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Impact of training on body composition in elite basketball players

Impacto del entrenamiento en la composición corporal de jugadores de baloncesto élite

Impacto do treino na composição corporal em jogadores de basquetebol de elite

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Abstract

The demands of professional basketball training involve a constant physiological stress that conditions the physical health of the players. In order to achieve a good performance, the body health of basketball players is essential, so it is necessary to know under what reference values should be worked. The aim of this study was to analyze the body composition of professional basketball players through two measurements. Under a descriptive correlational study, ten professional basketball players were analyzed during two months of regular league competition. Variables related to body composition (e.g. Weight, Fat Mass, Proteins…) and performance in competition (e.g. Minutes, Rebounds, Assists, Faults…) were analyzed. A descriptive analysis, two t-tests, a one-factor ANOVA test and a Pearson correlation were performed. The results of body composition indicate that it evolves throughout the monitored period, but without significant changes. Players are symmetrical in laterality considering body composition. The specific positions are different in terms of body composition. There is correlation between body composition and performance in competition in offensive rebounds ($p<0.05$, correlations >0.60). Regular measurements should be established to monitor body composition, both to monitor the health of the players and to improve the performance of the teams.

Keywords: competition; professional; male; performance; specific position.

Resumen

Las exigencias del entrenamiento del baloncesto profesional suponen un estrés fisiológico constante que condiciona la salud física de los jugadores. Para alcanzar un buen rendimiento, controlar la salud corporal de los jugadores de baloncesto es esencial, por lo que es necesario disponer de valores de referencia para focalizar los propósitos del entrenamiento. El objetivo de este estudio fue analizar la composición corporal de jugadores de baloncesto profesional a través de dos mediciones. Bajo un estudio descriptivo correlacional se analizaron diez jugadores profesionales de baloncesto durante dos meses de competición de liga regular. Se analizaron variables relativas a la composición corporal (ej. Peso, Masa grasa, Proteínas…) y el rendimiento en competición (ej. Minutos, Rebotes, Asistencias, Faltas…). Se realizó un análisis descriptivo, dos pruebas t, una prueba ANOVA de un factor y una correlación de Pearson. Los resultados de la composición corporal indican una evolución a lo largo del periodo monitorizado, pero sin cambios significativos. Los jugadores son simétricos en la lateralidad teniendo en cuenta la composición corporal. Los jugadores clasificados en función de su puesto específico tienen composición corporal diferente. Existe correlación entre la composición corporal y el rendimiento en competición en rebotes ofensivos ($p<0.50$, correlaciones >0.60). Se deben establecer mediciones regulares para controlar la composición corporal, tanto para controlar la salud de los jugadores, como para mejorar el rendimiento de los equipos.

Palabras clave: competición; profesional; masculino; rendimiento; posiciones específicas.

Resumo

As exigências do treino profissional de basquetebol colocam um stress fisiológico constante sobre a saúde física dos jogadores. Para alcançar um bom desempenho, a saúde corporal dos jogadores de basquetebol é essencial, pelo que é necessário saber sob que valores de referência devem trabalhar. O objetivo deste estudo foi analisar a composição corporal de jogadores profissionais de basquetebol através de duas medições. No âmbito de um estudo descritivo correlacional, foram analisados dez jogadores profissionais de basquetebol durante dois meses de competição regular da liga. Foram analisadas as variáveis relacionadas com a composição corporal (por exemplo, peso, massa gorda, proteínas...) e o desempenho em competição (por exemplo, minutos, ressaltos, assistências, faltas...). Foi efectuada uma análise descritiva, dois testes t, um teste ANOVA de um fator e uma correlação de Pearson. Os resultados da composição corporal indicam que a composição corporal evolui ao longo do período monitorizado, mas sem alterações significativas. Os jogadores são simétricos na lateralidade em termos de composição corporal. As posições específicas são diferentes em termos de composição corporal. Existe uma correlação entre a composição corporal e o desempenho competitivo em ressaltos ofensivos ($p<0.50$, correlaçãos >0.60). Devem ser estabelecidas medições regulares para monitorizar a composição corporal, tanto para controlar a saúde dos jogadores como para melhorar o desempenho da equipa.

Palabras clave: competição; profissional; masculino; desempenho; posições específicas.

Introduction

In team sports, the achievement of optimal physical performance depends on a large number of factors. Specifically, in basketball, the final result of a game depends directly on variables with different orientations such as physical (Fort-Vanmeerhaeghe et al., 2016), technical – tactical (Chen et al., 2025)(Escudero-Tena et al., 2021), psychological (Arruda et al., 2014) and anthropometric (Gál-Pottyondy et al., 2021). In order to deal with these conditioning factors in an optimal way, the player must be able to perform a considerable physical deployment, in accordance with the demands of the game and the competition (Castillo et al., 2021). A large number of studies consider basketball to have a hybrid character, where most of the energy mobilised comes from the aerobic route (Ge et al., 2023). However, explosive actions, such as changes of direction, jumps or high intensity movements depend on anaerobic routes and are determinant for performance (Correas-Gomez et al., 2023).

Basketball coaches and trainers often use a set of specific physical tests (Gómez-Carmona et al., 2020; Mancha-Triguero et al., 2019), which allow the evaluation of the player's body composition (BC) and physical condition because, for many years, the player's size has been the limiting factor that largely determined his position on the court (Corredor-Serrano et al., 2022). A better knowledge of the morphofunctional demands of basketball players will allow improving their performance (Sedeaud et al., 2014; Zaric, Kukic, et al., 2020), providing relevant information to determine not only the type of training and the intensity of the loads, but also for the selection of players, the application of an injury prevention programme and even to assess the efficiency of specific physical preparation programmes (Aggarwal et al., 2023; Vukovic et al., 2022).

Basketball players have common anthropometric characteristics such as tall stature, heavy weight and long limbs (Garcia-Gil et al., 2018). These indicators, together with the percentage of fat, muscle mass and body diameters, will be determinant for performance in this sport (Vaquera et al., 2015). Thus, several descriptive studies have established general characteristics of weight, height, body mass index (BMI), fat percentage and muscle percentage in basketball players (Ljubojevic et al., 2020; Rivera-Sosa, 2016). In most cases, these values have been related to physiological and competitive aspects, as well as to category, gender or level. Therefore, these anthropometric characteristics are part of the set of biological variables related to sports performance in basketball.

Traditionally, anthropometric characteristics have been used in basketball for player selection. The main specific positions are characterised by a different player prototype. Point guards are players of short stature compared to their teammates, and do not require large upper body musculature (Köklü et al., 2011). Forwards are more versatile players with a more balanced upper and lower body, who do not stand out for their height, but for the ability of their musculature to combine powerful gestures such as jumps or changes of direction (Ben Abdelkrim et al., 2010; Ramos-Campo et al., 2014). The centers have traditionally been tall players with a large mass, in many cases not necessarily muscular, which allows them to fight body-to-body for the ball in very tight spaces, while withstanding the impact of opponents (Köklü et al., 2011; Ramos-Campo et al., 2014). In all the studies carried out, the differences in BC found between the specific positions are significant, objectively demonstrating that the specific positions in basketball have naturally different bodies, due either to the selection of the players or to the demands of the competition, which differ between the different roles on the court.

BC, however, despite the differences found evident in the literature, is not stable during the season. Parton et al. (2017) found differences in BC measured during the pre-season, with no significant changes in fat mass. Díaz-Martínez et al. (2024) made several measurements during the season, detecting significant changes between the beginning and end of the pre-season, but no significant changes during the season. Walker et al. (2022) detected greater differences in the pre-season than during the season. Nevertheless, very few studies have analysed how BC and its fluctuations during the season affect athletic performance.

Hernandez-Martinez et al. (2024) correlated BC with physical performance, finding positive correlations between better BC and higher performance. The literature contains studies similar to the above, where BC is related to physical performance, based on specific test batteries (Ramos et al., 2023). However, the only study found in basketball that relates BC with performance in competition is the one by Zaric, Dopsaj, et al. (2020), where a relationship was found between better performance and optimal BC in three variables (percentage skeletal muscle mass, index of hypokinesis and protein-fat index).

As far as it is known, there are few studies that analyze the changes in the BC of professional players after being subjected to a training process; and there are fewer studies that relate BC to technical-tactical performance in competition. As a result, the general objective of this study was to analyze the changes in body composition and their influence on performance in professional basketball players through two measurements, at the beginning and at the end of two competitive work mesocycles. The specific objectives were i) to find out what the BC of professional basketball players is and how it evolves over time, ii) to find out the BC segmented by specific positions and detect possible asymmetries in laterality, iii) to find differences between two measurements of BC during the competitive period, iv) to find differences between the specific positions of the players, v) to detect possible relationships between the performance and the BC of the players.

Materials and Methods

Research design

This study was considered descriptive correlational, as it explored existing relationships between variables (Thomas et al., 2015). Neither the variables nor the experimental treatments administered were manipulated.

Participants

The sample consisted of ten players from a professional basketball team, competing in the second Spanish professional league, Liga LEB Oro (n = 10; age = 26.7±3.129 years; height = 194,8±7,843 cm). The research was conducted following the criteria of the Declaration of Helsinki (2013), the Ethical Standards in Sport and Exercise Science Research of Harriss et al. (2022) and was approved by the University Bioethics Committee (233/2019). The investigation respected the framework of Organic Law 3/2018 of 5 December on Personal Data Protection and Guarantee of Digital Rights (2021).

Eligibility Criteria

The following criteria were established for the selection of participants: (i) belonging to the team officially, (ii) have been called up for all the matches played, and (iii) have attended at least 80% of training sessions.

Exclusion criteria were: (i) having had an injury less than two months before the start of the measurement, and (ii) having been training in a national team during part of the data collection period.

Three players did not pass the inclusion criteria and were excluded from the measurement.

Variables

For the study of body composition (BC), the variables recorded were height (cm), weight (kg), BMI (ua), absolute and relative fat mass (kg), absolute and relative fat-free mass (kg), lean mass (kg), basal metabolism (kcal), protein (kg) and total body water (kg). Segmented BC was performed by analyzing the variables of trunk muscle mass and fat mass (kg), muscle mass and fat mass of each arm (kg) and muscle mass and fat mass of each leg (kg).

In order to classify the players, the specific positions they occupied on the pitch were taken into account, classifying them into three specific positions: point guards, forwards and centers.

The competition performance variables analyzed were the number of games played as a starter, minutes played, points, offensive rebounds, defensive rebounds, assists, fouls committed, fouls received, rating and rating index +/- (Fernández-Cortés et al., 2021).

Instruments

The TANITA MC-780MA analyzer (Figure 1), which uses the bioimpedance electrical impedance (BIA) technique, was used to measure BC. A table with the data and variables mentioned was extracted from its software for subsequent analysis.

Figure 1. Body composition measurement tool (TANITA MC-780MA).

The device included computer software that generated reports on the subject's BC, water, protein and health status data. In addition, it included segmented reports of the BC of the trunk and the different limbs. The evolution of the athlete was obtained at various time points, with graphs showing the evolution of the athlete over time. The data were given in absolute and relative values.

Process

The physical trainer of the club was contacted to carry out the research. The players were informed of the benefits and disadvantages that could derive from participation in this research. When all parties agreed, an informed consent form was drawn up and signed by all participants. This was followed by data collection.

For the data collection of the BC, a working period was established in relation to the competitive macrocycle in which the team was, during two months. Once this period was defined, two measurements were taken, before the beginning of the first mesocycle of work and at the end of the second one, with the aim of finding out whether or not the training had provoked adaptations, and if these adaptations were significant. Body composition measurements were carried out in a gym session before the track session in the morning, being the first physical activity of the day. All players were measured before joining the strength training session, under the same conditions.

Statistical analysis

Firstly, a descriptive analysis of the total sample in the pre-test and post-test was carried out, including the mean values and standard deviation in each of the variables analyzed. Subsequently, a descriptive analysis of the BC variables was carried out according to the specific positions, obtaining the BC values for each of the body segments.

To test for statistically significant differences between the two measurements, a parametric t-test for dependent samples was performed (Newell et al., 2010). A t-test was also performed to analyse the differences in the laterality of the players.

In order to analyze whether there were differences between the specific positions of the players, a one-factor ANOVA test was performed. For pairwise comparison, Tukey's post-hoc test was used. For effect size, the eta squared was used.

Finally, a Pearson's cross-correlation analysis was performed between the BC variables and the performance variables in official matches.

Results

Table 1 shows the descriptive results of the BC variables analyzed in each of the different intakes (pre-post).

Table 1. Body composition descriptive results.

Variables (n=10)	*Data collection*	*Average*	*S.D.*
Height (cm)	a/b	194.80	7.84
Weight (kg)	a	92.04	13.77
	b	88.73	13.16
BMI	a	24.14	2.22
	b	23.45	2.08
Fat Mass (kg)	a	10.81	5.27
	b	9.40	4.83
Fat Mass (%)	a	11.31	4.23
	b	10.23	4.40
Fat-Free Mass (kg)	a	81.23	9.75
	b	79.33	10.17
Fat-Free Mass (%)	a	88.69	4.23
	b	89.77	4.41
Lean Mass (kg)	a	77.25	9.31
	b	75.45	9.68
Basal metabolism (kcal)	a	2360.70	300.27
	b	2338.00	320.76
Proteins (kg)	a	19.40	2.31
	b	19.40	2.37
Total body water (kg)	a	56.70	6.92
	b	56.10	7.40

Note: a = “First data collection” / b = “Second data collection”

The results show changes in the mean BC of the players between the first and the second measurement, all values are lower in the second measurement.

The mean values of the segmented BC in the different specific positions can be visualized in Figure 2.

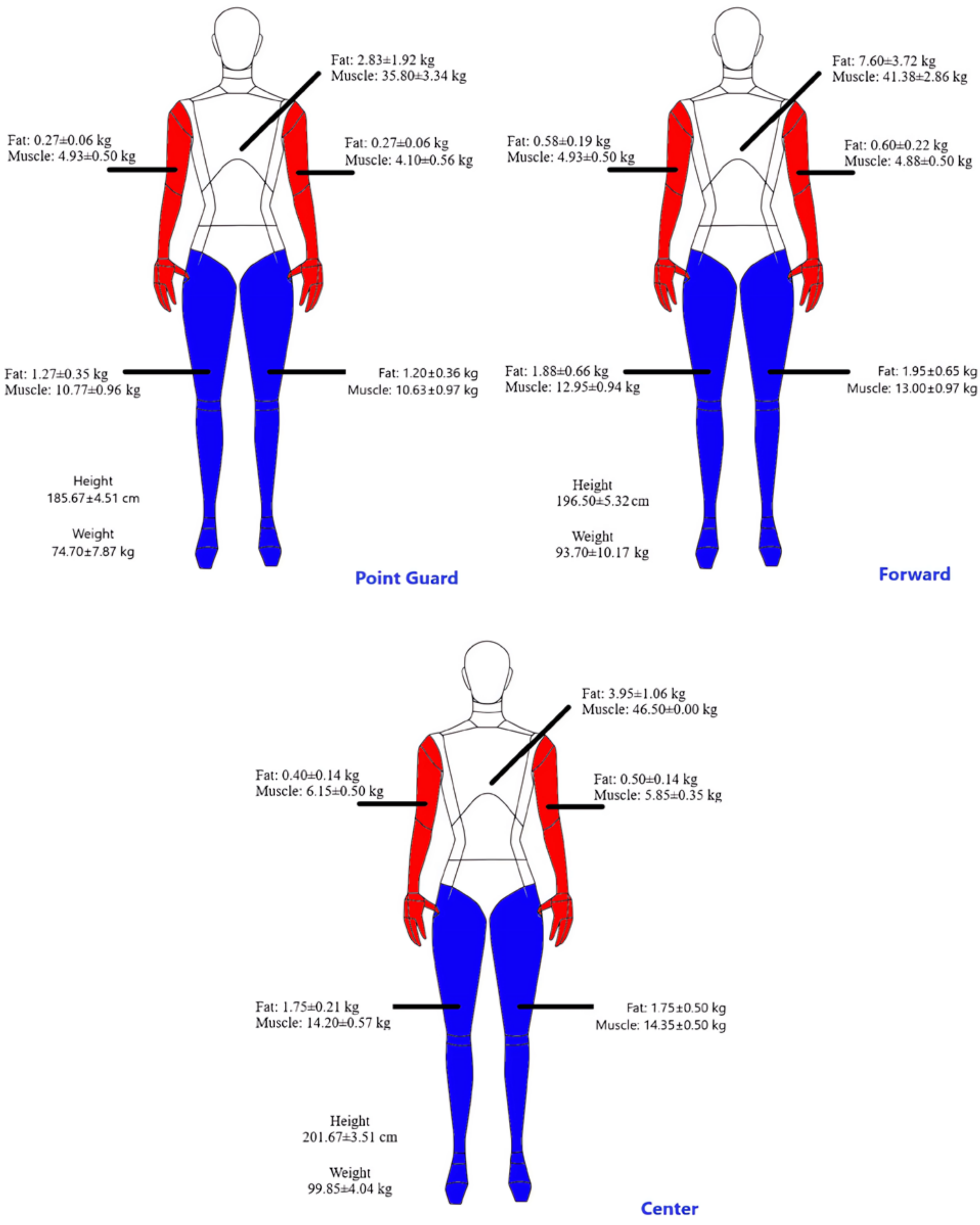

Figure 2. Segmentation of body composition by specific positions.

The analysis of the segmented BC showed no significant differences in any of the variables analysed between the right and left sides of the arms and legs ($p > .05$), despite the existence of different mean data in each segment of the different groups analysed.

To determine whether there are differences between the two measurements, a t-test was carried out, where it can be seen that no significant differences were found in any of the variables recorded (Figure 3).

The results of the t-test are shown in two parallel graphs, each corresponding to one variable in the two measurements. The first graph, on the left, compares two conditions, representing measurements taken before and after the intervention. The data illustrates trends in the observed changes, with the conditions displayed on the x-axis and their respective measurement values on the y-axis. The plot likely includes central tendency along with error bars that depict variability within the sample. This visual representation provides insight into whether the intervention resulted in notable changes between the two conditions. Below left is the p-value of the t-test performed, knowing whether or not there are significant differences between measurement 1 and measurement 2. A p-value of < .05 indicates significant differences between the means of measurement 1 vs measurement 2.

The graph on the right shows the results of the statistical analysis presented in two key visualizations. The first graph depicts the effect size, measured by Hedges's g, along with its confidence intervals at varying levels (0.68, 0.9, 0.95, and 0.999). Hedges's g was used to quantify the magnitude of the difference between pre- and post-intervention weights in basketball players, accounting for small sample size bias. The central value of Hedges's g and the width of the confidence intervals suggest the strength and precision of the observed effect. The second graph illustrates the mean difference in weight between the pre- and post-measurements, with zero representing no difference. The confidence intervals around the mean difference provide an indication of statistical significance and variability in the sample. Together, these graphs demonstrate whether a meaningful and statistically significant change occurred in the weight of the athletes following the intervention, with clear visual representation of the effect size and its precision.

The concrete statistical results can be seen in Table 4, located in the Annex.

Table 2 shows the results of the comparison of the QC variables according to the specific jobs.

Table 2. Comparison of body composition variables according to specific jobs.

Variable	*F*	*P*	*η2*	dif
Height (cm)	9.39	.001	0.728	1-3*, 1-5*
Weight (kg)	6.24	.034	0.675	1-5*
Fat mass (kg)	2.30	.181	0.434	
Fat-Free Mass (kg)	10.04	.012	0.770	1-5*
Lean Mass (kg)	10.03	.012	0.770	1-5*
Basa metabolism (kcal)	9.31	.014	0.756	1-5*
Proteins (kg)	8.34	.018	0.736	1-5*
Total body water (kg)	9.80	.013	0.766	1-5*

Note: 1 = “Point Guard”; 3 = “Forward”; 5 = “Center”; * = “higher value”.

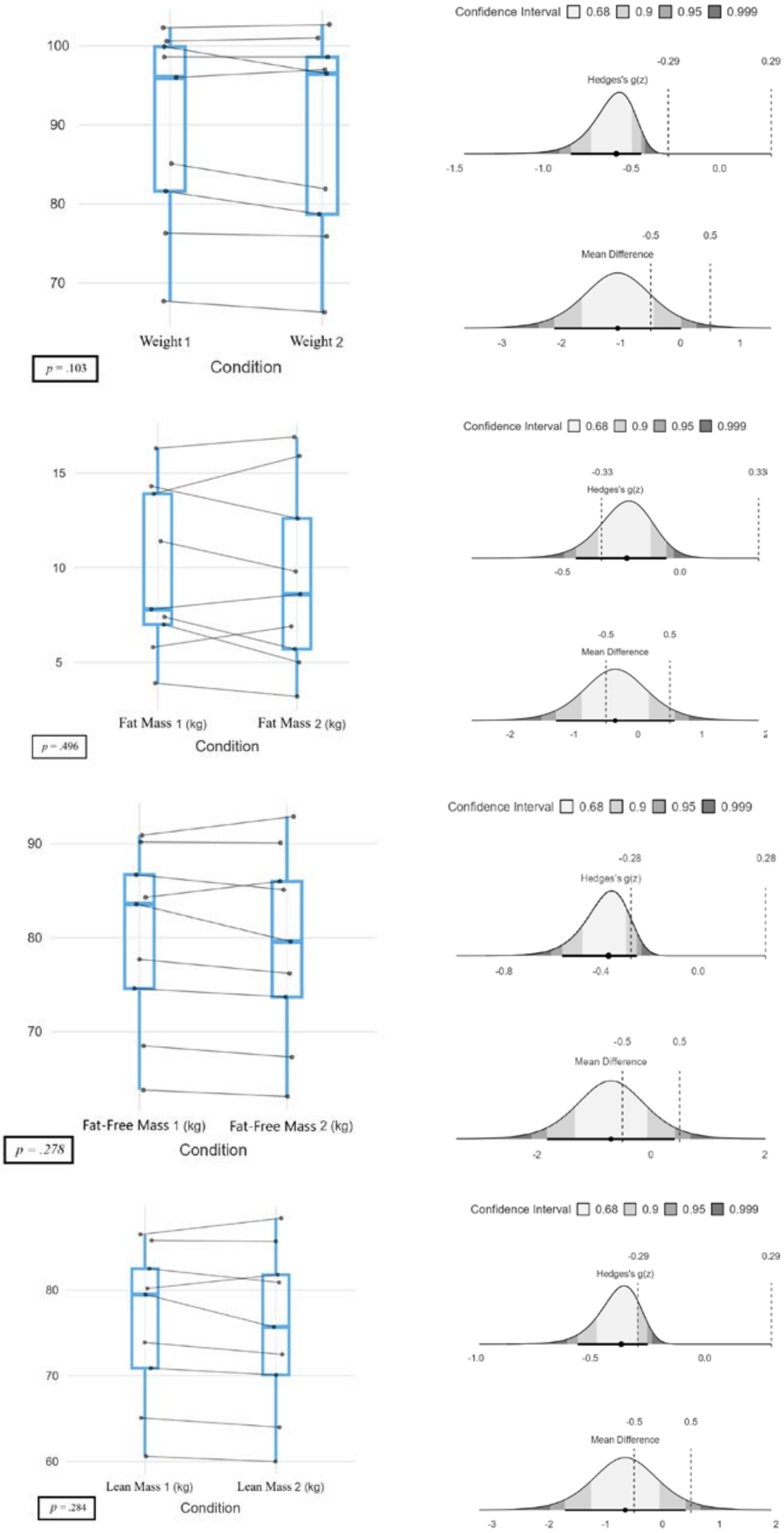

Figure 3. Statistical differences between pre and post in body composition values.

The main differences were identified between the specific positions of point guard and center, with centers outperforming point guards on all variables. Point guards and forwards only differ significantly in height, while there are no significant differences in BC between forwards and centers. The specific numerical values of the difference tests can be found in Table 4 in the annex.

Table 3 shows the results of the correlation analysis carried out between the BC variables and the performance variables in competition.

Table 3. Cross-correlations between body composition and performance.

	Height (cm)	Weight (kg)	Fat Mass (kg)	Fat-Free Mass (kg)	Lean mass (kg)	Proteins (kg)
Starting	.473	.45	.144	.554	.555	.666
Minutes	.255	.281	.211	.28	.28	.486
Points	-.107	.05	-.003	.072	.072	.053
Offensive Rebounds	**.635**	.616	.338	**.682**	**.683**	**.668**
Defensive Rebounds	.34	.26	-.147	.444	.445	.653
Assists	-.35	-.309	-.144	-.356	-.355	-.253
Faults Commited	.169	.314	.115	.379	.379	.176
Faults Received	-.167	-.039	-.185	.046	.047	-.006
Valoration	-.056	.048	-.015	.076	.076	.108
+/-	.232	.236	.451	.087	.086	.015

Note: Values in red means $p < .05$.

The results of the cross-correlation test between variables are shown in the table (values between -1 and 1). The significance analysis of the correlations was performed with a significance of p<0.05. Values in black are not significant, while bolded and red values indicate a significant correlation. Despite the significance value, only offensive rebounds have a significant correlation, with high correlation values, higher than 0.60. These correlations are with height, fat-free mass, lean mass and amount of protein.

Discussion

The objectives of this research were to describe the body composition (BC) of basketball players, to detect asymmetries in laterality, to analyze the differences in BC in two measurements during two competitive months, to find differences between the different specific positions that the players occupy in the team and to find correlations between the players' BC and performance in competition. Time-dependent changes were identified, but not significant, as well as differences between specific positions. No asymmetries by body segments were identified. Finally, a relationship was found between performance indicators (offensive rebounding) and BC, with height, fat-free mass, lean mass and the amount of protein.

Berdejo et al. (2008) analysed the BC of elite male basketball players. In their research they found that the players had a fat mass percentage of around 12% and between 44.8%-47.9% muscle mass. When compared with results found in the literature with lower category teams (university categories), the percentage of fat increases to 14% and the percentage of muscle mass decreases, with average values of 44.43% (Garcia-Gil et al., 2018). Therefore, from the aforementioned studies, it can be inferred that muscle development increases as the competitive level increases. This is why Sansone et al. (2022) found that international athletes had less fat mass than national athletes. The results obtained reveal high values of muscle mass and a low percentage of fat mass (11%), very similar to those found in studies of elite basketball players. As a result, the BC of players is of great importance in basketball, as it will be an indication that they are in great physical shape and will allow them to compete at a higher level. Quality time must be devoted to physical training and fluctuations must be monitored throughout the season to ensure that players are in optimal condition to compete.

The system used in the present study, based on bioimpedance, is one of the most widely used in the measurement of BC in basketball (Sansone et al., 2022). This system greatly facilitates the collection of BC data segmented in the different parts of the body. Other studies have analyzed regional BC in basketball players, finding higher fat mass values in arms and legs in centers (Raymond-Pope et al., 2020). Díaz-Martínez et al. (2024) found no differences in body proportion during the season, so that changes in local BC do not occur during the playing season. Our results differ from those found in the literature, as it is the forwards who have the worst segmented BC in relation to the rest of the specific positions. We do agree that point guards have the best BC in terms of fat mass. Segmented BC is important because changes in fat and muscle mass in the lower body are related to the change in resting and total energy consumed in basketball players (Silva et al., 2012). At critical times of the season, when the number of games per week increases, nutrition will be essential in order to achieve optimal performance levels, and these total and regional BC values should be taken into account to guide the energy needs to be consumed by the players.

The disaggregation of the BC data by body segments allowed to analyze the symmetry of BC in the different specific positions. The analyses performed revealed no differences in laterality in the BC of any specific position, so players are symmetrical in terms of BC. Poliszczuk et al. (2013) did find significant differences in segmented BC in upper body laterality. In addition, they found that these differences also manifested themselves at the cognitive level in reaction tests. Slater and Hart (2016) found asymmetries in closed movements in laboratory tests in basketball players. Nevertheless, despite these findings, Ibañez et al. (2023) analysed asymmetries in the lower body in real training and competition situations, and found no significant differences between movements and the strength used in both legs. Basketball is a sport that does not generate asymmetries. The appearance of asymmetries should be taken into account and studied with caution.

The BC analysis shows that none of the variables measured show significant changes between the first and second data collection. Díaz-Martínez et al. (2024) analyzed BC over a full season in basketball players, finding differences between the first and the last pre-season data collection, but no differences during the official season. This study was conducted during the regular season, in the last games of competition, so probably the explanation for these changes not being significant is that the athletes were in a high state of physical fitness, so they remain with slight improvements. In fact, subjects with overtraining syndrome often have significant weight losses (Lukonaitiene et al., 2020). Other studies carried out at the professional level support these results, finding changes throughout the season in players, with no significant differences (Russell et al., 2024). This is why it is relevant to monitor the BC of players to detect possible drastic changes in BC and to be able to act in time in the event of a localized problem.

However, although no differences in BC are found throughout the competitive period, it is interesting to analyze the possible differences that can be found between specific positions. Sallet et al. (2005) and Ramos et al. (2010) studied the morphology of professional basketball players according to their playing position, establishing that inside players are taller, heavier and also have a higher fat percentage compared to outside players. These differences between specific positions are also consolidated in youth (Vukovic et al., 2022) and female's basketball (Freire et al., 2023). It seems more than evident that the nutritional and physiological needs of basketball players should be individualized, at least, to the specific positions they usually occupy on the field. Moreover, these position-specific BC criteria can facilitate the selection of players beyond anthropometry, and the control of health and injury risk based on their body and the skills they perform on the field.

For performance improvement, one of the factors that must be known is the BC of players in order to maximize their performance and monitor their health status. Results indicate that players who participate in higher level leagues tend to have better BC (Sansone et al., 2022). Because of its direct relationship with physical performance, several studies have compared physical performance and BC. Ramos et al. (2023) found that players with lower body fat performed better in power-related tasks, but players with higher body fat values performed better in strength-related actions. Similar results were obtained. This supports the need to assess the BC of players according to their assigned playing roles.

Nevertheless, few studies have related BC to athletic performance in competition. Zaric, Dopsaj, et al. (2020) found a correlation between protein and muscle mass levels and overall competitive performance. The analysis carried out in the present study segmented competitive performance into more variables, finding only a correlation with offensive rebounding. Although only one performance variable is correlated with BC, it should be taken into account that offensive rebounding is a determining factor in the outcome of the game (Zhang et al., 2020), so at high competitive levels, where results are decided by small details, the BC of the players must be taken into account.

The study has certain limitations. Firstly, only a single team was monitored, due to the difficulty of access to professional athletes. In addition, it was only possible to monitor during two mesocycles, which was part of the second competitive macrocycle. Finally, it is important to highlight the importance of obtaining data on women's teams in future research. Weight is strongly conditioned by different processes that women face, also influencing their performance. The use of body composition measuring instruments is essential for the control of body composition in women, as it allows for precise knowledge of muscle or fat weight without the influence of hormonal processes that influence the absolute value of weight. The strengths of the study include the high-precision material used to obtain the BC data and the relationship with performance, something new in relation to what had been done in the literature. As a future prospective, BC should be analyzed in more longitudinal periods, looking for more direct relationships with performance, finding cause-effect relationships.

Conclusions

The body composition (BC) of basketball players is characterized by tall, heavy players with low fat percentage. Segmentation reveals that players are symmetrical based on laterality, showing different values in each specific position between upper and lower body. BC does not vary significantly during the season, maintaining the existing differences between specific positions. There is a correlation between BC and performance, although only in the offensive rebounding variable.

Practical applications

These results highlight the importance of maintaining an optimal body composition in basketball players, emphasizing position-specific adaptations. Physical trainers should ensure that point guards develop lower-body strength in the preseason through targeted exercises such as squats and plyometric training to enhance power and agility. Meanwhile, centers should focus on achieving optimal upper-body strength, as increased mass in this area can provide biomechanical advantages in physical duels, particularly in offensive rebounding and contesting space in the paint. In this regard, a certain percentage of fat in the upper body may not be detrimental, as it can contribute to improved performance in these situations.

Regular body composition assessments should be conducted throughout the competitive season to detect potential asymmetries or sudden weight fluctuations that may indicate overtraining or inadequate recovery. A significant reduction in weight over a short period should prompt adjustments in training loads, nutritional intake, or recovery protocols to prevent negative effects on performance. Players should understand that body composition monitoring is not solely a performance-tracking tool but also a fundamental aspect of health management. Given that variations in body composition influence caloric requirements, dietary strategies should be dynamically adapted to maintain optimal physical condition.

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Annex

Table 4. Body composition inferential results.

	95% confidence interval		t	gl	p
	Upper	Lower			
Weight	-0.2653	2.3764	1.843	8	.103
BMI	-0.0524	0.6746	1.974	8	.084
Fat Mass (kg)	-0.7943	1.5054	0.713	8	.496
Fat Mass (%)	-0.9195	1.5639	0.598	8	.566
Fat-Free Mass (kg)	-0.6868	2.0868	1.164	8	.278
Fat-Free Mass (%)	-1.5817	0.9150	-0.616	8	.555
Lean Mass (kg)	-0.6614	1.9725	1.148	8	.284

Note: $^{*}p < .05$.