION

Football 7-a-side for people with cerebral palsy or acquired brain injury (Fa7PC) is an invasion sport with a low score, where a higher number of ball possessions (Gamonales, León, Gómez-Carmona, Domínguez-Manzano & Muñoz-Jiménez, 2018a) and the shots performed by players with higher functional capability (Class 8) from the central areas (Gamonales, León,

Jiménez & Muñoz-Jiménez, 2019a) are associated with success in competition. There are some differences from conventional football, such as a lower number of players, different field size and the throw-in, which may be performed with only one hand. These adaptations are necessary due to the athletes' neurological characteristics and activity limitations (Reina, 2014). Besides, this sport modality requires high-intensity efforts (Henríquez et al., 2021).

The presence of research on Fa7PC in literature is recent and scarce (Gamonales et al., 2019a), the topics being very varied. Andrade, Fleury and Silva (2005) brought to light that muscle weakness, strength asymmetries and imbalances between antagonist muscles were risk factors for injuries in Brazilian Paralympic Fa7PC players. Yanci et al. (2014) analysed flight height in vertical jumps with and with no countermovement in Fa7PC players, and concluded that flight time was related to anthropometric variables and functional class. Yanci, Castillo, Iturricastillo, Urbán and Reina (2018) determined players' external load, according to the sport functional class (FC), during the classification tournament for the World Championships of the International Federation of Cerebral Palsy Football. The players with the mildest limitations covered longer distances at high intensity and performed more accelerations, decelerations and changes of direction at high intensity during matches, compared to the rest of the classes.

Besides, Gamonales et al. (2018a) examined the relationship between successful offensive play and both tactical and situation variables in Fa7PC teams. In this line, Gamonales et al. (2019a) determined the performance indicators that influenced the shot at goal in 2012 Paralympic Games. Gorla et al. (2019) conducted a study with Brazilian players focusing on body composition and somatotype variables, and their relationship with functional class. Peña-González, Sarabia, Roldan, Manresa-Rocamora and Moya-Ramón (2021) described the anthropometric and physical profiles of the Spanish team players and compared them with the rest of players from the National Fa7PC League. Lastly, Yanci, Castillo, Iturricastillo and Reina (2019) assessed the match's official external load in Fa7PC players during a classification tournament for the World Championships. The results revealed that players covered shorter distances at high intensity. Consequently, players' physical performance affects competition load (Peña-González, Sarabia, Mancha-Triguero, Mora-Ramón & Gamonales, 2021). Thus, the athletes with milder functional limitations ran the longest distances at high speed and received the highest number of impacts during matches (Gamonales, Muñoz-Jiménez, Gómez-Carmona & Ibáñez, 2021; Reina, Iturricastillo, Castillo, Urbán & Yanci, 2020).

Performance Analysis is a methodology that includes all research analysing competition or training (Hughes & Bartlett, 2008). It consists in the objective collection of behaviours that occur during competition. The ability to analyse them can be of key importance, both in team and individual sports, if players and teams aim to achieve success (Robles, Castellano & Perea, 2014). Its final purpose is to identify strengths that can be enhanced through training and weaknesses that can be improved before the competition. The analysis of performance indicators is recent and emerging, and it has rapidly gained

popularity among sport scientists and practitioners (Drust, 2010). Furthermore, it has its own space within Sport Sciences, featuring elements that make it very easy to apply to training and competition analysis (Gómez-Ruano, 2017). It seeks to predict and prescribe players' and teams' performance based on the competition characteristics, as well as to develop theoretical models for tactical decision-making in team sports (O´Donoghue, 2015; Rein & Memmert, 2016). Therefore, performance indicator analysis can provide very valuable information to help improve performance in invasion sports with a low score.

This type of analysis is applied to different sports for people with disabilities. This is the case of Molik, Kosmol, Mogulec-Adamowicz, Laskin, Jezior and Patrzatek (2009), who analysed game efficiency in wheelchair basketball. Morato, Da Cunha, Gamero, Magalhaes and Almeida (2017) developed and evaluated an observational system for goalball match analysis. In the same line, Morato, Menezes, Fonseca and Da Cunha (2018) examined the influence of ball time, ball trajectory and ball type on the probability of scoring a goal in elite goalball. Furthermore, previous studies on football 5-a-side for the blind or visually impaired (hereafter, Fa5) have analysed the shots at goal performed during 2014 World Championships (Gamonales, Muñoz-Jiménez, León & Ibáñez, 2018b) or 2016 Paralympic Games (Gamonales, Muñoz-Jiménez, León & Ibáñez, 2019b), or have analysed the penalty and double penalty kicks across several competitions (Gamonales, Muñoz-Jiménez, León & Ibáñez, 2018c). These studies allowed for observation of the behaviours that affect sport performance under good quality, reliability, validity and accuracy conditions (Salas & Hernández-Mendo, 2016) and for synchronic or concurrent analysis of a specific game phase (Hileno & Buscá, 2012). They also help sport practitioners understand the profiles of their athletes with disabilities depending on the sport modality (Roldan, Sarabia, Gómez-Marcos & Reina, 2020).

Additionally, performance indicator analysis is also applied to other sport modalities for people without disabilities. There are studies involving performance indicators in conventional football that used the definition of a variable and category system based on game sequence analysis with the aim to analyse France 1998 World Championships (Castellanos, Hernández, Morales & Anguera, 2007). Lago-Ballesteros, Lago-Peña, Rey, Casáis and Domínguez (2012) observed the relationship between the tactical models used and the situation variables on one hand, and successful offence on the other, in elite football. Other studies focused on analysing goals in elite competition (Tenga, Holme, Ronglan & Bahr, 2010a), shots at goal (Casáis, Lago-Peñas, Lago-Ballesteros, Iglesias & Gómez-Ruano, 2011; Ensum, Pollard, & Taylor, 2005; García-Rubio, Gómez-Ruano, Lago-Peñas & Ibáñez 2015), or the starting and ending areas (Hughes & Churchill, 2005; Tenga, Holme, Ronglan & Bahr, 2010b). Similarly, studies have been conducted regarding shots at the basket in basketball (Echeverría, Lapresa, Anguera & Arana, 2011; García-Tormo, Pérez-Manzano, Vaquera & Morante 2015; Ibáñez, Santos & García-Rubio, 2015).

Therefore, the shot was chosen as the action under study, with the aim to understand its relationships and relevance within the game. In order to examine the shot more accurately, several variables, such as shot importance and

outcome, were recorded. Besides, additional variables can be assessed in every shot, allowing for collection of much more accurate information (Ibáñez, Feu, García-Rubio, Parejo & Cañadas, 2009; Gómez-Ruano, 2017). Therefore, bearing all the above in mind, the overall purpose of this research was to determine the contextual factors that would potentially affect the performance of football 7-a-side players, taking the shot outcome as a performance indicator. To do so, the aims of this study were: i) to describe the sport modality of elite Fa7PC, ii) to analyse the shots in Fa7PC during 2012 and 2016 Paralympic Games, and iii) to determine the differences in this playing action between competitions.

2. METHOD

2.1. Design

The present study falls under the category of observational, descriptive, longitudinal, association studies that examine the differences between two or more variables (Ato, López & Benavente, 2013), with the aim to characterise the shot-at-goal action in Fa7PC.

2.2. Sample

All shots performed in 24 Fa7PC matches were recorded: total shots, shots at goal and shots in goal. The matches were randomly selected. More specifically, the shots of 12 matches from London 2012 Paralympic Games (*n*=444) and of 12 matches from Rio 2016 Paralympic Games (*n*=431) were analysed, meaning a total of 875 shots at goal.

2.3. Variables

In this research, situation variables, variables related to the shot execution and an outcome variable were used. The independent variable was the *Type of competition*. Table 1 contains the study variables regarding performance indicators in Fa7PC.

Table 1. Study variables regarding performance indicators in Fa7PC.

Type	Variables	Categories
Independent	Type of competition	Championships
Dependent	Situation	Functional class Moment of the game Shooting area* Playing situation
	Execution	Body segment Hitting type Shooting situation Height of shot Opposition to shot
	Outcome	Shot outcome

* The field diagram used to determine the Shooting area was designed by Gamonales et al. (2019a).

2.4. Procedure

Prior to data collection, a coder was trained with the aim to ensure that all data were valid and reliable. To do so, a procedure similar to those described in the scientific literature was applied. The observer followed a training process and, subsequently, the reliability of the collected data was assessed through two recordings of the same observations on two different days. A statistical procedure adapted from *Kappa coefficient* (Cohen, 1960), called *Multirater Kappa Free* (Randolph, 2005), was followed. It showed the observer's level of agreement. The acceptable value for Kappa coefficient varies depending on the author. A value of 0.70 or above shows appropriate agreement between coders (Gamonales, Muñoz-Jiménez, León & Ibáñez, 2018d). This was the reference measure used to assess the study's reliability. The mean Kappa value for inter-observer reliability was 0.92, or almost perfect, according to Landis and Koch (1977). Subsequently, the observer individually recorded all shots at goal (*n*=875) performed during the matches of both Paralympic Games. Table 2 contains the Kappa values to determine intra-observer reliability for the different variables that were analysed. Ten shots were randomly selected to conduct this test. The second data collection took place one week after the first one.

Table 2. Intra-observer level of agreement.

Variables	%	Free-Marginal Kappa	L.A.
Moment of the game	100	1.00	Almost perfect
Shooting area	90	0.89	Almost perfect
Playing situation	100	1.00	Almost perfect
Body segment	90	0.87	Almost perfect
Hitting type	100	1.00	Almost perfect
Shooting situation	100	1.00	Almost perfect
Height of shot	90	0.85	Almost perfect
Opposition to shot	90	0.80	Almost perfect
Shot outcome	90	0.87	Almost perfect

L.A. Level of agreement according to Landis and Koch (1977).

2.5. Statistical Analysis

A descriptive analysis of all variables was conducted (frequencies and percentages). Since the data were categorical, non-parametric statistics were used in order to examine the differences between competitions, i.e. *Chi-squared* ($\chi 2$) and *Cramer's Phi coefficient* (φc) (Newell, Aitchison & Grant, 2014). The strength of association revealed by φc indicator was interpreted according to Crewson's (2006) proposal. The degree of association between the study's dependent variables (*Situation variables*, *Execution variables* and *Outcome variable*) and the independent variable (*Type of competition*) was calculated through the *Corrected Typified Residuals* (*CTR*) of the contingency tables (Field, 2009).

3. RESULTS

Table 3 shows the differences in the variables selected to characterise shots in Fa7PC, depending on the variable *Type of competition*.

Table 3. Differences in the study variables between competitions.

Variables	Type of competition

	χ2	*df*	*Sig.*		*φc*	*Sig.*	*S.A.*
Functional class	30.959	3	0.000	*	0.188	0.000	Low
Player position	8.714	2	0.013	*	0.100	0.013	Small
Moment of the game	7.089	6	0.313		0.090	0.313	--
Shooting area	25.707	14	0.028	*	0.171	0.028	Low
Playing situation	0.430	2	0.807		0.022	0.807	--
Body segment	9.354	3	0.025	*	0.103	0.025	Low
Hitting type	399.008	7	0.000	*	0.675	0.000	High
Shooting situation	1.405	1	0.236		0.040	0.236	--
Height of shot	0.378	2	0.828		0.021	0.828	--
Opposition to shot	92.364	1	0.000	*	0.325	0.000	Moderate
Shot outcome	19.185	3	0.000	*	0.148	0.000	Low

S.A. Strength of association according to Crewson (2006).

The results of the analysis of the *Situation variables* are shown in Table 4. Players from *Functional class 7* were the ones who performed the highest number of shots at goal in both competitions analysed.

Table 4. Results corresponding to the situation variables in Fa7PC.

Variables	Type of competition					
	2012 Paralympic Games			2016 Paralympic Games		
Functional class	*n*	*%*	*CTR*	*n*	*%*	*CTR*
Functional class 5	15	3.4	-2.0	27	6.3	2.0
Functional class 6	9	2.0	-2.3	21	4.9	2.3
Functional class 7	243	54.7	-3.2	281	65.2	3.2
Functional class 8	177	39.9	5.1	102	23.7	-5.1
Moment of the game	*n*	*%*	*CTR*	*n*	*%*	*CTR*
00:00-09:59	48	10.8	-2.6	73	16.9	2.6
10:00-19:59	75	16.9	0.4	68	15.8	-0.4
20:00-30:00	72	16.2	0.8	61	14.2	-0.8
30:00-39:59	83	18.7	0.4	76	17.6	-0.4
40:00-49:59	64	14.4	0.3	59	13.7	-0.3
50:00-60:00	95	21.4	0.4	87	20.2	-0.4
Overtime	7	1.6	-0.1	7	1.6	0.1
Penalty	-	-	-	-	-	-
Player position	*n*	*%*	*CTR*	*n*	*%*	*CTR*
Forward	130	29.3	2.7	92	21.3	-2.7
Midfielder	199	44.8	-2.5	230	53.4	2.5
Defence	115	25.9	0.2	109	25.3	-0.2
Shooting area	*n*	*%*	*CTR*	*n*	*%*	*CTR*
Area 1	12	2.7	-0.3	13	3	0.3
Area 2	9	2.0	-0.7	12	2.8	0.7
Area 3	8	1.8	-0.8	11	2.6	0.8
Area 4	4	0.9	-1.5	9	2.1	1.5
Area 5	13	2.9	-0.1	13	3	0.1
Area 6	64	14.4	0	62	14.4	0
Area 7	72	16.2	1.2	57	13.2	-1.2
Area 8	12	2.7	-0.3	13	3	0.3
Area 9	4	0.9	-0.4	5	1.2	0.4
Area 10	49	11.0	-2.3	71	16.5	2.3
Area 11	49	11.0	-2	67	15.5	2
Area 12	6	1.4	-0.3	7	1.6	0.3
Area 13	9	2.0	1.3	4	0.9	-1.3
Area 14	123	27.7	2.8	85	19.7	-2.8
Area 15	10	2.3	2.3	2	0.5	-2.3
Shooting situation	*n*	*%*	*CTR*	*n*	*%*	*CTR*
In game	408	91.9	-0.6	401	93.0	0.6
Penalty	1	0.2	0	1	0.2	0

	Free kick	35	7.9	0.7	29	6.7	-0.7

CTR>|1.96|

Table 5 contains the results regarding the *Execution variables*, which refer to the shooting action. Significant differences were detected, in particular, in the variables *Body segment*, *Hitting type* and type of *Opposition*.

Table 5. Results corresponding to the execution variables in Fa7PC.

Variables	Type of competition					
	2012 Paralympic Games			2016 Paralympic Games		
Body segment	*n*	*%*	*CTR*	*n*	*%*	*CTR*
Right foot	251	56.5	2.7	204	47.3	-2.7
Left foot	164	36.9	-2.4	194	45.0	2.4
Head	24	5.4	-1.1	31	7.2	1.1
Other	5	1.1	1.1	2	0.5	-1.1
Hitting type	*n*	*%*	*CTR*	*n*	*%*	*CTR*
Inside of the foot	104	23.4	-15.2	323	74.9	15.2
Outside of the foot	223	50.2	15.5	15	3.5	-15.5
Toe	73	16.4	7.4	8	1.9	-7.4
Instep	12	2.7	-5.4	53	12.3	5.4
Back heel	4	0.9	2.0	9	2.1	-2.0
Front of the head	16	3.6	1.3	21	4.9	-1.3
Side of the head	2	0.5	-4.1	2	0.5	4.1
Other	10	2.3	2.3	323	74.9	-2.3
Shooting situation	*n*	*%*	*CTR*	*n*	*%*	*CTR*
After control	243	54.7	-1.2	253	58.7	1.2
First-time shot	201	45.3	1.2	178	41.3	-1.2
Defence	115	25.9	0.2	109	25.3	-0.2
Height of shot	*n*	*%*	*CTR*	*n*	*%*	*CTR*
Low	209	47.1	-0.4	209	48.5	0.4
Medium height	98	22.1	0.6	88	20.4	-0.6
High	137	30.9	-0.1	134	31.1	0.1
Opposition to shot	*n*	*%*	*CTR*	*n*	*%*	*CTR*
Without opposition	12	2.7	-9.6	108	25.1	9.6
With opposition	432	97.3	9.6	323	74.9	-9.6

CTR>|1.96|

Lastly, the results of the comparative analysis of the *Outcome variable* are displayed in Table 6.

Table 6. Results of the Outcome variable in Fa7PC.

Variables	Type of competition					
	2012 Paralympic Games			2016 Paralympic Games		
Shot outcome	*n*	*%*	*CTR*	*n*	*%*	*CTR*
Goal	63	14.2	2.3	40	9.3	-2.3
On goal (post)	117	26.4	-2.9	153	35.5	2.9
Directly out	147	33.1	-1.4	162	37.6	1.4
Other	117	26.4	3.1	76	17.6	-3.1

CTR>|1.96|

4. DISCUSSION

The purpose of the present study was to compare the shots performed in Fa7PC during 2012 and 2016 Paralympic Games, with the aim to determine the differences between competitions. The main differences were detected in

Functional class, *Player position*, *Shooting area*, *Body segment*, *Hitting type*, *Opposition to shot* and *Shot outcome*. Studies involving the shooting action in different sport modalities for people without disabilities can be found in the scientific literature; in particular, in conventional football (Casáis et al., 2011; Ensum et al., 2005; García-Rubio et al., 2015). Similarly, studies regarding shots in basketball have been conducted (Echeverría et al., 2011; García-Tormo et al., 2015; Ibáñez et al., 2015). Furthermore, there are studies that analysed shooting performance indicators in sports for people with visual impairments, such as elite goalball (Morato et al., 2017; Morato et al., 2018) or Fa5 (Gamonales et al., 2018b; Gamonales et al., 2018c; Gamonales et al., 2019b). With regard to the sport modality under study in this manuscript, documents that analyse the performance indicators in Fa7PC are scarce (Gamonales et al., 2019a; Gamonales et al., 2018a). These studies bring to light the importance of the shooting action, as well as its relevance on the final score. In Fa7PC, the shooting action is a relatively open technical-tactical action, which can be executed in many different ways, regardless of the competition in which it is performed.

As regards the *Situation variables*, differences between championships were found in the variables *Functional class*, *Position* and *Shooting area*. Nevertheless, the shot did not seem to be affected by the variables *Moment of the game* or *Playing situation*.

Differences between competitions were detected in the variable *Functional class*. The probability that *FC8* players performed a higher number of shots at goal in *2012 Paralympic Games* than in *2016 Paralympic Games* was higher than expected. FC8 players are the ones with the greatest mobility on the field. This is consistent with the rule modification implemented during *2016 Paralympic Games*, which reduced the number of *FC8* players allowed simultaneously on the field. This did not only mean that a lower number of shots were performed by *FC8* players during the *2016 Paralympic Games*, but also that the shots at goal were executed by other players, mostly those classified as *FC7*, who are the following in impairment severity. The results of the inferential analysis revealed this change, in agreement with previous results from the literature on Fa7PC, that showed that *FC8* and *FC7* players were the ones who performed the highest number of shots at goal (Gamonales et al., 2018a; Gamonales et al., 2019a). These findings are similar to those obtained from research conducted in other sports for people with disabilities, such as wheelchair basketball (Molik et al., 2009). Consequently, it is advisable that Fa7PC coaches always keep learning and know the rules in depth, with the aim to analyse the training sessions and prepare matches based on the current rules.

With regard to the *Moment of the game*, no significant differences were detected between competitions. Nonetheless, the results revealed higher probability than expected that shots at goal were performed in the interval *00:00-09:59* of the first half in *2016 Paralympic Games* than in *2012 Paralympic Games*. These results differ from previous studies (Gamonales et al., 2019a), as well as from other football modalities for people with disabilities, such as Fa5 for the blind (Gamonales et al., 2018b; Gamonales et al., 2019b), but they do

provide coaches with relevant information. Fa7PC is an invasion sport with a low score and a reduced variety of technical-tactical actions, as a consequence of the players' motor impairment. Thus, those with higher mobility presented greater ball possession in the *Pre-offensive area* (Gamonales et al., 2018b). As a result, *FC8* and *FC7* players performed the shots at goal within the first minutes of the match. This is understandable because these players present the best functional capacities and they usually play the complete match. Fa7PC coaches must design training tasks in which playing situations involving the rest of players (*FC5* and *FC6*) are practised, and that are close to the real game, with the aim to prevent fatigue in players with better functionality.

Association was also detected between *Player position* and *Type of competition*. Forwards presented higher probability of shooting at goal in *2012 Paralympic Games* than in 2016 Paralympic Games. Nevertheless, the probability that a shot was performed by a midfielder was higher in *2012 Paralympic Games* than in *2016 Paralympic Games*. These results are a consequence of the rule modification implemented during the latter Paralympic Games, and are similar to those reported in the previous literature (Gamonales et al., 2019a). Other sport modalities for people with disabilities, like goalball or Fa5, also presented differences in the percentage of shots per match depending on the player's position and role on the field (Morato et al., 2017). The rules prevailing during London Paralympic Games allowed a maximum of two *FC8* players on the field simultaneously, one of them playing as midfielder and the other one as forward. However, during Rio Paralympic Games only one *FC8* player was allowed on the field at the same time and most national teams made them play in the midfield, with the aim to have better control of the match and to be able to finish plays coming from their own side of the field.

With regard to the *Shooting area*, the results revealed differences between the two competitions. During London Paralympic Games, a higher number of shots were performed from areas that were far from the goal, i.e. *Area 14* and *Area 15*. This can be due to the fact that one of the *FC8* players used to play in a more backward position and, therefore, performed long-distance shots, while the other *FC8* player shot from the beginning of the penalty box. By contrast, during Rio 2016 Paralympic Games, since only one *FC8* player was allowed on the field, they usually took the ball to the beginning of the penalty box and shot at goal from *Area 10* or *Area 11*, where the success rate is higher since they are closer to the goal. The results from London 2012 Paralympic Games are similar to those found in the scientific literature regarding Fa7PC (Gamonales et al., 2019b), as well as other sport modalities like floorball (Prieto, Pérez-Tejero & Gómez-Ruano, 2013), basketball (Ibáñez et al., 2009) or Fa5 (Gamonales et al., 2019a; Gamonales et al., 2018b). They proved that the highest success rates corresponded to the shots performed from the areas that were closer to the goal or basket.

No differences were observed between the two competitions with regard to the *Playing situation*. The descriptive results showed a higher number of *In-game shots* and a lower number of *Penalty kicks* and *Free kicks* in both Paralympic Games. Therefore, Fa7PC coaches should design training tasks that address the shots at goal from different field areas with the aim to score a goal, since

Fa7PC characteristics determine the effectiveness of the final action, as it occurs in other cooperative sports, such as floorball (Prieto et al., 2013) or Fa5 (Gamonales et al., 2018b).

As regards the *Execution variables*, differences between the two competitions analysed were detected in the variables *Body segment*, *Hitting type* and *Opposition to shot*. By contrast, the shot did not seem to be affected by the variables *Shooting situation* or *Height of shot*.

The results revealed differences in *Body segment* between the two competitions under analysis. During *2012 Paralympic Games*, the probability of hitting with the *Right foot* was higher than expected, while hitting with the *Left foot* presented higher probability than expected during *2016 Paralympic Games*. Furthermore, an association was identified between the *Hitting type* and the *Type of competition*, revealing differences between competitions. That is, during *2012 Paralympic Games*, players were more likely to hit with the *Outside of the foot* and the *Toe*, while during *2016 Paralympic Games*, the probability was higher that they did it with the *Inside of the foot* and the *Side of the head*. This substantial change may be due to the fact that Fa7PC players have automated and assimilated hitting with both legs, regardless of the spasticity severity and in line with the game evolution, as it happens in other sport modalities (Gamonales et al., 2018b).

No differences were found in the variables *Shooting situation* or *Height of shot* in either of the Paralympic Games analysed. As regards the *Shooting situation*, the descriptive results showed that Fa7PC players hit the ball *After controlling* it and perform *First-time* shots. No differences between competitions were observed in the variable *Height of shot*. Nonetheless, players performed the shots at goal with either *Low* or *High* ball trajectories. This is in keeping with what occurs in other sports for people with disabilities, like goalball, where shot effectiveness depends on the ball height (Morato et al., 2017).

With regard to the variable *Opposition*, differences were found between the competitions analysed. The probability that shots at goal were performed *Without opposition* was higher than expected during *2016 Paralympic Games*, while during *2012 Paralympic Games*, the probability was higher than expected that shots were executed *With opposition*. This change in the way of playing may have been due to the reduction in the number of *FC8* players. This seems logical since players with greater mobility (*FC8*) cover longer distances at high intensity and perform a higher number of accelerations, decelerations and changes of direction at high intensity during an Fa7PC match, compared to the rest of players from other functional classes (Yanci et al., 2018), and they even receive a higher number of impacts (Gamonales et al., 2021; Reina et al., 2020). Thus, athletes' physical performance affects the competition load (Peña-González et al., 2021), so it is necessary to design training sessions adapted to the different functional classes. Moreover, the presence of two *FC8* players during *2012 Paralympic Games* had considerable influence on the opponent's shooting actions, since they are more capable of difficulting the shot for the rest of players.

Lastly, there were differences in the *Shot outcome* depending on the *Type of competition*. There was higher probability than expected that the shot outcome was *Other outcome* or a *Goal* during 2012 Paralympic Games, while during 2016 Paralympic Games, the probability that the shot hit the *Post* was higher than expected. The shot variability is in keeping with the results found in previous scientific literature, in particular in Fa5 (Gamonales et al., 2018b). Besides, shooting from far areas reduced the probability of scoring a goal (Gamonales et al., 2019b) or a basket (Ibáñez et al., 2009; Ibáñez et al., 2015).

5. CONCLUSIONS

Fa7PC is a cooperative sport very similar to conventional football, with a low and tight score, which very often depends on every team's mistakes. Shots are key actions that determine the *Final score*.

A higher number of shots and goals were recorded during London 2012 Paralympic Games than during Rio 2016 Paralympic Games. The rules applied in every competition determined the way of playing, where the players with the best functionality (*FC8*) hit the ball more effectively than the rest of players, as a consequence of their better mobility.

The reduction in shots and goals from one competition to the next one seems to be influenced by the rule modification. During *2012 Paralympic Games*, every team was allowed to have two *FC8* players simultaneously on the field, while during *2016 Paralympic Games*, only one *FC8* player was allowed.

The shots depended on the *Moment of the game*. In both competitions, the descriptive results revealed that teams performed a higher number of shots at goal within the last ten minutes of the match. This may be due to the fatigue accumulated by the players towards the end of the match.

Shots in Fa7PC are generally executed with the *Right foot*, *After control*, at *Low* height, *With opposition*, from *Area 14* and *In-game*, as observed in both competitions. Furthermore, a change in the hitting type from the inside to the outside of the foot was detected between competitions, which may be a consequence of the players' technical improvement, as they are progressively specialising.

This study presents several limitations, the most important one being the lack of previous scientific literature on Fa7PC. By contrast, this fact highlights the innovative nature of the present study. It is a pioneering work that provides novel comparison data between two high-level competitions. We would recommend following steps and strategies similar to those described in the present manuscript, and also applying them to other variables, such as *Situation variables*, *Execution variables* or *Outcome*, depending on the *Type of competition*.

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