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A Comparison of Physical Characteristics and Power Outputs in Adolescent Basketball Players According to Positions

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ABSTRACT

Purpose: The aim of this study is to compare the differences in physical characteristics and power output among adolescent basketball players according to their positions.
Method: A total of 25 participants (15.71±0.76 years) voluntarily took part in the study. To assess participants' physical characteristics, body weight, fat mass, muscle mass, core muscle mass, and basal metabolic rate were measured using the Tanita TBF-300 bioelectrical impedance analysis (BIA) method. Power output differences were determined using anaerobic power measurements obtained from handgrip and back strength tests and jump tests. The participants' data were analysed using the IBM SPSS 24 statistical software package. Descriptive statistics, Kruskal-Wallis and Tamhane post hoc tests were used to compare the physical characteristic and power output-based values between groups.
Results: Statistical analyses revealed significant differences in height, body weight, muscle mass, core muscle mass, basal metabolic rate, and anaerobic power values among adolescent basketball players according to their positions ($p<0.05$). However, no significant differences were found in body fat mass, handgrip strength or back strength. It was determined that most of the significant differences were between the guard and forward positions.
Conclusion: In conclusion, it has been determined that the height, body weight, muscle mass, core muscle mass, basal metabolic rate and anaerobic power values of adolescent basketball players differ according to their playing position. These findings support the idea that different positions in basketball require different physical and strength characteristics. The study has two limitations: the sample size is small, and the focus is on adolescent basketball players.
Keywords: Basketball, Player Position, Physical Characteristics, Power Outputs

ÖZET

Adolesan Basketbolcularda Fiziksel Özellikler ve Güç Çıktılarının Pozisyonlara Göre Karşılaştırılması

Amaç: Bu çalışmanın amacı, adolesan basketbolcuların fiziksel özellikleri ve güç çıktısına dayalı farklılıklarını pozisyonlara göre karşılaştırmaktır.
Yöntem: Çalışmaya 25 katılımcı (15,71±0,76 yaş) gönüllü olarak katılmıştır. Katılımcıların fiziksel özelliklerini değerlendirmek için; vücut ağırlığı, yağ kütlesi, kas kütlesi, core bölge kas kütlesi ve bazal metabolizma hızı Tanita TBF-300 biyoelektrik impedans analizi (BIA) yöntemi ile kullanılmıştır. Güç çıktısı farklılıkları, el kavrama ve sırt gücü testi ile sıçrama testlerinden elde edilen anaerobik güç ölçümleri ile belirlenmiştir. Katılımcıların verileri IBM SPSS 24 istatistik yazılım paketi kullanılarak analiz edilmiştir. Gruplar arasındaki fiziksel özellikleri ve güç çıkışı bazlı değerleri karşılaştırmak için tanımlayıcı istatistikler, Kruskal-Wallis ve Tamhane post hoc testleri kullanılmıştır.

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Bulgular: Yapılan istatistiksel analizler sonucunda, adolesan basketbolcuların pozisyonlarına göre boy, vücut ağırlığı, kas ağırlığı, core bölge kas ağırlığı, bazal metabolizma hızı ve anaerobik güç değerlerinde anlamlı fark bulunmuştur ($p<0,05$). Buna karşılık vücut yağ ağırlığı, el kavrama gücü ve sırt gücü değişkenlerinde anlamlı farklılık tespit edilmemiştir. Anlamlı farklılıkların çoğunun guard ve forward pozisyonları arasında olduğu belirlenmiştir.
Sonuç: Sonuç olarak, ergen basketbolcuların boy, vücut ağırlığı, kas kütlesi, core kas kütlesi, bazal metabolizma hızı ve anaerobik güç değerlerinin oyuncu pozisyonlarına göre farklılık gösterdiği belirlenmiştir. Bu bulgular, basketbolda her pozisyonun farklı fiziksel ve güç özellikleri gerektirdiğini desteklemektedir. Bu çalışmanın iki sınırlaması vardır: örneklem büyüklüğü küçüktür ve odak noktası ergen basketbolculardır.
Anahtar Kelimeler: Basketbol, Oyuncu Pozisyonu, Fiziksel Özellikler, Güç Çıktıları

INTRODUCTION

Adolescence represents a transitional stage characterized by rapid somatic growth, hormonal changes, and neuromuscular adaptations that significantly influence sport-specific performance capacities (Malina et al., 2004; Philippaerts et al., 2006). In basketball, these maturational processes affect players differently depending on their playing position, as the physical and physiological demands for guards, forwards, and centers vary considerably (Boone & Bourgois, 2013; Bae, 2022). For example, guards rely more on agility, speed, and relative anaerobic capacity, whereas centers depend on body size, absolute strength, and power-related outputs to fulfill their positional responsibilities (Sallet et al., 2005; Ostojić et al., 2006). Given that basketball is a sport requiring repeated bouts of explosive and high-intensity activity, anaerobic power emerges as a decisive factor that links physical growth during adolescence with performance effectiveness across positions (Abdelkrim et al., 2010; Nikolaidis et al., 2015). Therefore, understanding how adolescent development interacts with position-specific demands is crucial for optimizing training strategies and guiding talent development in youth basketball

Basketball is a positional sport in which players are typically categorized as guards, forwards, or centers, and these classifications reflect meaningful anthropometric, physiological, and performance-based differences. Guards are generally shorter and lighter, which supports greater speed, agility, and endurance capacities that are essential for tasks such as ball handling, rapid directional changes, and defensive coverage (Erol et al., 2016; Boone & Bourgois, 2013). Forwards represent an intermediate profile, combining size with mobility, and are often required to perform versatile roles, including rebounding, mid-range scoring, and defensive rotations (Ostojic et al., 2006). Centers, on the other hand, are typically the tallest and heaviest players on the court, demonstrating higher absolute strength and anaerobic power that enable them to dominate in areas such as shot-blocking, rebounding, and scoring near the basket (Sallet et al., 2005; Abdelkrim et al., 2010). These anthropometric and motor skill differences highlight the position-specific demands in basketball, underlining why training and performance assessments must consider positional distinctions.

Understanding these differences is particularly important during adolescence, when players are still undergoing rapid physical growth and neuromuscular development. Position-specific requirements interact with maturational status, influencing how effectively athletes adapt to training loads and competition stress (Malina et al., 2004; e-Silva et al., 2010). For example, while guards may benefit from enhanced agility and speed during early maturation phases, centers may experience greater advantages later as increased muscle mass and strength align with their positional requirements. Neglecting such distinctions could result in inappropriate training prescriptions, reduced performance optimization, and a higher risk of overuse injuries. Therefore, a systematic evaluation of anthropometric traits, motor abilities, and anaerobic power across playing positions not only clarifies developmental trajectories but also provides valuable insights for coaches and practitioners in tailoring individualized training strategies (Huyghe et al., 2018; Torres-Unda et al., 2013). Building on this foundation, the present study aims to compare the physical characteristics and power outputs of adolescent basketball players across different positions, with a focus on how these variables interact with performance outcomes.

Further, investigations among elite Belgian basketball players reveal that guards display higher endurance, speed, and agility, contrasted with centers and power forwards who show higher muscle strength (Boone & Bourgois, 2013). These position-based physical distinctions are mirrored in energy system profiles and power outputs: guards and forwards typically possess higher relative aerobic and anaerobic power, supporting frequent high-intensity movement, whereas centers exhibit greater absolute anaerobic power consistent with their body mass and specific role demands (Ostojić et al., 2006; Abdelkrim et al., 2010; Sallet et al., 2005).

In basketball sport, the use of short-term intense physical demands and the coordinated use of skills and basic motoric characteristics is the determinant of sportive performance. Changes in body dimensions and motoric characteristics are likely affect sportive performance. This period is critical because athletes experience rapid physical growth and physiological adaptations that directly influence their performance capacities (Makaracı et al., 2022).

Particularly during adolescence, rapid increases in height, body weight, and muscle mass are observed as a result of pubertal growth, which directly influences physical performance capacities (Malina et. al., 2004). This developmental stage is therefore considered critical for athletes, as physical growth interacts with training to shape performance outcomes. During adolescence, parameters such as running speed, agility, and muscular strength demonstrate significant improvements, largely due to neuromuscular maturation and hormonal changes (Philippaerts et al., 2006). For instance, sprint speed and agility tend to improve progressively between ages 13–16, while strength and anaerobic power increase more markedly in the later stages of adolescence as muscle hypertrophy accelerates (Malina et al., 2010; Makaracı et al., 2022). These developmental changes highlight the growing importance of body weight, running speed, agility, and strength in adolescent basketball players, as they become decisive factors influencing performance outcomes.

The growth spurt experienced in adolescence leads to the emergence of secondary sex characteristics, including significant increases in bone, fat, and muscle mass, acceleration in overall growth, physiological changes, reproductive ability, and the enlargement of endocrine glands and internal organs (Baş & Bundak, 2016). Growth hormone secreted from somatotropic cells in the pituitary gland plays a key role in this period (Civan et al., 2018). During the growth cycle, the distal part of the extremities elongates earlier than the proximal parts. This is a fact that the hands, arms and feet of adolescent basketball players grow earlier than the core of the body. This disproportionate growth may temporarily disrupt motor coordination, balance, and technical execution, which can negatively influence sportive performances ((Baltacı et al., 2008). Such disruptions are sometimes described as “adolescent awkwardness,” a developmental phase where athletes may experience decreases in motor efficiency and increased susceptibility to injury due to delayed adaptation of muscle strength and joint stability relative to skeletal growth (Beunen & Malina, 2008; van der Sluis et al., 2015). Recognizing these negative effects is essential because even short-term declines in coordination and movement quality can affect training progression and performance outcomes in competitive settings. For adolescent basketball players, who are required to frequently perform complex motor tasks such as rapid changes of direction, jumps, and precise ball handling, these growth-related imbalances may temporarily hinder technical and physical development (Lloyd & Oliver, 2012) .In this period, it is defined as important to follow both the performance and physical development of athletes to ensure development and to prevent possible negativities (Bayraktar & Kurtoğlu, 2009). Recognizing these negative effects is essential because even short-term declines in coordination and movement quality can affect training progression and performance outcomes in competitive settings. For adolescent basketball players, who are required to frequently perform complex motor tasks such as rapid changes of direction, jumps, and precise ball handling, these growth-related imbalances may temporarily hinder technical and physical development.

It is important to evaluate the strength and power characteristics of athletes in predicting training or competition performance. For this reason, the performance components needed vary according to the physical demands of each branch. In basketball, a sport that requires intense explosive power, it is important to analyse the jump performance and to evaluate the lower extremity strength in bilateral and unilateral directions to define the performance. Absolute average power can be calculated as a numerical value in Watts (Yüksel et al., 2016). There are different calculation approaches that can be estimated by considering absolute peak power, jump height (cm) and body mass (kg) (Sayers et al., 1999).

The aim of this study was to compare the physical characteristics and power outputs of adolescent basketball players across different playing positions. Specifically, the study assessed parameters such as body composition, lower and upper extremity strength, and anaerobic power, and analysed how these variables differ among guards, forwards, and centers

METHODS

Research Design

This study used a causal comparison design to compare the physical characteristic and power output-based differences among adolescent basketball players in terms of playing positions. This study used an intentional sampling experimental research design, collecting data from each participant at one point in time.

Participants

Bu A total of 25 participants (15.71±0.76 years) with at least 5 years of licensed sports experience voluntarily took part in the study. To compare the physical characteristic and power output-based differences among adolescent basketball players in terms of playing positions participants were assigned to three different groups in terms of playing positions. Guard group (n:13; 15.54±0.84 years), forward group (n:7; 15.84±0.39 years), center group (n:5; 15.98±0.96 years). Participants were selected based on the absence of any musculoskeletal injuries or medical conditions that might affect their performance. Prior to the study, informed consent was obtained from both the participants and their legal guardians.

Application Procedure

All measurements were carried out in a sports performance laboratory under standardized conditions (temperature 22–24°C, humidity 50–60%). Participants were instructed to avoid strenuous physical activity and caffeine consumption for at least 24 hours before the test sessions. Each participant attended the laboratory on a single day, and all assessments were completed in the morning hours (09:00–12:00) to minimize circadian variation.

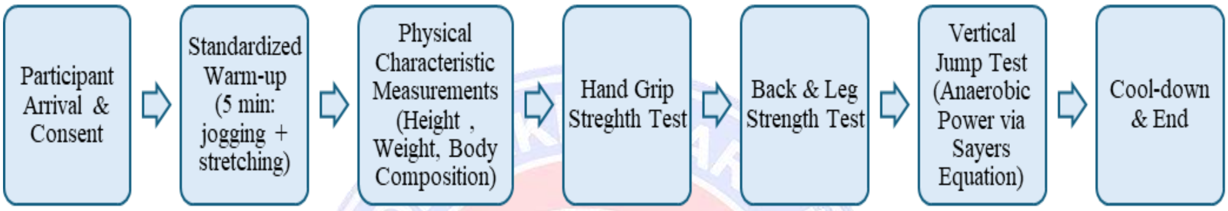

Figure 1. Diagram of application procedure

Physical Characteristic Measurements of the Participants: Height of the participants was measured with a portable stadiometer (Holtain Ltd, UK) accurate to the nearest 1 cm. Throughout the measurement, participants were instructed to stand in a steady position, keeping their hands and feet aligned with the specified contact points.

Body weight, fat mass, muscle mass, core muscle mass and basal metabolic rate characteristics were measured using the Tanita TBF-300. Participants were asked to take off their shoes and any metal accessories before using the analyser. On the day of the measurement, participants were asked to step barefoot on 4 contact electrodes (1 standing) mounted on the platform surface and to remain in a motionless and upright position until the results were displayed on the screen. Participants' body fat percentages were automatically calculated and recorded using special equations pre-programmed by the manufacturer.

Power Output-Based Measurements of the Participants: Hand grip strength was measured using a Takei hand dynamometer (T.K.K.5401 model, Japan). Participants were instructed to extend their arms at a 45° angle and apply maximum force while gripping the device. Each participant performed two trials with maximum effort, with a one-minute rest between attempts. The highest value obtained was recorded for analysis.

Takei back-leg dynamometer (T.K.K.5402 model, Japan) was used for the measurement. Participants placed their feet on the dynamometer stand, keeping their knees fully extended. While holding the dynamometer bar with their hands, they pulled it vertically upward, ensuring their arms were tense, their back remained straight, and their trunk was slightly tilted forward. The highest value from two trials was recorded, with a one-minute rest between each trial.

Anaerobic power was assessed through jump tests, where participants exerted maximal effort to achieve the highest possible jump. The jump height was measured using the Opto-jump device (Microgate, Bolzano, Italy). Anaerobic power was calculated as peak power using the Sayers equation, which is: [60.7 × jump height (cm)] + [45.3 × body weight (kg)] - 2055. The resulting anaerobic power data were then analysed based on this formula (Sayers et al., 1999)

Research Ethics

The study was conducted in accordance with the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board (IRB) of the Kütahya Dumlupınar University (protocol code: BIO-2025/07 — July 28, 2025).

For participants, informed consent was obtained from the participants' parents or legal guardians following ethical guidelines, and all participants voluntarily participated in this study. Participants were given a brief verbal briefing about the study before participating in the study. The authors declare that they acted in accordance with ethical guidelines in all stages of the present study.

Statistical Analysis

The participants' data were analysed using the IBM SPSS 24 statistical software package. The Shapiro-Wilk test was used to evaluate the normality of the data and the homogeneity of variances. Descriptive statistics and Kruskal-Wallis test was applied to compare physical characteristics and power outputs among guards, forwards, and centers, as some variables did not meet the assumption of normality. The Tamhane post hoc test was used to identify which specific positions differed, considering unequal variances between groups and independent samples t-tests were used to compare the physical characteristic and power output-based values between groups. A significance level of $p<0.05$ was set for the statistical analyses (Özdamar, 2002).

RESULTS

Table 1. Descriptive statistics of age, height and body weight

Variable	n	*M*	*SD*	Min	Max
Age (years)	25	15.71	0.76	15	17
Height (cm)	25	180.96	6.89	168	196.5
Body Weight (kg)	25	72.62	16.93	48.9	120.4

According to the descriptive statistics data presented in Table 1, the mean age of the 25 participants was 15.71±0.76 years, the mean height was 180.96±6.89 cm and the mean body weight was 72.62±16.93 kg.

Table 2. Descriptive statistics on physical characteristics and power outputs

Variable	Playing Positions	n	*M*	*SD*	Min	Max
Height (cm)	1 Guard	13	177.57	6.04	168.00	184.50
	2 Forward	7	181.35	3.92	175.50	187.50
	3 Center	5	189.96	5.51	183.50	196.50
Body Weight (kg)	1 Guard	13	64.50	10.13	48.90	83.20
	2 Forward	7	78.88	14.04	65.30	102.80
	3 Center	5	86.16	24.11	55.00	120.40
Muscle Weight (kg)	1 Guard	13	31.98	4.39	25.60	41.40
	2 Forward	7	38.30	4.36	33.80	46.60
	3 Center	5	39.86	7.48	27.60	46.00
Body Fat Weight (kg)	1 Guard	13	7.28	4.00	2.70	16.20
	2 Forward	7	11.57	10.13	3.90	33.60
	3 Center	5	16.00	14.01	5.20	39.60
Core Muscle Weight (kg)	1 Guard	13	24.67	3.08	20.10	31.00
	2 Forward	7	28.90	3.51	25.30	35.60
	3 Center	5	30.02	5.43	21.50	35.90
Basal Metabolic Rate (kcal)	1 Guard	13	1597.76	156.25	1367.00	1931.00
	2 Forward	7	1823.28	156.07	1659.00	2121.00
	3 Center	5	1885.00	269.90	1445.00	2115.00
Hand Grip Power (kg)	1 Guard	13	36.23	5.71	26.50	39.68
	2 Forward	7	38.35	6.93	27.30	44.77
	3 Center	5	41.08	8.19	27.10	51.25
Back Power (kg)	1 Guard	13	111.73	9.67	96.00	126.00
	2 Forward	7	132.64	26.12	101.50	170.50
	3 Center	5	126.00	31.07	76.50	158.50
Anaerobic Power (Watt)	1 Guard	13	2526.39	700.64	1424.18	3607.80
	2 Forward	7	3405.42	469.05	2845.49	4098.76
	3 Center	5	3471.16	1284.40	1480.54	4813.43

According to Table 2, centers were the tallest (189.96 ± 5.51 cm) and heaviest

(86.16 ± 24.11 kg), followed by forwards (181.35 ± 3.92 cm, 78.88 ± 14.04 kg) and guards (177.57 ± 6.04 cm, 64.50 ± 10.13 kg). Muscle mass, core muscle mass, and basal metabolic rate were also highest in centers, with forwards showing intermediate values and guards the lowest. Similarly, centers exhibited the greatest hand grip, back strength, and anaerobic power, while guards had the lowest values, and forwards fell in between. Body fat showed an increasing trend from guards to centres.

Table 3. Comparison of physical characteristics by playing positions

Variable	Playing Positions	n	Mean Rank	df	X2	p	Difference Tamhane post hoc test
Height (cm)	1 Guard 2 Forward 3 Center	13 7 5	9.69 13.00 21.60	2	9.482	0.009**	3-2 3-1
Body Weight (kg)	1 Guard 2 Forward 3 Center	13 7 5	9.23 16.57 17.80	2	7.185	0.028*	2-1
Muscle Weight (kg)	1 Guard 2 Forward 3 Center	13 7 5	8.92 17.00 18.00	2	8.368	0.015*	2-1
Body Fat Weight (kg)	1 Guard 2 Forward 3 Center	13 7 5	10.81 14.21 17.00	2	2.825	0.243	-
Core Muscle Weight (kg)	1 Guard 2 Forward 3 Center	13 7 5	8.96 16.64 18.40	2	8.324	0.016*	2-1
Basal Metabolic Rate (kcal)	1 Guard 2 Forward 3 Center	13 7 5	8.85 17.14 18.00	2	8.667	0.013*	2-1

**p<0.05 **p<0.01*

As shown in Table 3, significant differences were found among playing positions for height (p<0.009), body weight (p<0.05), muscle mass (p<0.05), core muscle mass (p<0.05), and basal metabolic rate (p<0.05). Centers had the highest mean ranks for all these variables, followed by forwards and guards. Post hoc comparisons indicated that the differences were mainly between guards and forwards. No significant differences were observed for body fat mass.

Table 4. Comparison of power outputs by playing positions

Variable	Playing Positions	n	Mean Rank	df	X2	p	Difference Tamhane post hoc test
Hand Grip Power (kg)	1 Guard 2 Forward 3 Center	13 7 5	10.85 14.07 17.10	2	2.814	0.245	-
Back Power (kg)	1 Guard 2 Forward 3 Center	13 7 5	10.23 16.00 16.30	2	3.836	0.147	-
Anaerobic Power (Watt)	1 Guard 2 Forward 3 Center	13 7 5	9.23 16.86 17.40	2	7.119	0.028*	2-1

$p<0.05$

As shown in Table 4 no significant difference was found between the hand grip and back leg strength data according to the playing positions of the participants. A significant difference was found between the anaerobic power data of the participants according to playing positions (p<0.05). The anaerobic power data of the participants were determined as mean rank=9.23 for guard position. mean rank=16.86 for forward position and mean rank=17.40 for centre position, respectively. As a result of the intra-group comparisons, it is observed that the significant difference is due to the rank mean data of the forward position compared to the guard position.

DISCUSSION and CONCLUSION

The results of this study provide valuable insights into the physical characteristics and power output-related differences among adolescent basketball players based on their playing positions. While the findings revealed statistically significant differences in height, body weight, muscle mass, core muscle mass, basal metabolic rate (BMR), and anaerobic power, these outcomes should not be considered in isolation but rather in relation to previous findings and the methodological limitations of the present study.

One important observation is that centers exhibited higher values in body size and power-related parameters compared to other positions. Although this is consistent with studies highlighting the anthropometric and physiological advantages of centers for rebounding and post-play (Hoare, 2000; Ostojic et al., 2006), some literature has reported that guards, despite smaller body dimensions, can demonstrate relatively greater values in explosive strength when normalized to body mass (Sattler et al., 2012; Jakovljevic et al., 2018). This discrepancy suggests that while absolute measures favour centers and forwards, relative performance indicators (e.g., strength per kilogram of body mass) may provide a different perspective, particularly for guards whose playing style emphasizes agility and rapid directional changes.

Interestingly, no significant differences were found in hand grip strength and back strength between positions. Previous research has shown mixed findings on this matter. For example, Sattler et al. (2012) reported positional differences in strength parameters among elite players, whereas Markovic and Mikulic (2010) emphasized that such differences may be less pronounced in youth athletes who have not yet undergone positional specialization. Our findings seem to align with the latter, indicating that in adolescence, training loads may still be generalized and not strongly differentiated by playing position.

The significant differences in anaerobic power, favouring forwards and centers, are consistent with previous studies emphasizing the importance of body size and muscular development for vertical jumping and rebounding (Nikolaidis et al., 2015). However, some evidence indicates that guards can outperform forwards and centers in jump tests when results are adjusted for body weight, reflecting the role of neuromuscular efficiency rather than pure muscle mass (Jakovljevic et al., 2012). This nuance highlights the need to consider both absolute and relative measures of power output in basketball performance analysis.

The small sample size, particularly the low number of centers (n=5), presents a limitation. This not only reduces statistical power but also constrains the generalizability of the findings. Given that adolescent players are at different stages of biological maturation, even within the same chronological age group, individual variation may have disproportionately influenced the results (Lloyd & Oliver, 2012). Future research with larger, more balanced samples is necessary to validate these observations and to examine how maturation status interacts with positional differences.

Another notable point is that body fat mass did not differ significantly between positions. While this aligns with studies suggesting that basketball players, regardless of role, tend to maintain low fat percentages due to high training demands (McGill et al., 2012), other research has reported slightly higher fat mass in centers compared to guards (Gryko et al., 2018). This inconsistency might reflect differences in sample characteristics, competitive level, or training regimens across studies.

From a practical standpoint, the differences observed in muscle mass, BMR, and core strength reinforce the importance of tailoring training programs to positional requirements. Yet, the lack of strong divergence in some parameters, such as grip and back strength, suggests that adolescent players may benefit more from holistic training before highly specialized regimens are introduced. Coaches and practitioners should therefore balance general physical development with emerging positional demands.

Finally, this study contributes to normative data on adolescent basketball players, but its limitations highlight the need for cautious interpretation. The findings generally support existing literature, but conflicting reports in the field indicate that positional differences in adolescence may not be as pronounced or consistent as in adult or elite populations. Longitudinal designs would be particularly valuable to track how anthropometric and performance variables evolve through maturation and how these changes ultimately shape positional roles in basketball.

In conclusion, this study demonstrates that physical characteristics and anaerobic power differ significantly among adolescent basketball players based on playing position, with centers and forwards exhibiting greater values in size and power related metrics. These findings support the notion that different physical characteristics and power outputs are required for guards, forwards, and centers, reflecting the functional demands of each role in basketball.

However, the results should be interpreted with caution due to certain limitations. The relatively small sample size, particularly in the center group, reduces the statistical power and limits the generalizability of the findings. In addition, the narrow age range of participants (15–16 years) means that the results may not fully capture variations across different stages of adolescence, where growth and maturation rates differ considerably. Furthermore, the reliance on specific measurement methods, such as bioelectrical impedance analysis (BIA) for body composition and selected jump-based tests for anaerobic power, restricts the scope of performance variables assessed.

Despite these limitations, the study provides practical implications for coaches and sports scientists in designing individualized training regimens and making position-based decisions in youth basketball. Future research with larger and more diverse samples, as well as the inclusion of additional variables such as speed, agility, and aerobic capacity, will enhance the generalizability and applicability of these findings.

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