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The Correlation Between Body Composition and Some Biomotor Characteristics in Male Basketball Players

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Abstract

Aim: This study was conducted to examine the relationships between body composition and some biomotor characteristics in male basketball players.

Method: A total of 20 male basketball players (Mean Age: 22.05±3.63 years) voluntarily participated in the study. Measurements included body composition parameters and performance tests. Normality was assessed using the Shapiro–Wilk test, and Pearson's correlation coefficient (r) was calculated to examine associations between body composition and biomotor performance.

Results: According to the findings of the study, fat-free ratio and muscle ratio showed significant correlation with vertical jump, speed, and flexibility performance. Fat ratio, on the other hand, is negatively correlated to vertical jump, speed, and flexibility performance measures, suggesting that a high fat ratio can have negative effects on performance. Fluid ratio has shown a significant correlation with flexibility in a positive direction; an increase in fluid ratio is associated with an increase in flexibility performance. Furthermore, body density was positively correlated with back strength, speed, and flexibility. In particular, fat-free mass showed significant correlations with vertical jump, sprint performance, and flexibility, while muscle ratio was strongly associated with flexibility. Conversely, fat percentage was negatively correlated with vertical jump and flexibility.

Conclusion: The findings of this study demonstrate that body composition is closely associated with key biomotor performance parameters in male basketball players.

Key words: *Athletic Performance, Basketball, Body Composition, Physical Fitness.*

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INTRODUCTION

Basketball is a high-intensity intermittent sport played on a 28 × 15 m court, requiring repeated sprinting, jumping, and rapid changes of direction. Its dynamic structure imposes significant physiological demands, particularly on explosive strength, speed, flexibility, and endurance, which are essential determinants of performance (Yazarer et al., 2004; Harley et al., 2018). Players are expected to perform multiple high-intensity actions within short recovery intervals, making basketball one of the most physically demanding team sports. The ability to sustain these actions throughout a game is closely linked to both training status and individual physical characteristics.

In recent years, the growing recognition of basketball's unique physiological profile has led to an increase in scientific interest. Researchers have sought to identify the factors that contribute most to success on the court, with particular emphasis on anthropometric characteristics, body composition, and their relationship to performance outcomes (Zhao et al., 2023). Such investigations provide valuable insights into how variations in body composition may influence explosive movements, speed, and overall conditioning, thereby guiding evidence-based training and player development strategies.

Looking at the current studies in the field of sports science, it seems that the priority is to evaluate the factors that affect the performance of players and to understand to what extent they affect their success (Peña et al., 2018). When sports branches are considered in general, it is aimed to achieve success as a result of the continuous development of the motor characteristics required by the sports branch and to maintain these skills at the level they are extracted and to obtain maximum performance from the player (Barlow et al., 2014). Researching new training methods, measuring players' performance levels, and continuously controlling their body composition are used as aids to develop the motor skills needed Demir et al., 2022). Girginer et al. (2025) stated in their study that preparing the muscular and nervous systems for the physical requirements of the branch increases movement efficiency (Gözlükaya Girginer

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et al., 2025). It is of great importance for the performance development of a player to develop motor skills appropriate to the requirements of their chosen discipline (Massidda et al., 2013).

In basketball, the jumping action requires muscular strength and explosive power at the same time (Pliauga et al., 2015). In stopper position, it is necessary to have a high degree of jumping ability to protect the hoop, to block the player heading to the hoop to score, to take the balls returning from the hoop before the opponent or to get away the block during the shot while attacking, and to dunk on the hoop (Izzo et al., 2015). If a basketball player wants to be successful, he/she must jump higher, run faster in order not to let his/her team down in attack and defence, and at the same time be strong and quick to overtake the opposing players. In addition, athletic and flexible players with mesomorph body structure are successful players who make a difference in basketball (Öz, 2018).

Previous studies have highlighted the strong influence of body composition on athletic performance across various sports. For instance, fat-free mass and muscle mass have been positively associated with jump height, sprint ability, and overall strength, whereas higher fat percentage has been linked to reduced speed, agility, and flexibility (Markovic & Mikulic, 2010; Nikolaidis, 2013). Research on basketball players specifically has shown that anthropometric and physiological characteristics play a decisive role in determining competitive success, particularly in explosive actions such as jumping and sprinting (McLellan et al., 2011; Ziv & Lidor, 2010). However, despite the growing body of evidence, there remains limited data examining the direct relationships between body composition parameters and multiple biomotor characteristics in basketball players.

Therefore, this study aimed to investigate the associations between body composition and key biomotor performance indicators; vertical jump, sprint performance, back strength, and flexibility in male basketball players. By clarifying these relationships, the findings are expected to contribute to a better understanding of how variations in body composition may influence athletic performance in basketball and to provide a scientific basis for future training and performance monitoring practices.

METHOD

Research model

This study was designed based on the quantitative research method and conducted using the correlational survey model. Correlational survey models aim to determine the degree of relationship between two or more variables (Karasar, 2022). Within this framework, the relationship between body composition and certain biomotor characteristics in male basketball players was examined.

Population and sample

The population of the study consisted of male basketball players who actively participated in interuniversity basketball competitions organized by the Turkish University Sports Federation. The sample of the study was composed of 20 male basketball players (n = 20) from Muş Alparslan University Basketball Team, who regularly engaged in training sessions and actively competed in league matches, with a mean age of 22 years and a mean height of 1.80 cm. In this study, the Voluntary Sampling method was employed, as the participants were included based on their willingness to take part in the research. This method, which relies on voluntary participation, is commonly used in studies involving athletes and supports the ethical appropriateness of the research.

Data collection tools

Height: The participants' heights were measured in the combined position of bare feet and heels in anatomical posture. During the measurement, participants were asked to hold their breath and keep their heads in an upright position, looking across. Height measurement made by adjusting the overhead table to contact the vertex point was taken in cm with the stadiometer, with an error margin of ± 0.01 cm.

Body weight, body fat percentage (BFP), and muscle mass (kg and %): These parameters were measured using a bioelectrical impedance analyzer (Tanita Body Composition Analyzer MC-780MA, Japan). Participants arrived on an empty stomach without prior food or fluid intake and were instructed to avoid physical activity and stimulant drinks on the day before measurement. During the procedure, they stood barefoot and wore only shorts, maintaining an upright posture with body weight evenly distributed on both legs.

Vertical Jump Test: The vertical jump test was performed using a Takai jump meter to assess lower-body explosive power. Participants performed a standardized warm-up consisting of 10 minutes of light jogging, dynamic stretching, and submaximal practice jumps prior to testing (Markovic & Mikulic, 2010). They were instructed to jump vertically from a squat position with knees flexed at 90° and hands on the waist. Three trials were performed with 2 minutes of rest between attempts, and the best value was recorded (McLellan et al., 2011).

Back Strength Test: Back strength was measured using a TKK 5402 Digital Back-Leg Dynamometer. Participants stood barefoot on the platform with knees extended, arms straight, trunk slightly inclined forward, and were instructed to pull the bar vertically with maximal effort. Three trials were performed with 1-minute rest between attempts, and the best value was recorded (Hoare, 2000).

Sprint Tests (10 m and 20 m): Sprint performance was measured using Fusion Sport Smartspeed PRO photocells (Australia). Gates were placed at the start, 10 m, and 20 m marks in an indoor sports hall under stable temperature and lighting conditions. Players started 0.5 m behind the first gate, and the best of two maximal sprints separated by 3 minutes of rest was used for analysis (Comfort et al., 2014).

Sit-and-Reach Test: Flexibility was measured using a Lafayette Sit-and-Reach device (ICC = 0.92 reliability). Participants performed the test barefoot, seated on the floor with knees extended and feet flat against the device. They reached forward with both hands, pushing the marker as far as possible without knee flexion. Three trials were performed, and the best score was recorded in cm (Ayala et al., 2012).

Testing Procedures

All tests were conducted indoors on two consecutive days in the Muş Alparslan University sports hall, between 09:00–12:00 a.m., under controlled temperature (22–24 °C) and humidity (50–60%) conditions to minimize environmental effects. Each participant completed the standardized warm-up before testing sessions. Tests were performed in groups of 4–6 athletes to ensure recovery intervals were respected and measurement accuracy was maintained.

Data analysis

The statistical package program SPSS (Statistical Package for the Social Sciences) was used in the analysis of the data obtained in this study. Within the scope of descriptive statistics, the mean (X) and standard deviation (SD) values of the variables were calculated. Whether the data meet the parametric test assumptions was evaluated by normality tests. The normality of the distribution of each variable was analysed by the Shapiro-Wilk test in this direction. It was decided to use parametric tests for the data provided by the assumption of normality. Pearson's product-moment correlation coefficient (Pearson's r) analysis was applied to determine the relationships between body composition parameters and performance measurements (vertical jump, back strength, 20 m sprint, flexibility). In all analyses, the significance level was accepted as $p<.05$, and $p<.01$ was taken into consideration for highly significant correlations.

RESULTS

In this study, the correlation of various anthropometric and physiological parameters with performance variables (vertical jump, back strength, 20 m sprint, flexibility) of male basketball players was investigated. Demographic characteristics are presented in Table 1, descriptive statistics of body composition and biomotor characteristics are in Table 2, and the findings obtained according to correlation analysis are in Table 3.

Table 1. Demographics

Demographics	n	Mean	Standard Deviation
Age (years)	20	22.05	3.63
Body Weight (kg)	20	80.48	13.82
Height (cm)	20	180.60	8.71
Body Mass Index (BMI)	20	23.38	2.93

Upon examining Table 1, the demographic characteristics indicate a relatively homogeneous group of participants with similar age, body weight, height, and BMI values, providing a balanced sample for subsequent analyses.

Table 2. Descriptive statistics of body composition and biomotor characteristics

Parameters	n	Mean	Std. Deviation
Vertical Jump (cm)	20	36.58	6.00
Back Strength (kg)	20	135.28	20.51
10 m Sprint (s)	20	1.77	0.09
20 m Sprint (s)	20	3.09	0.16
Flexibility (cm)	20	36.25	7.73
Fat-Free Mass (Kg)	20	63.17	7.23
Fat-Free Mass (%)	20	82.61	5.63
Muscle Mass (Kg)	20	59.82	6.77
Muscle Ratio (%)	20	78.89	5.30
Fat Mass (Kg)	20	13.58	6.34
Fat Ratio (%)	20	16.96	5.60
Fluid Mass (Kg)	20	44.26	4.25
Fluid Ratio (%)	20	58.36	4.46
Baseline Metabolism Rate (kcal)	20	1.88	0.23
Body Density	20	1.06	0.02
Internal fat deposition	20	3.15	2.39

Upon examining Table 2, it is evident that the participants exhibited generally favorable biomotor performance and body composition profiles. Measures of strength, speed, and flexibility reflected well-developed physical fitness, while body composition parameters indicated a predominance of lean mass and healthy fat levels, consistent with a physically active population.

Tablo 3. Correlation results between body composition and biomotor characteristics in basketball players

Parameters	Vertical Jump (cm)	Back Strength (kg)	20 m Sprint (s)	Flexibility (cm)
Fat-Free Ratio (%)	.543*	.240	-.506*	.668**
Muscle Ratio (%)	.506*	.176	-.462*	.719**
Fat Ratio (%)	-.504*	-.175	.463*	-.717**
Fluid Ratio (%)	.407	.001	-.424	.671**
Baseline Metabolism Rate (kcal)	.017	.316	.246	-.394
Body Density	.434	.491*	-.565**	.623**
Internal fat deposition	-.353	-.131	.399	-.546*

**p<0,05 **p<0,01*

Statistically significant relationships were found between fat-free percentage and vertical jump (r = .543, p<.05), 20 m sprint (r=-.506, p<.05) and flexibility (r= .668, p<.05). Similarly, muscle ratio also showed significant correlation with vertical jump (r = .506, p<.05), 20 m sprint (r =-.462, p<.05), and flexibility (r= .719, p<.01). These findings suggest that fat-free ratio and muscle ratio play a decisive role in jump, speed and flexibility performance. Statistically significant correlations were found between fat percentage and vertical jump (r=-.504, p<.05), 20 m sprint (r= .463, p<.05) and flexibility (r=-.717, p<.01). These findings suggest that increased body fat can negatively impact jumping, short-distance speed, and flexibility performance. Fluid ratio was significantly positively correlated with flexibility performance (r =.671, p<.01). That is, as the fluid ratio increases, the flexibility performance increases. Body density was significantly correlated with back strength (r=.491, p<.05), 20 m sprint (r =-.565, p<.01) and flexibility (r= .623, p<.01). This suggests that higher body density can improve back strength and speed performance and have positive effects on flexibility as well. Internal fat deposition was significantly negatively correlated with flexibility performance (r =-.546, p<.05). That is, as the internal fat deposition rate increases, the elasticity performance decreases.

DISCUSSION

The findings of this study reveal the critical role of body composition on biomotoric characteristics in male basketball players. The data obtained show that especially fat-free body mass and muscle ratio are positively and significantly correlated to basic basketball performance indicators such as vertical jump, speed, and flexibility.

In the study, it was found that fat-free body mass and muscle ratio were positively correlated with vertical jump, speed, and flexibility. This result is in line with previous studies in the literature. These studies emphasise that players with a high ratio of muscle mass and fat-free body mass exhibit higher performance in motor skills requiring explosive strength and agility (Markovic and Mikulic, 2010).

While the vertical jump test provides information about a basketball player's athletic performance, it is also used to determine the player's athletic weaknesses and strengths (McLellan et al., 2011). Because the vertical jump can give information to the researcher about the anaerobic power capacity of the player in the lower extremities (Heishman et al., 2019; Kabaciński et al., 2017). Since a large number of jumping actions occur during the performance in basketball, the player's jumping skill as well as the factors that affect this skill negatively or positively are of great importance (Kabaciński et al., 2017; Ziv & Lidor, 2010). This once again confirms the importance of optimal body composition to perform the characteristic movements of basketball, such as high jump, sudden acceleration, and change of direction (Ziv & Lidor, 2009).

Body mass can affect the performance of basketball players both positively and negatively. In this study, a significant correlation was found between body density and back strength ($r = 0.491$, $p < 0.05$), 20 m sprint ($r = -0.565$, $p < 0.01$), and flexibility ($r = 0.623$, $p < 0.01$) in male basketball players. This suggests that players with a denser body structure may have an advantage in parameters that require physical performance, such as back strength and speed. This situation shows that individuals with high muscle-mass density can produce more force; thus, the superiority it provides to the player physically in terms of performance also contributes to movement efficiency (Hoare, 2000). Sprint performance, especially over short distances, is shaped by a combination of both explosive force and neuromuscular control. Although body composition influences this performance to some extent, characteristics such as technical skill, agility, and coordination are more decisive (Comfort et al., 2014). In light of all this information, it can be said that our study results are in parallel with the literature findings.

Body fat, as a component contributing to total body mass, was found to have a significant negative correlation with vertical jump ($r = -0.504$, $p < 0.05$), 20 m sprint ($r = 0.463$, $p < 0.05$), and flexibility performance ($r = -0.717$, $p < 0.01$). These findings indicate that an increase in fat mass adversely affects key biomotor parameters. Similarly, Nikolaidis (2013) reported that higher body fat percentage imposes an additional load on performance, thereby limiting the effective use of motor skills. In line with this, Yıldızer et al. (2024) observed that body composition was significantly associated with flexibility in university students following an eight-week online fitness program, noting that reduced fat ratio and increased muscle mass both contributed positively to flexibility outcomes. Taken together, these results suggest that the present study’s findings are consistent with previous literature, further underscoring the detrimental role of excessive fat mass on athletic performance.

In this study, a significant positive correlation was found between muscle ratio and all biomotor performance parameters. Vertical jump ($r = 0.506$, $p < 0.05$), 20 m sprint ($r = -0.462$, $p < 0.05$), and flexibility ($r = 0.719$, $p < 0.01$). In the literature, there are studies indicating that an increase in muscle strength has a positive effect on balance, jumping, speed, and agility (Suchomel et al., 2016; Türker et al., 2018; Türker & Yüksel, 2019). It was observed that the findings were in parallel with the literature, and muscle mass made a more significant contribution, especially on flexibility and speed parameters.

In this study, a significant positive correlation was found between fluid ratio and only flexibility performance among the biomotor characteristics measured ($r = 0.671$, $p < 0.01$). Baker reported that 2% body weight loss (dehydration) caused prolonged sprint time, slowed lateral movements, and decreased shooting accuracy in basketball players (Baker, 2016). In addition, the positive significant relationship obtained between fluid ratio and flexibility is consistent with the effect of cellular hydration on muscle elasticity, as suggested by Casa et al. (2000). While it was observed that the decrease in the liquid ratio negatively affected the performance, it was seen that our research results were in parallel with the literature findings.

The significant negative correlation between internal fat deposition and flexibility ($r = -0.546$, $p < 0.05$) indicates that adipose tissue around the organ may limit the range of motion. In a study, it was reported that internal fat deposition may have negative effects on the range of motion and balance (Chua et al., 2021). Especially, the fat deposition around the internal organs can be considered an undesirable situation not only in terms of health but also in terms of performance. The finding in our study explains the effect of hydration on muscle elasticity and range of motion.

The positive correlations between fat-free mass and vertical jump ($r = 0.543$, $p < 0.05$), 20 m sprint ($r=-0.506$, $p<0.05$), and flexibility ($r=0.668$, $p<0.05$) indicate that fat-free mass offers a multifaceted performance-enhancing effect. In their study, Hernandez-Martinez et al. (2024) reported that they found a significant and high positive correlation between fat-free mass, vertical jump "CMJ" ($r=0.76$; $p<0.000$), and handgrip strength ($r=0.78$-0.81) performances. They also reported a significant negative correlation with 10 m ball sprint performance ($r=-0.51$; $p = .007$) (Hernandez-Martinez et al., 2024)

In another study, a moderate, negative, and significant correlation was reported between body fat percentage and vertical jump performance of the dominant leg in male players ($r=-0.412$; $p<0.001$). However, no significant association was observed in single-leg forward jump or vertical jump tests of the non-dominant side ($r=-0.044$ to 0.220; $p>0.05$), suggesting that the impact of fat ratio on performance may vary depending on test type, side dominance, and movement characteristics (Kaya, 2020). Similarly, Ceviz & Genç (2025) demonstrated that training not only increased force production capacity and movement efficiency in sedentary individuals but also promoted fat-free mass gains. Kızılca (2025) further reported that reductions in fat percentage through training were associated with improvements in both sprint speed and vertical jump strength in young football players. In parallel, Eroğlu et al. (2025) showed that high school students with lower fat volume exhibited significantly better athletic performance than their peers, supporting the notion that optimal body composition is a key determinant of physical fitness. Collectively, these findings align with the present study, highlighting that fat-free mass plays a decisive role in strength- and power-related performance, although its influence may be more limited in complex motor skills such as sprinting.

The findings of this study indicate that body composition is closely linked to performance-related outcomes in basketball players. In particular, lower body fat and higher fat-free mass were associated with superior results in explosive strength, sprint ability, and flexibility. These relationships suggest that maintaining an optimal balance between fat and lean mass may provide players with important physical advantages, contributing to more effective execution of high-intensity actions required in basketball.

CONCLUSION

This study examined the associations between body composition parameters and key biomotor characteristics in male basketball players. The results demonstrated that fat-free mass and muscle ratio were positively correlated with vertical jump, sprint performance, and flexibility, while body fat percentage and internal fat deposition showed negative correlations with these variables. Additionally, body density was positively associated with back strength and flexibility, and fluid ratio was related to flexibility performance.

These findings suggest that body composition plays a significant role in shaping the physical performance profile of basketball players. In particular, higher levels of fat-free mass and muscle mass appear beneficial for explosive strength, speed, and flexibility, whereas excessive fat accumulation may hinder these qualities. Overall, the study highlights the importance of monitoring body composition alongside performance assessments to better understand the physical determinants of success in basketball.

SUGGESTIONS

- Future research may benefit from examining the effects of targeted strength and conditioning programmes on body composition and performance outcomes, in order to clarify potential causal relationships.
- Nutritional strategies and conditioning approaches should be investigated as possible factors influencing body fat percentage and internal fat deposition in athletes.
- Periodic monitoring of body composition in basketball players, conducted during pre-season, in-season, and post-season phases, could provide valuable data when interpreted alongside performance assessments.

- Further studies including different age groups, genders, and sport disciplines, as well as longitudinal designs, are recommended to enhance the generalizability and depth of the findings.

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Ethical Approval and Permission Information

Ethics Committee:	Scientific Research and Publication Ethics Committee, Muş Alparslan University
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