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Articulo Original

Positional Differences in Physical, Maturational, and Performance Characteristics of Recreational Football Players

Características Físicas, de Maduración y Rendimiento Según la Posición en Jugadores de Fútbol Recreativo

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Abstract

Introduction: Youth football presents considerable variation in players' physical and maturational profiles, which may influence their performance and positional assignment on the field. **Aim:** To examine the physical, maturational, and performance characteristics of recreational youth football players across playing positions. **Methodology:** A total of 58 male players aged 12.9 ± 1.62 years participated in the study. Players were grouped according to their playing position (Center-Backs, Full-Backs, Center-Midfielders, Wide-Players, and Forwards). Anthropometric variables (height, body mass, and sitting height) were measured using standardized protocols, and biological maturation was assessed using maturity offset and predicted age at peak height velocity. Performance metrics included squat jump (SJ), countermovement jump (CMJ), and sprint times over 10 and 30 meters. Data were standardized using Z-scores to account for age-related differences, and statistical comparisons were made using ANOVA. **Results:** Center-Backs outperformed other positions in SJ and 30-meter sprint performance. In contrast, no positional differences were identified in CMJ or 10-meter sprint times. **Conclusions:** The findings suggest a maturity-related positional allocation bias, with more physically mature players being assigned to positions such as Center-Backs in recreational soccer.

Keywords: soccer; adolescent; physical performance; growth and development; motor activity

Resumen

Introducción: En el fútbol juvenil se ha observado consistentemente una variabilidad en los perfiles físicos y de maduración de los jugadores, lo cual puede influir en su rendimiento y en la asignación de su posición en el campo. **Objetivo:** Examinar las características físicas, de maduración y de rendimiento de jugadores de fútbol juvenil recreativo según su posición de juego. **Metodología**: Participaron en el estudio 58 jugadores varones con una edad de 12,9 ± 1,62 años. Se agruparon de acuerdo a su posición de juego en defensas centrales, laterales, mediocentros, extremos y delanteros. Se midieron variables antropométricas (estatura, masa corporal y talla sentado) siguiendo protocolos estandarizados, y la maduración biológica se evaluó mediante el maturity offset y la edad predicha en el pico de velocidad de crecimiento. Las variables de rendimiento incluyen el salto en cuclillas (SJ), el salto con contramovimiento (CMJ) y los tiempos de sprint a 10 y 30 metros. Los datos se estandarizaron mediante puntuaciones Z para ajustar las diferencias relacionadas con la edad, y las comparaciones estadísticas entre las posiciones de juego se realizaron mediante ANOVA. **Resultados:** Los defensas centrales superaron al resto de posiciones en el SJ y en la prueba de sprint de 30 metros. En cambio, no se detectaron diferencias

posicionales en el CMJ ni en los tiempos de sprint a 10 metros. **Conclusiones:** Los hallazgos sugieren un sesgo en la asignación posicional vinculado al estado de maduración, de manera que los jugadores con mayor desarrollo físico tienden a desempeñarse como defensas centrales, incluso desde etapas de fútbol recreativo.

Palabras clave: fútbol; adolescente; rendimiento físico; crecimiento y desarrollo; actividad motora

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Introduction

The specialization of roles across playing positions in soccer, leads to distinct physical attributes among players. Studies on professional adults and elite-level youth players have demonstrated that Goalkeepers (GK) and Center Backs (CB) are systematically taller and heavier than their teammates in other positions (Sporiš, G. et al., 2009). This specialization is driven by the specific demands of each role. For instance, goalkeepers benefit from height and reach for covering the goal, while center backs utilize their size and strength for aerial duels and defensive plays.

In young elite soccer players, it has also been reported that GK and CB are taller and heavier, and notably more advanced in maturity status compared to players in other positions (Towlson, C., et al., 2017). Beyond body size, a more advanced maturation is associated with greater physical performance, such as explosive strength in the lower limb muscles (Yapıcı, H., et al., 2022), which is a determinant factor in soccer (Xu, Z., 2023). These physical and performance attributes may influence coaches' decisions when assigning players to specific positions.

However, if in the earliest stages of sport formation, players are allocated to a determined position considering only their physique, regardless of their biological maturation and other skills that justify their assignment in that specific position, the long-term sport development of the players could be limited (Towlson et al., 2019).

Maturity status varies greatly, and physical differences in youth may be transitory (Malina, R. M. et al., 2004); players who, at a given moment, present superior physical attributes associated with an early maturity status may not maintain their relative advantages as their peers catch up later (Meylan, C. et al., 2010).

Although the relationship between maturity status and positional allocation has been well-documented in elite youth players (Towlson et al., 2019; Altmann, S. et al., 2021), there is limited data available regarding

recreational soccer. Therefore, the present study aimed to compare the physical, maturational, and performance characteristics of recreational football players by playing position.

Methods

Participants

A total of 58 soccer players, aged 12.9 ± 1.62 years, from the municipal soccer league of Cajeme, Sonora, Mexico, participated in the study. The sample included players from the following age categories: U-11 (n=8), U-12 (n=14), U-13 (n=14), U-14 (n=5), U-15 (n=11), and U-16 (n=9).

The teams to which the players belonged trained twice a week and played one match per week. None of the players were part of any selection team or trained at a competitive level.

Soccer players were grouped according to their playing position in Center-Backs (n=9), Full-Backs (n=9), Center-Midfielders (n=15), Wide-Players (n=14), and Forwards (n=11).

All participants, at the moment of the study, had attained at least one year of uninterrupted formal training in their respective club. Soccer players were informed about the procedures of the study and, if they agreed to participate, signed an information letter. Parents and coaches were present during the explanation session. Once soccer players accepted to participate, parents or legal tutors-guardians, if they agree, signed a consent letter where the objectives, procedures, potential risks, and benefits of the study were clearly explained. The procedures of the present study were followed according to the Helsinki declaration.

Players that presented an injury that prevented normal participation in training or matches at the moment of the study were excluded. Owing to low representation in the sample, goalkeepers were not considered in the present study.

Anthropometric variables

Height, Body Mass, and Sitting Height were measured using standardized protocols. Height was assessed with a portable stadiometer (SECA 213, Hanover, MD, USA) with an accuracy of 0.1 cm; players standing barefoot, heels together, and heads in the Frankfurt plane. Body mass was recorded using a calibrated digital scale (SECA 770, Hanover, MD, USA) with an accuracy of 0.1 kg, with players weighed barefoot and in light clothing. Sitting height was also measured with the SECA 213 stadiometer, following the same protocol as standing height; players sat with their backs straight and feet flat on the ground, and measurements were taken from the surface of the anthropometric bench to the top of the head.

Maturation

Maturity offset (MO) and Predicted Age at Peak Height Velocity (PHV) were considered to assess the biological maturation status of soccer players. The method proposed by Mirwald et al. (2002) was employed to calculate MO. This approach uses sex-specific regression equations that incorporate three key anthropometric variables (height, sitting height, and leg length), chronological age (CA), and the interaction between these dimensions and CA.

Anthropometric measurements were taken once and applied to the corresponding equations to determine each player's MO. The Predicted Age at PHV was then calculated as:

Predicted Age at PHV= Chronological Age (CA) –Maturity Offset (MO)

Performance tests

Vertical jumps (SJ and CMJ) and Speed over 10 and 30 meters were assessed using standardized protocols (Bosco et al., 1983). The Squat Jump (SJ) and Countermovement Jump (CMJ) were measured with an AXON JUMP C contact platform (AXON Sports, Argentina). For the SJ, players started statically with hands on their hips, while the CMJ involved a rapid downward movement before jumping. Two attempts were allowed for each jump, with 60-second rests, and the best height was recorded to the nearest 0.1 cm. Speed was evaluated using MICROGATE – KIT WITTY Sportmaster photoelectric cells (Microgate, Italy), with players sprinting from a static position. Two attempts were allowed for 10 and 30 meters, with 2-minute rests, and the best time for each distance was recorded to the nearest 0.01 seconds.

Análisis de datos

Al examinar los datos cualitativos derivados de las entrevistas semiestructuradas, se empleó el software ATLAS.ti, que mejoró la organización, la codificación y la interpretación de las narrativas proporcionadas por los participantes. Se implementó una metodología de codificación abierta, que permitió identificar las categorías emergentes que se alinean con los objetivos de la investigación. Posteriormente, se utilizó la codificación axial para delinear las relaciones entre las categorías lo que facilitó una comprensión más profunda de las experiencias articuladas por los participantes (Herbest et al., 2024). Este marco analítico promovió la detección de patrones, similitudes y discrepancias en las experiencias relacionadas con la adquisición de la LSM, lo que arrojó pruebas sustanciales para la interpretación de los resultados de la investigación.

Statistical analysis

Descriptive statistics was performed to obtain means and standard deviations of the anthropometric, maturation and performance variables from the total sample and for each playing position group.

For all variables (anthropometric, maturation, and performance), the Z-score of each individual was calculated based on their age category. This standardization enabled comparisons between playing position groups composed of players from different age categories.

The Z-score was calculated using the formula:

$$Z = Xi - X_{age}/SD_{age}$$

In this equation, Xi represents the observed value of the variable for an individual within the study. The term X_{age} refers to the mean value of the variable for the individual's specific age category, calculated across all participants in that group. Similarly, SD_{age} corresponds to the standard deviation of the variable for the same age category.

The normality of the data was assessed using the Shapiro-Wilk test, and the homogeneity of variances was evaluated with Levene's test. After confirming that the data followed a parametric distribution, an ANOVA was conducted to compare the anthropometric, maturation, and performance variables among playing position groups.

All statistical analyses were performed using IBM SPSS Statistics software (version 22).

Results

Descriptive statistics for the total sample are presented in **Table 1**, including age, APHV, MO, height, body mass, and physical performance outcomes. The average age was 12.93 years, with an APHV of 14.58 years and a maturity offset of -1.65 years. Participants' mean height was 155.4 cm, and their average body mass was 45.87 kg. The mean of squat jump and countermovement jump were 29.41 cm and 30.55 cm, respectively, while sprint times for the 10 m and 30 m distances were 2.01 and 5.02 seconds.

Table 1

Anthropometric Characteristics, Maturity Indicators, and Physical Performance of the Total Sample (n=58)

	Ẋ	±	SD	Min	Max
Age (yr)	12.93	±	1.62	10.12	15.96
APHV (yr)	14.58	±	0.58	13.12	15.83
MO	-1.65	±	1.36	-3.81	0.92
Height (cm)	155.4	±	10.84	136.50	172.40
Body Mass (kg)	45.87	±	10.72	28.00	75.60
SJ (cm)	29.41	±	5.62	18.80	45.30
CMJ (cm)	30.55	±	5.72	18.80	47.70
Sprint 10m (sec)	2.01	±	0.14	1.60	2.34
Sprint 30m (sec)	5.02	±	0.42	3.31	5.98

APHV: Age at peak height velocity, MO:Maturity Offset, SJ: Squat Jump, CMJ Countermovement Jump, Vel.: Velocity, yr: year, cm: centimeters, kg: kilograms

Significant differences in APHV and maturity offset across player positions are shown in **Table 2**. ANOVA revealed significant differences in APHV ($F = 3.04$, $p = 0.02$), with center-backs exhibiting the earliest APHV.

Table 2

Mean, and Standard Deviation, of Age, APHV and Maturity Offset and Z Scores of APHV by Player Position

	Center-Backs (CB) (n=9)				Full-Backs (FB) (n=9)				Center-Midfielders (CM) (n=15)				Wide-Players (WP) (n=14)				Forwards (FW) (n=11)				ANOVA	
	Ẋ	±	SD	Z score	Ẋ	±	SD	Z score	Ẋ	±	SD	Z score	Ẋ	±	SD	Z score	Ẋ	±	SD	Z score	F	Sig.
Age (yr)	12.76	±	1.69		12.64	±	1.94		12.81	±	1.42		13.11	±	1.90		13.24	±	1.38			
APHV (yr)	14.09[a]*	±	0.53	-0.75	14.32	±	0.70	-0.45	14.82	±	0.54	0.39	14.62	±	0.40	0.24	14.83	±	0.51	0.29	3.04	0.02
MO	-1.33	±	1.42		-1.67	±	1.52		-2.01	±	1.22		-1.51	±	1.57		-1.58	±	1.24			

APHV: Age at peak height velocity, MO: Maturity Offset, yr: year.
[a]: CB < FB, CM, WP, FWD.
*: p<0.05.

As summarized in **Table 3**, significant differences in anthropometric characteristics were observed by player position. Significant differences were found in height (F = 7.199, p = 0.00) and body mass (F = 6.187, p = 0.00), with center-backs being taller and heavier than players in other positions. BMI also differed significantly across positions (F = 2.528, p = 0.05), with center-backs having the highest BMI.

Table 3

Mean, Standard Deviation, Z Scores, and ANOVA of Anthropometric Variables by Player Position

	Center-Backs (CB) (n=9)				Full-Backs (FB) (n=9)				Center-Midfielders (CM) (n=15)				Wide-Players (WP) (n=14)				Forwards (FW) (n=11)				ANO	
	□	±	SD	Z score	□	±	SD	Z score	□	±	SD	Z score	□	±	SD	Z score	□	±	SD	Z score	F	
Height (cm)	162.45 [a]***	±	9.06	1.28	156.35	±	12.4	0.10	151.07	±	8.36	-0.55	154.93	±	12.30	-0.30	155.38	±	10.61	-0.13	7.199	
Body Mass (kg)	54.93 [a]***	±	13.56	1.23	45.54	±	10.83	0.04	42.58	±	9.76	-0.35	44.27	±	8.96	-0.36	45.29	±	9.03	-0.28	6.187	
Body Mass Index	20.53 [a]*	±	3.43	0.89	18.36	±	2.29	0.05	18.44	±	2.70	-0.12	18.29	±	2.20	-0.32	18.59	±	1.95	-0.18	2.528	

cm: centimeters, kg: kilograms
[a]: CB > FB, CM, WP, FWD
*: p<0.05; **p<0.01; ***p<0.001

Physical performance measures across the player positions are presented in **Table 4**. ANOVA revealed significant differences in countermovement jump (CMJ) ($F = 3.105$, $p = 0.02$) and 30 m sprint time ($F = 3.107$, $p = 0.02$). For CMJ, forwards showed the highest performance (31.90 ± 4.74 cm), while wide-players had the lowest (28.09 ± 3.18 cm). The fastest 30 m sprint times were recorded by forwards (4.84 ± 0.57 sec), while center-backs had the slowest times (5.05 ± 0.54 sec). No significant differences were found for 10 m sprint time.

Table 4

Mean, Standard Deviation, Z Scores, and ANOVA of Physical Performance Variables by Player Position

	Center-Backs (CB) (n=9)				Full-Backs (FB) (n=9)				Center-Midfielders(CM) (n=15)				Wide-Players (WP) (n=14)				Forwards (FW) (n=11)				ANOVA	
	Ẋ	±	SD	Z score	Ẋ	±	SD	Z score	Ẋ	±	SD	Z score	Ẋ	±	SD	Z score	Ẋ	±	SD	Z score	F	Sig.
SJ (cm)	33.5 [a]***	±	5.31	0.98	27.80	±	9.08	-0.34	27.50	±	3.40	-0.46	29.01	±	4.03	-0-06	30.23	±	5.19	0.07	3.823	0.00
CMJ (cm)	34.13 [b]**	±	6.32	0.83	28.85	±	9.21	-0.37	28.09	±	3.18	-0.50	30.58	±	3.93	0.05	31.90	±	4.74	0.16	3.105	0.02
Sprint 10m (sec)	1.99	±	0.17	-0.49	2.08	±	0.12	0.50	2.03	±	0.13	0.16	1.95	±	0.13	-0.58	2.05	±	0.17	0.32	2.077	0.10
Sprint 30m (sec)	5.05 [a]*	±	0.54	-0.71	4.95	±	0.38	-0.08	5.14	±	0.25	0.40	4.84	±	0.57	-0.27	5.12	±	0.26	0.52	3.107	0.02

cm: centimeters, sec: seconds

[a]: CB > FB, CM, WP, FWD; [b]: CB > FB, CM, WP.

*: $p<0.05$; **$p<0.01$; ***$p<0.001$

Discussion

The aim of the present study was to examine the physical, maturational, and performance characteristics of recreational football players across positions. Results confirmed a bias in position allocation with Center-Backs (CB) exhibiting larger body size and superior lower-limb muscle power, which were associated with an earlier maturity status compared to Full-Backs (FB), Center-Midfielders (CM), Wide-Players (WP), and Forwards (FW).

In the present study, CB were taller and heavier than players in other positions (see Table 3). This physical distinction gives them an advantage in scenarios requiring strength and physical presence, both of which are essential for a defensive role (Sporiš, G., et al., 2009).

Adolescence is characterized by considerable variation in the timing and rate of maturation, leading to pronounced differences in physique based on maturity status (Malina RM, et al., 2015; Towlson, C., et al., 2018). In line with this variability, a study on elite soccer players (n=465) from U13 to U18

analyzed the impact of relative age, anthropometry, maturation, and physical fitness on playing positions. The study found that Central Defenders and Goalkeepers were taller and heavier than players in other positions at all category groups. Additionally, at U13–14, they exhibited advanced maturation (Towlson, C. et al., 2017). In the referenced study, the larger body size associated with advanced maturity may have influenced the assignment to defensive positions. Similarly, our results showed that CB tended to be more physically mature than players in other positions (see table 2). This suggests that maturity status may influence position allocation, regardless of competition level.

Player positioning in soccer is often influenced by a coach's perspective rather than a standardized, systematic approach (Alarcón Rodrigo, J., 2018). A well-considered allocation of positions, however, can enhance player development by exposing them to different roles and responsibilities, fostering a more comprehensive skill set and improving overall performance (González-Ródenas et al., 2024). In the present study, it is possible that CB were assigned to this position by a coach or coaches who recognized only their physical advantage. While physical attributes are important in defense, an optimal selection process would also consider essential technical and tactical skills such as anticipation, field vision, passing precision, and leadership (Oneda et al., 2022; Clemente et al., 2022; Pfeiffer et al., 2025; Vidigal et al., 2022).

Furthermore, allocating players with a larger physique in defensive roles, specifically as center-backs, without considering their maturation status can have long-term drawbacks. The advantages provided by their advanced maturation status (such as greater body size, higher speed, and explosive strength) may be temporary, as their less mature counterparts could eventually catch up in terms of biological maturation.

CBs showed significantly higher Z-scores than other position players in the Squat Jump (SJ), but in the Countermovement Jump (CMJ), they only surpassed CM and FB. These discrepancies likely exist in part due to the specific characteristics of each Jump (Pazar, 2012). The SJ tests direct concentric force production from a static position, thereby emphasizing lower-limb strength and excluding the assistance of elastic energy (Almutairi & Singh, 2022). The CMJ uses the stretch-shortening cycle as the mode of contraction to help with the elastic energy of a muscle and enhance its efficiency (Santos et al., 2024). Possibly, the greater height, and the greater muscle mass associated with the more advanced maturity status of the CB, contributes to generate absolute strength which better relates to performances in SJ; by contrast, in CMJ, the coordination and the effective use of elastic energy seem to downplay positional differences.

The differing tactical demands of forwards, midfielders, and central defenders may partially explain the SJ and CMJ results. FW and midfield players frequently engage in dynamic movements, rapid changes of direction, and precise ball control, all of which contribute to neuromuscular coordination

(Alanen et al., 2023; Gee et al., 2020; Rouissi et al., 2018). This enhanced coordination may provide an advantage in the CMJ, where performance depends on the efficient synchronization of muscle contractions and elastic energy utilization. However, further research is required to directly assess neuromuscular coordination differences across playing positions and their impact on jump performance.

It is not surprising that CB in the present study outperformed other positions in the 30-meter sprint test (see Z score in table 4), as sprint performance is well-documented to be significantly influenced by maturity status, with early-maturing athletes achieving superior results (Lehnert, M., et al., 2024). Similar to the SJ, greater body size and muscle mass likely contribute positively to sprint performance (Sudlow et al., 2024). On the other hand, no significant differences were found in the 10-meter sprint test among positions (see table 4). This test may not be sensitive enough to detect differences between players at this recreational level of competition. Similarly, when young elite soccer players are compared to sub-elite players, differences in this test are minimal, favoring the former (Haugen et al., 2014).

An appropriate playing position allocation may have implications beyond the sport performance. Continuity in sport participation depends on various factors, one of the most significant being how individuals perceive their own abilities and progress (Santos, L., et al., 2011). A proper position assignment allows players to maximize their strengths and feel more capable within their role which can enhance their long-term engagement and satisfaction with the sport.

Sports clubs should emphasize a philosophy that prioritizes the long-term development of football players over the pursuit of immediate success without considering its broader implications. Additionally, ongoing coach education is essential, as it can help reduce biases in player positioning and other factors that impact player development and participation.

Conclusions

This study demonstrates that recreational football Center-Backs display greater body size, advanced maturity, and lower levels of lower-limb strength compared to players in other positions, consistent with patterns observed at the elite level. However, these physical advantages may be associated with early maturation rather than inherent positional superiority. These findings underscore the importance of coaches avoiding premature specialization, allowing players to develop holistically and mitigating the potential risks of early maturation bias.

Limitations of the study

Although the study provides valuable insights into player characteristics, such as anthropometric traits, physical performance, and maturation, it is not without limitations. The small sample size and the uneven distribution of

players across age categories and positions may have constrained the statistical power and generalizability of the findings. Additionally, while the use of Z-scores for standardization facilitates comparisons across age groups, it may not have fully captured the nuanced differences between positions within each category. Future research should aim to include larger, more balanced samples and employ additional statistical methods to better identify variations among playing positions in recreational soccer players. Furthermore, alternative approaches to assessing biological maturation, as skeletal age, should be explored to enhance the robustness of the analysis.

Conflicts of interest

Authors confirm that there are no conflicts of interest.

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