

## Differences in wheelchair basketball game statistics

### *Diferencias en estadísticas de juego en baloncesto en silla de ruedas*

Received November 7, 2025/ Accepted March 2, 2026

DOI: <https://doi.org/10.24310/riccafd.15.1.2026.2026.22566>

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#### ABSTRACT

The study aims to analyze game performance based on player statistics in wheelchair basketball according to sex, functional class, and bonus status. Wheelchair basketball is characterized by high tactical complexity and functional diversity. However, there is limited evidence on how these variables jointly influence performance. This study analyzed data from three national leagues (N = 365 players) over a full competitive season. Descriptive analyses, t-tests, Welch's ANOVA, and multiple linear regression were applied. Male players showed higher values than female players in most performance statistics ( $p < .05$ ), and the regression model explained 90.9% of the variance in player efficiency rating (VAL;  $R^2 = .909$ ;  $p < .001$ ). Performance in wheelchair basketball depends on the interaction between functional, tactical, and contextual factors rather than on functional ability alone. The current bonus system shows limited competitive impact, suggesting the need for structural revision.

**KEY WORDS:** wheelchair basketball, sports performance, functional classification, bonus system.

#### RESUMEN

El estudio tiene como objetivo analizar el rendimiento de juego basando en las estadísticas de los jugadores de baloncesto en silla de ruedas en función de su sexo, clase funcional y situación de bonificación. El baloncesto en silla de ruedas se caracteriza por alta complejidad táctica y diversidad funcional. Sin embargo, existe escasa evidencia sobre cómo las variables afectan conjuntamente el rendimiento. Este estudio analizó datos de tres ligas nacionales (N = 365 jugadores) durante una temporada completa. Se aplicaron análisis

descriptivos, pruebas t, ANOVA de Welch y regresión lineal múltiple. Los hombres mostraron valores superiores a las mujeres en las estadísticas de juego ( $p < .05$ ) y el modelo explicó el 90.9% de la varianza de la valoración ( $R^2 = .909$ ;  $p < .001$ ). El rendimiento depende de la interacción entre factores funcionales, tácticos y contextuales, y el sistema de bonificación requiere revisión estructural.

**PALABRAS CLAVE:** baloncesto en silla de ruedas, rendimiento deportivo, clasificación funcional, bonificación.

## INTRODUCTION

Wheelchair basketball (WB) is one of the most established Paralympic sports at international level, characterized by its tactical complexity, functional diversity and increasing professionalization (1). In Spain, it is a mixed discipline, which allows the joint participation of men and women in national-level championships, under a functional classification system designed to ensure competitive equity on the track (2,3).

The functional rating assigns each player a value between 1.0 and 4.5, with lower scores indicating lower functional ability and vice versa. The sum of the five players on the court cannot exceed a regulatory limit of 14.0 points in international competitions (4) and 14.5 in any Spanish league (5), in addition to the fact that in these leagues, in order to promote the participation and inclusion of underrepresented groups, such as women and new and/or young players, a functional bonus is applied. Specifically, when a female player participates, the total limit allowed for the team on the court increases by 1.5 points, while in the case of new or young players, a reduction of 1 point is applied in their functional class for the purposes of calculating the team (6). For example, a team made up of players with functional classes of 4.5, 3.5, 3.0, 2.0, and 1.5 would reach exactly the maximum allowed (14.5). In such a case, a change of player could be made, taking out of the court for example a player with a functional rating of 1.5, replacing it with a player with up to a rating of up to 3.0. These rules of the points system condition both the tactical composition and the distribution of effort in the game (7). Empirical evidence has shown that players with higher functional class tend to perform significantly better in physical condition variables (8), even more so if the players are from higher leagues (9), as well as in offensive variables (points, converted shots, assists and efficiency) in attack sequences in both men (4.10) and women (11.12) due to their superior core stability and mobility (13.14). Likewise, it has been observed that players in the center position exhibit better quantitative and qualitative results than point guards or small forwards (15).

However, the actual impact of this bonus on individual statistical performance has been poorly researched. It is unknown if the bonus players assume an active role in the game or if their inclusion responds only to tactical-regulatory criteria. In terms of gender, although the regulations promote mixed competition, they have pointed to a higher statistical productivity in male players, partly attributed to their more frequent participation in offensive roles (16).

At the same time, the analysis of performance in RHL has evolved through observational analysis tools and data models that have made it possible to identify key indicators of competitive success, such as shooting efficiency, assists, turnovers and steals (10,17,18), in addition to analyzing the optimization of the composition of the team in play to attempt sporting success (19).

Despite these advances, no studies have been found that jointly address the influence of sex, functional class and bonus on individual performance in real competition. This gap limits the understanding of the impact these factors can have on the distribution of prominence, tactical equity and talent development in sport.

In this context, the present study aims to analyze the playing performance based on the statistics of WB players according to their gender, functional class and bonus situation, using the real data of three national leagues in Spain. The purpose is to identify significant differences in key performance variables, such as valuation, points, rebounds, assists and shooting efficiency, thus providing empirical evidence on the functional and competitive impact of these factors on real play. Based on previous literature, it was suggested that players with higher functional class and greater participation in the game would present higher values in the performance indicators. Likewise, it was expected to find differences according to gender and bonus condition, as well as to identify relevant technical-tactical variables to explain the overall rating of the player.

## **MATERIAL AND METHODS**

This study is part of quantitative research of non-experimental, descriptive and comparative design, with cross-sectional analyses of data obtained from official matches of the Spanish Federation of Sport with Physical Disabilities (20), played in three national RHL leagues during a full season. As data from an official public source were used (20), this study did not require approval by an ethics committee under current regulations. The objective was to analyze the individual statistical performance of the players according to their sex, grouped functional class (high/low), and bonus condition (yes/no), according to the current functional regulations.

### **Participants**

The player data and performance statistics were obtained from reports published on the official website of the Spanish Federation of Sports for Physical Disabilities. Records were collected from all the leagues in Spain. The sample was composed of all the players who had some statistical record on the web, being a total of 365 players belonging to the teams of the three main national leagues. These players are included in level 3 (highly trained/national) of the classification proposed by McKay et al. (21), although there are also Tier 4 (International) athletes. Of the total, 334 were men and 31 women, aged between 15 and 68 years (mean =  $36.72 \pm 11.96$ ). Participants were categorized according to their sex, functional class (grouped into class group (GC), low classes  $\leq 2.5$

and high classes  $\geq 3.0$ ), and bonus (received for being a woman or a novice player, in accordance with current regulations).

The players were not subjected to experimental manipulation. All data was obtained from official records of the matches and was treated on condition of anonymity.

### **Variables and Registers**

16 quantitative performance variables extracted from official statistics were analyzed: VAL: Average player rating; I: Number of ownerships; Min/Pr: Minutes per game; PTS/Pr: Points per game; As/Pr: Assists per game; FRe/Pr: Fouls received per game; Fo/Pr: Offensive fouls per game; RT/Pr: Total rebounds per game; TI/Pr: Shots attempted per game; TC/PR: Shots Made Per Game; TLI/Pr: Free throws attempted per game; TLC/Pr: Free Throws Made Per Game; 2PI/Pr: Two-point shots attempted per game; 2PC/Pr: Two-point shots made per game; 3PI/Pr: Three-point shots attempted per game; 3PC/Pr: Three-point shots made per game. The player rating variable (VAL) is a composite index commonly used in basketball performance analysis to estimate the overall contribution of the player during the game. This indicator integrates different positive and negative actions recorded in the official statistics of the meeting. In the present study, the value of VAL was not calculated by the authors but was obtained directly from official statistics published by the Spanish Federation of Sports for People with Physical Disabilities (FEDDF). This index is used in a standard way in the competitions analyzed and reflects the overall efficiency of the player combining offensive production, defensive contribution and technical actions of the game. Although some of the independent variables (e.g. points, rebounds or shots) are part of the calculation of the valuation index, the objective of the analysis was not to recalculate the valuation index, but to examine the relative contribution of different technical-tactical and contextual indicators to the variability of the overall performance represented by VAL.

In addition, three categorical variables were considered: sex (male 91.5% / female 8.5%), which may be a limitation for the analysis, functional class group (high/low) and bonus (yes/no). Regarding the bonus, an additional variable was created in the database in which the bonus functional classification was calculated by applying the corresponding regulatory adjustments to each player. In this way, 1.5 points were deducted from the real functional classification in the case of female players and 1 point in the case of young players, in accordance with the competition regulations. From this operationalization, a dichotomous variable was generated that distinguished between bonus and non-bonus players, later used in the statistical analyses.

### **Statistical analysis**

All analyses were performed with the Jamovi program (2.6.26) (22) based on an R program, establishing a significance level of  $p < 0.05$  for all tests.

First, a descriptive analysis of the performance variables was carried out, obtaining the means (M), standard deviations (SD) and standard errors (EE). Subsequently, the assumptions of normality were verified using the Shapiro Wilk test, and the homogeneity of variances were verified using the Levene test. These verifications determined the type of inferential contrast to be used in each case.

To analyze the differences between groups, the Welch test was applied, considered more robust against the heterogeneity of variances and unequal sample sizes (23), used to compare the performance variables according to sex (male vs. female) and the bonus condition (bonus vs. non-bonus).

In addition, a multiple linear regression model was developed with the mean rating per game (VAL) as the dependent variable, to identify the main predictors of individual performance (24). The model included technical-tactical variables (shots attempted and converted, assists, rebounds, fouls), structural variables (gender, functional class, bonus) and contextual variables (league, starting role, minutes per game). The assumptions of residue independence (Durbin–Watson), linearity, homoscedasticity, and absence of multicollinearity ( $FIV < 10$ ) were verified (25).

The confidence level adopted was 95%, and all evidence was interpreted considering bilateral significance.

## RESULTS

This section describes the main findings obtained from the analysis of the data corresponding to the three national RHL leagues. First, the descriptive results of the performance variables are presented, followed by inferential comparisons according to gender and bonus condition. Finally, the multiple linear regression model developed to identify the most relevant predictors of the average rating per game (VAL) is presented, as an integrated indicator of individual performance.

The descriptive analysis (Table 1) showed clear differences in performance indicators between sexes, functional classes and leagues. In general, male players and those with higher functional class presented higher values in most of the variables of the performance assessment according to the game statistics.

**Table 1:** Descriptive results

LEAGUE	GC	SEX	N	VAL		I		Min/Pr		PTS/Pr	
				M	SD	M	SD	M	SD	M	SD
1	1	1	46	53,8	± 98,9	8,29	± 7,06	19,1	± 7,9	3,45	± 3,73
		2	8	1,29	± 16	8,57	± 7,85	20,9	± 9,96	1,1	± 1,16
	2	1	81	213	± 167	11,4	± 7,78	23,4	± 10,1	9,45	± 6,04
		2	8	101	± 196	6,38	± 9,74	15,9	± 12,9	4,89	± 6,97
2	1	1	70	39,2	± 62,5	5,12	± 5,59	19,5	± 12,5	3,88	± 4,7
		2	4	28,8	± 68,3	5,25	± 7,27	19,6	± 11,8	1,58	± 2,88
	2	1	47	112	± 122	6,95	± 5,34	22,3	± 11,5	7,63	± 6,35
		2	2	54,5	± 72,8	6,5	± 9,19	19,2	± 16,5	4,45	± 4,03
LEAGUE	GC	SEX	N	VAL		I		Min/Pr		PTS/Pr	
				M	SD	M	SD	M	SD	M	SD
3	1	1	43	29,1	± 68,3	5,08	± 4,37	22,4	± 10,9	4,11	± 5,13
		2	5	1,6	± 5,73	2,2	± 2,49	14,6	± 8,41	0,58	± 0,7
	2	1	47	62,8	± 54,1	5,66	± 3,9	26,1	± 10,1	7,03	± 5,32
		2	4	102	± 119	10	± 5,23	28,7	± 11,4	9,53	± 7,92
LEAGUE	GC	SEX	N	IT/Pr		TC/Pr		TLI/Pr		TLC/Pr	
				M	SD	M	SD	M	SD	M	SD
1	1	1	46	3,21	± 3,34	1,59	± 1,65	0,378	± 0,5	0,18	± 0,28
		2	8	1,1	± 0,86	0,54	± 0,59	0,129	± 0,14	0,04	± 0,05
	2	1	81	8,42	± 5,14	4,14	± 2,56	1,72	± 1,39	0,96	± 0,87
		2	8	4,61	± 5,77	2,19	± 3,05	0,613	± 0,61	0,35	± 0,5
2	1	1	70	4,32	± 4,73	1,75	± 2,12	0,817	± 1,05	0,33	± 0,5
		2	4	1,73	± 2,85	0,77	± 1,42	0,15	± 0,19	0,02	± 0,05
	2	1	47	8,06	± 6,07	3,37	± 2,79	1,77	± 1,3	0,73	± 0,73
		2	2	5	± 3,39	2,2	± 1,98	0,2	± 0,28	0,1	± 0,14
3	1	1	43	4,58	± 5,11	1,88	± 2,33	0,841	± 1,05	0,3	± 0,46
		2	5	1,04	± 0,98	0,26	± 0,34	0,34	± 0,53	0,06	± 0,09
	2	1	47	7,47	± 5,51	3,14	± 2,32	1,75	± 1,57	0,69	± 0,8
		2	4	10,4	± 7	4,35	± 3,6	2,05	± 1,42	0,8	± 0,82
LEAGUE	GC	SEX	N	As/Pr		FR <sub>e</sub> /PR		Fo/Pr		RT/Pr	
				M	SD	M	SD	M	SD	M	SD
1	1	1	46	1,17	± 1,85	0,58	± 0,58	1,32	± 0,59	1,27	± 1,03
		2	8	0,57	± 0,66	0,27	± 0,16	1,29	± 0,49	0,63	± 0,24
	2	1	81	2,45	± 2,17	1,98	± 1,5	1,68	± 0,8	4,25	± 2,72
		2	8	1,32	± 2,26	0,74	± 0,89	0,963	± 0,84	1,9	± 2,24
2	1	1	70	1,14	± 1,19	1,07	± 1,12	1,3	± 0,94	2,23	± 2,22
		2	4	1	± 1,87	0,45	± 0,38	1,05	± 0,62	1,32	± 1,56
	2	1	47	1,97	± 1,9	1,8	± 1,47	1,83	± 0,95	5,37	± 4,38
		2	2	0,95	± 1,06	0,35	± 0,49	1	± 1,41	2,3	± 2,12
3	1	1	43	1,03	± 1,26	1,09	± 1,14	1,54	± 0,99	2,16	± 1,87
		2	5	0,14	± 0,19	0,4	± 0,44	0,74	± 0,71	1,08	± 1,2
	2	1	47	1,31	± 1,14	2	± 1,66	1,83	± 0,93	4,78	± 3,04
		2	4	1,85	± 1,37	2,75	± 1,83	1,47	± 0,61	4,13	± 1,87

LEAGUE	GC	SEX	N	2PI/Pr	2PC/Pr	3PI/Pr	3PC/Pr
1	1	1	46	2,84 ± 2,72	1,49 ± 1,5	0,38 ± 1,06	0,11 ± 0,3
		2	8	1,09 ± 0,87	0,54 ± 0,59	0,03 ± 0,05	0 ± 0
	2	1	81	7,61 ± 4,52	3,9 ± 2,41	0,81 ± 1,19	0,25 ± 0,4
		2	8	4,2 ± 4,83	2,02 ± 2,64	0,42 ± 1,12	0,16 ± 0,46
2	1	1	70	4,1 ± 4,43	1,71 ± 2,06	0,22 ± 0,58	0,05 ± 0,14
		2	4	1,68 ± 2,75	0,75 ± 1,37	0,07 ± 0,15	0,02 ± 0,05
	2	1	47	7,4 ± 5,36	3,21 ± 2,64	0,66 ± 1,07	0,15 ± 0,27
		2	2	5 ± 3,39	2,2 ± 1,98	0 ± 0	0 ± 0
3	1	1	43	4,29 ± 4,79	1,81 ± 2,27	0,29 ± 0,59	0,06 ± 0,19
		2	5	1,04 ± 0,98	0,26 ± 0,34	0 ± 0	0 ± 0
	2	1	47	7,11 ± 5,07	3,09 ± 2,26	0,36 ± 0,59	0,06 ± 0,12
		2	4	10,2 ± 6,74	4,3 ± 3,6	0,32 ± 0,43	0,02 ± 0,05

GC: Functional Class Group; N: Sample number; VAL: Average player rating; I: Number of ownerships; Min/Pr: Minutes per game; PTS/Pr: Points per game; TI/Pr: Shots attempted per game; TC/Pr: Shots Made Per Game; TLI/Pr: Free throws attempted per game; TLC/Pr: Free throws made per game; As/Pr: Assists per game; FRe/Pr: Fouls received per game; Fo/Pr: Offensive fouls per game; RT/Pr: Total rebounds per game; 2PI/Pr: Two-point shots attempted per game; 2PC/Pr: Two-point shots made per game; 3PI/Pr: Three-point shots attempted per game; 3PC/Pr: Three-point shots made per game.

### Results by league and functional class

In league 1, male players of high functional class (Group 2) showed higher average rating ( $213 \pm 167$ ) compared to those of lower class ( $53.8 \pm 98.9$ ). Similarly, the average points per game was higher ( $9.45 \pm 6.04$  vs.  $3.45 \pm 3.73$ ), along with higher production in assists ( $2.45 \pm 2.17$  vs.  $1.17 \pm 1.85$ ) and total rebounds ( $4.25 \pm 2.72$  vs.  $1.27 \pm 1.03$ ).

In league 2, the same pattern was repeated in men, with the highest functional class players having an average rating of  $112 \pm 122$  compared to  $39.2 \pm 62.5$  in the lower class, as well as higher point averages ( $7.63 \pm 6.35$  vs.  $3.88 \pm 4.70$ ) and rebounds ( $5.37 \pm 4.38$  vs.  $2.23 \pm 2.22$ ).

In league 3, high-class players, men also achieved better rating indicators ( $62.8 \pm 54.1$  compared to  $29.1 \pm 68.3$ ), with consistent differences in points, assists and rebounds. These results confirm that performance increases progressively with functional class, regardless of the competitive level.

In the female group, a pattern similar to that described in men was observed, although with lower absolute values in all leagues and functional categories. In general, players in high functional class (Group 2) presented better performance indicators than those in low class (Group 1), evidencing the direct influence of functional capacity on statistical effectiveness.

In league 1, the high-class players obtained an average rating (VAL) of  $101 \pm 196$ , clearly higher than that of the lower-class players ( $1.29 \pm 16.0$ ). They also recorded higher averages of points per game ( $15.9 \pm 12.9$  vs.  $1.10 \pm 1.16$ ), assists ( $4.89 \pm 6.97$  vs.  $0.57 \pm 0.66$ ) and total rebounds ( $1.90 \pm 2.24$  vs.  $0.63 \pm 0.24$ ), confirming a more active offensive and defensive participation among athletes with greater functional capacity.

In league 2, the players in Group 2 also achieved a higher average rating ( $54.5 \pm 72.8$ ) compared to their lower-class teammates ( $28.8 \pm 68.3$ ). This difference was also reflected in points ( $4.45 \pm 4.03$  vs.  $1.58 \pm 2.88$ ), rebounds ( $2.30 \pm 2.12$  vs.  $1.32 \pm 1.56$ ) and assists ( $0.95 \pm 1.06$  vs.  $1.00 \pm 1.87$ ), with a slight tendency to greater efficiency in high-class players.

In league 3, the functional difference was even more marked. The high-class players recorded an average rating of  $102 \pm 119$ , much higher than that of the lower-class players ( $1.60 \pm 5.73$ ). Similarly, the high-class players far outnumbered the lower-class players in points ( $9.53 \pm 7.92$  vs.  $0.58 \pm 0.70$ ), assists ( $1.85 \pm 1.37$  vs.  $0.14 \pm 0.20$ ) and rebounds ( $4.13 \pm 1.87$  vs.  $1.08 \pm 1.20$ ).

These results show that, in all three leagues, the performance of female players improves consistently with the increase in functional class, although the overall average values are still lower than those observed in the male sample.

### **Differences in offensive indicators**

Analyses of pitching variables showed notable differences between sexes and functional classes in the three leagues. In general terms, in both men and women, players in the high functional class (Group 2) performed more offensive actions, with higher shooting volumes and better efficiency, although the absolute values were systematically lower in women.

For men, upper-class players recorded a higher number of shots attempted (TI/Pr =  $8.42 \pm 5.14$ ) and converted (TC/Pr =  $4.14 \pm 2.56$ ) than lower-class players (TI/Pr =  $3.21 \pm 3.34$ ; TC/Pr =  $1.59 \pm 1.65$ ). They also showed superiority in free throws attempted and converted (TLI/Pr =  $1.72 \pm 1.39$ ; TLC/Pr =  $0.96 \pm 0.87$ ) and two-point shots (2PI/Pr =  $7.61 \pm 4.52$ ; 2PC/Pr =  $3.90 \pm 2.41$ ), suggesting greater offensive involvement and a high contribution to collective scoring.

In women, a similar pattern was maintained, although with smaller magnitudes. The high-class players had more shots attempted (IT/Pr =  $4.61 \pm 5.77$ ) and converted shots (TC/Pr =  $2.19 \pm 3.05$ ) than the lower-class players (IT/Pr =  $1.10 \pm 0.86$ ; TC/Pr =  $0.54 \pm 0.59$ ). Similarly, differences were observed in attempted free throws (TLI/Pr =  $0.61 \pm 0.61$  vs.  $0.13 \pm 0.14$ ) and converted (TLC/Pr =  $0.35 \pm 0.50$  vs.  $0.04 \pm 0.05$ ), as well as in two-point shots (2PI/Pr =  $4.20 \pm 4.83$ ; 2PC/Pr =  $2.02 \pm 2.64$  in high class vs.  $1.09 \pm 0.87$ ;  $0.54 \pm 0.59$  in low class).

In both samples, three-point shots were less frequent, but followed the same trend: greater volume and efficiency in players with a higher functional class. In men, attempted (3PI/Pr =  $0.81 \pm 1.19$ ) and converted (3PC/Pr =  $0.25 \pm 0.40$ ) triples were significantly higher than those of women (3PI/Pr =  $0.43 \pm 1.12$ ; 3PC/Pr =  $0.16 \pm 0.46$ ).

### Differences between men and women

A comparison of performance indicators between male (N = 334) and female (N = 31) players was performed in the WB (Table 2). The results showed statistically significant differences in most of the variables analyzed, with men presenting higher values in almost all key game indicators.

**Table 2.** Differences between male and female

	Male (N=334)		Female (N=31)		p	d	Conf. Int.at 95%	
	Media	SD	Media	SD			Bottom	Superior
VAL	92,43	± 128,01	47,03	± 114,88	*	0.373	-0.012	0.726
Min/Pr	21,99	± 10,82	19,82	± 11,53		0.194	-0.169	0.568
PTS/Pr	6,07	± 5,80	3,38	± 5,30	*	0.485	0.097	0.837
	Male (N=334)		Female (N=31)		p	d	Conf. Int.at 95%	
	Media	SD	Media	SD			Bottom	Superior
As/Pr	1,56	± 1,76	0,94	± 1,47	*	0.386	-0.009	0.728
RT/Pr	3,31	± 3,02	1,68	± 1,82	***	0.653	0.183	0.923
IT/PR	6,06	± 5,40	3,56	± 4,89	*	0.484	0.095	0.834
TC/Pr	2,71	± 2,54	1,56	± 2,38	*	0.466	0.084	0.823
TLI/Pr	1,21	± 1,31	0,55	± 0,84	***	0.600	0.147	0.887
TLC/Pr	0,55	± 0,71	0,22	± 0,44	***	0.559	0.107	0.847
2PI/Pr	5,60	± 4,90	3,41	± 4,52	*	0.465	0.080	0.819
2PC/Pr	2,59	± 2,42	1,51	± 2,24	*	0.465	0.081	0.820
3PI/Pr	0,46	± 0,90	0,17	± 0,59	*	0.377	-0.043	0.695
3PC/Pr	0,12	± 0,27	0,05	± 0,23		0.278	-0.106	0.630

VAL: Average player rating; Min/Pr: Minutes played per game; PTS/Pr: Points per game; As/Pr: Assists per game; RT/Pr: Total rebounds per game; TI/Pr: Shots attempted per game; TC/PR: Shots Made Per Game; TLI/Pr: Free throws attempted per game; TLC/Pr: Free Throws Made Per Game; 2PI/Pr: Two-point shots attempted per game; 2PC/Pr: Two-point shots made per game; 3PI/Pr: Three-point shots attempted per game; 3PC/Pr: Three-point shots made per game; SD: Standard deviation; d: d for Cohen; Int de conf: Confidence interval; \*P<0.05; \*\*P<0.01; p<0.001.

Males (N = 334) scored significantly higher on the total assessment (VAL) (M =  $92.43 \pm 128.01$ ) compared to females (N = 31) (M =  $47.03 \pm 114.88$ ; p < .05). This pattern was repeated across most offensive performance variables, including points per game (PTS/Pr) (men: M =  $6.08 \pm 5.80$ ; women: M =  $3.38 \pm 5.30$ ; p = .07), assists per game (As/Pr) (M =  $1.56 \pm 1.76$  vs.  $0.94 \pm 1.47$ ; p < .05), shots attempted (TI/Pr) (M =  $6.06 \pm 5.40$  vs.  $3.56 \pm 4.89$ ; p < .05), and shots made (TC/Pr) (M =  $2.71 \pm 2.54$  vs.  $1.56 \pm 2.38$ ; p < .05).

Likewise, men had a higher number of total rebounds (RT/Pr) ( $M = 3.31 \pm 3.02$  vs.  $1.68 \pm 1.82$ ;  $p < .001$ ), free throws attempted (TLI/Pr) ( $M = 1.21 \pm 1.31$  vs.  $0.55 \pm 0.85$ ;  $p < .001$ ) and converted (TLC/Pr) ( $M = 0.55 \pm 0.71$  vs.  $0.22 \pm 0.44$ ;  $p < .001$ ). Differences were also significant in overall throwing efficiency (TI/Pr) ( $M = 6.59 \pm 5.88$  vs.  $3.81 \pm 5.22$ ;  $p < .01$ ) and two-point shots attempted (2PI/Pr) ( $M = 5.60 \pm 4.90$  vs.  $3.41 \pm 4.52$ ;  $p < .05$ ) and converted (2PC/Pr) ( $M = 2.59 \pm 2.42$  vs.  $1.51 \pm 2.24$ ;  $p < .05$ ).

Regarding outside shot actions, men made more three-pointers attempted (3PI/Pr) ( $M = 0.46 \pm 0.90$  vs.  $0.17 \pm 0.59$ ;  $p < .05$ ), although the difference in three-pointers converted (3PC/Pr) did not reach statistical significance ( $p > .05$ ).

On the contrary, no significant differences were observed in the average playing time (Min/Pr) (men:  $M = 22.00 \pm 10.82$ ; women:  $M = 19.83 \pm 11.53$ ;  $p > .05$ ), which suggests that, although the time on the court was similar, men showed a higher statistical productivity in most of the dimensions evaluated.

### Differences between bonus and non-bonus players

A comparison of performance indicators between bonus players ( $N = 64$ ) and non-bonus players ( $N = 247$ ) was made in the WB (Table 3). The results showed statistically significant differences in most of the variables analyzed, with non-bonus players registering higher values in practically all performance indicators, both offensive and defensive.

**Table 1.** Comparison between non-bonuses and bonuses

	Non-Bonuses (N=247)		Bonuses (N=64)		p	d	Conf. Int.at 95%	
	M	SD	M	SD			Bottom	Superior
VAL	107,39	± 137,43	53,12	± 106,26	***	0.442	0.135	0.689
Min/Pr	22,97	± 10,25	19,11	± 11,90	*	0.348	0.087	0.640
PTS/Pr	6,57	± 5,94	4,16	± 5,16	**	0.434	0.139	0.694
As/Pr	1,71	± 1,85	1,02	± 1,34	***	0.427	0.115	0.668
RT/Pr	3,57	± 3,12	2,13	± 2,16	***	0.537	0.210	0.766
IT/PR	6,49	± 5,49	4,49	± 5,08	**	0.383	0.097	0.650
TC/Pr	2,92	± 2,58	1,91	± 2,30	**	0.413	0.122	0.676
TLI/Pr	1,29	± 1,33	0,81	± 1,10	**	0.392	0.095	0.648
TLC/Pr	0,61	± 0,74	0,30	± 0,52	***	0.473	0.155	0.709
2PI/Pr	5,95	± 4,92	4,27	± 4,68	*	0.349	0.067	0.620
2PC/Pr	2,78	± 2,45	1,86	± 2,21	**	0.393	0.105	0.658
3PI/Pr	0,54	± 1,01	0,23	± 0,57	**	0.381	0.057	0.610
3PC/Pr	0,14	± 0,31	0,05	± 0,17	**	0.384	0.060	0.613

VAL: Average player rating; Min/Pr: Minutes played per game; PTS/Pr: Points per game; As/Pr: Assists per game; RT/Pr: Total rebounds per game; TI/Pr: Shots attempted per game; TC/PR: Shots Made Per Game; TLI/Pr: Free throws attempted per game; TLC/Pr: Free Throws Made Per Game; 2PI/Pr: Two-point shots attempted per game; 2PC/Pr: Two-point shots made per game; 3PI/Pr: Three-point shots attempted per game; 3PC/Pr: Three-point shots made per

game; SD: Standard deviation; d: d for Cohen; Int de conf: Confidence interval; \*P<0.05; \*\*p<0.01; \*\*\*p<0.001.

Non-bonus players had a significantly higher mean rating (VAL) than bonus players ( $M = 107.39 \pm 137.43$  vs.  $53.13 \pm 106.26$ ;  $p < .001$ ), as well as higher average points per game (PTS/Pr) ( $M = 6.57 \pm 5.94$  vs.  $4.16 \pm 5.16$ ;  $p < .01$ ) and minutes played (Min/Pr) ( $p < .05$ ). They also significantly outperformed the bonuses in assists (As/Pr) ( $p < .001$ ), total rebounds (RT/Pr) ( $p < .001$ ), shots attempted and converted (TI/Pr, FG/Pr) ( $p < .01$ ), and three-point shots attempted and converted (3PI/Pr, 3PC/Pr) ( $p < .01$ ). They also made more free throws (TLC/Pr) ( $p < .001$ ) and better results in two-point shots attempted 2PI/Pr ( $p < .05$ ) and converted 2PC/Pr ( $p < .01$ ).

### Multiple Linear Regression Model to Predict Valuation (VAL)

A multiple linear regression model was developed with the aim of identifying the main predictors of the mean rating per game (VAL), considered as an integrated index of individual performance (Table 4). The model included technical-tactical, functional and contextual variables, showing an excellent fit ( $R^2 = 0.909$ ;  $p < .001$ ). The results made it possible to determine which factors contribute significantly to the overall performance of WB players.

**Table 2.** Multiple linear regression for titration prediction

Predictors	B	EE	t	p
(Constant)	21,01	7,18	2,93	**
IT/PR	-82,05	75,07	-1,09	
TC/Pr	-33,43	102,60	-0,33	
FRI/PR	9,66	5,81	1,66	
FO/Pr	-18,00	3,98	-4,53	***
TLI/Pr	-26,35	22,32	-1,18	
TLC/Pr	12,43	35,99	0,35	
MIN/PR	-2,44	0,45	-5,38	***
PTS/Pr	52,12	34,95	1,49	
RT/Pr	13,86	1,52	9,12	***
3PI/Pr	75,32	71,22	1,06	
3PC/Pr	-42,40	92,82	-0,46	
2PI/Pr	60,12	70,29	0,86	
2PC/Pr	-12,13	82,55	-0,15	
SEX (2-1)	-2,80	8,54	-0,33	
LEAGUE (2-1)	-10,10	6,35	-1,59	
LEAGUE (3-1)	-16,85	7,09	-2,38	*
CLASS GROUP (2-1)	6,01	10,50	0,57	
BONUS (2-1)	3,12	10,33	0,30	
I (ownership)	7,57	0,63	11,96	***

TI/Pr: Shots attempted per game; TC/PR: Shots Made Per Game; FRE/Pr: Fouls received per game; FO/Pr: Offensive fouls per game; TLI/Pr: Free throws attempted per game; TLC/Pr: Free Throws Made Per Game; MIN/Pr: Minutes

played per game; PTS/Pr: Points per game; RT/Pr: Total rebounds per game; 3PI/Pr: Three-point shots attempted per game; 3PC/Pr: Three-point shots made per game; 2PI/Pr: Two-point shots attempted per game; 2PC/Pr: Two-point shots made per game; SEX (2–1): Difference between female (2) and male (1); LEAGUE (2–1): Difference between league 2 and league 1; LEAGUE (3–1): Difference between league 3 and league 1; CLASS GROUP (2–1): Difference between high (2) and low (1) functional class groups; BONUS (2–1): Difference between bonus (2) and non-bonus (1) players; I (starts): Number of games started as a starter; B: Non-standardized coefficient; EE: Standard error; t: t-statistic; \*P<0.05; \*\*P<0.01; p<0.001.

The number of incumbents (I) emerged as the most robust and significant predictor (B = 7.57; t = 11.96; p < 0.001). This indicates that, for each game started as a starter, the average rating of the player increases by 7.57 points. This finding suggests that the structural role within the team (starter vs. substitute) decisively determines the exposure to high-impact technical-tactical actions and the accumulation of statistical merits.

Total rebounds per game (RT/Pr) were also positively associated with performance (B = 13.86; t = 9.12; p < 0.001), underlining their relevance as an indicator of physical dominance, anticipation and defensive contribution. On the contrary, offensive fouls (FO/Pr) showed a significant negative relationship with rating (B = –18.00; t = –4.53; p < 0.001), reflecting their penalizing impact on the player's overall efficiency by generating losses of possession or interruptions of offensive flow.

A particularly interesting result was the negative relationship between minutes played per game (MIN/Pr) and rating (B = –2.44; t = –5.38; p < 0.001). This effect suggests that longer exposure time does not always translate into better statistical performance, possibly due to accumulated fatigue or participation in less productive gaming contexts. This phenomenon coincides with recent observations that link sustained competitive load with a decrease in technical efficiency in the final stages of matches.

### **Non-significant predictors**

Other variables classically associated with performance, such as points per game (PTS/Pr), assists (As/Pr) and shooting efficiency (TC/Pr, TLC/Pr, 2PC/Pr, 3PC/Pr), did not reach statistical significance within the multivariate model (p > 0.05). This suggests that, when controlling simultaneously for the effects of participation, volume of play and defensive efficiency, overall performance depends not solely on offensive production, but on a more complex set of tactical and functional indicators.

Similarly, no significant effects were found for the variables sex (p = 0.743), grouped functional class (p = 0.568) or bonus (p = 0.763). These results suggest that the differences observed in the descriptive analyses between men and women or between bonus and non-bonus players are not maintained when controlled for structural factors and game load, which reinforces the interpretation

that efficiency depends fundamentally on the role and participation in the tactical system. rather than structural conditions.

### **Effects of the competitive context**

Regarding the competitive level, the model revealed significant differences between leagues: players belonging to League 3 presented lower average rating values than those of League 1 ( $B = -16.85$ ;  $t = -2.38$ ;  $p = 0.018$ ), while the differences with League 2 were not significant ( $p = 0.113$ ).

## **DISCUSSION**

The present study provides new empirical evidence on the multifactorial determinants of performance in the WB, showing that individual efficiency emerges from the interaction between functional capacity, tactical role, competitive context and physical demands of the game. These findings reinforce the current view that performance in this sport does not depend exclusively on motor ability or classification level, but on a dynamic network of biomechanical, tactical and organizational factors (4,26,27).

### **Determinants of individual performance**

The multiple linear regression model explained more than 90% of the performance index (VAL) variance ( $R^2 = 0.909$ ;  $p < 0.001$ ), showing exceptional fit and strong predictive ability. Among all the variables, the number of starters (I) was the most robust and significant predictor, indicating that the structural role within the team decisively determines exposure to high-impact technical and tactical actions. This result coincides with what was pointed out by Cavedon et al. (19) and Gómez et al. (28), who observed that more stable and functionally balanced alignments favor consistency and collective efficiency.

Total rebounds per game (RT/Pr) also established themselves as a key determinant of performance, reflecting not only physical capacity and propulsive power, but also the player's tactical reading and spatial anticipation (18). In contrast, offensive fouls showed a negative effect on the VAL, suggesting that risky behaviors or decision-making deficiencies tend to penalize the player's overall performance.

A particularly interesting finding was the negative relationship between minutes played per game (MIN/Pr) and average rating. This result should not be interpreted directly as a longer playing time reducing performance, but as an effect conditioned by the rest of the variables included in the model. In other words, once direct production indicators such as points, rebounds, shots or starts have been controlled, a higher volume of minutes is associated with lower relative efficiency. This pattern can be explained, on the one hand, by processes of accumulated fatigue derived from greater competitive exposure, which affect technical precision and propulsion control during the final stages of the match. This result can be explained by phenomena of accumulated fatigue or by prolonged participation in contexts of low offensive efficiency. Previous studies

have documented that neuromuscular and cardiovascular fatigue affects propulsion control and precision in technical gestures (29,30). On the other hand, it is possible that some players with more time on the court assume tactical functions of organization, defensive balance or control of the pace of play that, although fundamental for collective functioning, do not always translate into direct increases in the traditional statistical indicators included in the assessment. Consequently, exposure time does not appear to be a direct indicator of productivity but could be linked to performance through factors such as physical load management and technical efficiency.

A relevant issue is the discrepancy observed between the bivariate analyses and the results of the multivariate model. While variables such as sex or bonus condition showed significant differences in the descriptive analyses, these did not maintain their significance in the regression model. This fact suggests that its influence could be mediated by other variables included in the model, such as playing time, role in the team or technical-tactical indicators. In this sense, multivariate analyses allow the identification of independent effects, showing that some differences observed in simple analyses may be due to confounding factors or indirect relationships between variables.

Taking together, these results suggest the usefulness of composite indicators such as the VAL to assess individual effectiveness in ecologically valid contexts, overcoming the limitations of isolated metrics (points or attendances) that do not capture the interaction between participation volume, effectiveness (31) and functional efficiency (19).

### **Functional Classification, Gender and Bonus System**

Although the statistical model did not show direct effects of sex, functional class or bonus on the rating, the descriptive analyses did show consistent differences in gross performance. The bonus players, due to novelty or gender condition, showed lower values in practically all offensive and defensive performance metrics, despite having structural incentives in the regulations. This pattern reproduces what has been observed in previous research, which has questioned the competitive effectiveness of the bonus system as a tool for real inclusion, even considering the participation of people without disabilities (32).

From a socio-sporting perspective, these differences could reflect dynamics of participation and recognition within mixed teams, where implicit hierarchies of gender and functionality persist (16,26). Therefore, the lower statistical contribution of the bonus players could be due to objective physical limitations as well as to a lower allocation of tactical roles of responsibility or to the differential management of playing time.

Furthermore, although the literature has documented correlations between functional classification and performance indicators, the results of the present study suggest that, when tactical and structural variables are considered simultaneously, these differences are attenuated or disappear. This indicates that functional capacity does not directly determine statistical performance, but that

its effect is mediated by exposure to the game and tactical integration. This interpretation reinforces the need to design training programs that enhance the participation of low-class or bonus players, favoring their real impact on the game beyond normative inclusion (33).

### **Competitive level and contextual differences**

The significant differences found between leagues suggest that competitive levels could be associated with variations in performance patterns. Players from lower-level leagues showed lower average rating values (9), which could be related to differences in tactical structure, game intensity, and functional specialization (2). These results could have implications for the adaptation of physical and technical-tactical preparation models to the specific demands of each competitive context.

### **Methodological and classification implications**

The results obtained offer relevant implications for the current debate between the International RHL Federation (34) and the International Paralympic Committee (IPC) on functional classification criteria versus disability-based models (35). Empirical evidence suggests that variability in performance does not derive exclusively from classification, but from the tactical load and the assigned playing role. Therefore, the integration of objective performance metrics such as game statistics or integrated VAL indices can contribute to the evolution towards more equitable classification systems that are representative of the real functional impact (36).

Finally, the trend identified by Lee and Kim (18), which shows a progressive increase in playing time for high-class players over the last decade, suggests a process of professionalization and functional optimization of WB. In this scenario, inclusion or bonus policies could be analyzed not only in terms of participation, but also in relation to their integration into increasingly sophisticated tactical structures.

Taken together, the results suggest that performance in wheelchair basketball is mainly associated with variables related to participation and role in the game, rather than with structural factors considered in isolation. In the multivariate model, ownership, rebounds and offensive fouls showed significant associations with rating, while gender and bonus did not have independent effects. These findings should be interpreted in terms of association, given the cross-sectional nature of the study, and suggest that the influence of structural factors could be mediated by technical-tactical and contextual variables.

### **LIMITATIONS AND FUTURE PATHS**

This study has some limitations that should be considered when interpreting the results. Firstly, the data come from a single season and from national leagues in Spain, so the conclusions may not be directly generalized to contexts in other nations. Second, although the valuation (VAL) is an integrated

performance indicator, it does not capture qualitative tactical components, such as decision-making, collective interactions, or unquantified defensive impact. For future research, it would be pertinent to extend the analysis to leagues in other countries to check whether the observed patterns are maintained in different competitive and regulatory contexts; incorporate longitudinal data from several seasons in order to evaluate the stability and evolution of performance predictors over time; and to carry out qualitative studies with coaches that allow us to understand the criteria and strategies used in decision-making on the composition of the team, especially in relation to the tactical use of the bonus and the assignment of functional roles.

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