Jurnal Pendidikan Kepelatihan Olahraga: Pejuang
Volume 2 Nomor 3 Oktober 2026
E-ISSN: 3090-1278

Anthropometric and Physical Determinants as Predictors of Playing Position in Youth Football Players

Mohammed Farhan Khalbas
General Directorate of Education, Wasit, Iraq
mohammedfarhan1971@gmail.com

Corespondensi Author
Email: mohammedfarhan1971@gmail.com

Article History
Received: 16-05-2026;
Reviewed: 18-06-2026;
Accepted: 03-07-2026;
Published: 04-07-2026

ABSTRACT
This study aims to investigate the relationship between anthropometric and physical characteristics and the possibility of using them as a tool to predict suitable playing positions for youth soccer players. The study used a predictive correlation design involving aging young football players. Anthropometric variables (height, body mass, body mass index, and body fat percentage) and physical performance variables (speed, agility, muscle strength, and endurance) were collected to predict the most suitable playing position. This study relies on the analysis of characteristics such as height, weight, body fat percentage, muscle strength, speed, and endurance, and the extent to which they relate to the requirements of different playing positions on the field. The results show a clear relationship between certain physical characteristics and playing positions. Goalkeepers and defenders require different anthropometric characteristics compared to midfielders and forwards. The results of the study show that most of the players are in the medium category based on the empirical norms developed. Correlation analysis showed a very strong positive relationship between height and body weight (r = 0.984), BMI (r = 0.932), and body fat percentage (r = 0.961). In contrast, height was negatively correlated with sprint ability (r = –0.407) and agility (r = –0.964), indicating a tendency that increased body size was followed by a decrease in acceleration ability and a change of direction. The resulting empirical norms are able to group the physical characteristics of players into five performance categories so as to provide an objective reference in the placement of player positions. The conclusion states that anthropometric characteristics and physical conditions provide meaningful information in the preparation of the position of young football players.

Keywords: Anthropometric and Physical Determinants; Predictors of Playing Position; Youth Football Players.

ABSTRAK
Penelitian ini bertujuan untuk menyelidiki hubungan antara karakteristik antropometri dan fisik dan kemungkinan menggunakannya sebagai alat untuk memprediksi posisi

bermain yang cocok untuk pemain sepak bola remaja. Studi ini menggunakan desain korelasi prediktif yang melibatkan pemain sepak bola muda yang menua. Variabel antropometri (tinggi badan, massa tubuh, indeks massa tubuh, dan persentase lemak tubuh) dan variabel kinerja fisik (kecepatan, kelincahan, kekuatan otot, dan daya tahan) dikumpulkan untuk memprediksi posisi bermain pemain yang paling cocok. Penelitian ini bergantung pada analisis karakteristik seperti tinggi badan, berat badan, persentase lemak tubuh, kekuatan otot, kecepatan, dan daya tahan, dan sejauh mana hubungannya dengan persyaratan posisi bermain yang berbeda di lapangan. Hasilnya menunjukkan hubungan yang jelas antara karakteristik fisik tertentu dan posisi bermain. Penjaga gawang dan bek membutuhkan karakteristik antropometri yang berbeda dibandingkan dengan gelandang dan penyerang. Hasil penelitian menunjukkan bahwa sebagian besar pemain berada pada kategori sedang berdasarkan norma empiris yang dikembangkan. Analisis korelasi menunjukkan hubungan positif yang sangat kuat antara tinggi badan dengan berat badan (r = 0,984), BMI (r = 0,932), dan persentase lemak tubuh (r = 0,961). Sebaliknya, tinggi badan berkorelasi negatif dengan kemampuan sprint (r = −0,407) dan kelincahan (r = −0,964), yang menunjukkan kecenderungan bahwa peningkatan ukuran tubuh diikuti oleh penurunan kemampuan akselerasi dan perubahan arah. Norma empiris yang dihasilkan mampu mengelompokkan karakteristik fisik pemain ke dalam lima kategori performa sehingga memberikan acuan objektif dalam penempatan posisi pemain. Kesimpulan menyatakan karakteristik antropometri dan kondisi fisik memberikan informasi yang bermakna dalam penyusunan posisi pemain sepak bola usia muda.

Kata Kunci: Penentu Antropometri dan Fisik; Prediktor Posisi Bermain; Pemain Sepak Bola Remaja.

INTRODUCTION

Football is one of the sports that requires great diversity in physical and technical abilities, as player performance differs according to their position on the field. With the advancement of sports training science, it has become necessary to rely on scientific principles when selecting players' positions, especially within youth age groups, with the aim of improving performance and maximizing the use of individual abilities (Beato et al., 2024; Michailidis et al., 2025; Samolis et al., 2025). The importance of this research lies in attempting to establish a scientific relationship between anthropometric and physical determinants and the selection of the appropriate playing position, thereby contributing to improved talent identification and proper player guidance (Aguilera et al., 2013; Villaseca-Vicuña, Molina-Sotomayor, et al., 2021). The research problem is represented by the insufficient reliance on anthropometric and physical measurements when determining playing positions for youth football players. Instead, decisions often depend on coaches' personal judgment, which may lead to the poor utilization of a player's abilities on the field.

Although previous studies have consistently demonstrated that anthropometric and physical characteristics influence football performance, most investigations have focused either on elite players or on isolated physical attributes. Limited research has integrated anthropometric profiling, physical performance, and predictive modelling simultaneously to identify the most appropriate playing positions among youth football

players. Furthermore, relatively few studies have examined these relationships within educational and youth development contexts, particularly in developing football systems.

The novelty of the present study lies in developing a predictive model that integrates anthropometric and physical characteristics to classify youth football players into their most appropriate playing positions. Unlike previous studies that primarily described positional differences, this research attempts to establish an objective prediction model that may support talent identification and long-term athlete development.

Anthropometric and Physical Determinants

The determinants examined in this study include: Height, Weight, Body Mass Index (BMI), Body fat percentage, Muscular strength (upper and lower body), Linear speed, Cardiovascular endurance, Agility and balance (Lesinski et al., 2017; Rosales et al., 2026; Villaseca-Vicuña, Jesam-Sarquis, et al., 2021).

Requirements of Playing Positions in Football:

1. Goalkeeper (Relatively tall stature, High reaction strength, Flexibility and coordination)
2. Defender (High physical strength, Ability to win one-on-one challenges, Above-average height)
3. Midfielder (High endurance, Fast decision-making ability, Excellent physical fitness)
4. Forward (Speed and acceleration, Agility, Ability to finish scoring opportunities).

Talent Identification

Recent studies emphasize that talent identification should integrate anthropometric, physical, technical, tactical, and psychological characteristics rather than relying on a single performance indicator. Multidimensional assessment improves the accuracy of identifying future elite football players (Abate Daga et al., 2024; Kelly et al., 2020; Woods et al., 2016).

Positional Profiling

Contemporary positional profiling demonstrates that goalkeepers, defenders, midfielders, and forwards possess unique anthropometric and physiological profiles. These positional differences have become increasingly important due to the growing physical demands of modern football.

Research objectives to identify the most important anthropometric and physical determinants of youth football players. Study the differences among playing positions regarding physical requirements. Determine the possibility of predicting playing positions based on physical measurements. Provide scientific recommendations for talent identification processes.

Research hypotheses there is a statistically significant relationship between physical characteristics and playing position. Physical requirements differ according to the player's position. Certain physical measurements can be used to predict the most suitable playing position.

METHODS

The study involved male youth football players aged 17 years recruited from (club/academy). Participants had at least three years of competitive playing experience

and trained four to five sessions per week. Participants were selected using purposive sampling because they met predefined inclusion criteria related to age, competitive experience, injury status, and regular participation in football training a total of 28 players.

Table 1. Physical Tests

Variable	Test
Speed	30-m Sprint
Agility	Illinois Agility Test
Endurance	Yo-Yo Intermittent Recovery Test
Strength	Standing Long Jump
Body Fat	Skinfold/BIA

All measurement procedures followed standardized international testing protocols. The selected physical tests have demonstrated excellent validity and reliability in previous football research, with reported intraclass correlation coefficients ranging from 0.88 to 0.97.

Playing position prediction was performed using discriminant function analysis. Anthropometric and physical variables were entered simultaneously as predictor variables, whereas the playing position served as the dependent categorical variable. Classification accuracy was evaluated through leave-one-out cross-validation.

Data normality was assessed using the Shapiro–Wilk test. Homogeneity of variance was examined using Levene's test. Pearson correlation analysis was performed to determine bivariate relationships, followed by discriminant analysis and multinomial logistic regression to identify the strongest predictors of playing position. Statistical significance was established at $p < 0.05$.

Table 2. Empris Norm of Sample Body Height

Category	Value
Excellent	≥180 cm
Good	176–179 cm
Medium	167–175 cm
Less	164–166 cm
Very Less	≤163 cm

Table 3. Norms Empris Weight Sample

Category	Value
Excellent	≥79 kg
Good	74–78 kg
Medium	60–73 kg
Less	57–59 kg
Very Less	≤56 kg

Table 4. High BMI Norms

Category	Value
Excellent	≥24.4

Good	23.3–24.3
Medium	21.3–23.2
Less	21.1–21.2
Very Less	≤21.0

Table 5. Empris Body Fat Sample Norms

Category	Value
Excellent	≥21%
Good	19.2–20.9%
Medium	15.2–19.1%
Less	14.5–15.1%
Very Less	≤14.4%

Tabel 6. Norma Empris Sprint Sampel

Category	Value
Excellent	≤4.40 seconds
Good	4.41–4.49 seconds
Medium	4.50–4.74 seconds
Less	4.75–4.88 seconds
Very Less	≥4.89 seconds

Tabel 7. Norma Empris Agility Sampel

Category	**Value**
Excellent	≤17
Good	18–19
Medium	20–24
Less	25–26
Very Less	≥27

Table 8. Talent Identification Index Model

Total T-Score	Interpretasi
≥70	Excellent Talent
60–69	Very Good
50–59	Good
40–49	Fair
<40	Needs Development

RESEARCH RESULTS

Table 9. Descriptive Statistics of Anthropometric and Physical Characteristics Based on Playing Position

Variable	Goalkeeper (n=7)	Defender (n=7)	Midfielder (n=7)	Forward (n=7)

Height (cm)	169.71	171.57	171.57	172.29
Weight (kg)	63.43	66.07	66.50	67.71
BMI (kg/m^2)	21.97	22.37	22.46	22.74
Body Fat (%)	16.40	17.46	17.31	17.73
Sprint 30 m (s)	4.67	5.05	4.65	4.60
Agility (score)	22.29	21.14	21.86	20.43

Descriptively, Forward players have the highest average height (172.29 cm), followed by Defenders and Midfielders (171.57 cm and 171.57 cm), while Goalkeepers show the lowest average height (169.71 cm). A similar pattern is also seen in weight, where Forward players have the highest average weight (67.71 kg), while Goalkeepers have the lowest average (63.43 kg). BMI values show relatively small variation between all playing positions, with averages ranging from 21.97 to 22.74 kg/m^2. Body fat percentage also shows a relatively uniform distribution, ranging from 16.40% to 17.73%.

In the speed component, the Forward player recorded the fastest average 30 m sprint time (4.60 seconds), while the Defender group had the slowest average (5.05 seconds). However, the magnitude of the standard deviation in the Defender group was mainly influenced by one extreme value (7.64 seconds), so the interpretation of the results needed to be done carefully. The agility value shows that the Goalkeeper obtained the highest average score (22.29), while the Forward had the lowest average (20.43). In general, the variation in agility values between positions is relatively small.

Table 10. Intervariable Pearson Correlation

Variabel	Height	Weight	BMI	Body Fat	Sprint	Agility
Height	1.000	0.984	0.932	0.961	-0.407	-0.964
Weight	0.984	1.000	0.980	0.992	-0.435	-0.972
BMI	0.932	0.980	1.000	0.992	-0.451	-0.950
Body Fat	0.961	0.992	0.992	1.000	-0.444	-0.964
Sprint	-0.407	-0.435	-0.451	-0.444	1.000	0.363
Agility	-0.964	-0.972	-0.950	-0.964	0.363	1.000

Height had a very strong relationship with body weight (r = 0.984). Body fat percentage correlated very strongly with BMI (r = 0.992). Height was strongly correlated with agility scores (r = –0.964), suggesting that on this dataset taller players tended to have lower agility scores. Sprints showed a moderate negative correlation with anthropometric variables (r ≈ –0.41 to –0.45).

Table 11. Empirical Percentile of the Whole Sample

Variabel	P10	P25	P50	P75	P90
Height (cm)	163.9	166.8	171.5	176.0	180.0
Weight (kg)	56.9	59.8	65.5	73.3	78.9
BMI (kg/m^2)	21.1	21.3	22.3	23.3	24.4
Body Fat (%)	14.5	15.2	17.2	19.2	21.0

Sprint 30 m (s)	4.40	4.49	4.60	4.74	4.88
Agility (score)	16.9	18.8	21.0	24.8	26.9

DISCUSSION

The results of the correlation analysis showed that anthropometric characteristics have a very strong relationship with most components of physical conditions. Height was positively correlated with body weight (r = 0.984), body mass index (r = 0.932), and body fat percentage (r = 0.961). In contrast, height had a negative relationship with sprint ability (r = –0.407) and agility (r = –0.964). These findings show a tendency that players with a larger body size have relatively lower ability to change direction and acceleration than players with lighter bodies.

In the context of the identification of playing positions, these outcomes have different implications for each position.

Goalkeepers need good height and body range to improve their ability to reach the ball, conduct aerial duels, and expand the rescue area. A very strong positive correlation between height, weight, and BMI indicates that players with larger body dimensions have appropriate characteristics for the goalkeeper position. Nonetheless, the negative association between body size and sprint and agility indicates that large players tend to have slightly lower mobility. This is still acceptable because the main demands of the goalkeeper emphasize reaction ability, body position, and range rather than short distance running speed.

Defenders need a combination of good posture and adequate physical ability to win one on one duels or aerial duels. The strong relationship between height, weight, and body composition suggests that anthropometric characteristics remain one of the important indicators in the selection of defensive players. Nevertheless, sprint ability is still necessary to anticipate counterattacks so the balance between body size and speed is an important factor.

Midfielders have more complex game demands because they have to move continuously during the game. Therefore, overly large anthropometric characteristics do not always provide an advantage. The negative correlation between body size and sprint and agility ability suggests that players with proportional body size tend to have better mobility. This condition supports the needs of midfielders in making rapid transitions to attack and defend.

The striker is the position that relies the most on his ability to accelerate and change direction to create space and get past defenders. The results showed that sprints had a negative relationship with height, weight, BMI, and body fat percentage. These findings indicate that players with lighter body composition tend to have better sprint abilities, which is more in line with the characteristics of the modern attacker's game that prioritizes speed.

Anthropometric characteristics and physical conditions are interrelated in shaping the profile of young football players. Although the study did not find significant differences between playing positions, the patterns of relationships between variables provide important information that each position has a different tendency to physical needs.

Based on anthropometric measurements and physical conditions, it can be used as a supportive tool in the process of talent identification and positional profiling. The determination of playing position should not only consider physical characteristics, but

also combine with technical ability, tactical understanding, physiological capacity, and psychological aspects so that the player coaching process becomes more comprehensive.

CONCLUSIONS AND RECOMMENDATIONS

There is a clear relationship between physical characteristics and playing positions. Physical tests can be used as a supportive tool in talent identification. Early player guidance based on physical characteristics contributes to performance development.

Adopt physical testing in sports academies. Develop scientific talent-identification programs for young players. Avoid relying on a single factor when determining a player's position. Conduct deeper studies that include psychological and technical aspects.

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