ORIGINAL ARTICLE

Anthropometric profile of female basketball players: The influence of competitive level and playing position

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ABSTRACT

This study aimed to analyse the anthropometric characteristics of female basketball players, focusing on competitive level and specific playing position. The sample included 62 female basketball players from teams across all senior women's basketball leagues in Spain, (1st to 4th division). Different anthropometric measurements were evaluated to evaluate body composition and somatotype. Significant differences emerged between competitive levels, with higher-level players showing more favourable results in some measures. Furthermore, a distinctive profile was identified based on playing position: centers were generally taller, heavier and had higher percentages of body fat and muscle mass compared to forwards and guards. This study provides valuable information on the physical attributes of female basketball players across competitive levels, improving knowledge of the demands of current women's basketball.
Keywords: Performance analysis, Anthropometric profile, Female basketball, Somatotype.

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INTRODUCTION

In sports today, performance depends on a number of variables, including anthropometric characteristics, physical fitness, psychological traits and sport-specific skills (Campa et al., 2019). Specifically in team sports, performance is greatly influenced by conditional factors, technical-tactical skills, and the physical characteristics of the athletes (Drinkwater et al., 2008). Achieving optimal sports performance requires a connection between the different skills that player have to execute, since they have to perform a large number of high-intensity actions during the offensive and defensive phases (Gryko et al., 2022). Therefore, it's essential to understand how the anthropometric characteristics in basketball, in addition to checking whether these evolve along with the technical-tactical development of the players.

The physical characteristics of the players show the reality of the athlete, being a mixture that involves morphological features, physical fitness and technical-tactical skills (Köklü et al., 2011). Among all these factors, morphological characteristics are essential for the evaluation and selection of players (Vaquera et al., 2015). Furthermore, the scientific literature states that both anthropometric characteristics and somatotype profiles are recognized as performance predictors (Ostojic et al., 2006). In addition, anthropometric characteristics such as fat percentage, skin fold thickness, height, span and diameters are relevant in elite basketball players, making them indicators of highly competitive level (Vaquera et al., 2015).

These characteristics are worth mentioning because they affect the playing position and the roles that players play within their teams. In women's basketball, for example, players who have greater speed of movement or greater agility tend to play positions further away from the rim, while taller or more corpulent players tend to play closer to the rim (Cui et al., 2019). Historically, literature has categorized basketball positions into three (guard, forward, and center) or five (point guard, shooting guard, small forward, power forward, and center) roles, each defined by a combination of physical, technical, and tactical factors (Ibáñez et al., 2018).

In recent years, basketball has undergone major changes in technical-tactical demands in addition to physical demands (Ibáñez et al., 2018). The higher the level of competition, the greater technical-tactical and physical demands. Consequently, analysing basketball players by competitive level and specific position is crucial. While some players may adapt to multiple positions, it is essential to assess them according to their primary role on the court (Vaquera, 2008). Additionally, understanding the evolution of anthropometric profiles in women's basketball is important, as it aids in talent identification and performance differentiation (Ziv & Lidor, 2009). Therefore, this study aimed to analyse the anthropometric characteristics of female basketball players to determine the influence of playing position and competition level on these attributes.

MATERIALS AND METHODS

Subjects

The study involved 62 active female basketball players from Spain's four senior women's divisions during the 2023/24 season. Players were divided by category (Table 1) and position (Table 2). To facilitate analysis, the leagues were grouped into three categories: First Division (1st; n = 12, training 16.0 ± 1.0 hours per week), Second and Third Divisions combined (2nd–3rd; n = 22, training 16.0 ± 3.5 hours per week) and Fourth Division (4th; n = 28, training 6.8 ± 1.1 hours per week) (Table 1). This grouping allowed for a distinction between fully professional (1st), semi-professional (2nd–3rd), and amateur players (4th). All participants were informed about the study's benefits and risks, and each provided written consent. The study was approved by the Ethics Committee of the Universidad de León (Code: ETICA-ULE-004-2021).

Players were classified into three positions (guards, forwards, and centers) (Table 2) following the criteria of Salgado et al. (2009) as it remains a relevant method for classifying positions in women's basketball.

Table 1. Descriptive characteristics of the players based on their category.

	1st (n = 12)	2nd-3rd (n = 22)	4th (n = 28)	Total (n = 62)	F	*p*
Age (years)	25.1 ± 2.2[a]	23.6 ± 4.8[a]	19.3 ± 1.9	21.7 ± 2.9	13.461	.001
Height (cm)	179.4 ± 8.7[a]	179.7 ± 12.3[a]	170.7 ± 6.7	175.1 ± 8.8	6.172	.004
Body mass (kg)	71.6 ± 8.0	73.1 ± 8.9[a]	65.3 ± 8.4	68.9 ± 8.5	4.830	.012

Note. 1st = First Division; 2nd-3rd = Second and Third Division; 4th = Fourth Division; a = significant differences with 4th; Significance level p = <.05.

Table 2. Descriptive characteristics of the players based on their specific playing-position.

	G (n = 16)	FW (n = 31)	C (n = 15)	Total (n = 62)	F	*p*
Age (years)	20.3 ± 3.7	22.4 ± 5.6	22.6 ± 3.7	21.7 ± 2.9	46.431	.372
Height (cm)	165.2 ± 3.0[a,b]	176.1 ± 6.9[a]	184.3 ± 5.7	175.1 ± 8.8	17.612	.001
Body mass (kg)	60.3 ± 4.5[a,b]	68.9 ± 6.3[a]	77.3 ± 8.9	68.9 ± 8.5	1.053	.001

Note. G = Guards; FW = Forwards; C = Centers; a = significant differences with C; b = significant differences with FW; Significance level p = <.05.

Data collection

Anthropometric measurements followed the International Society for the Advancement of Kinanthropometry (ISAK) protocols and were conducted in a standardized environment with controlled lighting and temperature. All measurements were performed by the same trained and ISAK-certified evaluator to ensure consistency and minimize measurement variability. Data collection occurred between 10:00 and 12:00 a.m., with players arriving fasted and refraining from physical activity the day prior. The collected data included height, body mass, seven skinfolds (triceps, subscapular, biceps, suprailiac, abdominal, anterior thigh, medial calf), three diameters (humeral biepicondylar, wrist biestylion, femoral biepicondylar), and four circumferences (relaxed arm, flexed and contracted arm, mid-thigh, calf) (Alvero et al., 2010). The instruments used were a Surface Precision 9400 Full Healthy scale (0–180 kg; precision: 100 grams), a stadiometer (precision: 1 mm), a Harpenden skinfold calliper (0–80 mm; precision: 0.2 mm), a small anthropometer (precision: 1 mm), and an anthropometric measuring tape (0–100 cm; precision: 1 mm).

Body composition was analysed following Salgado et al. (2009), using a four-component model: 1) fat percentage, calculated with Faulkner's equation (1968) based on six skinfolds; 2) bone mass, estimated with the modified Von Dobeln formula by Rocha (1974); 3) residual mass, based on Würch's constants (1974); and 4) muscle mass, calculated with Lee's formula (2000). Somatotype was determined using the Heath-Carter anthropometric method (Campa et al., 2020).

Statistical analysis

Descriptive statistics (mean ± standard deviation) were calculated for each variable. A one-way ANOVA with a 95% confidence interval was used to assess differences across competitive levels and playing positions, followed by the Scheffé post-hoc test to identify specific group differences. Statistical significance was set at $p < .05$. Analyses were conducted using SPSS software (Version 26.0; IBM Corp., Armonk, NY, USA).

RESULTS

Significant differences were found across competitive levels in key anthropometric and body composition variables. Players in higher competitive categories were generally older, taller, and heavier compared to those in lower divisions (Table 1). Muscle mass percentage was highest among players in the First Division, with additional significant differences observed in bone mass across divisions (Table 3). No significant differences in body fat percentage were identified by competitive level.

Table 3. Descriptive characteristics of the body composition of basketball players based on their category.

	1st	2nd-3rd	4th	F	*p*
% Body fat	15.2 ± 2.8	17.7 ± 3.9	18.2 ± 3.7	2.28	.111
% Muscle mass	45.5 ± 3.0[a]	42.8 ± 4.2[a]	38.7 ± 3.6	93.48	.001
% Bone mass	21.7 ± 1.5[a]	19.9 ± 1.2[a]	20.2 ± 1.4	7.94	.001

Note. 1st = First Division; 2nd-3rd = Second and Third Division; 4th = Fourth Division; a = significant differences with 4th Level of significance p = <.05.

Differences were also observed in player characteristics based on specific playing positions. Centers were the tallest and heaviest, followed by Forwards, while Guards presented the lowest values in height and body mass (Table 2). Muscle mass percentage was highest for Centers and lowest for Guards (Table 4). No significant differences in body fat percentage were found across positions, although Centers showed slightly higher values than other positions.

Table 4. Descriptive characteristics of the body composition of basketball players based on their specific playing-position.

	G	FW	C	F	*p*
% Body fat	16.2 ± 3.3	17.0 ± 3.5	18.6 ± 4.8	1.088	.344
% Muscle mass	40.5 ± 3.3[a,b]	42.8 ± 2.9[a]	45.2 ± 3.1	1.709	.001
% Bone mass	19.4 ± 1.8	20.6 ± 1.9	21.2 ± 1.6	24.22	.190

Note. G = Guards; FW = Forwards; C = Centers; M = Mass; a = significant differences with C; b = significant differences with FW; Level of significance p = <.05.

In terms of somatotype, no significant differences were found among competitive levels (Table 5). By playing position, Guards showed a higher mesomorphic component compared to the other playing positions, with no significant differences in the endomorphic and ectomorphic components among playing positions (Table 6).

Table 5. Descriptive characteristics of the somatotype of basketball players based on their category.

	1st	2nd-3rd	4th	F	*p*
Endomorph	3.32 ± 0.31	3.02 ± 0.89	3.66 ± 0.75	2.98	.059
Mesomorph	3.62 ± 1.22	2.73 ± 1.44	3.14 ± 0.69	0.218	.805
Ectomorph	2.42 ± 0.60	2.19 ± 0.94	2.05 ± 0.60	0.242	.786

Note. 1st = First Division; 2nd-3rd = Second and Third Division; 4th = Fourth Division.

Table 6. Descriptive characteristics of the somatotype of basketball players based on their specific playing-position.

	G	FW	C	F	*p*
Endomorph	3.3 ± 0.0	3.21 ± 0.92	3.64 ± 1.01	0.219	.804
Mesomorph	3.49 ± 0.88[a]	2.71 ± 1.10	2.33 ± 1.24	5.870	.005
Ectomorph	1.92 ± 0.62[a]	2.30 ± 0.79	2.38 ± 0.82	3.225	.470

Note. G = Guards; FW = Forwards; C = Centers; M = Mass; a = significant differences with C; b = significant differences with FW; Level of significance p = <.05

DISCUSSION

The primary aim was to analyse the anthropometric characteristics of female basketball players by competitive category and playing position. A key finding has been the presence of distinct anthropometric differences based on competition level. Height and weight, frequently highlighted in the literature on basketball player body composition (Cabarkapa et al., 2024; Dominguez-Navarro et al., 2023), were significantly greater in higher-level players. Players in the First and Second-Third Divisions were both taller and heavier than those in the Fourth Division (Table 1), suggesting that these parameters play an essential role in player selection across competitive levels.

In terms of body composition, muscle mass percentage was highest in First Division players, followed by Second-Third Division and then Fourth Division players. These finding are similar to those found in the scientific literature (Casajaús & Aragonés, 1997; González de los Reyes et al., 2020), which suggest that an increase in competition demands my contribute to an improvement in the development of muscle mass thought more specialized training focused on performance (Fox et al., 2018). However, no significant differences were observed between categories when assessing body fat. Players at higher levels shower a tendency towards a lower percentage of fat, probably influenced by the number of sessions performed by the players. The results of our study are similar to those reflected in other studies, which indicate that female basketball players had an average percentage of fat mass of 18% (Bayios et al., 2006).

Height also had a positive correlation with competitive level, which is directly related to previous studies in which it can be observed how taller players competed in higher leagues (Rodríguez-Alonso et al., 1998; Bayios et al., 2006; Salgado et al., 2009). Similar to this, we found a study of regional level U-19 players, which shows height data similar to those found in fourth division players, reinforcing this trend (Rodríguez-Fernández et al., 2023).

In relation to playing positions, centers were the tallest and heaviest players, followed by forwards, with guards being the shortest and lightest. This is in line with findings from other studies where height is given a major factor for center and forwards due to the competitive demands seen in the game (Köklü et al., 2011; Ostojic et al., 2006). Body composition data revealed that centers had the highest muscle mass percentage, with guards showing the lowest. Although fat mass differences were not significant between positions, centers had slightly higher fat percentages, something that is due to their competitive demands, as these players develop their game closer to the rim (Ferioli et al., 2018), which can help to gain a certain advantage in body-to-body actions (Ackland et al., 1997; Erculj et al., 2009). However, this may also negatively impact performance in other variables related to high-intensity actions (Gil et al., 2014). Looking at specific playing positions, the players who in our study had the lowest height and percentage of fat were the guards. This can also be observed in the studies by Moncef et al. (2012) and Ostojic et al. (2016), where the guards have a low height and percentage of fat, making them explosive players with a better performance in speed and agility test.

Regarding somatotype, the first division players had predominantly mesomorphic profiles, while the players from the other divisions had a predominantly endomorphic somatotype, similar results to those found in the study by Salgado et al. (2009). If we now focus on the specific playing position, the guards had a mesomorphic profile, while the forwards and centers showed an endomorphic profile, which also supports previous findings (Salgado et al., 2009).

In recent years, basketball has evolved significantly in all its aspects (Mancha-Triguero et al., 2021). Comparing the current data with that of players from 15 seasons ago, with similar teams and leagues, it could be observed that today's players are generally shorter and less corpulent, however they have a higher muscle mass, which suggest a change in physical tendency since the 2007/08 season (Salgado et al., 2009).

CONCLUSIONS

In summary, our results identified significant differences in both body composition and somatotype component according to competitive level and playing position in female basketball players. In addition, we observed an evolution in the characteristics of female basketball players, with today's players being shorter and lighter but with greater muscle mass. Finally, it's important to recognise the individual characteristics of the players according to the level at which the compete and the playing position they play, as it's crucial for the improvement of talent selection programmes as well as improving individualised training strategies for basketball players.

AUTHOR CONTRIBUTIONS

Introduction, E.F.-G. and A.R.-F.; methodology, E.F.-G. and J.A.R.-M.; results, A.R.-F. and A.V.; discussion, E.F.-G., A.R.-F., J.A.R-M.; conclusions, A.V. and E.F.-G.; writing-writing of the original draft, E.F.-G.; writing-revising and editing, J.A. R.-M., A.V. and A. R.-F.

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DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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REFERENCES

Ackland, T. R., Schreiner, A. B., & Kerr, D. A. (1997). Absolute size and proportionality characteristics of World Championship female basketball players. Journal of sports sciences, 15(5), 485-490. https://doi.org/10.1080/026404197367128

Alvero, J. R., Cabañas, M. D., Herrero, A., Martínez, L., Moreno, C., Porta, J., et al. (2010). Protocolo de valoración de la composición corporal para el reconocimiento médico deportivo. Documento de consenso del Grupo Español de Cineantropometría (GREC) de la Federación Española de Medicina del Deporte (FEMEDE). Archivos de Medicina del Deporte, 27(139), 330-342.

Bayios, I. A., Bergeles, N. K., Apostolidis, N. G., Noutsos, K. S., & Koskolou, M. D. (2006). Anthropometric, body composition and somatotype differences of Greek elite female basketball, volleyball and handball players. The Journal of sports medicine and physical fitness, 46(2), 271- 280.

Cabarkapa, D., Cabarkapa, D. V., Nagy, D., Szabo, K., Balogh, L., Safar, S., & Ratgeber, L. (2024). Differences in anthropometric and vertical jump force-time characteristics between U16 and U18 female basketball players. Frontiers in sports and active living, 6, 1425475. https://doi.org/10.3389/fspor.2024.1425475

Campa, F., Bongiovanni, T., Matias, C. N., Genovesi, F., Trecroci, A., Rossi, A., Iaia, F. M., Alberti, G., Pasta, G., & Toselli, S. (2020). A New Strategy to Integrate Heath-Carter Somatotype Assessment with Bioelectrical 131 Impedance Analysis in Elite Soccer Player. Sports, 8(11), 142. https://doi.org/10.3390/sports8110142

Campa, F., Semprini, G., Júdice, P. B., Messina, G., & Toselli, S. (2019). Anthropometry, Physical and Movement Features, and Repeated-sprint Ability in Soccer Players. International Journal of Sports Medicine, 40(2), 100-109. https://doi.org/10.1055/a-0781-2473

Casajaús, J.A. & Aragonés, M.T. (1997). Estudio cineantropométrico del futbolista profesional español. Archivos de Medicina del Deporte, 14 (59), 177 - 184.

Cui, Y., Liu, F., Bao, D., Liu, H., Zhang, S., & Gómez, M. Á. (2019). Key anthropometric and physical determinants for different playing positions during national basketball association draft combine test. Frontiers in Psychology. https://doi.org/10.3389/fpsyg.2019.02359

Dominguez-Navarro, F., Casaña, J., Perez-Dominguez, B., Ricart-Luna, B., Cotolí-Suárez, P., & Calatayud, J. (2023). Dynamic balance and explosive strength appears to better explain single leg hop test results among young elite female basketball athletes. Scientific reports, 13(1), 5476. https://doi.org/10.1038/s41598-023-31178-7

Drinkwater, E. J., Pyne, D. B., & Mckenna, M. J. (2008). Design and Interpretation of Anthropometric and Fitness Testing of Basketball Players. Sports Medicine, 38(7). https://doi.org/10.2165/00007256-200838070-00004

Erčulj, F., Blas, M., Čoh, M., & Bračič, M. (2009). Differencesin Motor Abilities of Various Types of various types of European young elite female basketball players. Kinesiology, 41(2), 203-211.

Ferioli, D., Rampinini, E., Bosio, A., La Torre, A., Azzolini, M., & Coutts, A. J. (2018). The physical profile of adult male basketball players: Differences between competitive levels and playing positions. Journal of sports sciences, 36(22), 2567-2574. https://doi.org/10.1080/02640414.2018.1469241

Fox, J. L., Stanton, R., & Scanlan, A. T. (2018). A Comparison of Training and Competition Demands in Semiprofessional Male Basketball Players. Research quarterly for exercise and sport, 89(1), 103-111. https://doi.org/10.1080/02701367.2017.1410693

Gil, S. M., Badiola, A., Bidaurrazaga-Letona, I., Zabala-Lili, J., Gravina, L., Santos-Concejero, J., Lekue, J. A., & Granados, C. (2014). Relationship between the relative age effect and anthropometry, maturity and performance in young soccer players. Journal of sports sciences, 32(5), 479-486. https://doi.org/10.1080/02640414.2013.832355

Gryko, K., Adamczyk, J. G., Kopiczko, A., Calvo, J. L., Calvo, A. L., & Mikołajec, K. (2022). Does predicted age at peak height velocity explain physical performance in U13-15 basketball female players? BMC Sports Science, Medicine and Rehabilitation, 14(1). https://doi.org/10.1186/s13102-022-00414-4

González de los Reyes, Y., Gálvez Pardo, A. Y., & Mendoza Romero, D. (2020). Comparación antropométrica, fuerza explosiva y agilidad en jugadoras jóvenes de baloncesto de Bogotá-Colombia (Anthropometric comparison, explosive strength, and agility in young basketball players from Bogotá- Colombia). Retos, 38, 406-410. https://doi.org/10.47197/retos.v38i38.71967

Ibáñez, S. J., Mazo, A., Nascimento, J., & García-Rubio, J. (2018). The Relative Age Effect in under-18 basketball: Effects on performance according to playing position. PLoS ONE, 13(7). https://doi.org/10.1371/journal.pone.0200408

Köklü, Y., Alemdaroğlu, U., Koçak, F. Ü., Erol, A. E., & Findikoğlu, G. (2011). Comparison of chosen physical fitness characteristics of turkish professional basketball players by division and playing position. Journal of Human Kinetics, 30(1), 99-106. https://doi.org/10.2478/v10078-011-0077-y

Mancha-Triguero, D., García-Rubio, J., Gamonales, J. M., & Ibáñez, S. J. (2021). Strength and Speed Profiles Based on Age and Sex Differences in Young Basketball Players. International journal of environmental research and public health, 18(2), 643. https://doi.org/10.3390/ijerph18020643

Moncef, C., Said, M., Olfa, N., & Dagbaji, G. (2012). Influence of morphological characteristics on physical and physiological performances of tunisian elite male handball players. Asian journal of sports medicine, 3(2), 74-80. https://doi.org/10.5812/asjsm.34700

Ostojic, S. M., Mazic, S., & Dikic, N. (2006). Profiling in Basketball: Physical and Physiological Characteristics of Elite Players. In National Strength & Conditioning Association J. Strength Cond. Res (Vol. 20, Issue 4). https://doi.org/10.1519/00124278-200611000-00003

Rodríguez-Alonso, M.; Terrados, N.; Pérez-Landaluce, J.; Fernández, B.; García-Herrero, F. (1998). Déficit máximo acumulado de oxígeno en baloncesto femenino. Archivos de Medicina del Deporte XV (64), 115- 122.

Rodríguez-Fernández, A., Lago, Á., Ramírez-Campillo, R., Sánchez, M., & Sánchez-Sánchez, J. (2023). Cardiopulmonary- versus neuromuscularbased high-intensity interval training during a pre-season in youth female basketball players. Human Movement, 24(2), 44-51. https://doi.org/10.5114/hm.2023.115832

Salgado, I., Sedano-Campo, S., de Benito Trigueros, A., Izquierdo Velasco, J. & Cuadrado, G. (2009). Perfil antropométrico de las jugadoras de baloncesto españolas. Análisis en función del nivel competitivo y de la posición específica de juego. Revista Internacional de Ciencias del Deporte, 5. https://doi.org/10.5232/ricyde2009.01501

Vaquera, A., Santos, S., Villa, J. G., Morante, J. C., & García Tormo, V. (2015). Anthropometric Characteristics of Spanish Professional Basketball Players. Journal of Human Kinetics, 46(1), 99-106. https://doi.org/10.1515/hukin-2015-0038

Vaquera Jiménez, A. (2008). Heart rate response to game-play in professional basketball players. Journal of Human Sport and Exercise, 3(1), 1-9. https://doi.org/10.4100/jhse.2008.31.01

Ziv, G., & Lidor, R. (2009). Physical attributes, physiological characteristics, on-court performances and nutritional strategies of female and male basketball players. Sports medicine (Auckland, N.Z.), 39(7), 547-568. https://doi.org/10.2165/00007256-200939070-00003