Original Research

Analysis of Scored Goals in Cerebral Palsy Football Spanish League

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Abstract: This study aimed to report the goal patterns in cerebral palsy (CP) football according to the time in which goals were scored, the importance of the first goal of the match and the sport class of players who scored the goals, to improve the knowledge of performance in this para-sport. The goals scored by the seven teams of the Spanish National League, during the 21 matches of the 2021/2022 season, were analyzed. The data was collected from the official match reports of the Spanish Federation of CP sports. The results showed a total of 142 goals and an average of 6.8 goals per match. A Pearson's correlation analysis showed moderate correlations between the scored goals by teams, the received goals and the final position in the team ranking ($r = 0.71$ to 0.81; $p = 0.02$ to 0.07). The distribution of the goals scored was not biased by halves (53.5% vs 46.5%; $\chi 2 = 0.5$; $p = 0.50$) nor by 15-min periods (31.0% vs 22.5% vs 26.8% vs 19.7%; $\chi 2 = 2.9$; $p = 0.40$). In the 72.7% of the matches, the team which scored the first goal finally won the match ($\chi 2 = 26.4$; $p < 0.01$). FT3 players scored more goals by player ($\chi 2 = 9.7$; $p = 0.05$). The results from this study improve the knowledge of the goal patterns in CP football and they could be interesting for coaches and CP football professionals to plan their game strategies considering the importance of scoring the first goal of the match and the higher scoring rate of FT3 players.

Keywords: Para-sport, sport performance, performance analysis, disability

1. Introduction

Football for people with cerebral palsy (CP) or acquired brain injury, hereinafter referred to as CP football, is a worldwide practiced para-sport (77 countries) which is practiced at a national and international level. CP football is an adaptation of regular football in which 7 players per team compete on a 70-m x 50-m field with 5-m x 2-m goals. The time of the match (two 30-minute halves), the possibility of performing the throw-in with only one hand and the absence of the offside rule are among the adaptations from regular football established by the International Football Association Board (IFCPF, 2018). CP football

players must have a minimum impairment of hypertonia, athetosis or ataxia to be eligible for this para-sport, and once they are eligible, they receive a sport class according to their activity limitation in the game caused by the eligible impairment (FT1 for severe impact of the impairment on the game, FT2 for moderate impact of the impairment and FT3 for mild impact of the impairment) (Tweedy et al., 2018). This classification process has an impact on the game and on the coaches' decisions as there must be at least one FT1 player on the field during the whole match and the maximum of one FT3 player at all times. This classification has even been related to the talent identification and

coaches' selection decisions as a key factor of anticipated succeed (Dehghansai et al., 2021).

During the last years, there has been an increase of scientific research in the field of sprot performance in CP football (Henríquez et al., 2020; Peña-González et al., 2021; Yanci et al., 2019, 2021), however, the literature regarding the goal performance is scarce at national (Goh et al., 2022; Yanci, 2015) and international levels (Gamonales et al., 2019). The Spanish Federation of Sports for People with Cerebral Palsy or Acquired Brain Injury (FEDPC) is responsible for organizing the Spanish CP Football League, in which seven teams took part in the last edition (2021/22 season). The goal patterns are a key aspect in this sport since this is the main aim in football and the ultimate determinant of succeeding (Kubayi, 2020). Goal patterns have been widely analyzed in regular football (football for able-bodied people), from national leagues to international championships due to their importance for coaches and professionals, showing the scoring rates, the moment in which goals are scored, the probability of winning, drawing or losing the match when a team scores the first goal, the attack strategies or the distance from which the goals are scored, among others (García-Rubio et al., 2017; Kubayi, 2020; Ramos-Pérez et al., 2021; Sarkar & Chakraborty, 2018). However, although there are some references about CP football goal patterns, there remains limited knowledge regarding some questions, such as the importance of the first goal of the match or the probability of scoring according to the sport class, among others, which could give coaches crucial information to plan and to decide the best strategies for a match. For this reason, the aim of this study was to analyze the goal patterns, according to the time in which goals were scored, the importance of the first goal of the match and the sport class of players who scored the goals in Spanish national CP football, to help coaches and professionals of this para-sport to apply better competitive strategies and to increase the knowledge of the game.

2. Materials and Methods

A total of 21 group stage matches were analyzed, corresponding to the total matches of the Spanish National CP Football League. The play-off matches, who were played only by four teams, were excluded for the analysis to compare teams' goal patterns with the same played matches. The official matches reports were obtained from the official FEDPC website (http://www.fedpc/org). Participating teams belonged to seven different Spanish cities or regions: Barcelona, Alicante, Madrid, Valencia, Malaga, Eibar and Extremadura.

Performance variables considered in this study were: 1) the relationship between goals scored and received and the teams ranking in the league; 2) the scored goal frequency according to the two halves, and also according to the four 15-min periods (1'-15', 16'-30' including the added time of the first half; 31'-45', and 46'-60', including the added time of the second half); 3) the winning, drawing and losing probability when a team scored the first goal of the match; and 4) the sport class of the players who scored the goals (FT1, FT2 or FT3).

Statistical Analysis— Data were reported by absolute (n) and relative (%) frequency. The relationships between the teams ranking and their scored and received goals were analyzed by the Pearson's correlation coefficient, and they were interpreted as: <0.10, trivial; 0.10-0.29, small; 0.30-0.49, moderate; 0.50-0.69, high; 0.70-0.89, very high; and 0.90-1.0, almost perfect (Hopkins et al., 2009). The goal distribution by time halves and periods, the probability of winning, drawing or losing the match if a team scored the first goal of the match, and the distribution of goals according to the players' sport class were analyzed with a Krustal-Wallis test with the chi-squared ($\chi 2$) statistic. All the analyses were performed using Microsoft Excel® (Microsoft, Seattle, WA, USA) and SPSS statistics (version 25.0 for Windows; SPSS Inc, Chicago, IL, USA). The statistical significance was set at $p < 0.05$.

3. Results

The results showed that 142 goals were scored with an average of 6.8 goals per

match during the league. Table 1 shows the scoring trend per team throughout the matches during the Spanish CP Football League, detailing the scored goals (SG), the received goals (RG) and the final position in the classification of the league. The analysis of Pearson's correlations showed a high, negative and non-significant correlation (r = - 0.71; p = 0.07) between the SG of teams and their final classification. Similarly, there was a high, positive and significant (r = 0.81; p = 0.02) correlation between the teams' RG and their final classification. A moderate, negative and significant correlation was also found between the SG and RG of the teams in the Spanish CP Football League (r = -0.76; p = 0.04)

Table 1. Scored and received goals by team and final position in the classification of the CP Football Spanish League.

Teams	SG	RG	TR
Disport FC	35	10	1°
Hercules Paralimpico	15	14	2°
Fundación Rayo Vallecano DCA	24	12	3°
Levante UD	24	19	4°
CD AMDDA	20	14	5°
SD Eibar	20	25	6°
Federación Extremeña	4	48	7°

SG: Scored goals; RG: Received goals; TR: Teams ranking

Table 2. Distribution of goals between the first and second halves of matches and between periods of 15-minutes.

Teams	1st Half			2nd Half			TG	χ^2 Halves	χ^2 15-min periods
	Total	1'-15'	16'–30'	Total	30'–45'	46'–60'			
Disport FC	21 (60.0%)	13 (37.1%)	8 (22.9%)	14 (40.0%)	5 (14.3%	9 (25.7%)	35	4.0*	10.6*
Hercules Paralimpico	8 (53.3)	5 (33.3%)	3 (20.0%)	7 (46.7%)	4 (26.7%)	3 (20.0%)	15	240.5	4.9
Fundación Rayo Vallecano DCA	11 (45.8%)	5 (20.8%)	6 (25.0%)	13 (54.2%)	9 (37.5%)	4 (16.7%)	24	0.7	9.7*
Levante UD	13 (54.2%)	8 (33.3%)	5 (20.8%)	11 (45.8%)	5 (20.8%)	6 (25.0%)	24	0.7	4.2
CD AMDDA	11 (55.0%)	6 (30.0%)	5 (25.0%)	9 (45.0%)	6 (30.0%)	3 (15.0%)	20	1.0	14.0*
SD Eiba	11 (55.0%)	6 (30.0%)	5 (25.0%)	9 (45.0%)	7 (35.0%)	2 (10.0%)	20	1.0	14.0*
Federación Extremeña	1 (25.0%)	1 (25.0%)	0 (0.0%)	3 (75.0%)	2 (50.0%)	1 (25.0%)	4	25.0*	50.0*
Total	76 (53.5%)	44 (31.0%)	32 (22.5%)	66 (46.5%)	38 (26.8%)	28 (19.7%)	142	0.5	2.9

TG: Total goals; χ^2: chi-square statistic test. * p < 0.05

Table 3. Number of times the first goal of the match is scored and times the match ends up being won, drew and lost, when the first goal was scored.

Teams	First goal	Win (%)	Draw (%)	Lose (%)	χ^2
Disport FC	5 (83.3%)	5 (100%)	0 (0.0%)	0 (0.0%)	110.5*
Hercules Paralimpico	4 (66.7%)	2 (50.0%)	1 (25.0%)	1 (25.0%)	90.8*
Fundación Rayo Vallecano DCA	4 (66.7%)	4 (100.0%)	0 (0.0%)	0 (0.0%)	110.5*
Levante UD	2 (33.3%)	2 (100.0%)	0 (0.0%)	0 (0.0%)	110.5*
CD AMDDA	3 (50.0%)	1 (33.3%)	0 (0.0%)	2 (66.7%)	17.0*
SD Eibar	3 (50.0%)	2 (66.7%)	0 (0.0%)	1 (33.3%)	17.0*
Federación Extremeña	1 (16.7%)	0 (0.0%)	0 (0.0%)	1 (100.0%)	110.5*
TOTAL	22 (100.0%)	16 (72.7%)	1 (4.5%)	5 (22.8%)	26.4*

χ^2: chi square statistic test. * p < 0.05

Table 4. Distribution of goals according to the athlete's sport class.

Teams	FT1 (%)	FT2 (%)	FT3 (%)	χ^2
Disport FC	11 (31.4%)	12 (34.3%)	11 (31.4%)	60.2*
Hercules Paralimpico	0 (0.0%)	8 (53.3%)	7 (46.7%)	92.3*
Fundación Rayo Vallecano DCA	2 (8.3%)	13 (54.2%)	9 (37.5%)	44.3*
Levante UD	2 (8.33%)	22 (91.7%)	0 (0.0%)	22.5*
CD AMDDA	1 (5.3%)	16 (84.2%)	2 (10.5%)	9.0*
SD Eibar	1 (5.3%)	15 (78.9%)	3 (15.8%)	6.6*
Federación Extremeña	0 (0.0%)	1 (25.0%)	3 (75.0%)	302.1*
Total	17 (12.2%)	87 (62.6%)	35 (25.2%)	9.7*

FT1: Players with severe impact of the impairment; FT2: Players with moderate impact of the impairment; FT3: Players with mild impact of the impairment. χ^2: chi square statistic test. * $p < 0.05$

A total of 76 goals (53.5%) were scored in the first halves of the matches and the remaining 66 goals (46.5%) were scored in the second halves of the matches, showing a non-biased distribution of goals by halves (χ^2 = 0.5; p = 0.50) (Table 2). The distribution of goals was not-biased either by the 15-min periods of the matches (1'-15': 44 goals [31.0%]; 16'-30': 32 goals [22.5%]; 31'-45': 38 goals [26.8%]; 46'-60': 28 goals, [19.7%]; χ^2 = 2.9; p = 0.40).

In addition, in 16 occasions (72.7% of the matches), the team which scored the first goal of the match went on to win the match. In just one occasion (4.5%) the team which scored the first goal finally drew and in 5 occasions (22.8%) the team which scored the first goal finally lost the match (Table 3). The chi-square analysis revealed a biased distribution of the percentage of wins, draws and loses when a team scored the first goal of the match (χ^2 = 26.4; p < 0.01).

Regarding the sport class of the players who scored the goals, FT2 players scored more goals (87 goals [62.6%]) than FT1 (17 goals [12.2%]) and FT3 players (35 goals [25.2%]) (Table 4) but the chi-square analysis showed a biased distribution of goals favoring FT3 players (χ^2 = 9.7; p < 0.05). Three of the 142 goals were own goals.

4. Discussion

The aim of this study was to analyze the goals scored during the Spanish CP Football League for a better understanding of the goal performance in this para-sport and to help coaches and CP football professionals to plan the best strategies to improve their game performance. The main finding of the present investigation revealed that there are differences with regular football in the goal scoring patterns and, compared to Goh et al., (2022) and a non-published study with international data from the CP Football World Cup (Peña-González et al., under review), it seems that PC football at the national level also has its own characteristics compared to international CP football. This means that there are goal patterns that seem to be specific to national CP football championships and which are non-comparable to both regular football and international CP football.

The results from this study revealed an average of 6.8 goals per match (142 goals in 21 matches). This goal ratio seems to be very high if it is compared to regular football, in which an average of 2.6 goals per match in international championships (2018 FIFA World Cup, Russia) (Kubayi, 2020) and 2.5 goals per match in national championships (2022 Spanish football League) have been observed. The comparison of this data with both national and international data from regular football reveals that there are more goals in CP football than in regular football, which may indicate that the rule adaptations such as the smaller size of the field or the absence of the offside rule have an impact on the goal incidence. In addition to this, the rule that forces teams to have at least one FT1 player (with high impact of the impairment on the game) on the field may create high differences in the players' functionality in the game, which could have a high incidence in goals, even more for those teams with the

strategy to line-up the FT1 player as a goalkeeper. The observed goal average per match in this study was very similar than the reported in national Australian CP football championship, in which it was observed an average of 6.0 goals per match (Goh et al., 2022). Similarly, a non-published work (Peña-González et al., under review) has shown 5.6 goals per match during the CP Football World Cup held in Seville in 2019. This data is in line with the idea that there are systematically more goals scored in CP football (both in national and international events) than in regular football.

High correlations were found between the teams' scored (SG) and received goals (RG) and their final position in the league classification (r = -0.709; p = 0.07 and r = 0.807; p = 0.02 for SG and RG, respectively). Although the relationship between SG and the final classification of a team was non-significant, the general results as well as the high correlation between the SG and RG (r = -0.807; p = 0.02) show a clear tendency to finish in a higher position in the final classification of the Spanish CP Football League for teams who score more goals and receive fewer goals. This is in line with previous research in regular football in Spanish leagues, where it has been observed that the best-ranked teams score more goals than the worse-ranked teams (i.e., Spanish first and second divisions, 2017/2018 season) (Raya-González et al., 2020) and that there are high correlations (r > 0.90; p < 0.01) between SG and RG and the final classification in the Spanish first and second divisions, 2013/2014 and 2014/2015 (Castellano, 2018). In CP football, Gamonales-Puerto et al., (2019), showed higher throws from best-ranked teams, which may be related to the results of this study, in which best-ranked teams scored more goals.

The analysis of goals by halves and by 15-min periods revealed non-biased distribution of goals scored in the first and second half of the match (53.5% vs 46.5%; χ2 = 0.5; p = 0.50), and scored in the different 15-min periods of the match (1'-15' [31.0%], 16'-30' including the added time of the first half

[22.5%]; 31'-45' [26.8%], and 46'-60' including the added time of the second half [19.7%]). These results agree with previous literature in CP football, which showed that the 54.9% and 58.9% of goals were scored in the first half (Goh et al., 2022; Yanci, 2015). Similarly to the present study, Goh et al., (2022) showed higher goal rates in the first minutes of each half (1'-15' and 30'-45' periods), but they found statistical differences in comparison to the other periods (Goh et al., 2022). Although in the present study there were not statistical differences by halves and periods, the same tendency in the minutes of scored goals than in the previous literature suggest that physical performance of CP football practitioners should be enhanced to reach the end of the match in better physical conditions and score more goals (Goh et al., 2022; Yanci, 2015). The results from the regular football also agree with our data. Martínez and González-García (2019) studied the moment of the goals in the 2016/2017 season for all the teams of the five best football leagues in Europe and they observed non-statistical differences in goal distribution among halves and six 15-min periods (Martínez & González-García, 2018).

In addition to the moment in which goals are scored, it seems that scoring first is a key factor for success in CP football, in which 72.7% of the times a team scored the first goal, they won the match, while only 4.5% and 22.8% of the times a team scored the first goal they eventually drew or lost the match, respectively. This could be a very interesting finding for coaches and their game strategies as it reveals that in CP football it is very difficult to turn the result around in the game. In line with this result, previous research from regular football observed that scoring the first goal increases the probabilities to finally go on to win the match (Altarriba-Bartés et al., 2020; Ugalde-Ramírez & Rodríguez-Porras, 2021).

One of the main distinctive features of CP football is that players receive a sport class according to the impact of their impairment on their abilities in the game. This classification process is important for the game as teams can line-up only one FT3

player (mild impact of the impairment) while it is mandatory to line-up at least one FT1 player (severe impact of the impairment) during the whole match. The results of this study revealed a higher percentage of goals scored by FT2 players (FT1: 12.2%; FT2: 62.6%; FT3: 25.2%). But given the rules in this sport, the largest number of players on the field are usually FT2 class (Peña-González et al., 2021; Reina et al., 2022). For this reason, a higher percentage of goals by FT2 players is normal but, considering the unbalanced distribution of players in the field (more FT2 players), the chi-square analysis revealed a biased distribution of goals favoring FT3 players ($\chi 2$ = 9.7; p = 0.05). In other words, FT3 players scored more goals in percentage than the percentage of FT3 players who play. This finding is in line with the results of Gamonales-Puerto et al., (2019) in which it was observed that players with less impairment performed more goal actions than players with a higher impact of their impairment, despite not being more effective (Gamonales-Puerto et al., 2019).

This study presents some limitations that should be considered to future research about this topic. First, this study was performed by describing the goal patterns using the data obtained from the official matches reports. These reports do not include some relevant information as the distance from the goal was scored, the kind of attack, the action performed to score the goals, among others. In future research, a video-analysis of goals should be performed to the better understanding of the context of goals, given more information to coaches regarding the goal patterns and thus, regarding the better strategies to carry out to score more goals. In addition to this, and as reported Goh et al., (2022), the normalization of the goals scored by the total opportunities of goal of each team, could provide more information about the goal performance of teams. In future research, this information about goal succeed rates by total attempts could be given to coaches to inform them about the effectiveness of the team, the effectiveness of their attacks, and even the effectiveness of players according to their sport class, and

how this could affect the team's playing strategies.

5. Practical Applications

This study shows novel findings regarding the goal patterns in CP football, which may help coaches and CP football professionals to decide the best strategies to be successful in the game. The results obtained suggest that, although the scoring goal rates by halves and periods did not show statistical differences, the higher percentage of goals in the first half and in the first minutes of each half, suggest that physical performance of players could be limiting an increase of goals in the last minutes of each half due to the fatigue. Coaches and conditioning trainers in CP football may use this information to plan their players' physical development trainings to reach the final minutes of the match with less fatigue. CP football technical staffs could even benefit from the information of this study that revealed that in the 72.7% of the times in which a team score the first goal, this team finally win the match. Given the importance of scoring first to win the match, technical staffs could encourage their teams to score first, increasing the intensity in the first minutes of the match as a game strategy. Finally, FT3 players are the players who score more goals (normalizing the data with the number of FT3 players in the field). This information may be important for coaches to decide the best field position of their FT3 player and to determine their attack strategy.

Conflicts of Interest: The authors declare no conflict of interest.

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