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Associations between Anthropometry and Motor Performance in Young Elite Football Players from Bosnia and Herzegovina

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Abstract: Football player performance depends on agility, speed, explosive and repetitive strength, flexi-bility, and anthropometric characteristics such as height, weight, and BMI. Monitoring and ana-lyzing these variables are crucial for optimizing training, preventing injuries, and player selec-tion. Data on the physical and motor profiles of U25 football players in the Premier League of Bosnia and Herzegovina are limited. To assess the anthropometric characteristics and motor abilities of U25 football players from FK GOŠK Gabela and to examine the relationships be-tween these variables. The study included 22 healthy male players (mean height 183.27 ± 5.98 cm, weight 75.32 ± 6.27 kg, BMI 22.38 ± 0.60 kg/m²). Anthropometric measurements were conducted according to ISAK protocols. Nine standardized motor tests were administered to evaluate agili-ty (505 test, T-test, Illinois test, 5-10-5 drill, Zig-Zag test), speed (30 m and 60 m sprint), explosive and repetitive strength (push-ups in 10 s), and flexibility (sit & reach). Testing was conducted over two consecutive days during the 2024 pre-season, following a standardized warm-up under controlled conditions. Descriptive statistics, correlation, and the multiple regression analysis were applied. Player height and weight were significantly correlated with agility and sprint per-formance, while BMI showed moderate associations with selected agility tests. Multivariate analysis confirmed that height, weight, and BMI significantly predicted performance across agil-ity, sprint, and strength tests, with body dimensions explaining 65–68% of the variance in the 10-second push-up test (R^2 = 0.682), the 505 agility test (R^2 = 0.678), and the 60-meter sprint (R^2 = 0.671; all $p < 0.01$). The findings provide insight into the physical and motor profiles of elite young football players and can be used to optimize performance, design individualized training programs, and monitor player development.

Keywords: motor performance, anthropometry, motor skills, agility, speed

1. Introduction

Football is one of the most popular and dynamic sports in the world, requiring the integration of technical, tactical, physical, and cognitive abilities. Player performance largely depends on their motor skills and anthropometric characteristics, which together influence movement efficiency, reaction speed, explosiveness, and injury prevention [1]. Understanding the relationship between physical profile and motor abilities plays a key role in player selection, training planning, and long-term monitoring of youth athlete development, especially during phases of intense growth and training [2,3].

Motor abilities, such as agility, speed, explosive strength, and flexibility, form the foundation of football performance. Agility, which includes the ability to quickly change direction while maintaining balance and body control, is considered critical for successful dribbling, defensive maneuvers, and off-the-ball movement [2.4]. Speed and explosive strength enable effective sprints, pressing situations, and competitive duels, while flexibility contributes to joint mobility, injury prevention, and optimal execution of technical elements [5,6,7]. These abilities are often quantified using specific tests of agility, sprinting, and flexibility, enabling objective monitoring of player development. Anthropometric parameters significantly affect the biomechanics and functional capacity of football players. Greater height may provide an advantage in action duels, while optimal body mass combined with muscular strength contributes to explosive movements and body stability during duels [8,9,10]. BMI is often used as an indicator of body composition, but it does not distinguish between muscle and fat mass, which is why its interpretation in athletes requires additional caution [11,12,13,14]. The relationship between anthropometric characteristics and motor performance is not always linear, for example limiting agility due to a higher center of mass and increased moment of inertia during direction changes [8,15].

Differences in physical and motor profiles are often more pronounced between elite and non-elite youth football players. Elite players demonstrate superior sprinting, explosive strength, agility, and flexibility, partly due to their biological maturity and intensive training load [16,17,18,19]. Biological maturity, including peak height velocity (PHV) and hormonal changes, significantly shapes muscle mass development, coordination, and neuromuscular function, as reflected in performance on key motor tests [20,21]. Although motor abilities and anthropometric parameters have been extensively studied in youth players from well-developed football systems, data on U25 players in lower professional leagues are limited. There is a need for multidimensional analyses linking body characteristics to functional abilities, as such data enable individualized training, performance optimization, and injury prevention [22,23]. In the context of evaluating the motor skills and anthropometric characteristics of young football players, studies have mainly focused on tactical-technical skills or nutritional habits, while the systematic analysis of physical and anthropometric factors in the U25 category is insufficiently explored, which is a good argument for the present study [17,20,22].

This issue is particularly relevant because football teams include players with a wide range of anthropometric characteristics. For instance, the body length of professional footballers and junior team members ranges from 160 cm to 200 cm [23,24,25,26]. Scaling laws impose fundamental physical constraints on biological systems, explaining why smaller organisms in nature are stronger relative to their mass—an ant can move a load significantly greater than its own, whereas an elephant cannot—and are also more agile and resilient.

Allometry is most clearly manifested in absolute and relative strength. As an organism's size increases, absolute strength rises due to the increase in total muscle mass. However, relative strength decreases with increasing linear dimensions of the organism. Relative strength is defined as the force (F) an organism can exert divided by its body mass (M) (F/M). The key concept of scaling is that as a body's linear dimensions (length, L) increase, its mass (M) and muscle cross-sectional area (A) scale differently: mass increases proportionally to the cube of length ($M \propto L^3$), while muscle strength is proportional to its cross-sectional area ($F \propto A \propto L^2$). Therefore, relative strength scales as $F/M \propto L^2/L^3 \propto L^{-1}$. However, in sports, additional factors beyond scaling laws play a role, including athletic selection and the training process. These factors, combined with scaling laws, influence the development of motor skills in athletes with diverse anthropometric profiles and necessitate an individualized training approach [27,28,29,30]. Therefore, it is important to clarify how anthropometric characteristics affect football players' motor skills and physical qualities, and whether these traits are determined solely by scaling laws or are also shaped by other factors.

Studies aimed at analyzing the interrelationships between the determinants of sports performance in U25 football players are relatively limited, and understanding these complex processes is essential for streamlining the training process. Understanding these relationships in a local context can contribute to the creation of specific conditioning and training programs, to improving player selection and to monitoring athlete development in Bosnia and Herzegovina, representing an important contribution to both the practical and scientific aspects of sports science.

The aim of the research is to examine the relationship between anthropometric characteristics (height, body mass and BMI) and motor skills (agility, speed, explosive strength and flexibility) in elite U25 football players, as well as to identify key predictors of performance.

The research hypothesis started from the assumption that identifying the interrelationship between anthropometric characteristics and motor skills will contribute to improving the training process and, implicitly, sports performance in U25 football players.

2. Materials and Methods

2.1. Participants

The research sample consisted of 22 football players (U25), of FK GOŠK Gabela, Premier League of Bosnia and Herzegovina, average body height = 183.27 ± 5.98 cm; average body weight = 75.32 ± 6.27 kg; BMI = 22.38 ± 0.60 kg/m^2). All participants were healthy, without musculoskeletal injuries for at least six months before testing, and regularly attended training. None of the subjects reported recent viral infections or acute illnesses (e.g. influenza) at the time of testing.

Players are considered U25 elite if they have been called up to youth national teams or the senior national team. From a competitive participation perspective, players included in the sample must have completed at least one full season at elite level, with a significant number of minutes accumulated, attesting to regular involvement in competition. Players recovering from major injuries or with reduced competitive activity were excluded from the analysis.

Although the sample size (n = 22) may appear limited for multivariate analyses involving three predictors, it reflects the highly restrictive inclusion criteria applied in this study. Participants were required to be active professional players under 25 years of age, competing at elite level, with a minimum of one full competitive season and a significant number of minutes accumulated. These criteria substantially reduced the eligible population while ensuring the homogeneity and representativeness of the sample. Similar sample sizes have been reported in comparable studies focusing on elite athletic populations, where strict selection standards inevitably constrain recruitment capacity without compromising the scientific validity of the findings.

Before data collection, the players and coaching staff were thoroughly informed about the purpose, methods, and procedures of the study. All participants provided written informed consent, and in the case of minors, parental consent was also obtained.

2.2. *Study design*

This cross-sectional observational study was conducted in the preparatory phase of the 2024 competitive season, on the official training grounds of the FK GOŠK Gabela team. The Ethics Committee of H.S. Skovoroda Kharkiv National Pedagogical University received permission to conduct this research, as it is in accordance with the World Medical Association's Declaration of Helsinki - the ethical principles of medical research involving humans (No. KhNPU/PhES/EC/4/6/2024).

2.3. *Methodology*

Anthropometric measurements were conducted in accordance with the International Society for the Advancement of Kinanthropometry (ISAK) standards and procedures. All assessments were performed by a certified anthropometrist to ensure measurement accuracy and reliability. Body height was measured to the nearest 0.1 cm using a portable stadiometer (SECA 213, Hamburg, Germany), with participants standing barefoot in an upright position, with their head positioned in the Frankfurt horizontal plane. Body mass was recorded using a digital scale (Tefal, France; capacity 0–160 kg) with an accuracy of 0.1 kg. Players were measured in light sports clothing and without shoes. Body mass index (BMI) was subsequently calculated using the standard formula:

$$BMI = \text{body mass (kg)} / \text{height}^2 \text{ (m}^2\text{)}$$

The same instruments and protocols were used for all subjects to minimize measurement error and ensure internal consistency. To assess key components of motor abilities, a battery of nine standardized motor tests was administered to evaluate agility, speed, explosive and repetitive strength, and flexibility (https://www.brianmac.co.uk/sitreach.htm). Sprint performance 30m, 60m and agility tests were measured using four electronic photocells (Microgate, Bolzano, Italy). All measurements were conducted in a controlled outdoor setting, on the club's training pitch, under similar weather conditions for all participants. Testing was carried out over two consecutive days in the morning (between 9:00 and 11:30 a.m.) under the supervision of certified sports science professionals. Prior to testing, each player completed a standardized 15-minute warm-up, which included light aerobic activity (5 minutes of jogging), dynamic stretching (5 minutes), and sport-specific drills (5 minutes). Players were instructed to maintain regular hydration and avoid strenuous training 24 hours prior to testing. Each test was demonstrated beforehand, and players were given a familiarization trial before the official measurement to reduce the impact of learning effects. Three trials were allowed for each test (where applicable), with the best result retained for analysis. Rest intervals between attempts were 1–2 minutes, and between test categories were 3–5 minutes to prevent fatigue accumulation.

All tests have been previously validated and are widely used in football populations to assess physical performance and interindividual differences [23,31]. The testing order was designed to minimize interference between tests targeting different energy systems and muscle groups.

Agility Tests:

- 505 Agility Test (s) – measures the ability to accelerate, decelerate, and change direction over a short distance.
- Agility T-Test (s) – evaluates multidirectional movement, including forward sprinting, lateral shuffling, and backpedaling.

- Illinois Agility Test (s) – measures agility through a course requiring fast changes of direction and speed.
- 5-10-5 Agility Drill (s) – assesses lateral agility and quickness in a short shuttle format.
- Zig-Zag Test (s) – performed between cones set at an angle to measure reactive and cutting ability.

Strength and Flexibility Tests:

- Push-ups in 10 Seconds (iter.) – measures explosive and repetitive strength of the upper body. Players performed the maximum number of correct push-ups in 10 seconds while following strict form.
- Sit and Reach Test (cm) – a standard test of hamstring and lower back flexibility, using a sit-and-reach box with centimeter precision. The best of three attempts was recorded.

Speed Tests:

- 30 m Sprint Test (s) – players performed maximal sprints from a standing start; time was recorded in seconds using a stopwatch.
- 60 m Sprint Test (s) – players performed maximal sprints from a standing start; time was recorded in seconds using a stopwatch.

All tests have been previously validated and widely used in football populations to evaluate physical performance and inter-individual differences [23,31]. The testing order was designed to minimize interference between tests targeting different energy systems and muscle groups.

2.4. Statistical analysis

All collected data were analyzed using Statistics 10.0. Descriptive statistics, including mean (Mean) and standard deviation (SD), were calculated for all variables. The normality of data distribution was assessed using the K-S test. In cases where data did not meet the assumptions of normal distribution, the nonparametric Mann-Whitney U test was applied (results are not shown, as all tests met the criteria for normality). We used the Multiple regression analysis and the multivariate analysis (Wilks). The statistical significance level was set at $p < 0.05^*$; $p < 0.01^{**}$. 95% confidence intervals (CI) for each estimated difference are also shown.

3. Results

The analysis of the obtained results (Tables 1–3) reveals how the physical characteristics of young football players influence their motor abilities, including agility, explosive power, and sprint performance. Table 1 presents the basic anthropometric and motor parameters of U25 football players. The average height of the players is 183.27 ± 5.98 cm, body mass 75.32 ± 6.27 kg, and BMI 22.38 ± 0.60 kg/m², indicating a relatively homogeneous group in terms of body dimensions, with low coefficients of variation (CV: 2.69–8.32%).

Table 1. Descriptive Statistics Football players

Parameters	Mean± SD	Min	Max	Range	±95%CI	CV%	Skew.	Kurt.	K-S
Body height (cm)	183.27 ± 5.98	174.30	195.50	21.20	4.60 to 8.54	3.26	0.23	-0.82	0.258
Body weight(kg)	75.32 ± 6.27	63.50	86.70	23.20	4.82 to 8.96	8.32	0.03	-0.62	0.258
BMI (kg/m²)	22.38 ± 0.60	20.90	23.40	2.50	0.46 to 0.86	2.69	-0.70	0.53	0.109
505 agility test (s)	1.78 ± 0.20	1.16	2.10	0.94	0.16 to 0.29	11.40	-1.28	3.09	0.154
Agility T – test (s.)	10.32 ± 0.63	9.50	11.52	2.02	0.48 to 0.90	6.08	0.76	-0.61	0.215
Illinois Agility Test (s)	18.27 ± 1.38	16.10	20.60	4.50	1.06 to 1.97	7.53	0.04	-1.06	0.128
5-10-5 agility drill (s)	6.48 ± 1.10	4.92	8.93	4.01	0.84 to 1.57	16.92	0.55	-0.37	0.165
Zig-Zag test (s)	26.65 ± 3.26	19.70	30.80	11.10	2.50 to 4.65	12.22	-0.80	-0.22	0.198
Push-ups 10" (iter.)	9.18 ± 1.71	6.00	12.00	6.00	1.31 to 2.44	18.60	0.00	-0.88	0.144
Sit & Reach test (cm)	20.73 ± 5.40	13.00	29.00	16.00	4.15 to 7.72	26.05	0.08	-1.47	0.153
Run 30m (s)	3.77 ± 0.23	3.40	4.20	0.80	0.17 to 0.32	5.97	0.15	-1.11	0.225
Run 60m (s)	6.93 ± 0.55	5.70	7.60	1.90	0.42 to 0.78	7.90	-0.86	-0.03	0.244

The analysis of motor abilities shows average results in agility (505 test: 1.78 s; T-test: 10.32 s; Illinois test: 18.27 s; 5-10-5 drill: 6.48 s; Zig-Zag test: 26.65 s), upper-body strength (push-ups in 10 s: 9.18 repetitions), flexibility (Sit & Reach test: 20.73 cm), and sprint performance (30 m: 3.77 s; 60 m: 6.93 s). The greatest individual variability is observed in flexibility and short-agility tests (CV > 12%), whereas sprint test results and basic anthropometric values are relatively uniform (CV < 9%). The skewness and kurtosis values indicate that the distributions of most variables are approximately normal, with no extreme deviations.

Table 2. Correlation among anthropometric and motor parameters of U25 football players ($p < 0.05$)

Parameters	505 agility test	Agility T – test	Illinois Agility Tes	5-10-5 agility drill	Zig-Zag test	Push-ups 10"	Sit & Reach test	Run 30m	Run 60m
Body Height (cm)	0.279 p=.208	0.738 p=0.000	0.702 p=0.000	0.497 p=0.018	0.401 p=0.064	-0.510 p=0.015	-0.739 p=0.000	0.516 p=0.014	0.720 p=0.000
Body weight (kg)	0.275 p=.214	0.620 p=0.002	0.722 p=0.000	0.476 p=0.025	0.446 p=0.037	-0.573 p=0.005	-0.804 p=0.000	0.491 p=0.020	0.672 p=0.001
BMI (kg/m²)	0.209 p=.351	0.087 p=0.699	0.482 p=0.023	0.337 p=0.124	0.320 p=0.146	-0.523 p=0.012	-0.705 p=0.000	0.269 p=0.224	0.394 p=0.069

Table 2 presents the Pearson correlations between anthropometric characteristics (height, weight, BMI) and the motor performance of football players. Height showed a significant positive correlation with the T-test ($r = 0.738$; $p < 0.001$) and the Illinois test ($r = 0.702$; $p < 0.001$), indicating that taller players generally achieve poorer results in certain agility tests. At the same time, height was negatively correlated with the number of push-ups ($r = –0.739$; $p < 0.001$), suggesting that shorter players have better upper-body explosive strength. Similarly, weight was positively correlated with the T-test and Illinois test, and negatively correlated with push-ups and flexibility, confirming the influence of body mass on agility and strength. BMI showed moderate correlations with certain agility tests (Illinois test, $r = 0.482$; $p = 0.023$) and a negative correlation with push-ups ($r = –0.705$; $p < 0.001$), although its overall impact was weaker compared to height and weight. All correlations confirm that anthropometric characteristics significantly influence agility, strength, and sprint performance, while flexibility and certain motor abilities also depend on additional factors, such as training and individual predispositions.

Table 3. Test of SS Whole Model vs. SS Residual, and the key-predictors for football players U25

Parameter	505 agility test (s)	Agility T-test (s)	Illinois Agility Test (s)	5-10-5 agility drill (s)	Zig-Zag test (s)	Push-ups 10" (iter.)	Sit & Reach test (cm)	Run 30m (s)	Run 60m (s)
Multiple R	0,824	0,74	0,632	0,588	0,597	0,826	0,523	0,816	0,82
Multiple R^2	0,678	0,548	0,399	0,346	0,356	0,682	0,274	0,665	0,671
Adjusted R^2	0,625	0,473	0,299	0,237	0,249	0,629	0,153	0,61	0,623
SS Model	5,62	21,78	10,08	77	21,81	417,71	0,29	4,18	4,34
MS Model	1,87	7,26	3,36	25,67	7,27	139,24	0,1	1,39	1,53
SS Residual	2.66	17.96	15.19	145.55	39.47	194.66	0.77	2.10	2.18
MS Residual	0.15	1.00	0.84	8.09	2.19	10.81	0.04	0.12	0.16
F	12,66	7,27	3,98	3,17	3,32	12,88	2,26	11,93	12,04
p	0.000**	0.002**	0.024*	0.049*	0.043*	0.000**	0.116	0.000**	0.000**
Height — β	-0,142	-0,089	-0,071	-0,062	-0,068	0,183	0,031	-0,138	-0,141
Height — SE	0,038	0,051	0,044	0,041	0,043	0,042	0,034	0,036	0,037
Height — p	0.001**	0.088	0.117	0.138	0.122	0.000**	0.367	0.001**	0.001**
Weight — β	0,031	0,044	0,028	0,019	0,024	-0,067	-0,012	0,028	0,03
Weight — SE	0,021	0,028	0,024	0,022	0,023	0,023	0,018	0,02	0,021
Weight — p	0.148	0.122	0.253	0.391	0.307	0.006**	0.511	0.168	0.159
BMI — β	0,118	0,076	0,052	0,047	0,051	-0,124	-0,019	0,112	0,115
BMI — SE	0,094	0,112	0,097	0,089	0,092	0,101	0,077	0,089	0,091
BMI — p	0.216	0.501	0.594	0.601	0.583	0.226	0.806	0.214	0.211

*Statistically significant *p < 0.05; **p < 0.01. β = standardized regression coefficient; SE = standard error.*

The multivariate analysis (Wilks) showed that anthropometric characteristics significantly influence the combined results of the players' motor tests. Player height had a significant effect on all tests collectively (Wilks $\lambda = 0.255$; $F(9,10) = 4.021$; $p = 0.018$), as did body weight (Wilks $\lambda = 0.282$; $F(9,10) = 3.508$; $p = 0.029$). BMI was at the threshold of statistical significance (Wilks $\lambda = 0.319$; $F(9,10) = 2.941$; $p = 0.050$). These findings indicate that height and weight play a key role in motor performance, while BMI has a smaller but still present effect.

Multiple regression analysis revealed that body dimensions (height, weight, BMI) collectively explained a significant proportion of variance in six of nine motor skill tests ($p < 0.01$). The highest explanatory power was observed for the Push-ups 10" test ($R^2 = 0.682$; $F = 12.88$; $p < 0.001$), the 505 Agility Test ($R^2 = 0.678$; $F = 12.66$; $p < 0.001$), and the Run 60m ($R^2 = 0.671$; $F = 12.04$; $p < 0.001$), indicating that anthropometric characteristics account for approximately 67–68% of performance variance in these tasks. Flexibility (Sit & Reach) was the only test for which the overall model did not reach significance ($R^2 = 0.274$; $F = 2.26$; $p = 0.116$). At the predictor level, height emerged as the most consistent and significant predictor: negative β coefficients were recorded across all sprint and agility tests (e.g., Run 60m: $\beta = -0.141$, SE = 0.037, $p = 0.001$; 505 Agility: $\beta = -0.142$, SE = 0.038, $p = 0.001$), indicating that greater stature was associated with slower performance in speed-dependent tasks, whilst a positive and significant contribution was observed for upper-body muscular endurance (Push-ups 10": $\beta = 0.183$, SE = 0.042, $p < 0.001$). Body weight demonstrated a significant independent contribution only in the Push-ups 10" test ($\beta = -0.067$, SE = 0.023, $p = 0.006$), with all remaining coefficients being non-significant ($p > 0.05$). BMI did not reach statistical significance in any model (all $p > 0.05$), suggesting limited independent predictive utility beyond that captured by height and weight. These findings indicate that anthropometric profiling — particularly stature — should be considered when establishing sport-specific performance benchmarks in football. The results confirm that player height and weight significantly influence agility, explosive strength, and sprint performance, whereas flexibility and some motor attributes depend on other factors.

4. Discussions

The aim of this study was to examine the influence of anthropometric characteristics, including body height, body mass, and BMI, on the motor performance of young U25 football players. Special attention was paid to identifying key predictors of agility, strength, speed, and flexibility, and to assessing the practical implications of these relationships for the training process and performance optimization. The results of this study showed that anthropometric characteristics—primarily body height and body mass—significantly affect the motor performance of U25 football players. The multivariate analysis confirmed that height (Wilks' $\lambda = 0.255$; $p = 0.018$) and weight (Wilks' $\lambda = 0.282$; $p = 0.029$) are significant predictors of combined motor abilities, while the effect of BMI was at the threshold of statistical significance ($p = 0.050$). These findings indicate that body dimensions play an important role in determining success in tests of agility, strength, and speed, which is in line with previous research [14,32,33,34,35]. The positive correlations between height and the results of agility tests (T-test and Illinois test) suggest that taller players tend to have slightly reduced ability to change direction rapidly and maintain body control at high speeds. This finding is supported by previous studies noting that greater body height may pose a biomechanical limitation to optimal agility due to a higher center of mass and increased moment of inertia during direction changes [4,8]. Conversely, shorter and lighter players usually achieve better results on upper-body explosive strength (push-up test), as confirmed by negative correlations between height, weight, and the number of repetitions in this test.

The significant association between body weight and agility and sprint tests suggests that increased body mass may negatively affect speed and acceleration, as higher body mass requires greater force production to achieve the same acceleration [19, 32,34]. However, within sport-specific optimal ranges, adequate body mass combined with well-developed muscular strength can be an advantage in duels and stability. This balance between mass and strength is crucial for optimal performance, especially for players in positions that require physical contact (e.g., defenders and central midfielders). BMI showed weaker correlations with motor tests compared to height and body mass. This result suggests that BMI does not adequately distinguish between muscle and fat mass and must be interpreted with caution in athletic populations [12,34]. The highest explained variance in the regression models was recorded for the 505 agility test, the push-up test, and Run 60m, indicating that these abilities are largely determined by anthropometric parameters. These results suggest that body dimensions significantly contribute to performance that requires explosiveness, stability, and efficient force generation within short time intervals. Conversely, flexibility (Sit & Reach test) was not significantly associated with anthropometric variables, which aligns with previous findings that flexibility is more strongly influenced by specific training and individual biomechanical characteristics [6,9,35].

The obtained results have practical implications for assessing the physical profiles of football players and planning the training process. Coaches and strength and conditioning specialists can use information about players' body characteristics to optimize programs aimed at improving agility, speed, and strength, depending on individual anthropometric predispositions [36,37]. Compared with the available literature, the findings of this study confirm that anthropometric parameters significantly contribute to explaining variability in motor performance among football players, but they are not the sole determinants of athletic success [33,38]. Motor abilities also develop through continuous training, technical-tactical improvement, and adaptation to the demands of the game [1,22,39,40]. Therefore, it is important to emphasize that anthropometric characteristics should be observed within the broader context of physical preparation and biological maturation of athletes. The obtained results further confirm that football performance does not depend solely on body structure, but also on the ability to develop and efficiently utilize one's morphological characteristics through specific forms of training [2,18]. In this regard, coaches should use data on height and weight as guidelines for personalizing training programs—for example, taller players may benefit from additional agility and movement control exercises, while lighter players may focus on developing absolute strength and explosive stability [41,42]. Nevertheless, it is possible to develop these abilities, and good results can be achieved, although it is more difficult than for shorter athletes. In our study, body length (i.e., due to Scalling laws, not training and playing in different positions) only affected push-ups.

If football players' strength increases significantly, their muscle mass will increase as well. This is only good within a certain range. If their mass increases significantly, it will be more difficult for football players to perform technical elements quickly. So, perhaps tall football players don't need high relative strength indicators. In my opinion, the other results are related to the specifics of training and playing in different positions, which require the development of distinct qualities and skills. In our study, the range of differences in body length for men was not very large [9,43,44,45]. The sports training process requires a holistic approach to training factors with the identification of interdisciplinary aspects that can optimize performance [18,31,45]. Elite football players, through explosive training and neuromuscular coordination, develop exceptional stride frequency, allowing them to generate impressive absolute running speed over short distances, which is essential in modern football [17,19,45].

A jump is a demonstration of power and work. Taller people have longer limbs (levers). Long legs allow the leg muscles to apply force over a much greater distance. Work (W) = Force (F) × Distance (D). We have found that scaling laws negatively impact only the relative strength of football players.

4.1. Practical Applications

The study highlights important practical implications for coaches and sports practitioners by identifying the anthropometric and motor profiles of young football players. This knowledge enables tailored training programs to enhance agility, speed, strength, and flexibility, while accounting for individual body characteristics. Analyzing height, body mass, and BMI aids player selection and optimal positioning, while monitoring these variables helps identify those needing additional support and prevents injuries through balanced training loads.

4.2. Limits and future dirrections of the study

However, the study has limitations, including a small sample from a single club, which limits generalizability. The preseason testing phase may also affect physical readiness, and the analysis neglected to account for tactical and cognitive performance.

Future research should involve larger, more diverse samples and integrate tactical, cognitive, and psychological factors with physical measures to provide a comprehensive understanding of performance. Longitudinal studies using advanced technologies like GPS and video analysis may provide more precise insights into the development of physical abilities in relation to training and competition.

5. Conclusions

The study provided significant insights into the relationship between anthropometric traits and the motor skills of football players under 25 years of age. It was found that key physical characteristics, particularly height and body mass, play a crucial role in influencing essential motor skills such as agility, speed, and strength. While BMI displayed moderate correlations with certain agility assessments, it did not emerge as a leading predictor of overall performance in these young athletes. Body dimensions are significant determinants of motor performance in football players, with the greatest anthropometric influence observed in speed, agility, and upper-body strength tasks, whereas flexibility shows negligible effect. These findings confirm that body morphology is a relevant and measurable factor in the physical profiling of football athletes. Among the anthropometric predictors examined, height emerged as the primary and most consistent determinant of motor performance, exerting a negative influence on speed and agility while positively contributing to muscular endurance. Body weight demonstrated limited independent predictive value, and BMI did not reach statistical significance in any model, indicating redundancy within a multivariate anthropometric framework. These results support integrating individualized anthropometric profiles into talent identification and physical conditioning protocols in football. The study underscores the critical importance of ongoing monitoring and analysis of both anthropometric and motor variables. By systematically assessing these factors, organizations can better identify talent, optimize training strategies, and track each athlete's progress, ensuring that young players reach their full potential in a competitive sporting environment. Overall, integrating these findings into training and development programs could lead to significant improvements in young footballers' performance.

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