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To what extent does the height of an NBA player impact their performance?

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Abstract

In the world of basketball, there is a widespread misconception that a player's performance is primarily determined by their physical characteristics, particularly their height. This research paper aims to statistically examine the degree to which height actually influences a player's offensive and defensive performance. The total number of blocks a player made during the 2022–2023 NBA season is used in this paper to statistically analyze the relationship between a player's height and his defensive performance. On the other hand, the number of field goals a player made overall during the 2022–2023 NBA season is used to analyze the relationship between a player's height and his offensive performance. The sample population randomly chosen for the study consists of 50 NBA players which represent 10% of all players who competed in the 2022–2023 season. The statistical analysis of the performance is done using Pearson's correlation coefficient test which is then followed by a two-tailed t-test with a significance value of 95% to determine whether the coefficients obtained are statistically significant. The overall findings suggest that whilst height has a positive correlation with both defensive and offensive performance, it may be more beneficial in the context of the former.

Introduction

How many times have you wondered if height really gives you the upper hand on the basketball court?

With more than 2.2 billion fans, basketball is one of the most-watched sports in the world. The game is played at the local, regional, and international levels in 213 countries by approximately 450 million people (The Sporting Blog, 2023). The main objective of the game is to score points offensively by making 2-pointers, 3-pointers, and free throws while discouraging the opposition from doing the same through defense. In line with this, a team's strategy for trying to score points is called the offense and the main components of it are passing, dribbling, and shooting, all of which increase the likelihood of scoring a basket. Coaches use a variety of offensive plays, such as motion offense, triangle offense, and fast breaks, very effectively. On the other hand, defense is the strategy a team

employs to keep the opposing team from scoring baskets and to enable them to generate more fast-break opportunities. Defensive strategies include guarding the opponent very well, using zone defense to their advantage, and using screens.

There are several basketball leagues that are played worldwide; however, one of the most popular is the National Basketball Association (NBA). For instance, it has been reported by Forbes that the regular season has an annual viewership of 1.59 million across TNT, ESPN, and ABC (Adgate, 2023). The NBA was formed in 1949 after the merger of the Basketball Association of America (BAA) and the National Basketball League (NBL) (Britannica, 2018). The NBA is made up of two conferences (Eastern and Western), each with 15 teams, for a total of 30 teams. Furthermore, there are three divisions within each conference. The NBA season itself is divided into three segments: the preseason, regular season, and playoffs. To have a chance at winning, the teams must make it through the regular season and be chosen for the playoffs. The winner of that particular NBA season is determined by a 7-game series between the winner of the eastern conference and that of the western conference.

Within the world of basketball, there has been a common misconception that a basketball player's effectiveness and success are determined most greatly by their physical attributes, more particularly their height. However, further research suggests that the players and their game can be significantly affected by a number of factors ranging from personal skills and other physical characteristics to mental toughness, group dynamics, and environmental conditions. In line with the aforementioned, this research paper aims to answer the question, **"To what extent does the height of an NBA player impact their performance?"**

This research paper aims to statistically analyze data pertaining to the height and defensive and offensive performance of a sample population of NBA players from the 2022-2023 season to determine whether height truly influences performance or not.

Literature Review

As per the existing literature, there are several factors that influence the performance of a basketball player. These factors can include both physical as well as psychological ones, including confidence, focus and concentration, motivation, mental toughness, anxiety and stress, strength and power, speed, stamina, flexibility, agility, and recovery. It is important to remember that these factors can interact, and the effects on performance may be different between players. In addition, athletes can help enhance their basketball performance by training and exercising in the right way as well as being provided with appropriate coaching and support.

In the book "Size Matters: How Height Affects the Health, Happiness, and Success of Boys"
Dr. Steven Halls (2006) - an award-winning journalist - states that "male basketball players tend to be 9 inches taller than the average male". Being tall is advantageous in a sport like basketball for several apparent reasons. For instance, the rim is 10 feet tall, so the closer you are to it, the simpler it is to put the ball in the basket. Basketball players who aren't very good sometimes use the idiom "You can't teach size," which implies that having size is an

asset that makes improving a player more straightforward. However, having height on one's side is not always an advantage on the basketball court. Instead, an article from Jeff Stotts (2014) proves how height has a direct association with more injuries and being more injury-prone, which can represent a great opportunity cost in the context of competitive basketball.

When discussing players who do not necessarily have height on their side, the main disadvantages that come to light are a greater distance to the basket, a shorter arm span, and the inability to play "above the rim". While this might create the notion and fuel the idea that being short is always a disadvantage in the context of a sport like basketball, being smaller can actually have a lot of advantages in a game with big men. For instance, an article in the Japanese Journal of Physiology implies that nerve impulses take less time to travel from the limbs to the brain in shorter people, allowing them to take the first step quicker and move faster, which can usually give them an upper hand in sports such as basketball (TAKANO et al., 1991). Some examples of short players who excelled in the game of basketball are Nate Robinson, who is 5-foot-7 and has won three slam-dunk contests, and Allen Iverson, who is 5-foot-11 and is arguably one of the greatest NBA players of all time. Players like these, who are both under 6 feet tall, have dispelled all scepticism and given shorter athletes much more confidence.

Interestingly, much of the existing literature focuses greatly on the influence of psychological factors on the performance of basketball players. Factors such as confidence, motivation, mental toughness, focus, anxiety, stress, and concentration affect a basketball player's performance immensely. In a paper published by Hannibalsson (2018) titled "Psychological Skills, Mental Toughness, Anxiety and Performance in Young Basketball Players", the findings showed that performance was positively correlated with mental toughness and self-confidence, but negatively correlated with anxiety. The latter finding was also in line with findings published in a review article in the Journal of Applied Sport Psychology that concluded that the decision-making capacity, motor control, and general performance in basketball and other sports can all be impacted by excessive anxiety (Cox, 2012). This implies that raising mental toughness and confidence while lowering anxiety levels can help a basketball player perform better.

With regard to self-confidence, more particularly, studies have found that this factor can improve performance by boosting motivation and focus. Focus in a game like basketball is imperative when striving to achieve success. According to research, performance can suffer from interruptions and attention lapses. A study that was published in the Journal of Sports Sciences looked at the connection between focus and basketball shooting performance and came to the conclusion that doing so was related to improved shooting accuracy (Memmert et al., 2009). Players who are mentally strong are better able to respond to changing game situations, execute skills efficiently, and make better decisions.

Overall, whilst some of the literature suggests that height is an important physical characteristic for better performance in basketball, much of it also speaks of the several advantages that shorter-than-average players could have on the court. Moreover, with the ability of psychological factors to so greatly influence the manner in which a player plays, it could be further argued that height is not the only crucial aspect to succeed in this game.

Hypothesis

Pearson's Correlation Coefficient

On the basis of the literature review and research problem that this paper intends to explore, the following hypotheses have been developed for **Pearson's Correlation Coefficient** testing:

Hypothesis 1

As stated in the literature review, height may not be the only vital characteristic to ensure successful performance in a basketball game. Height can, however, be much more helpful to a player's performance when they are using defensive strategies. For instance, a study by Zarić et al. (2020) discovered that basketball teams with taller players had a higher chance of placing well at the FIBA World Cup. The authors hypothesize that this is because taller players have a variety of advantages on defense, such as the capacity to reach higher to block shots, cover more ground, and more successfully contest shots. Additionally, an article by Waihenya (2022) proposes that since taller players can cover more distance per unit of time, this is likely to help them shuffle fast and defend the opponent without much difficulty (Authority Basketball, 2022).

In line with the aforementioned, the first hypothesis predicts that *There will be a strong positive correlation between the height and defensive performance of an NBA player*

Hypothesis 2

In contrast to a player's defensive performance, it may be argued that height does not influence one's offensive performance to such a great extent. For instance, an article by Rachel Nall (2011) suggests that since the NBA rim is at a height of 10 feet, being closer to it would mean more of your shots going in, which clearly gives an advantage to a taller player, but shorter players are normally faster and more agile, which would help them get free shots. Therefore, height is important for scoring a basketball but only to a certain extent. Furthermore, research by Zhang and Zeng (2022) proves that even though height could be beneficial for basketball players when scoring buckets, it is not the only factor. Instead, psychological factors influence a basketball player's offensive performance immensely - as has also been elaborated upon previously.

In line with the aforementioned, the second hypothesis predicts that *There will be a weak positive correlation between the height and offensive performance of an NBA player*

<mark>Two-tailed t-tests</mark>

Once Pearson's Correlation Coefficient testing has been completed, **two-tailed t-tests** will be conducted to ensure that the coefficient values obtained are statistically significant.

The null and alternate hypothesis for the statistical significance of the correlation between the height and defensive performance of the NBA players is as follows:

Null: *The relationship between the height and the defensive performance of the NBA players is not statistically significant*

Alternate: *The relationship between the height and the defensive performance of the NBA players is statistically significant*

The null and alternate hypothesis for the statistical significance of the correlation between the height and offensive performance of the NBA players is as follows:

Null: *The relationship between the height and the offensive performance of the NBA players is not statistically significant*

Alternate: *The relationship between the height and the offensive performance of the NBA players is statistically significant*

Methodology

A sample population of 10% of all NBA players who competed in the 2022–2023 season - totalling 50 players - was chosen for this study. In order to select the members of the sample population, a random sampling technique was used. In line with this, each of the players was assigned a number which was then fed into an online random number generator to determine 50 random numbers each of which corresponded with a player. This technique was used in order to eliminate any selection bias which could have arisen.

As the first hypothesis is concerned with the defensive performance of the players, the statistic relating to the *total blocks made* by the players across all the games played in the 2022-2023 season was used as the criterion. On the other hand, the second hypothesis is concerned with the offensive performance of the players and the criterion decided to assess that was the *total field goals* made by the players in the 2022-2023 season.

Because it is the official source of NBA data, the official NBA website, which is a trusted website for player stats, was used to redact all of the required data, including the players' height. The NBA has a team of statisticians who keep track of every game and player statistic and are in charge of ensuring the accuracy of the information on the NBA website, making it a reliable source. The NBA also adheres to a strict policy of data transparency, and all of its data is made available on its website in an accessible format.

Based on the aim of this paper to determine the correlation between the height of the player and their defensive performance as well as the height of the player and their offensive performance, the parametric test of Pearson's Correlation Coefficient was chosen. Furthermore, to ensure that the correlation coefficients calculated in Pearson's correlation coefficient test were statistically significant for both data sets, a two-tailed t-test with a significance level of 95% was conducted.

Data collection

Table 1: Height and defensive performance (judged by total blocks) of 50 NBA players in the 2022-2023 season

Player Name	Height (cm)	Total Blocks in 22-23
Bam Adebayo	206	61
Carlik Jones	183	0
Giannis	213	51
OG anunoby	201	50
Harrison Barnes	203	10
Jordan Goodwin	191	26
Jae'Sean Tate	196	7
troy brown jr.	201	16
CJ McCollum	191	38
Kentavious caldwell-pope	196	35
Jordan Poole	193	21
John collins	206	73
Darius Garland	185	9
Donte Divincenzo	193	10
Luguentz Dort	193	23
David Duke Jr.	193	1
Eric gordon	191	25
Jerami Grant	203	53
Quinten Grimes	196	26
James Harden	196	31
Jaden Hardy	191	7
Joe harris	198	13
Nikola Jokic	211	47
Josh Okogie	193	34
Kevin Durant	208	67
Cameron johnson	203	14

Keldon Jhonson	196	11
Malachi Flynn	185	4
Corey kispert	198	9
Rodney McGruder	193	1
Terry Rozier	185	16
Jamal Murray	193	16
Mike Muscala	211	24
Royce O'Neale	198	49
Cameron Payne	185	8
Bobby Portis	211	16
Josh Richardson	198	20
Landry Shamet	193	5
Jayson Tatum	203	51
Clint Capela	208	79
Sam Hauser	201	21
Nic Claxton	211	189
Russell Westbrook	191	33
Buddy Hield	193	26
Grant Williams	198	31
Jaylin Williams	206	12
Scottie Barnes	203	61
Kenrich Williams	198	14
Zion Williamson	198	16
Karl-Anthony Towns	213	17

Table 2: Height and offensive performance (judged by total field goals made) of 50 NBA players in the 2022-2023 season

Player Name	Height (cm)	Total FGM in 22-23
Bam Adebayo	206	602
Carlik Jones	183	6
Giannis	213	707
OG anunoby	201	421
Harrison Barnes	203	374
Jordan Goodwin	191	158
Jae'Sean Tate	196	110
troy brown jr.	201	200
CJ McCollum	191	587

Name	Value 1	Value 2
Kentavious caldwell-pope	196	292
Jordan Poole	193	550
John collins	206	359
Darius Garland	185	522
Donte Divincenzo	193	235
Luguentz Dort	193	339
David Duke Jr.	193	36
Eric gordon	191	291
Jerami Grant	203	434
Quinten Grimes	196	282
James Harden	196	371
Jaden Hardy	191	146
Joe harris	198	201
Nikola Jokic	211	646
Josh Okogie	193	162
Kevin Durant	208	483
Cameron johnson	203	223
Keldon Jhonson	196	503
Malachi Flynn	185	87
Corey kispert	198	291
Rodney McGruder	193	62
Terry Rozier	185	493
Jamal Murray	193	473
Mike Muscala	211	131
Royce O'Neale	198	229
Cameron Payne	185	188
Bobby Portis	211	398
Josh Richardson	198	239
Landry Shamet	193	113
Jayson Tatum	203	727
Clint Capela	208	350
Sam Hauser	201	180
Nic Claxton	211	414
Russell Westbrook	191	432
Buddy Hield	193	475
Grant Williams	198	216
Jaylin Williams	206	102

Scottie Barnes	203	463
Kenrich Williams	198	179
Zion Williamson	198	285
Karl-Anthony Towns	213	212

Statistical Analysis

Pearson's Correlation Coefficient

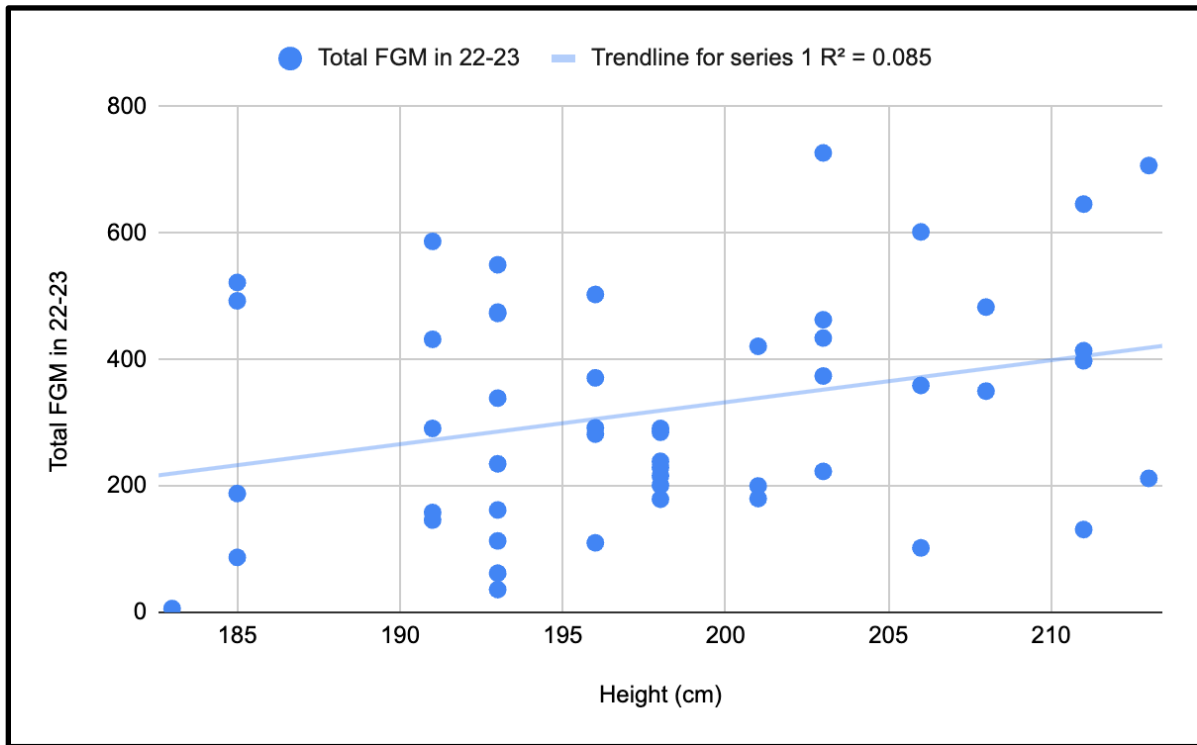**Chart 1: Correlation testing for the height and defensive performance of 50 NBA players**
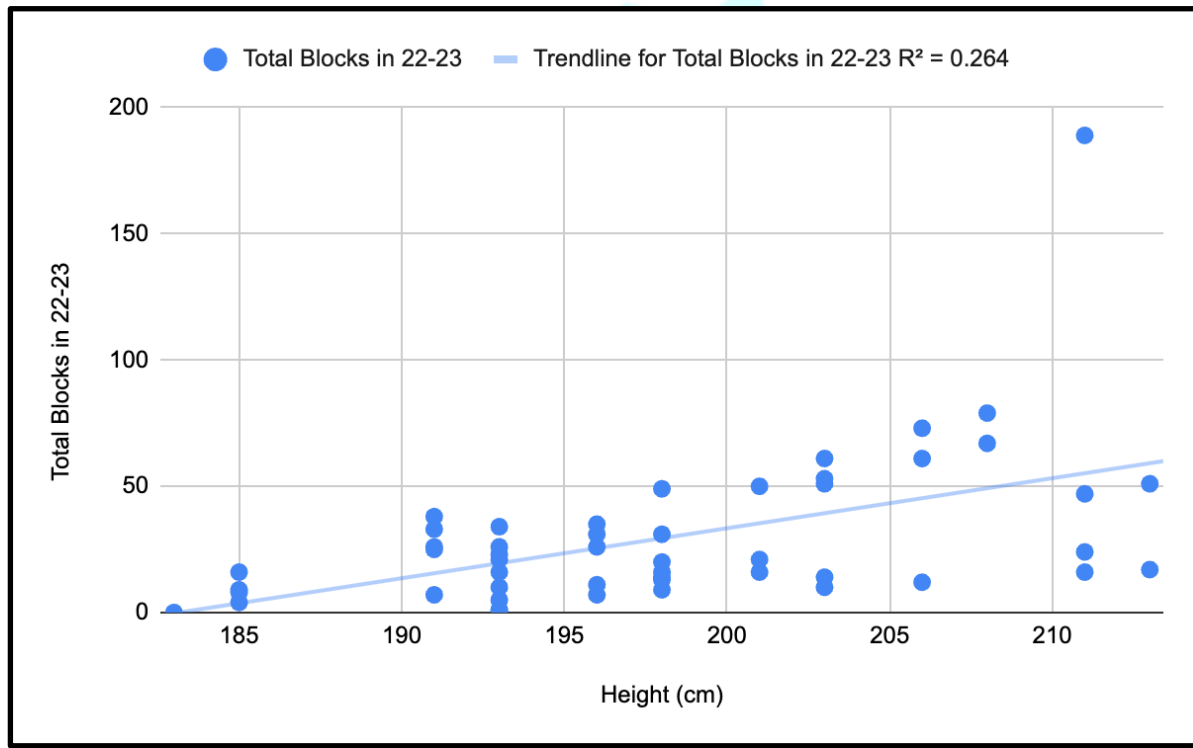
$R^2 = 0.264$

$$r = \sqrt{0.264}$$

$$r = 0.5135956287$$

Chart 2: Correlation testing for the height and offensive performance of 50 NBA players

$\underline{R^2 = 0.085}$

$$\underline{r = \sqrt{0.085}}$$

$$\underline{r = 0.2923454503}$$

==T-test for the coefficient obtained in Chart 1==

$$t = r\sqrt{\frac{(n-2)}{(1-r^2)}}$$

$$\underline{t = 0.5135956287\sqrt{\frac{(50-2)}{(1-0.5135956287^2)}}}$$

$$\underline{t = 4.147040439}$$

==P value obtained as per excel formula 0.000136453389==

==T-test for the coefficient obtained in Chart 2==

$$\underline{t = r\sqrt{\frac{(n-2)}{(1-r^2)}}}$$

$$t = 0.2923454503 \sqrt{\frac{(50-2)}{(1-0.2923454503^2)}}$$

$$t = 2.117956311$$

P value obtained as per excel formula 0.03938368379

Discussion

Pearson's Correlation Coefficient

Hypothesis 1 "There will be a strong positive correlation between the height and defensive performance of an NBA player"

As per Pearson's correlation coefficient, the r value obtained is **0.5135956287**, which is a moderate positive correlation as it falls between 0.5 and 0.7. A statistical relationship between two variables in which the values of the two variables largely move in the same direction is known as a moderate positive correlation. This implies that to some extent, an NBA player's height is directly correlated with how well they defend the opposition. That being said, as the correlation is on the lower end of the moderate positive correlation range, it can be said that despite being short, a player can still play solid defense depending on the strength of the other factors that have the ability to influence their performance

As hypothesis 1 had predicted a strong positive correlation between the two variables tested, it will be **REJECTED**

Hypothesis 2 "There will be a weak positive correlation between the height and offensive performance of an NBA player"

As per Pearson's correlation coefficient, the r value obtained is **0.2923454503**, which is a weak positive correlation as it falls between 0.1 and 0.3. A statistical relationship between two variables known as a weak positive correlation occurs when there is a slight tendency for the values of the two variables to move in the same direction. This implies that an NBA player's height directly correlates with his or her offensive performance, but only to a certain extent. Therefore, the offensive performance of a player can be strong regardless of if they are tall or short. Whilst it may be deemed that taller players could sometimes have an advantage, it could also be assumed that most other factors besides height are more crucial in determining whether a player is good at offense or not.

In light of the above and based on the prediction for both tested variables to have a weak positive correlation, hypothesis 2 will be **ACCEPTED**

Two-tailed t-tests

For the coefficient in hypothesis 1, the p-value obtained is 0.000136453389, i.e. $p < 0.05$. The null hypothesis will, therefore, be rejected and the **alternate hypothesis will be accepted**. This implies that *the relationship between the height and the defensive performance of NBA players is statistically significant*

For the coefficient in hypothesis 2, the p-value obtained is 0.03938368379, i.e. $p < 0.05$. Once again, the null hypothesis will be rejected and the **alternate hypothesis will be accepted**. This implies that *the relationship between the height and the offensive performance of NBA players is statistically significant*

Conclusion

In the game of basketball, players are concerned with scoring points on offense and limiting the number of points scored by the opponent with the help of the defense. With regard to the performance of players, many different factors that influence this have been observed in the literature - these factors are both physical (such as height, weight, and arm span) as well as psychological (focus, concentration, and self-confidence). The aim of this paper was particularly to examine the relationship between height and the defensive as well as the offensive performance of a sample population of NBA players from the 2022-2023 season.

After collecting the required data from the NBA's official website, the parametric test of Pearson's correlation coefficient was used to examine the relationship between height and both offensive and defensive performance, individually. The coefficient obtained for the test between the height and total blocks made by the players (defensive performance) was 0.5135956287. The moderate positive correlation suggests that an NBA player's height is directly correlated with how well they defend the opposition to some extent. As hypothesis 1 predicted a strong positive correlation for these variables, it was rejected. On the other hand, the coefficient obtained for the test between the height and field goals made by the players (offensive performance) was 0.2923454503. The weak positive correlation suggests that while taller players may occasionally be considered to have an advantage when playing offense, it is also possible to assume that most other factors besides height are equally or even more important in determining whether a player is good at offense or not. In light of the aforementioned, hypothesis 2, which predicted a strong positive relationship between the variables, was accepted.

Additionally, a two-tailed t-test with a 95% significance level was performed to assess the statistical significance of the correlations obtained in both tests. The t-test conducted on the correlation obtained for the height and defensive variables derived a p-value of 0.000136453389 - as $p < 0.05$, the alternate hypothesis was accepted and the null hypothesis was rejected. For the t-test conducted on the correlation obtained for the height and offensive variable derived, a p-value of 0.03938368379 was obtained - once again, $p < 0.05$ led to the alternate hypothesis being accepted and the null hypothesis being rejected. Overall, this implies that both correlations were statistically significant.

So, "To what extent does an NBA player's height impact their performance?" An NBA player's height does, to a certain extent, affect how they play the game. With the aid of statistical analysis, it has been demonstrated that height is not as crucial for offense as it is for defense. It can be emphasized again that factors other than height, such as psychological factors like confidence, focus, and concentration, also play a significant role in determining a player's overall performance.

Limitations

While the findings from this study were statistically significant, it is important to acknowledge some limitations that may be present.

The study conducted represented only 10% of the total players who played in the NBA during the 2022–2023 season, which could reduce the applicability of the conclusions to a wider population. However, this limitation can be overcome by conducting a study on a much wider scale, where the sample population is representative of a greater percentage of the total population. By increasing the sample size, the findings would be more reliable, and the conclusions could be applied to a large, diverse population.

Furthermore, in this study, the offensive performance was judged based on the field goals made, while the defensive performance was based on the blocks. However, there is potential to study other indicators of such performance, including total points, assists, and steals. By considering these additional indicators, a more comprehensive understanding of player performance can be achieved, which would allow for more nuanced conclusions to be drawn.

Finally, another limitation of this study could lie in the fact that the players were randomly selected from the entire population database, with no differentiation made between rookies and experienced players. This approach could have influenced the findings and the conclusions made. To overcome this limitation, future studies could potentially differentiate between the two sets of players, and examine the differences between them in greater detail.

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