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Original Article

Differences in physical conditions for each playing position in basketball athletes

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Abstract:
While there have been numerous studies examining physical conditions in sports, there remains a scarcity of research on the physical conditions required for team sports that involve playing position assignments, particularly the five positions in basketball. Although physical conditioning in basketball has been studied with regards to playing positions, the majority of research has focused on the traditional three positions of guard, forward, and center. Only limited research has been conducted on the physical requirements of the five distinct playing positions, including Point guard, Shooting guard, Small forward, Small forward, and Center. The aim of this study is to investigate the differences in physical conditioning between each of the five basketball playing positions. The study utilized a quantitative descriptive design with a retrospective causal comparative or ex-post facto design. The sample included 20 basketball athletes from 27 regencies and cities in West Java. The data were analyzed using SPSS software with a one-way ANOVA test. The results revealed significant differences in the physical conditioning of each basketball athlete based on their playing position.
Keywords: **basketball, playing position, physical conditioning**

Introduction

Basketball is a popular collective sport both in Serbia and around the world, known for its dynamic and attractive nature (Marinkovic & Pavlović, 2013). According to Kamble et al. (2012), basketball is one of the most popular big ball games worldwide, characterized by the unpredictability of its outcomes – even a few seconds remaining can turn the tide of a game in favor of a losing team. With over 70 million players and representation from more than 210 countries, basketball is recognized globally as a significant sport, governed by the Fédération Internationale de Basketball (FIBA), or the International Basketball Federation. In basketball, each player is assigned a specific position and role within a team's tactics and must carry out a series of planned activities accordingly (Bhadu & Singh, 2017).

Traditionally, basketball player positions have been grouped into three categories based on their similarities: guards, forwards, and centers (Ben Abdelkrim et al., 2010). However, as basketball rules and tactics have evolved, more specific positions have emerged, including Point guard, Shooting guard, Small forward, Small forward, and Center (Harris et al., 2000). Modern basketball relies heavily on these five distinct positions, which have replaced the outdated group classifications of guard, forward, and center. Predictive classification models can assist coaches in placing players in the appropriate positions on the court (Pion et al., 2018). Each player's position requires different fitness levels and body compositions, making it necessary for coaches to tailor training accordingly. Guards are typically the shortest and fastest players, with superior ball control, while centers are generally the tallest and slowest players on the team (Pojskic et al., 2014).

Recent studies have shown that there are significant differences between player positions in terms of physical and psychological skills. Centers have been found to be taller, heavier, and have a higher percentage of body fat compared to guards and forwards (Jelicić et al., 2002; Ostojic et al., 2006; Sallet et al., 2005). Meanwhile, guards have better aerobic and anaerobic capacities, speed, and agility than forwards and centers (Ben Abdelkrim et al., 2010; Cormery et al., 2007; Latin et al., 1994). Forward and center players, on the other hand, have been found to be better in terms of strength (Ben Abdelkrim et al., 2010; Ostojic et al., 2006; Pojskic et al., 2014). A significant amount of attention has been given to identifying the relevant psychological skills and how to effectively apply them in basketball (Vealey, 1988). The application of these psychological skills is aimed at enhancing performance and achieving optimal results (Mahoney et al., 1987). Furthermore, research suggests that psychological skills training can lead to desirable outcomes such as improved commitment, self-confidence, and reduced pre-competition anxiety (Goudas et al., 1998; White, 1993; Williams & Krane, 1992), in addition to enhanced performance. The success of an athlete is influenced by several factors, including

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physical, technical, tactical, and psychological skills. Nanda and Dimyati (2019) reinforce this idea, as they argue that psychological factors also play a crucial role in determining an athlete's success.

The role of physical fitness in sports is a crucial factor that requires continuous study (Khasanah & Hariyanto, 2023; Saputra et al., 2022). Studies have shown significant differences in body size, speed, agility, vertical jump, and maximum oxygen consumption among playing positions (Cormery et al., 2007; Hoffman et al., 1996; Ostojic et al., 2006; Sallet et al., 2005). These studies have also established a strong relationship between body composition, aerobic and anaerobic capacity, and playing position in basketball. An athlete's physical characteristics are a significant predictive factor in determining their potential for achieving high levels of success in their chosen sport (Kucsa & Mačura, 2015; Sallet et al., 2005).

The physical condition of basketball players is an important aspect that coaches must consider to ensure optimal performance. However, there is still a lack of research on the physical condition of basketball players, especially after the development of more specific player positions. This study aims to investigate the physical condition of each player position, including Point guard, Shooting guard, Small forward, Small forward, and Center. The primary objectives of the study are to identify and compare the physical characteristics of players in each position. By doing so, this study can contribute to a better understanding of the physical demands of basketball and assist coaches in making informed decisions regarding player selection and positioning.

Material & methods

The study utilized a quantitative descriptive design with a retrospective causal-comparative design, also known as an ex-post facto design. This research design was chosen to determine whether there are significant differences in the physical condition among basketball players of different positions.

The subjects of this study were basketball athletes between the ages of 16 and 18 from 27 regencies and cities in West Java. The sample size was 40 players, consisting of 20 males and 20 females, who were selected from every regency and city in West Java. The male sample included seven players from Bandung City, five players from Cirebon City, four players from Bogor Regency, one player from Bandung Regency, one player from Indramayu Regency, one player from Pangandaran Regency, and one player from Bogor City. The female sample included seven players from Bandung City, two players from West Bandung Regency, one player from Bogor City, four players from Cirebon City, two players from Pangandaran Regency, three players from Bandung Regency, and one player from Bogor Regency. These athletes were considered the best in their respective regencies and cities. The sampling method utilized in this study was non-probability sampling, which provides unequal chances for each element or member of the population to be selected as a sample. The type of non-probability sampling employed in this study was quota sampling.

The data for this study were collected through physical condition tests, which were conducted after obtaining research permission from Pemprov PERBASI West Java (Permit No. 0425/UN40.B.D1/KM/2019). The athletes were called to the provincial capital, Bandung City, where they stayed for two days and one night for the data collection process. Once the data were collected, it was recapitulated and analyzed using SPSS software with a one-way ANOVA test.

The instruments utilized in this study were specifically adapted to meet the requirements of the basketball sport, in addition to some instruments previously employed in previous studies. These instruments included the Wall Sit Test, the 20-meter Sprint Test, the Illinois Agility Test, the Vertical Jump Test, and the Bleep Test, as stated by Rismayadi (2021).

Results

This section presents the results obtained from the data collection process, followed by a discussion of the findings based on the research objective, which is to identify differences in the physical condition of basketball players across different positions.

The validity and reliability values of the physical condition instrument are listed in Table 1 below.

Table 1:
Instrument Validity and Reliability Value

Physical Condition	Coefficient of Validity	Coefficient of Reliability
Wall sit	0.93	0.85
Speed 20 m	0.80	0.88
Illinois agility test	0.99	0.96
Vertical jump	0.95	0.81
Bleep test	0.98	0.97

(Source: Rismayadi, 2021)

Based on Table 1, it can be interpreted that all physical condition variables have a validity coefficient > 0.80, indicating good and usable criteria. Similarly, all physical condition variables have a reliability coefficient > 0.81, indicating good and usable criteria.

Table 2. One Way-ANOVA Calculation Results for the Physical Conditions of Each Playing Position of Male Basketball Athletes in West Java

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10.200	4	2.550	6.375	.003
Within Groups	6.000	15	.400		
Total	16.200	19			

The analysis revealed significant differences in the physical condition of basketball athletes based on their playing position in West Java. Table 2 shows the results of the one way-ANOVA calculation for differences in the physical condition of male athletes according to playing position, with a significance value of 0.003 < 0.05. Thus, the null hypothesis (Ho) is rejected, indicating that there are significant differences in the physical conditions of male basketball athletes based on their playing position.

Table 3:One Way-ANOVA Calculation Results for the Physical Conditions of Each Playing Position of Feale Basketball Athletes in West Java

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10.300	4	2.575	6.180	.004
Within Groups	6.250	15	.417		
Total	16.550	19			

The one way-ANOVA for the physical condition of female basketball athletes based on their playing position is presented in Table 3, which yielded a significance value of 0.004 < 0.05. Therefore, the null hypothesis (Ho) is rejected, indicating significant differences in physical conditions across different playing positions of female basketball athletes. As there were differences in the physical conditions of each playing position for both the male and female basketball teams, a further test was conducted using Bonferroni's multiple comparison.

Male Team: The Point guard position showed a significant difference in physical condition compared to the Power Forward and Center positions with a significance value of <0.05. However, the Point guard showed no difference in physical condition from the Shooting guard and Small forward positions with a significance value of > 0.05. The Shooting guard position showed a significant difference in physical condition compared to the Center position with a significance value of <0.05. However, the Shooting guard showed no difference in physical condition from the Point guard, Small forward, and Power forward positions with a significance value of > 0.05. The Small forward position showed no significant difference in physical condition from the other positions with a significance value of > 0.05. The Power forward position only showed a significant difference in physical condition with the Point guard position with a significance value of <0.05, but showed no difference in physical condition with the Shooting guard, Small forward, or Center positions with a significance value of >0.05. The Center position showed a significant difference in physical condition compared to the Point guard and Shooting guard positions with a significance value of <0.05, but showed no difference in physical condition compared to the Small forward and Power forward positions with a significance value of > 0.05. A more detailed breakdown of the differences in physical condition for each male playing position is presented in Table 4.

Table 4:Multiple Comparison Calculation Results for the Physical Conditions of Each Playing Position of Male Basketball Athletes in West Java

	Playing Position	Playing Position	Mean Difference	Std. Error	Sig.
Bonferroni	PG	SG	.500	.447	1.000
		SF	1.250	.447	.136
		PF	1.500*	.447	.043
		C	2.000*	.447	.004
	SG	PG	-.500	.447	1.000
		SF	.750	.447	1.000
		PF	1.000	.447	.410
		C	1.500*	.447	.043
	SF	PG	-1.250	.447	.136
		SG	-.750	.447	1.000
		PF	.250	.447	1.000
		C	.750	.447	1.000
	PF	PG	-1.500*	.447	.043
		SG	-1.000	.447	.410
		SF	-.250	.447	1.000
		C	.500	.447	1.000
	C	PG	-2.000*	.447	.004
		SG	-1.500*	.447	.043
		SF	-.750	.447	1.000
		PF	-.500	.447	1.000

Female Team: the physical condition of the Point guard position differs from that of the Power Forward and Center positions with a significance value of <0.05. However, the Point guard position does not differ in physical condition from the Shooting guard and Small forward positions with a significance value of > 0.05. The Shooting guard and Small forward positions do not show significant differences in physical condition from the other positions, with a significance value of > 0.05. Similar to the male team, the Power forward position only differs in physical condition from the Point guard position with a significance value of <0.05, but has no difference in physical condition with the Shooting guard, Small forward, or Center positions because of a significance value of >0.05. The Center position also only differs in physical condition from the Point guard position with a significance value of <0.05, and has no difference in physical condition with the Shooting guard, Small forward and Power forward positions because the significance value is > 0.05. A more detailed breakdown of the differences in physical condition for each female playing position is presented in Table 5.

Table 5:Multiple Comparison Calculation Results for the Physical Conditions of Each Playing Position of Feale Basketball Athletes in West Java

	Playing Position	Playing Position	Mean Difference	Std. Error	Sig.
Bonferroni	PG	SG	.750	.456	1.000
		SF	1.000	.456	.447
		PF	1.750*	.456	.016
		C	2.000*	.456	.005
	SG	PG	-.750	.456	1.000
		SF	.250	.456	1.000
		PF	1.000	.456	.447
		C	1.250	.456	.152
	SF	PG	-1.000	.456	.447
		SG	-.250	.456	1.000
		PF	.750	.456	1.000
		C	1.000	.456	.447
	PF	PG	-1.750*	.456	.016
		SG	-1.000	.456	.447
		SF	-.750	.456	1.000
		C	.250	.456	1.000
	C	PG	-2.000*	.456	.005
		SG	-1.250	.456	.152
		SF	-1.000	.456	.447
		PF	-.250	.456	1.000

Discussion

The findings of this study demonstrate significant differences in the physical condition among basketball playing positions. Although research on physical conditions in basketball playing positions is limited, the present study is consistent with previous findings. For instance, Pion et al. (2018) reported differences in five playing positions of basketball. Moreover, in rugby, research has indicated a link between psychological skills and playing position, with players differing based on their position and level of competition (Andrew et al., 2007). These differences in playing positions have been found to influence ball possession development in basketball. Thus, coaches and players should be mindful of the positional demands of each playing position (te Wierike et al., 2018).

In the analysis of the Point guard position for both male and female teams, there were significant differences in physical condition with the Power forward and Center, but no differences with Shooting guards and Small forwards. In contrast, the male Shooting guard had different physical conditions compared to the Center, while the female Shooting guard did not differ from any other position. The physical condition of the Small forward position did not differ from any other position for both male and female teams. The Power forward position only showed significant differences in physical condition compared to the Point guard, but not with the Shooting guard, Small forward, or Center, for both male and female teams.

The male Center position has different physical conditions with the Point guard and Shooting guard positions but has no difference in physical condition with the Small forward and Power forward positions. Meanwhile, the female Center position only has a difference in physical condition with the Point guard position, but not with the Shooting guard, Small forward, and Power forward positions. In a study conducted by Hoare (2000), it was found that there was no difference in the ANOVA calculation overall. However, the Point guards were found to be faster than Small forwards when running 20 meters, and they are also the most agile players compared to Power forwards and Centers. Speed is an important attribute that affects basketball performance (Bhadu & Singh, 2017). Furthermore, the research conducted by Delextrat and Cohen (2009) showed that playing position has a significant effect on the anaerobic fitness of female basketball players. Differences were

mostly observed between guards and centers, with guards having higher relative strength and power of the lower extremities and jumping higher than centers.

These observations may assist coaches and athletes in identifying the unique skills required for each playing position, which should be targeted and practiced individually during physical fitness sessions. Dereceli (2018) highlights the importance of psychological skills, particularly concentration and mental preparation, in basketball. Point Guards, in particular, require leadership skills, a deep understanding of their teammates' personalities, and the ability to build strong relationships with them. They tend to have more stable personalities and are better able to manage their emotions than players in other positions (Chartrand et al., 1992; Nanda & Dimyati, 2019). According to Nanda and Dimyati (2019), guards need to have strong shooting skills, but shooting skills are also important for players in other positions to score points. Forwards are crucial for scoring points (Khoeron, 2017; Nanda & Dimyati, 2019), with Small forwards being particularly effective at breaking through an opponent's defense. The Small forward position is essential for a team to succeed, as the player in this position must score points (Nanda & Dimyati, 2019). The Power forward's primary responsibility is to secure rebounds when opposing players are attempting to score points or break through the defensive line. A team relies heavily on this position to defend and protect their defense area (Nanda & Dimyati, 2019). Additionally, Power forwards tend to perform better in rebounding, defending, assisting, stealing, and blocking during a basketball game (Sampaio et al., 2004). The Center position requires the tallest player on the team and is responsible for preventing opposing players from shooting in vital areas and passing the ball into vital areas. The Center is also responsible for winning rebounds in vital areas (Nanda & Dimyati, 2019). Centers tend to have a higher body posture than guards or forwards (Nageswaran, 2013).

Conclusions

The results of the study show that there is a significant difference in the overall physical condition of each playing position. The Point guard, Shooting guard, and Small forward positions do not differ in physical condition, while only Power forwards and Centers tend to have different physical conditions from Point guards. Therefore, the positions can be grouped into three parts: the Small forward position has no difference in physical condition with other positions, the Point guard and Shooting guard positions have different physical conditions than the Power forward and Center, and the Power forward and Center have different physical conditions than the Point guard and Shooting guard.

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