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Impact of Anthropometric Characteristics on Football Performance by Playing Position

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ABSTRACT

The purpose of the present study is to find out the correlation between anthropometric variables and different playing positions in football. The objective of this study is to examine and compare the different body measurements of district-level football players across different playing positions: defenders, midfielders, and forwards. Body measurements are critical anthropometric attributes that contribute significantly to a football player's performance, and understanding their variation across positions can provide valuable insights into position-specific training and talent identification. A sample of 90 players from Bhopal district-level teams was selected for the study, and their body measurements were assessed through standardized anthropometric kit.

The findings suggest that position-specific anthropometric variable could enhance the performance of football players, and coaches should consider these differences when developing conditioning programs.

The study highlights the importance of specific anthropometric characteristics in determining positional effectiveness on the football field. These findings suggest that coaches and scouts should incorporate anthropometric data into player recruitment and development strategies, allowing for position-specific training that enhances individual and team performance. Tailoring physical conditioning based on these characteristics could further optimize athletic output and overall gameplay.

Keywords- Speed, Agility, Defenders, mid-field & forward Football players, etc.

I. INTRODUCTION

Football is a sport that demands a combination of technical, tactical, and physical skills. Among the physical attributes, anthropometric characteristics such as height, weight, body composition, and limb lengths are critical determinants of a player's ability to perform in specific playing positions. Different positions on the football field, such as goalkeeper, defender, midfielder, and forward, require varying physical traits for optimal performance. For instance, goalkeepers often benefit from taller stature and longer arms for shot-stopping, while midfielders require a balance between endurance, agility, and body composition to maintain control in high-pressure situations.

Previous studies have shown that players with different anthropometric profiles tend to excel in specific positions due to the physical demands of those roles (Bangsbo, 1994; Reilly, 2005). However, there is limited research available on the impact of these characteristics on district-level football players. This study aims to analyze the relationship between anthropometric characteristics and football performance across different playing positions at the district level.

Football, known as soccer in some parts of the world, is more than just a sport; it is a global phenomenon that captivates the hearts and minds of billions. The sport's simplicity, combined with its capacity to foster community, competition, and global unity, has made it the most popular sport in the world. This comprehensive exploration delves into the various aspects of football, including its history, rules, essential skills, training methodologies, and its broader cultural significance.

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Football is a team sport that involves two teams of eleven players each, competing to score goals by getting a spherical ball into the opposing team's net. The game is played on a rectangular field with a goal at each end. It is governed by a set of rules known as the Laws of the Game, which ensure fair play and competition. Football's popularity stems from its accessibility—requiring minimal equipment—and its capacity to bring together people from diverse backgrounds. Football's universal appeal is undeniable whether played professionally in massive stadiums or casually in local parks.

Anthropometric measurements refer to the systematic collection of data related to the physical dimensions of the human body. These measurements, which include variables such as height, weight, limb length, body circumference, skinfold thickness, and body composition, are crucial in assessing an individual's physical capabilities and their potential for performance in sports. Anthropometry is an essential tool in sports science, allowing coaches and trainers to tailor training programs to an athlete's unique physical attributes and optimize performance according to the demands of their specific sport or position (Ackland, Elliott, & Bloomfield, 2009).

Anthropometric measurements have been used for decades to classify athletes based on their body types and to predict their potential in various sports disciplines. For instance, athletes in sports like basketball and volleyball, where height plays a significant role, are often selected based on their stature and reach. Conversely, endurance athletes such as marathon runners tend to have lean body compositions with low body fat percentages, as this aids in improving aerobic efficiency (Norton & Olds, 2001). These measurements also assist in injury prevention, recovery, and overall athletic performance by ensuring that training regimens are aligned with the athlete's physical attributes.

1.1 Objectives of the Study

The research objectives of this study are as follows:

1. To examine the relationship between selected anthropometric variables and the playing performance of district-level football players.
2. To analyze the differences in anthropometric variables among football players excelling as defenders, midfielders, and forwards.
3. These objectives aim to comprehensively understand how anthropometric factors vary across playing positions and their impact on overall performance.

II. METHODOLOGY

2.1 Selection of the subjects

For the study 90 subjects of district football players were selected based on purposive sampling technique for the present study, and the age level of the players was 18 to 25 years old.

2.2 Variables

1. Height
2. Weight
3. Length of legs
4. Thigh girth
5. Calf girth
6. Biceps girth
7. Chest circumference
8. Fat

2.3 Criterion measures

1- All the variables was measured by an anthropometric kit

STATISTICAL ANALYSIS

The results of the study are based on the data analysis conducted in the experimental research. The study aimed to analyse the selected anthropometric and performance variables among football players across different playing positions. For testing the hypothesis the level of significance was set at 0.05 levels.

Findings

Table 1.1: Descriptive Statistics of Anthropometric Variables of Mid-Field Football Players

S. No.	N	Physical variable	Min.	Max.	Mean	Standard deviation
1	30	Height (cm.)	158.00	183.00	170.3831	6.01245
2	30	Weight (kg.)	58.00	70.00	63.4444	2.59554
3	30	Fat (%)	8.00	12.00	10.5501	0.74221
4	30	Leg Length (cm.)	83.00	96.00	89.2834	2.99335
5	30	Chest girth (cm.)	79.00	91.00	84.2501	2.45565
6	30	Thigh girth (cm.)	50.00	56.00	53.3168	1.42928
7	30	Calf girth (cm.)	26.00	37.00	31.6334	2.11292
8	30	Biceps girth (cm.)	20.00	31.00	26.2834	2.23100

Table 1.1 and Figure 1.1 present the descriptive statistics of anthropometric variables for midfield football players. The data shows the following descriptive scores for these variables:

- **Mean height**: 170.38 cm with a standard deviation

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(S.D.) of 6.01

- **Mean weight**: 63.44 kg with a standard deviation of 2.60
- **Mean fat percentage**: 10.55% with a standard deviation of 0.74
- **Mean leg length**: 89.28 cm with a standard deviation of 2.99
- **Mean chest girth**: 84.25 cm with a standard deviation of 2.46
- **Mean thigh girth**: 53.32 cm with a standard deviation of 1.43
- **Mean calf girth**: 31.63 cm with a standard deviation of 2.11
- **Mean biceps girth**: 26.28 cm with a standard deviation of 2.23

These statistics provide a detailed overview of the physical dimensions of the midfield players analyzed in the study.

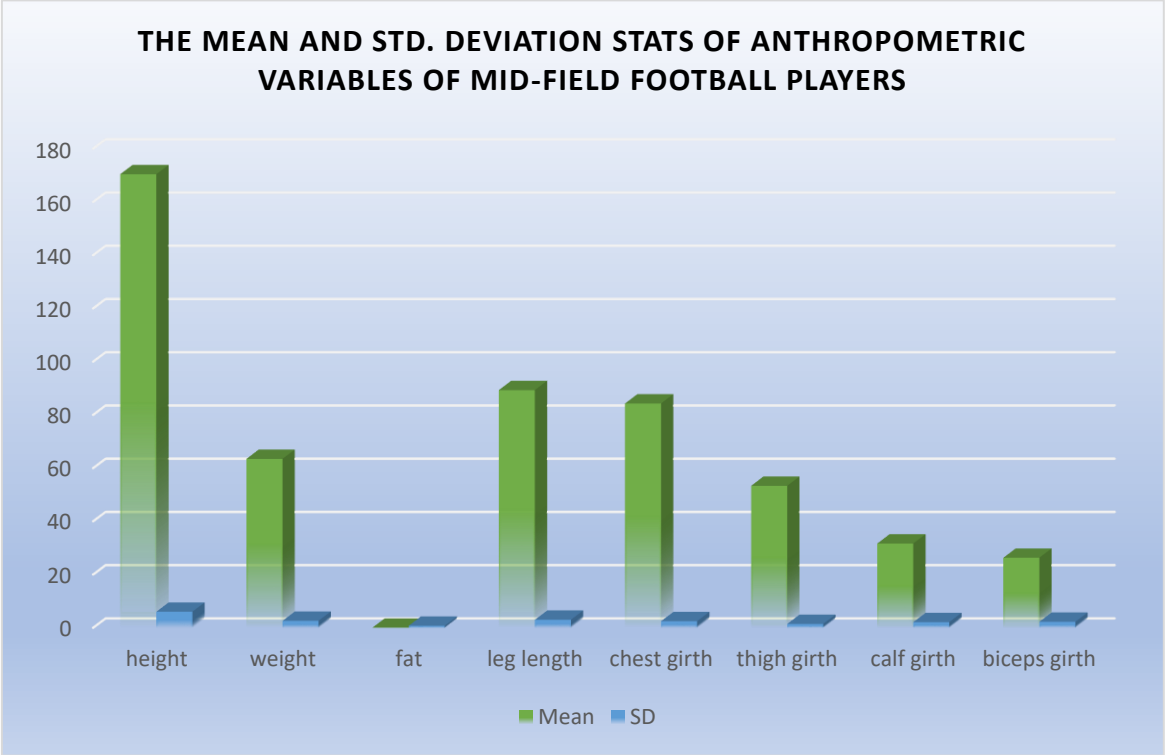

Figure 1.1: The Mean and Std. deviation of anthropometric variables of Mid-Field football players

Table 1.2: Descriptive Statistics of Anthropometric Variables of defender Football Players

S. No.	N	Physical variable	Min.	Max.	Mean	Standard deviation
1	30	Height (cm.)	158.00	183.00	169.7001	6.47301
2	30	Weight (kg.)	58.00	70.00	63.9144	3.31104
3	30	Fat (%)	8.00	12.00	10.4430	0.76170
4	30	Leg Length (cm.)	83.00	96.00	88.8430	3.95334
5	30	Chest Girth (cm.)	79.00	91.00	84.0285	1.97015
6	30	Thigh Girth (cm.)	50.00	56.00	53.8285	1.70613
7	30	Calf Girth (cm.)	26.00	37.00	31.3430	2.13781
8	30	Biceps Girth (cm.)	20.00	31.00	27.0858	2.18108

Table 1.2 and Figure 1.2, the descriptive statistics of anthropometric variables for defender football players are presented. The data reveals the following descriptive scores for the defender players:

- **Mean height**: 169.70 cm with a standard deviation (S.D.) of 6.47
- **Mean weight**: 63.91 kg with a standard deviation of

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- **Mean fat percentage**: 10.44% with a standard deviation of 0.76
- **Mean leg length**: 88.84 cm with a standard deviation of 3.95
- **Mean chest girth**: 84.03 cm with a standard deviation of 1.97
- **Mean thigh girth**: 53.83 cm with a standard deviation of 1.71
- **Mean calf girth**: 31.34 cm with a standard deviation of 2.13
- **Mean biceps girth**: 27.08 cm with a standard deviation of 2.18

These statistics provide a comprehensive overview of the physical characteristics of defender football players, highlighting their anthropometric measurements across various body dimensions.

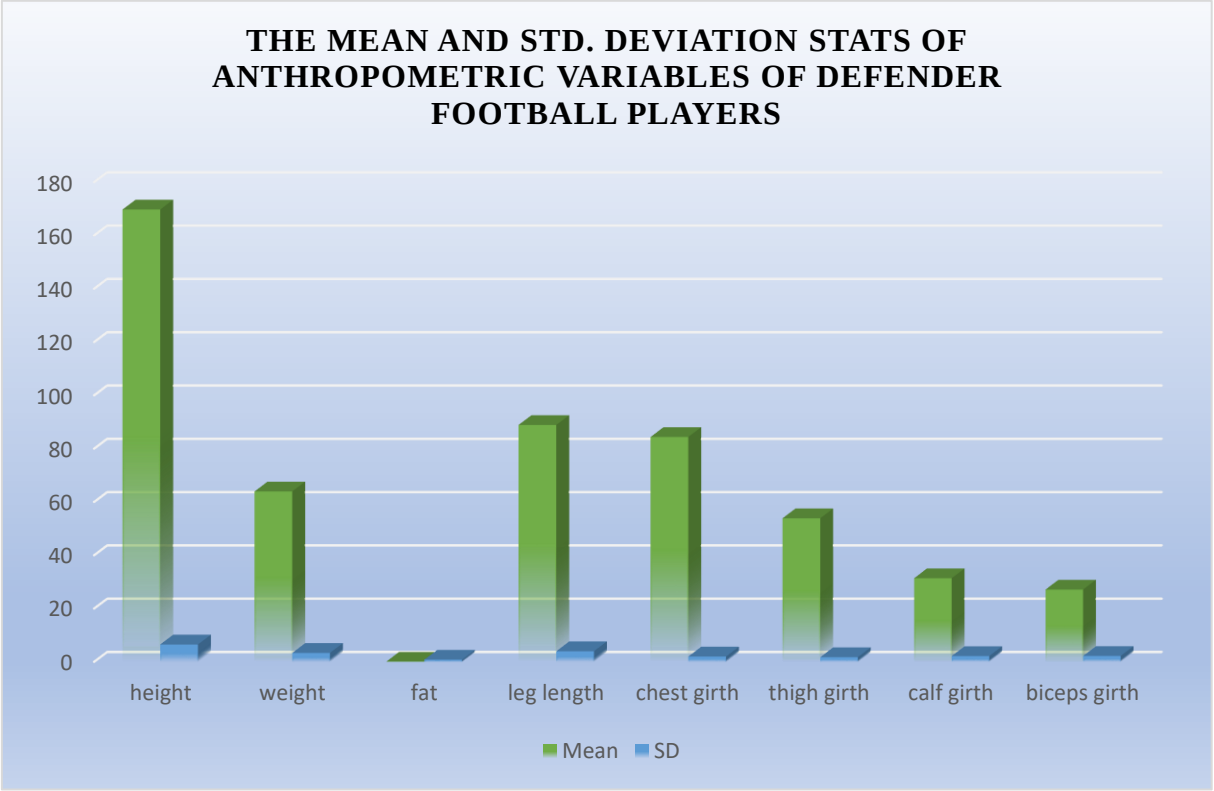

Figure 1.2: The Mean and Std. deviation of anthropometric variables of defender football players

Table 1.3: Descriptive Statistics of Anthropometric Variables of forward Football Players

S. No.	N	Physical variable	Min.	Max.	Mean	Standard deviation
1	30	Height (cm.)	158.00	183.00	170.6123	5.66959
2	30	Weight (kg.)	54.00	70.00	62.8656	3.09785
3	30	Fat (%)	8.00	12.00	10.4301	0.70569
4	30	Leg Length (cm.)	82.00	96.00	88.6335	4.47107
5	30	Chest Girth (cm.)	79.00	91.00	84.3354	2.57755
6	30	Thigh Girth (cm.)	50.00	56.00	53.6721	1.16281
7	30	Calf Girth (cm.)	26.00	37.00	31.7131	2.40798
8	30	Biceps Girth (cm.)	20.00	31.00	26.0158	2.40554

Table 1.3 and Figure 1.3, the descriptive statistics for the anthropometric variables of forward football players are summarized as follows:

- **Mean height**: 170.61 cm with a standard deviation (S.D.) of 5.66
- **Mean weight**: 62.86 kg with a standard deviation of 3.09
- **Mean fat percentage**: 10.43% with a standard

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deviation of 0.70

- **Mean leg length**: 88.63 cm with a standard deviation of 4.47
- **Mean chest girth**: 84.33 cm with a standard deviation of 2.58
- **Mean thigh girth**: 53.67 cm with a standard deviation of 1.16
- **Mean calf girth**: 31.71 cm with a standard deviation of 2.40
- **Mean biceps girth**: 26.01 cm with a standard deviation of 2.40

These statistics provide a detailed profile of the physical characteristics of forward football players, showcasing the variation in their anthropometric measurements across key body dimensions.

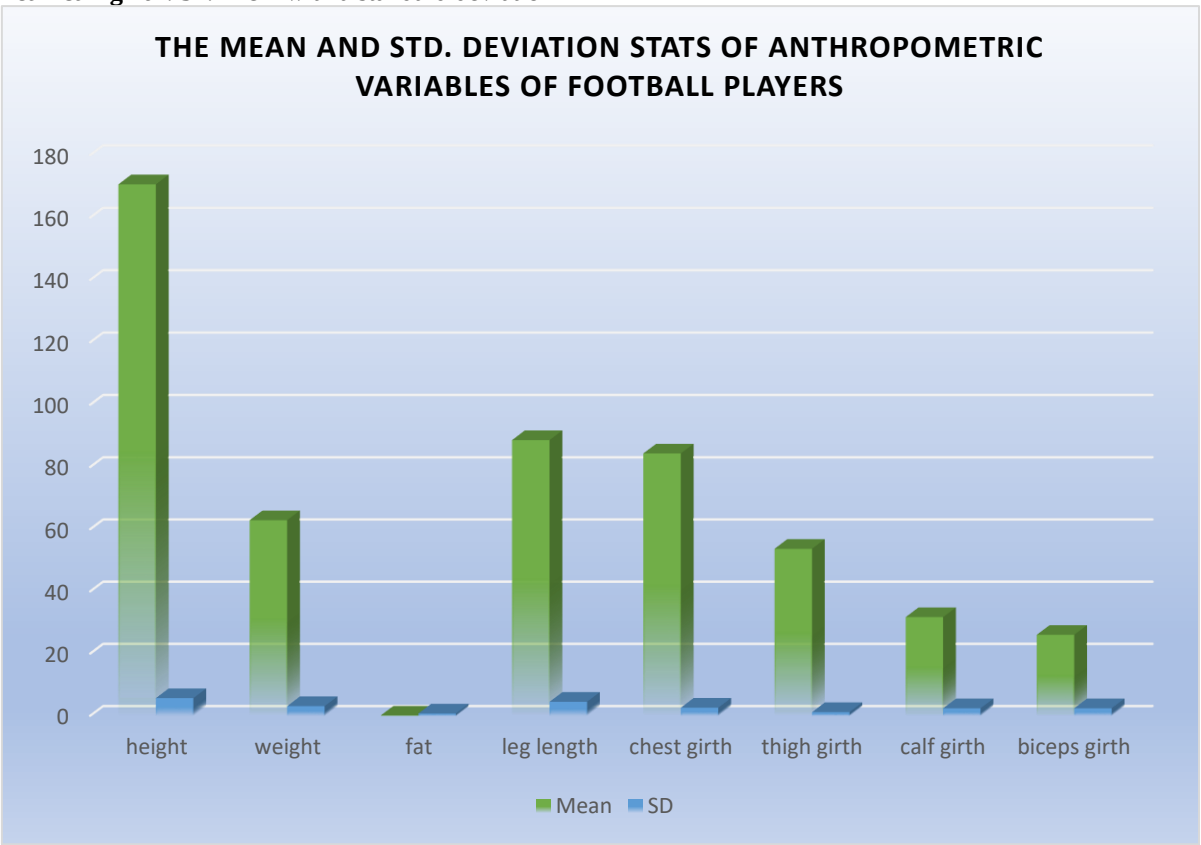

Figure 1.3: The Mean and Std. deviation of anthropometric variables of forward football players

Table 1.4: statistics for correlations between anthropometric variables and playing ability of midfield football players

S. No.	Physical variables	Statistical Analysis	Playing Ability
1	Height	Pearson Correlation	0.474**
		Sig. (2-tailed)	0.008
		N	30
2	Weight	Pearson Correlation	-0.356
		Sig. (2-tailed)	0.053
		N	30
3	Body Fat (%)	Pearson Correlation	0.549**
		Sig. (2-tailed)	0.002
		N	30
4	Length of Legs	Pearson Correlation	0.025
		Sig. (2-tailed)	0.896
		N	30

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5	**Chest Girth**	Pearson Correlation	0.525**
		Sig. (2-tailed)	0.003
		N	30
6	**Thigh Girth**	Pearson Correlation	0.198
		Sig. (2-tailed)	0.294
		N	30
7	**Calf Girth**	Pearson Correlation	0.097
		Sig. (2-tailed)	0.609
		N	30
8	**Biceps Girth**	Pearson Correlation	0.459**
		Sig. (2-tailed)	0.011
		N	30

The analysis of the correlation between the anthropometric variables and the playing ability of midfield football players, as depicted in Table 4.6, shows the following results based on Pearson's Coefficient of Correlation:

- **Height**: The correlation value of 0.474 indicates a significant positive relationship between height and playing ability.
- **Body Fat Percentage**: A correlation value of 0.549 suggests a strong positive correlation with playing ability.
- **Chest Girth**: With a correlation value of 0.525, there is also a significant positive relationship between chest girth and playing ability.
- **Biceps Girth**: A correlation value of 0.459 further shows a significant positive correlation with playing ability.

Since these values exceed the tabulated "r" value at a 0.05 confidence level, it can be concluded that height, body fat percentage, chest girth, and biceps girth are positively correlated with the playing ability of midfield football players.

However, no significant correlation was observed in **weight**, **length of legs**, **thigh girth**, and **calf girth**, as the obtained 'r' values were lower than the tabulated 'r' at the 0.05 confidence level, suggesting these variables do not have a significant impact on the playing ability of midfield players.

Table 1.5: statistics for correlations between anthropometric variables and playing ability of defender football players

S. No.	Physical variables	Statistical Analysis	Playing Ability
1	**Height**	Pearson Correlation	0.200
		Sig. (2-tailed)	0.248
		N	30
2	**Weight**	Pearson Correlation	-0.113
		Sig. (2-tailed)	0.517
		N	30
3	**Body Fat (%)**	Pearson Correlation	0.254
		Sig. (2-tailed)	0.141
		N	30
4	**Length of Legs**	Pearson Correlation	-0.146
		Sig. (2-tailed)	0.402
		N	30
5	**Chest Girth**	Pearson Correlation	0.530**
		Sig. (2-tailed)	0.001
		N	30
6	**Thigh Girth**	Pearson Correlation	-0.22
		Sig. (2-tailed)	0.902

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		N	30
7	**Calf Girth**	Pearson Correlation	-0.107
		Sig. (2-tailed)	0.539
		N	30
8	**Biceps Girth**	Pearson Correlation	0.209
		Sig. (2-tailed)	0.229
		N	30

The analysis of the correlation between the anthropometric variables and the playing ability of defender football players, as depicted in Table 4.7, reveals the following key findings:

Chest Girth*:* The Pearson Coefficient of Correlation value of 0.530 is greater than the tabulated "r" value at the 0.01 confidence level. This indicates a significant positive correlation between chest girth and playing ability in defender football players.

However, no significant correlation was observed in other variables such as **weight**, **fat percentage**, **length of legs**, **thigh girth**, **calf girth**, and **biceps girth**, as the obtained 'r' values for these variables were lower than the tabulated 'r' value at the 0.05 confidence level. Therefore, these anthropometric variables do not show a significant relationship with the playing ability of defender football players.

Table 1.6: statistics for correlations between anthropometric variables and playing ability of forward football players

S. No.	Physical variables	Statistical Analysis	Playing Ability
1	**Height**	Pearson Correlation	0.107
		Sig. (2-tailed)	0.542
		N	30
2	**Weight**	Pearson Correlation	-0.288
		Sig. (2-tailed)	0.093
		N	30
3	**Body Fat (%)**	Pearson Correlation	0.231
		Sig. (2-tailed)	0.182
		N	30
4	**Length of Legs**	Pearson Correlation	-0.022
		Sig. (2-tailed)	0.901
		N	30
5	**Chest Girth**	Pearson Correlation	0.351*
		Sig. (2-tailed)	0.039
		N	30
6	**Thigh Girth**	Pearson Correlation	0.224
		Sig. (2-tailed)	0.197
		N	30
7	**Calf Girth**	Pearson Correlation	0.015
		Sig. (2-tailed)	0.932
		N	30
8	**Biceps Girth**	Pearson Correlation	0.377*
		Sig. (2-tailed)	0.026
		N	30

The analysis of the correlation between the anthropometric variables and the playing ability of forward football players, as shown in Table 4.8, reveals the following:

- **Chest Girth**: The Pearson Coefficient of Correlation

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value of 0.351 exceeds the tabulated "r" value at the 0.01 confidence level.

- **Biceps Girth**: Similarly, the Pearson Coefficient of Correlation value of 0.377 is greater than the tabulated "r" value at the 0.01 confidence level.

Thus, it was concluded that there is a significant positive correlation between **chest girth** and **biceps girth** with the playing ability of forward football players.
However, no significant correlation was observed for **weight**, **fat percentage**, **length of legs**, **thigh girth**, and **calf girth**, as the obtained 'r' values for these variables were lower than the tabulated 'r' value at the 0.05 confidence level. Therefore, these variables do not show a significant relationship with the playing ability of forward football players.

III. DISCUSSION/CONCLUSION

The findings from the data analysis in this study were aimed at determining the relationship between selected anthropometric variables with the playing performance of district-level football players. The study also sought to identify differences in anthropometric and physical variables among football players in different playing positions, namely forwards, defenders, and midfielders.

3.1 Anthropometric Variables and Playing Ability of Midfielders:

Pearson's coefficient of correlation was applied to determine the relationship between anthropometric variables and the playing ability of midfielders. Significant positive correlations were found between playing ability and the anthropometric variables of height (r = 0.474), body fat percentage (r = 0.549), chest girth (r = 0.525), and biceps girth (r = 0.459), as these values exceeded the tabulated "r" value at the 0.05 confidence level. However, no significant correlations were observed between playing ability and weight, leg length, thigh girth, and calf girth, as the obtained 'r' values were lower than the tabulated value at the same confidence level.

3.2 Anthropometric Variables and Playing Ability of Defenders:

For defenders, Pearson's coefficient of correlation indicated a significant relationship between chest girth (r = 0.530) and playing ability, with the obtained 'r' value exceeding the tabulated "r" value at the 0.01 confidence level. However, no significant correlations were observed between playing ability and other anthropometric variables such as weight, body fat percentage, leg length, thigh girth, calf girth, and biceps girth.

3.3 Anthropometric Variables and Playing Ability of Forwards:

The correlation analysis for forwards revealed significant relationships between chest girth (r = 0.351) and biceps girth (r = 0.377) with playing ability, as these values exceeded the tabulated "r" value at the 0.01 confidence level. However, no significant correlations were observed between playing ability and weight, body fat percentage, leg length, thigh girth, and calf girth.

RECOMMENDATIONS

Based on the findings and conclusions of this study, several recommendations are made to improve the development and performance of district-level football players:

1. Greater emphasis should be placed on the preparation and training of district-level football players to help them reach higher levels of success in sports.
2. Future studies could explore similar research across a broader range of sports disciplines to better understand the relationship between anthropometric variables and performance.
3. The results of this study can serve as a valuable tool for district-level football players to self-evaluate and identify areas for improvement.
4. Similar studies could be conducted at various levels of achievement, providing insights into how players at different competitive levels can benefit from tailored physical.

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