Position-Specific Body Composition Trend in Football: A Comparative Study

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Abstract

This study explores body composition trends in players categorized into the respective positions: forwards, midfielders, defenders/goalkeepers. Body composition—fat mass, lean mass, and skeletal muscle—affects athletic performance, and considering its position-specific variations can allow for optimized training and reduce injury. Purposive sampling was used to select 200 players (18-28 years of age) from the Punjab Football Association. The Body Composition Monitor (HBF-361) evaluated participants' body composition by assessing body fat percentage, visceral fat, BMI, skeletal muscle mass, and basal metabolic rate (BMR). Overall, data showed significant differences in body composition according to playing positions. Defenders showed the highest body fat percentage (17.34%) and visceral fat (4.45%), while goalkeepers demonstrated the lowest results for both. The physical data were observed such that the BMI of midfielders were higher than other factors. At the same time, defenders also had the maximum skeletal muscle mass and forwards demonstrated higher basal metabolic rate in comparison to goalkeepers. Statistical analyses revealed that there were overall significant differences in body fat, visceral fat, skeletal muscle mass, and BMR among positions. Yet, there were no overall significant differences found for BMI. These results highlighted the significance of position-specific body composition in football. Optimizing body composition through position-specific training Programming By recognizing the needs of each athlete's role, coaches can maximize performance and minimize injury risk. The unique body composition profiles according to the three functional playing positions are demonstrative of the nature of the game, and these findings provide helpful information for strength and conditioning practitioners working in the confines of football.

Introduction

Football is among the most renowned sports worldwide, with involvement spanning virtually every nation, reflecting interest in the sport at many competitive and leisure levels (FIFA, 2018; Giulianotti and Robertson, 2004). Due to its dynamic and robust character, football requires physical abilities, facilities, and certain physical qualities that may significantly impact an athlete's performance, particularly in high-intensity sports, as noted by Bangsbo and his colleagues and

Williams and others. Football may serve as a recreational pursuit, a means for professional development, a health-enhancing exercise, or a competitive arena (Reilly & Gilbourne, 2003; FIFA, 2018). Each position on the pitch, including goalie, midfielder, forward, and defender, has distinct features and demands for physical condition, abilities, and training, which stem from their specific roles (Bloomfield et al., 2007; Rampinini et al., 2007). Sports such as football have recommended body and physique that athletes ought to have, bearing in mind the fact that events such as the World Cup are more popular than ever before, especially among the youth; nevertheless, recommended standards of youth's male football teams across various nations remain scarce (Reeves et al., 1999; Malina et al., 2005).

Body composition is a whole definition of the amounts of muscle, bone, fat mass, and fat-free materials in our body. A healthy body composition is believed to be indicative of lower risks for chronic conditions such as cardiovascular disease and diabetes. Optimal balance of fat mass to lean mass is necessary for human athletic performance, as excess body fat has been shown to degrade performance quality and quantity, while basal muscle mass is required for strength and endurance (Heyward, 2010). Body composition refers to a person's fat and lean mass proportion. An athlete's ability to perform at their best can be enhanced if their body composition is optimal. An athlete with a higher percentage of lean mass (muscles, bones, organs, and water) and a lower percentage of body fat usually demonstrates better speed, agility, and endurance than one with a lower percentage of lean mass. By maintaining a healthy body composition, you can reduce the risk of injuries that might occur as a result. It is common for athletes to suffer from injuries due to excess body fat that strains their joints and muscles.

Methods

This study was done under descriptive research, where samples were selected, variables were defined, and a suitable research instrument was employed. Football players were used as the sample, and the main variable of the study was body composition. In this study, through purposive sampling, 200 football players from registered clubs of the Punjab Football Association (PFA) between the age of 18-28 years were taken. The samples were also restricted to the players, such as forwards, midfield, defenders, and goalkeepers. All recruited players were active participants in competitive football and must have at least three years' experience as the selection criterion to

ensure that the sample is relevant to the study's goals. All the data was estimated using the **Body Composition Monitor with Scale HBF-361**. Statistical technique, One-way ANOVA and Post-Hoc used for the data analyses.

Result

Table 1.1: Descriptive Statistics of body fat percentage Among Football Players of Various Playing Positions

Variable	Playing Position	N.	Means	Std. Deviation
Body Fat Percentage	Forwards	60	15.54	2.32
	Mid Fielders	60	16.26	3.21
	Defenders	60	17.34	1.91
	Goal Keepers	20	15.34	3.61

Table 1.1 displays the descriptive data for body fat percentage among football players playing different positions. The defenders have the greatest mean value (17.34) with a standard deviation (1.91), followed by mid-fielders (16.26) with a standard deviation (3.21) and forwards (15.54) with a standard deviation (2.32). The goalkeepers have the lowest mean value (15.34) with a standard deviation (3.61) among the football players of different playing positions. A graphical depiction of the same is also provided in Figure 1.

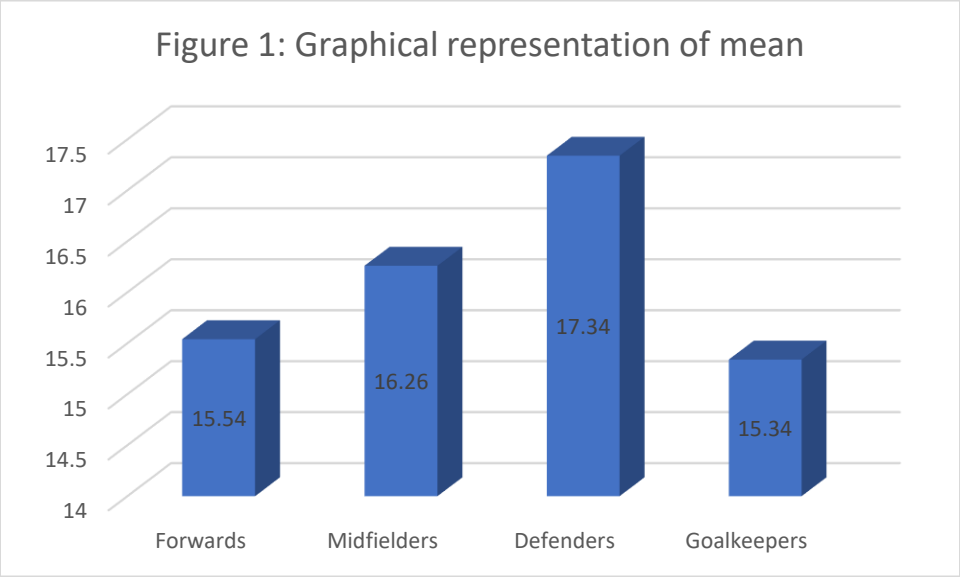

Table 1.2: One-Way Analysis of Variance for Body Fat Percentage Among Football Players of Various Playing Positions

Source of Variation	Sum of Squares	Df	Mean Square	F- value	p-value
Between Groups	117.55	3	39.18	5.42	.001
Within Groups	1388.92	196	7.08		
Total	1506.47	199			

Based on the data in Table 1.2, it has been determined that there is a statistically significant variation in body fat percentages between the players of various playing positions in football (forwards, midfielders, defenders, and goalkeepers). The p-value of 0.001 suggests significant evidence that the body fat percentages fluctuate depending on playing position. However, it does not assist in determining the playing position in which body fat percentage changes greatly. Thus,

a post hoc test was done to examine the differences, and the findings are provided in the following table.

Table 1.3: Post hoc Analysis of Body Fat Percentage Among Football Players of Various Playing Positions

Playing Position	Forwards	Mid Fielders	Defenders	Goal Keepers
Forwards	-			
Mid Fielders	1.46	-		
Defenders	3.69**	2.22*	-	
Goal Keepers	.31	1.34	5.05**	-

Table 1.3 depicts the "t" value derived from the post hoc study of the body fat % among players of different playing positions in football, i.e., forwards, midfielders, defenders, and goalkeepers. The findings demonstrated that defensive football players had considerably bigger body fat percentages than goalkeepers, strikers, and mid-fielders, with t values of 5.05 & 3.69, respectively, at the .01 and t values of 2.22 and .05 significance levels. However, players of various playing positions have showed minor differences with each other in the variable of body fat %.

Table 1.4: Descriptive Statistics of Visceral Fat Among Football Players of Various Playing Positions

Variable	Playing Position	N.	Means	Std. Deviation
Visceral Fat	Forwards	60	4.17	.81
	Mid Fielders	60	3.95	1.05
	Defenders	60	4.45	.89
	Goal Keepers	20	3.7	.85

Table 1.4 displays the descriptive data for visceral fat among football players of different playing positions. The defenders have the greatest mean value (4.45) with a standard deviation (.89), followed by strikers (4.17) with a standard deviation (.81) and midfielders (3.95) with a standard deviation (1.05). The goalkeepers have the lowest mean value (3.7) with a standard deviation (.85) among the football players playing different positions. The graphical depiction for the same is also provided in Figure 2.

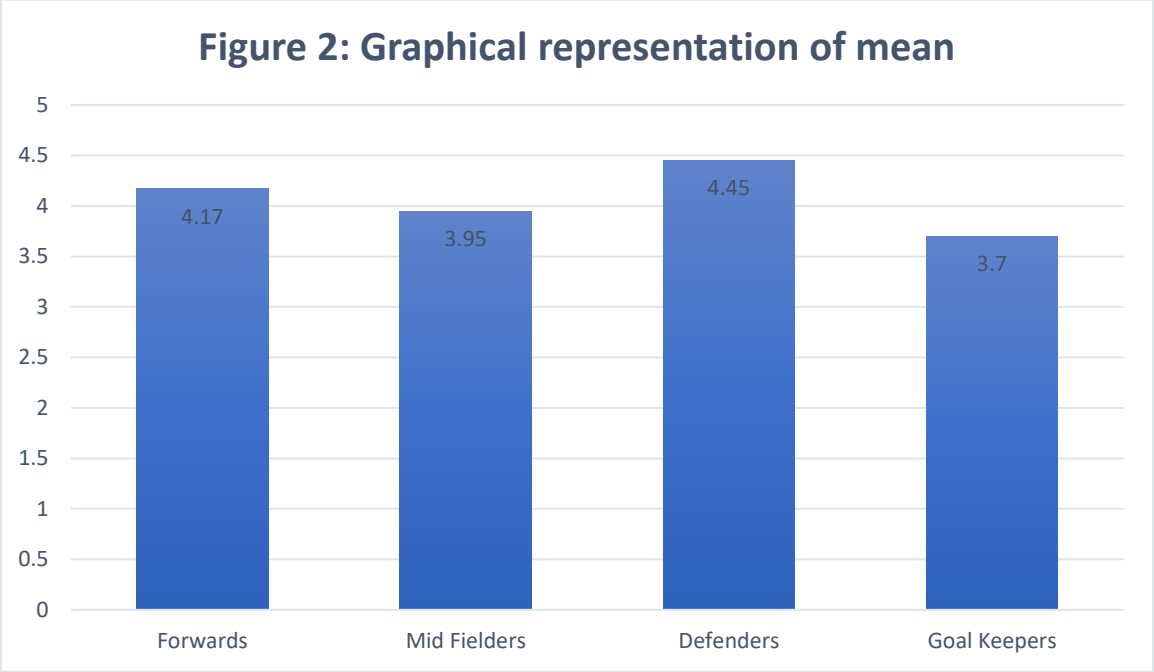

Table 1.5: One-Way Analysis of Variance for Visceral Fat Among Football Players of Various Playing Positions

Source of Variation	Sum of Squares	Df	Mean Square	F- value	p-value
Between Groups	11.53	3	3.84	4.57	.004
Within Groups	164.96	196	.84		
Total	176.49	199			

Based on the data in Table 1.5, it has been shown that there is a statistically significant difference in visceral fat between the players of various playing positions in football (forwards, midfielders, defenders, and goalkeepers). The p-value of 0.004 suggests significant evidence that the visceral fat varies considering playing positions. However, it does not assist in determining the playing position in which visceral fat differs greatly. Thus, a post hoc test was done to examine the differences, and the findings are provided in the following table.

Table 1.6: Post hoc Analysis of Visceral Fat Among Football Players of Various Playing Positions

Playing Position	**Forwards**	**Mid Fielders**	**Defenders**	**Goal Keepers**
Forwards	-			
Mid Fielders	1.28	-		
Defenders	1.63	2.91**	-	
Goal Keepers	1.99*	1.09	5.45**	-

Table 1.6 depicts the "t" value derived from the post hoc analysis of the visceral fat among players of different football positions, i.e., forwards, midfielders, defenders, and goalkeepers. The findings demonstrated that defence football players had considerably larger visceral fat than goalkeepers and midfielders, with t values of 5.45 & 2.69 at the .01 significance level, respectively. Similarly, strikers have showed considerably more visceral fat in compared to goalkeepers, with a t value of 1.99 at the .05 level of significance. However, players of various playing positions have showed minimal differences with each other in the variable of visceral fat.

Table 1.7: Descriptive Statistics of Body Mass Index Among Football Players of Various Playing Positions

Variable	**Playing Position**	**N.**	**Means**	**Std. Deviation**
Body Mass Index	Forwards	60	20.66	2.01
	Mid Fielders	60	21.15	2.26
	Defenders	60	21.01	1.94

	Goal Keepers	20	20.37	1.99

Table 1.7 displays the descriptive data for body mass index among football players playing different positions. The midfielders have the greatest mean value (21.15) with a standard deviation (2.26), followed by defenders (21.01) with a standard deviation (1.94) and forwards (20.66) with a standard deviation (2.01). The goalkeepers have the lowest mean value (20.37) with a standard deviation (1.99) among the football players of different playing positions. The graphical depiction for the same is also provided in Figure 3.

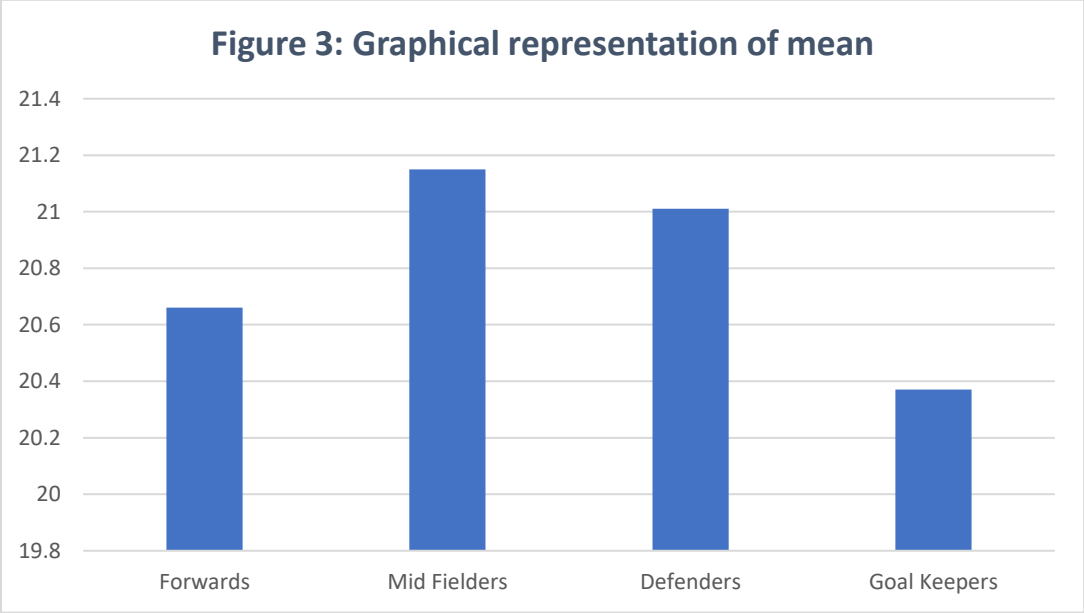

Table 1.8: One-Way Analysis of Variance for Body Mass Index Among Football Players of Various Playing Positions

Source of Variation	**Sum of Squares**	**Df**	**Mean Square**	**F- value**	**p-value**
Between Groups	13.56	3	4.52	1.062	.377
Within Groups	833.4	196	4.25		

Total	846.96	199			

Based on the data in Table 1.8, it has been discovered that there is a statistically negligible variation in body mass index between the players of various playing positions in football (forwards, midfielders, defenders, and goalkeepers). The p-value of 0.337 is high, suggesting that the changes in body mass index are attributable to chance rather than the playing positions.

Table 1.9: Descriptive Statistics of Skeletal Muscle Mass Among Football Players of Various Playing Positions

Variable	**Playing Position**	**N.**	**Means**	**Std. Deviation**
Skeletal Muscle Mass	Forwards	60	36.92	1.85
	Mid Fielders	60	37.02	1.51
	Defenders	60	37.50	1.79
	Goal Keepers	20	35.89	.94

Table 1.9 displays the descriptive data for skeletal muscle mass among football players of different playing positions. The defenders have the greatest mean value (37.50) with a standard deviation (1.79), followed by mid-fielders (37.02) with a standard deviation (1.51) and forwards (36.92) with a standard deviation (1.85). The goalkeepers have the lowest mean value (35.89) with a standard deviation (.94) among the football players playing different positions. The graphical depiction for the same is also provided in Figure 4.

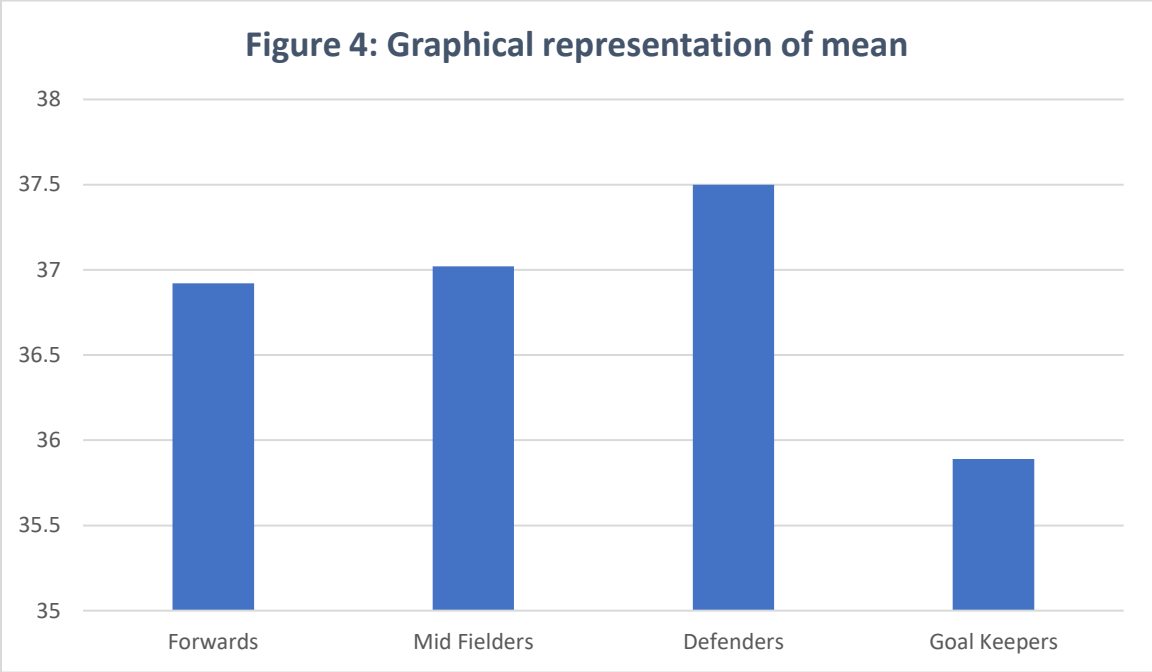

Table 1.10: One-Way Analysis of Variance for Skeletal Muscle Mass Among Football Players of Various Playing Positions

Source of Variation	Sum of Squares	Df	Mean Square	F- value	p-value
Between Groups	39.96	3	13.32	4.81	.002
Within Groups	542.70	196	2.77		
Total	582.67	199			

Based on the data in Table 1.10, it has been determined that there is a statistically significant variation in skeletal muscle mass between the players of various playing positions in football (forwards, midfielders, defenders, and goalkeepers). The p-value of 0.002 suggests significant evidence that the skeletal muscle mass varies in connection to playing positions. However, it does not assist to determine the playing position in which skeletal muscle mass differs greatly. Thus, a post hoc test was done to examine the differences, and the findings are provided in the following table.

Table 1.11: Post hoc Analysis of Skeletal Muscle Mass Among Football Players of Various Playing Positions

Playing Position	Forwards	Mid Fielders	Defenders	Goal Keepers
Forwards	-			
Mid Fielders	.32	-		
Defenders	1.90	1.59	-	
Goal Keepers	2.40*	2.62*	6.49**	-

Table 1.11 depicts the "t" value derived from the post hoc examination of the skeletal muscle mass among players of different football playing positions, i.e., forwards, midfielders, defenders, and goalkeepers. The findings demonstrated that goalkeepers had considerably smaller skeletal muscle mass than defenders, midfielders, and forwards, with a t value of 6.49 at the .01 and t values of 2.62 & 2.40 at the .05 significance level, respectively. However, players of various playing positions have showed minor differences with them other in the variable of skeletal muscle mass.

Table 1.12: Descriptive Statistics of Basal Metabolic Rate Among Football Players of Various Playing Positions

Variable	Playing Position	N.	Means	Std. Deviation
Basal Metabolic Rate	Forwards	60	1582.02	89.53
	Mid Fielders	60	1580.17	92.27
	Defenders	60	1543.47	96.50
	Goal Keepers	20	1533.21	108.1

Table 1.12 displays the descriptive data for basal metabolic rate among football players playing different positions. The forward players have the greatest mean value (1582.02) with a standard deviation (of 89.53), followed by mid-fielders (1580.17) with a standard deviation (of

92.27) and defenders (1543.47) with a standard deviation (of 96.50). The goalkeepers have the lowest mean value (1533.21) with a standard deviation (108.1) among the football players playing different positions. The graphical depiction for the same is been provided in figure-5.

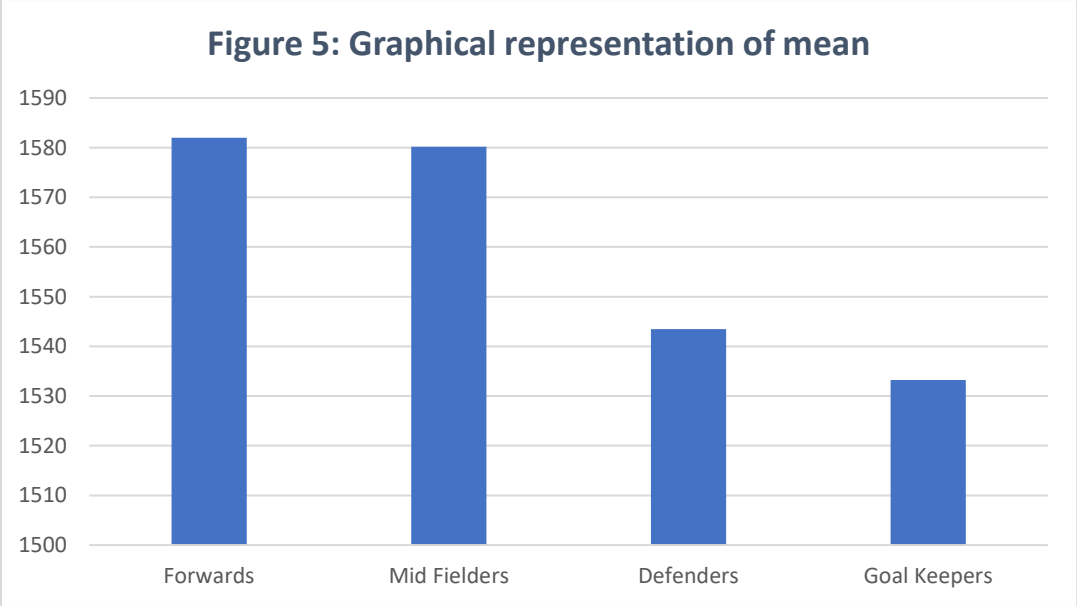

Table 1.13: One-Way Analysis of Variance for Basal Metabolic Rate Among Football Players of Various Playing Positions

Source of Variation	Sum of Squares	Df	Mean Square	F- value	p-value
Between Groups	79223.05	3	26407.68	2.96	.03
Within Groups	1746301.75	196	8909.70		
Total	1825524.8	199			

Based on the data in Table 1.13, it has been established that there is a statistically significant variation in basal metabolic rate between the players of various playing positions in football (forwards, midfielders, defenders, and goalkeepers). The p-value of 0.03 demonstrates that the basal metabolic rate changes in relation to playing positions. However, it does not assist to

determine the playing position in which basal metabolic rate changes greatly. Thus, a post hoc test was done to examine the differences and the findings are provided in the following table.

Table 1.14: Post hoc Analysis of Basal Metabolic Rate Among Football Players of Various Playing Positions

Playing Position	Forwards	Mid Fielders	Defenders	Goal Keepers
Forwards	-			
Mid Fielders	.11	-		
Defenders	2.24*	2.13*	-	
Goal Keepers	2.00*	1.92	.72	-

Table 1.14 depicts the "t" value derived from the post hoc examination of the basal metabolic rate among players of different football playing positions, i.e., forwards, midfielders, defenders, and goalkeepers. The findings demonstrated that forward football players had a considerably basal metabolic rate compared to defenders and goalkeepers, with t values of 2.24 & 2.00 at the .05 significance level, respectively. Similarly, midfielders have exhibited a considerably larger baseline metabolic rate than defenders, with a t value of 2.13 at the .05 significance level. However, players of various playing positions have shown minor differences with each other in the variable of basal metabolic rate.

Discussion

The findings found that defenders have the greatest mean value for body fat percentage, and goalkeepers have the lowest value for body fat % among the football players of different playing positions. In the previous research, it was done that did not corroborate the outcome of the current study; they observed that goalkeepers owned a greater body fat percentage in comparison to playing positions (Cavia et al., 2019). Defenders have the greatest mean value for visceral fat and goalkeepers exhibit the least value for visceral fat among the football players of different playing

positions. Defenders have the greatest mean value for skeletal muscle mass and goalkeepers have the least value for skeletal muscle mass among the football players of different playing positions. Another research indicates that there is considerable variance in muscle mass (kg) among football players of various playing positions (Sebastia-Rico et al., 2023). Midfielders have the greatest mean value for body mass index, while goalkeepers have the least value for body mass index among the football players of different playing positions. Similarly, another investigated the body mass index (BMI) and body fat percentage in soccer players aged 16-18 years. The research indicated that BMI values among young soccer players were not substantially linked with physical fitness markers such as aerobic power, maximum anaerobic power, and local muscle endurance (Nikolaïdis, 2012). One such research likewise did not identify any significant variations across jobs in body mass index (Hazir, 2010). Forwards have the greatest mean value for basal metabolic rate and goalkeepers have the least value for basal metabolic rate among the football players of different playing positions. Another research study demonstrated that centre midfielders had the best value for metabolic power and central defenders as football players. However, players of various playing positions have shown minimal variation with each other in the variable of basal metabolic rate (Akyildiz et al., 2022).

Conclusion

This study emphasizes significant variations in players' physical features based on their roles, underscoring the need for position-specific characteristics for maximum performance. Defenders had the most significant amounts of body fat, visceral fat and skeletal muscle mass, whilst goalkeepers demonstrated the lowest levels. Midfielders had a greater BMI and BMR than forwards, with the most enormous skeletal muscle mass. These discrepancies indicate that the specific physical requirements of each location, including endurance, agility, strength, and power, need customised training strategies. The results emphasise the need to tailor conditioning programs to accommodate each person's unique physiological requirements, hence optimising performance and minimising injury risks. Understanding these position-specific tendencies may assist coaches and mentors in developing more effective, individualised training and nutrition programs, enhancing overall player development and team performance. In conclusion, the findings clarified how physical composition may be deliberately used to enhance athletic performance in football.

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