

Exploring differences in body composition and physical fitness between U11 and U12 soccer players: Implications for health promotion and athletic performance

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ABSTRACT

Soccer is a highly demanding sport requiring the integration of physical, technical, and tactical skills. This study aimed to compare anthropometric characteristics and physical performance between Spanish male soccer players aged 11 (U11) and 12 (U12), and to examine the relationships between body composition and fitness variables. Forty-two participants (21 U11 and 21 U12) underwent assessments of height, weight, body fat percentage, BMI, countermovement jump (CMJ), 10-meter sprint, 505 change-of-direction test (505 COD), and estimated VO₂max. Results showed that U12 players were significantly taller, heavier, and had lower body fat percentages than U11 players ($p < 0.05$). Physically, U12 players outperformed U11 in CMJ height (+27.7%), sprint speed (+3.4%), change-of-direction ability (+3.9%), and aerobic capacity (+9.5%). Correlation analysis revealed that better body composition profiles, specifically lower fat percentage and BMI, were associated with superior physical performance metrics ($p < 0.05$). These findings emphasize the importance of monitoring growth and body composition in youth soccer for optimizing training and talent identification. Early physical development appears critical for enhancing athletic performance, supporting individualized training programs that integrate physical and technical preparation.

KEYWORDS

Youth Soccer; Physical Performance; Body Composition; Sports Development; Physical Fitness

1. INTRODUCTION

The regular practice of soccer has become one of the most widespread sporting activities among children and adolescents worldwide, due to its role in the development of endurance, speed, agility, and strength (Hermassi et al., 2023; Stanković et al., 2023). This sport, characterized by a wide range of movements, including tackles, jumps, and turns, requires a complex combination of technical, cognitive, neuromuscular, and metabolic abilities (Leyhr et al., 2021). This complexity has sparked growing interest in analyzing the physical and anthropometric characteristics of young soccer players, particularly during the early stages of development when the foundations for future performance are established.

Understanding how physical attributes vary with age is essential for evaluating the development of young athletes (Rey et al., 2023; Silva et al., 2022). Several studies have revealed notable differences in physical and body-related variables depending on age and playing position. For instance, younger players tend to be more agile and flexible, whereas older players typically exhibit greater strength and endurance (Buchheit & Mendez-Villanueva, 2014). These distinctions are crucial for designing personalized training plans according to each athlete's developmental stage (McBurnie et al., 2021). The identification of physical and motor skills in soccer is not limited to somatic characteristics, but must also consider technical and tactical dimensions (Prieto-Ayuso et al., 2022). Nowadays, many coaches prioritize tactical aspects as a central component of performance, supported by solid physical preparation and technical ball control (Barreira et al., 2014; Slimani et al., 2016).

Professional clubs constantly seek young talent with high potential, as early identification increases the chances of long-term success. In this context, early talent detection enables investment in training and provides appropriate tools and conditions for optimal development (Sarmiento et al., 2018). For this reason, physical and technical profiling is commonly used to assess players. These evaluations often include speed, endurance, strength, and technical skills tests, along with body metrics such as height, weight, and body composition (Hermassi et al., 2020; Hermassi et al., 2020b). This information is vital for designing individualized programs that optimize athletic performance. Moreover, beyond physical capacities, technical mastery and tactical decision-making play a critical role in a player's success (Fuhre et al., 2022). Making fast and effective decisions in a dynamic environment requires advanced cognitive abilities, which distinguish top-level players. Therefore, training programs should integrate physical, technical, and tactical components in a balanced way (Joo & Seo, 2016).

Numerous studies have examined the relationship between physical fitness and soccer performance, showing a direct correlation between good physical condition and on-field success (da Costa et al., 2023; Marques et al., 2016). Maintaining a consistent physical activity routine not only strengthens the body but also improves motor and technical skills essential to the sport. Morphological characteristics have proven useful in differentiating competitive levels among players (Reilly et al., 2000; Slimani et al., 2018; Slimani & Nikolaidis, 2019), especially in youth soccer, where tests such as sprint speed or jump ability can distinguish elite from non-elite athletes (Gissis et al., 2006). For this reason, training plans should go beyond technical performance improvement, also promoting the athlete's overall well-being (Sabarit Peñalosa et al., 2022).

Physical development in young soccer players is a dynamic process involving progressive changes in body composition and physical performance, both of which are essential for long-term athletic success. Current scientific literature has shown that variables such as height, weight, body fat percentage, and Body Mass Index (BMI) are closely related to performance in explosive strength, speed, agility, and aerobic capacity tests (França et al., 2024; Portella et al., 2023).

In this context, comparative assessment between close age groups, such as U11 and U12 players, provides evidence of the impact of biological growth on athletic performance. Recent studies have reported that U12 players tend to be taller and heavier, with lower body fat percentages compared to their U11 peers, translating into significant improvements in physical tests such as vertical jump (CMJ), 10-meter sprint, and the 505 change-of-direction test, along with higher estimated maximal oxygen uptake ($VO_2\text{max}$). These differences reflect not only a natural maturation process but also emphasize the importance of appropriate physical development as a basis for more efficient athletic performance. Significant correlations between body composition and performance—such as the negative relationships between body fat and $VO_2\text{max}$, or BMI and aerobic endurance—support this approach (Kovačević et al., 2023; Sun et al., 2025). Therefore, establishing evaluation, training, and nutrition strategies aimed at optimizing muscle mass and controlling adipose tissue from early stages becomes essential for enhancing performance and preventing risks associated with overweight or disproportionate development. Understanding and monitoring these indicators allow for not only characterizing athletic growth, but also timely interventions in favor of the holistic development of young soccer players.

In this context, soccer can be considered a discipline that requires a high level of physical fitness and an optimal body composition. Therefore, the present study has three main objectives: (i) to compare Spanish male soccer players aged 11 (U11) and 12 (U12) in terms of their anthropometric

measurements and physical performance, (ii) to explore the relationships between body composition variables (weight, height, body fat percentage, and BMI) and overall physical fitness variables (CMJ, 505 COD, linear sprint, and VO₂max), and (iii) to identify which body composition variables can best explain performance in physical fitness tests. In this sense, our hypothesis proposes that players with better body composition profiles will exhibit superior physical performance. Additionally, we anticipate significant differences in physical performance between age categories, with U12 players demonstrating enhanced outcomes.

2. METHODS

2.1. Design

The present study employed a cross-sectional design, recruiting forty-two young male soccer players at the beginning of the 2023-2024 season. Assessments of body composition and various physical fitness tests were conducted during the preseason. The study took place between September and November 2024. All participants completed all evaluation sessions without exception. All procedures adhered to the ethical guidelines established by the American Psychological Association (APA), guaranteeing the confidentiality of participants throughout the study. Additionally, research compliance was aligned with the ethical principles outlined in the 1964 Helsinki Declaration and received approval from the Research Ethics Committee at the University of Granada (Nº. 4712/CEIH/2024).

2.2. Participants

A total of forty-two male soccer players participated in this study, divided into two age groups: Under-12 (U12, n = 21) and Under-11 (U11, n = 21). For further details, please refer to Table 1. Participants were selected using a convenience sampling approach. Regarding the sample size, a minimum of twenty-one participants was necessary to achieve a statistical power 83.5% (actual power). This determination was made using an a priori power analysis for a t-test, focusing on correlation analysis with an alpha level set at 0.05, a desired power (1 - β error probability) of 0.80, and a medium-to-large effect size derived from previous research. The calculations for sample power were conducted using G*Power software. University of Düsseldorf, Düsseldorf, Germany).

Before the study commenced, parents were informed about the research objectives, and informed consent was obtained to ensure voluntary participation. The eligibility criteria for inclusion in the study were as follows: (i) possessing normal vision and no history of neuropsychological impairments that could affect study outcomes, (ii) being an active player with a valid federation license,

(iii) not having sustained any injuries in the two months prior to the investigation, and (iv) providing informed consent. Individuals who did not meet these criteria were excluded from participation.

2.3. Measures

Body Composition

Body composition assessments were conducted under standardized conditions in the morning to minimize diurnal variation. Height was measured to the nearest 0.1 cm using a stadiometer (Seca 213, Hamburg, Germany), with participants standing barefoot, in an upright position, and with the head aligned in the Frankfurt plane. Body weight was recorded to the nearest 0.1 kg using a calibrated digital scale (Tanita BC-418 MA, Tokyo, Japan), with players wearing light clothing and no shoes. Body fat percentage was estimated using bioelectrical impedance analysis (BIA), also with the Tanita BC-418 MA device. Participants were instructed to avoid intense physical activity and to refrain from consuming food or liquids at least two hours before the assessment to reduce measurement variability. Body mass index (BMI) was calculated using the standard formula: weight (kg) divided by height squared (m²). All anthropometric and body composition measurements were performed by the same trained evaluator, ensuring consistency and reliability throughout the data collection process. These measurements enabled the analysis of age-group differences and the examination of associations with physical performance, providing a deeper understanding of the role of body composition in young soccer players' athletic performance.

Countermovement Jump (CMJ)

The countermovement jump (CMJ) test was initiated with the participant standing upright, hands fixed on the hips, and maintaining this posture throughout the jump. The test required a rapid flexion-extension movement of the lower limbs, minimizing the transition time between the eccentric and concentric phases. Knee flexion should reach approximately 90 degrees, allowing free adjustment of the knee angle. During the jump, flight time (t_v) was recorded and used to calculate the height reached by the center of gravity using Bosco's formula (Bosco et al., 1998): $H = t_v^2 \times g \times 1/8$ (m), where H represents jump height, t_v is flight time, and g is the acceleration due to gravity.

10-Meter Sprint Test

For speed evaluation, players adopted a standing start position and were required to sprint a distance of 30 meters at maximum velocity upon hearing the starting signal. The starting point was set two meters behind the first timing mark to prevent the initial acceleration phase from affecting the speed measurement. All sprints were recorded for subsequent analysis. Filming was conducted from a

fixed point located 10 meters from the center of the track, with the camera positioned at a height of one meter. According to Morin and Samozino (2016), five timing gates are essential for effective analysis; therefore, markers were placed every five meters along the track. This setup allowed for the recording of total sprint time, as well as split times for each 5-meter segment.

505 Change-of-Direction Test (505 COD)

The 505 COD test was conducted following the methodology established by Draper and Lancaster (1985). The protocol involved a 10-meter linear sprint from a static start, followed by a 180-degree turn in a designated turning zone (either to the left or right), ensuring that the foot maintained contact with the marked turning line. The athlete then sprinted back 5 meters to cross a clearly identified finish line. The total time required to complete the final 5 meters of the initial sprint, the turn, and the return sprint was recorded (Dugdale et al., 2020). To ensure precise time measurement, two LED FitLight Trainer® sensors were used during the assessment.

Intermittent Endurance Assessment

The Yo-Yo Intermittent Recovery Level 1 Test (Yo-Yo IR1) involved repeated 20-meter shuttle runs between two markers, with progressive speed increments controlled by an audio signal. After each 40-meter repetition, the athlete had a 10-second recovery period, during which a light jog (2×5 m) was performed. The test began at a speed of 10 km/h, which gradually increased throughout the protocol. The test ended when the participant reached voluntary exhaustion or was unable to maintain the required pace in sync with the audio signals. At the conclusion of the test, the total number of levels and shuttles completed, along with the total distance covered, were recorded. The total distance (in meters) was used to estimate maximal oxygen uptake (VO_{2max} in mL/min/kg) using the formula proposed by Bangsbo et al. (2008): $VO_{2max} = \text{final distance (m)} \times 0.0084 + 36.4$.

2.4. Statistical Analyses

Descriptive statistics were calculated for each variable to summarize the data effectively. Prior to conducting any analyses, we assessed the assumptions of normality and homoscedasticity using the Kolmogorov-Smirnov test and Levene's test, respectively. We employed a paired sample t-test to evaluate differences between the two groups of young soccer players (U11 and U12) as part of our repeated measures analysis. The effect size was quantified using Cohen's d , interpreted with the following guidelines: $d \leq 0.20$ signifies a small effect, $d \leq 0.50$ indicates a medium effect, and $d \leq 0.80$ reflects a large effect. To explore the relationships among body composition metrics (such as weight, height, body fat percentage, and BMI) and physical fitness measures (including counter-movement

jump, 505 change of direction, linear sprint, and VO₂ max), we utilized Pearson's correlation coefficient (*r*). The interpretation of correlation magnitudes was categorized as follows: trivial (≤ 0.10), small (0.10 to 0.29), moderate (0.30 to 0.49), large (0.50 to 0.69), very large (0.70 to 0.89), and almost perfect (≥ 0.90). Additionally, multiple regression analysis was conducted to predict body composition values based on the other variables in our study. Each variable was analyzed in isolation within this regression context. All data analyses were performed using SPSS v.27.0 for Windows (SPSS Inc., Chicago, IL)

3. RESULTS

The data from the body composition metrics (such as weight, height, body fat percentage, and BMI) and physical fitness measures (including countermovement jump, 505 change of direction, linear sprint, and VO₂max) were presented in Table 1.

Table 1. Parameters of body composition and physical condition in both groups, presented as mean \pm standard deviation (Mean \pm SD), reflecting the characteristics of the participants in the study

	U11 (n=21)	U12 (n=21)	p value	Cohen <i>d</i>
Body Composition metrics				
Height (cm)	144.27 \pm 4.29 (136.40 16.60 153.00)	149.87 \pm 5.79 (137.30 23.20 160.50)	0.001	1.09
Weight (kg)	36.92 \pm 2.44 (33.70 8.20 41.90)	39.25 \pm 4.48 (32.70 16.10 48.80)	0.04	0.64
Body Fat (%)	20.91 \pm 3.74 (15.30 13.20 28.50)	18.92 \pm 2.61 (15.70 8.60 24.30)	0.05	-0.61
BMI (kg/m²)	18.14 \pm 1.75 (15.40 5.70 21.10)	17.43 \pm 1.46 (14.80 6.00 20.80)	0.13	-0.44
Physical Fitness Measures				
CMJ (cm)	20.59 \pm 2.61 (17.17 9.73 26.90)	22.29 \pm 3.25 (14.22 13.82 28.04)	0.04	0.57
10 m sprint (sec)	2.08 \pm 0.10 (1.91 0.32 2.23)	2.01 \pm 0.07 (1.89 0.21 2.11)	0.04	-0.70
505 COD (sec)	2.56 \pm 0.14 (2.32 0.54 2.86)	2.46 \pm 0.14 (2.10 0.61 2.71)	0.03	-0.88
Yo-Yo IR1.VO₂max (ml/kg/min)	47.82 \pm 3.95 (40.76 12.76 53.53)	52.33 \pm 8.98 (42.11 23.18 65.29)	0.04	0.65

Note. **BMI:** Body Mass Index; **CMJ:** Counter-movement Jump; **COD:** Change of Direction; **VO₂max:** Maximum Oxygen Volume; **Yo-Yo IR1:** Yo-Yo Intermittent Recovery Level 1. The values presented are expressed as means and standard deviations, with the minimum, range, and maximum values included in parentheses. VO₂max (in milliliters per minute per kilogram) = IR1 distance (in meters) \times 0.0084 + 36.4 (Bangsbo et al., 2008) * Denotes significance at $p < 0.05$ and ** denotes significance at $p < 0.01$.

3.1. Body Composition

An examination of body composition has identified notable disparities between the U11 and U12 age categories (refer to Table 1). When assessing height, it was found that U11 players are shorter than those in the U12 group, with a significant height difference of 3.8% favoring the U12 players. This finding is supported by a t-test result of 0.01 and a Cohen's d value of 1.09, indicating substantial physical growth between these two groups. Similarly, in terms of body weight, the U11 cohort exhibited lesser weight compared to their U12 counterparts, showing a 6.3% difference in favor of the U12 group, corroborated by a t-test of 0.04 and a Cohen's d of 0.64. This suggests that U12 players have attained higher levels of body mass development. Conversely, the U11 group displayed a higher percentage of body fat, indicating a variation in body composition when compared to the U12 players. The difference in body fat percentage was statistically significant, with a t-test of 0.05 and a Cohen's d of -0.61, signifying that the U12 players possess a more advantageous body composition characterized by a lower fat percentage. Finally, while the body mass index (BMI) for the U11 group was greater than that of the U12 group, this difference did not reach statistical significance, as indicated by a t-test of 0.13 and a Cohen's d of -0.44. Additional details can be found in Figure 2.

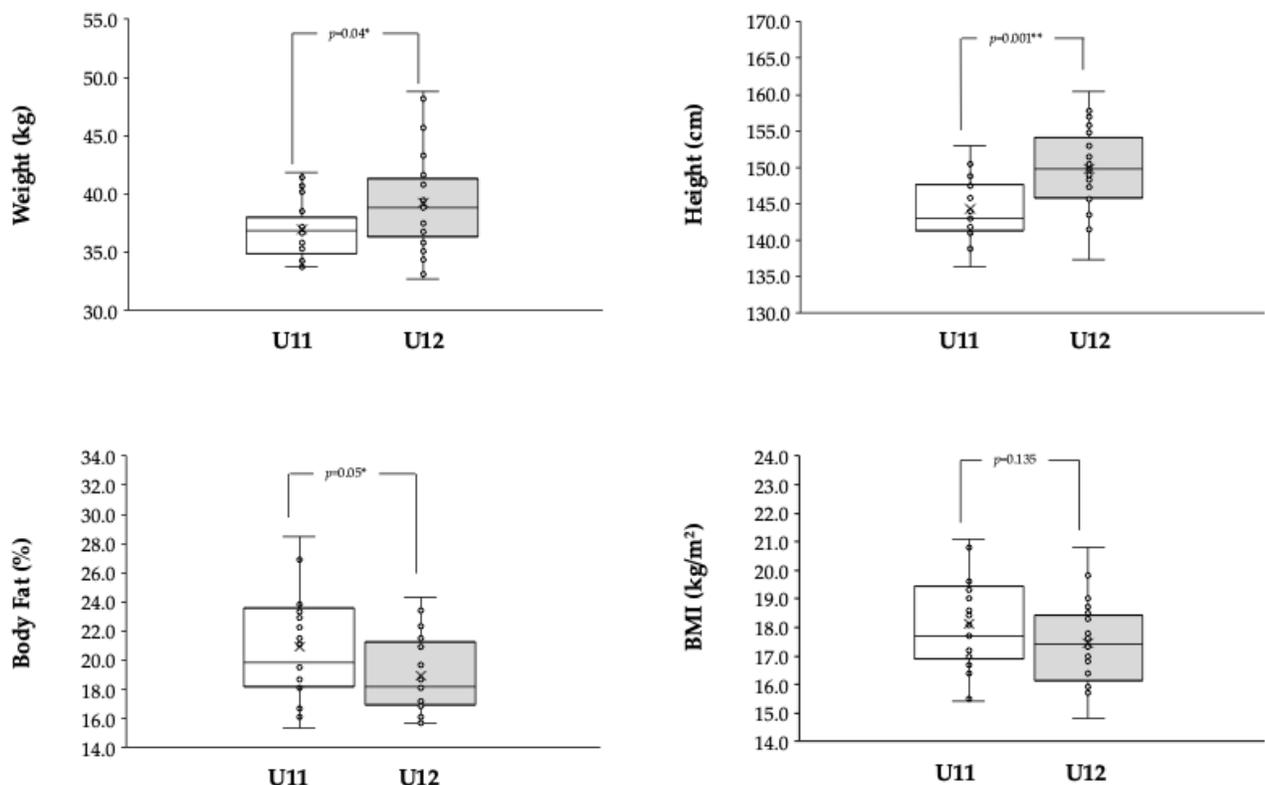


Figure 2. Body Composition Variables (Weight, Height, % Body Fat, and BMI) comparing U11 and U12 groups

3.2. Physical Fitness Test

The results regarding physical conditioning reveal significant differences between the U11 and U12 age groups (see Table 1 for more details). In the countermovement jump (CMJ) test, the U12 group displayed superior performance compared to the U11 players, demonstrating a remarkable 27.7% increase in jump height. This improvement is supported by a t-test result of 0.04 and a Cohen's d value of 0.57, indicating a notable enhancement in explosive power among the U12 athletes. Similarly, in the 10-meter sprint test, U12 participants achieved faster times than their U11 counterparts, resulting in a 3.4% improvement in speed. This difference was significant, as evidenced by a t-test of 0.04 and a Cohen's d of -0.70, suggesting that U12 players are more efficient over short distances. In the change of direction test (505 COD), the U12 group again outperformed the U11 players, recording a 3.9% better time. This finding was significant, with a t-test of 0.03 and a Cohen's d of -0.88, highlighting the ability of U12 players to execute rapid and precise movements. Finally, the VO_2max values, a crucial indicator of aerobic capacity, were significantly higher in the U12 group, with a 9.5% increase compared to the U11 group. This disparity was confirmed by a t-test of 0.04 and a Cohen's d of 0.65, suggesting that U12 athletes possess enhanced abilities for sustaining prolonged efforts. For additional information, please refer to Figure 3.

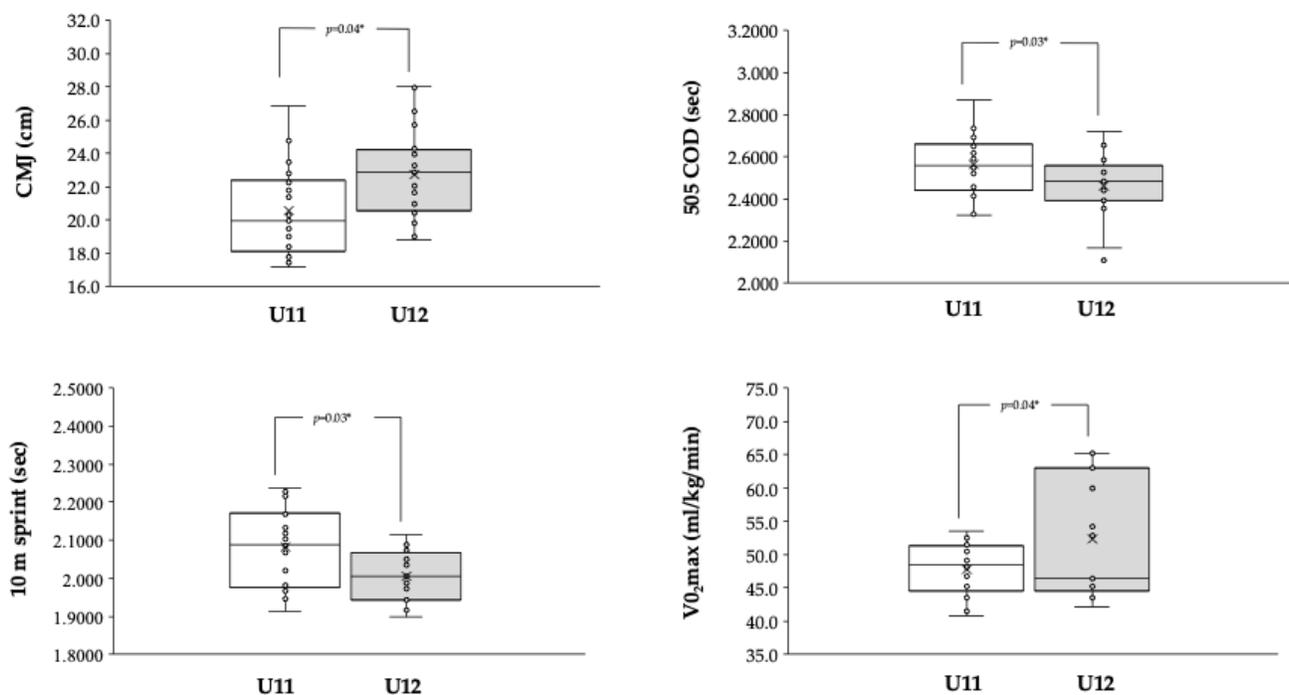


Figure 3. Physical Fitness Variables (Weight, Height, % Body Fat, and BMI) comparing U11 and U12 groups

A correlation analysis was conducted to explore the relationships between body composition metrics and physical fitness values. The findings from this analysis yielded several noteworthy correlations that contribute to our understanding of how body composition may influence athletic performance. First, a moderate negative correlation was observed between weight and performance on the 505 COD test, with a moderate negative correlation, $r = -0.32$ ($p = 0.04$). This suggests that as weight increases, the time taken to complete the 505 COD test tends to be better, indicating that young soccer players heavier were more in executing quick directional changes.

Second, a moderate positive correlation was found between height and CMJ performance, $r = 0.34$ ($p = 0.03$), indicating that individuals may achieve higher jump heights, potentially due to longer limb lengths that can enhance explosive power. Height also demonstrated a moderate negative correlation with the 505 COD test ($r = -0.34$, $p = 0.03$), suggesting that young soccer players with greater development may be more capable of executing direction changes effectively.

Third, a moderate negative correlation was observed between body fat percentage and performance on the CMJ ($r = -0.30$, $p = 0.05$). This suggests that higher levels of body fat may positively affect a young soccer players ability to execute higher jumps.

Furthermore, a similar moderate negative correlation was noted between body fat percentage and maximum oxygen uptake ($r = -0.30$, $p = 0.03$), indicating that players with lower body fat percentages tend to perform significantly better on the Yo-Yo Intermittent Level 1 test, which subsequently correlates with higher VO₂max values. Lastly, in line with these findings, the analyses of BMI revealed a moderate negative correlation with the CMJ ($r = -0.30$, $p = 0.05$) and another moderate negative correlation with VO₂max ($r = -0.33$, $p = 0.03$). These results align with the previously mentioned trends associated with body fat percentage.

These findings (see Table 2 and Figure 4, for comprehensive statistics) highlight the significance of evaluating body composition not just independently, but also in conjunction with physical performance indicators. Furthermore, in this age group context, it can be stated that these factors are entirely interconnected with the athlete's overall development.

Table 2. Correlation analysis involving each value from body composition and CMJ, 505 COD, 10m sprint, and VO₂max

Body Compositions metrics	CMJ (cm)	505 COD test (sec)	10m sprint (sec)	VO ₂ max (ml/kg/min)
Weight (kg)	r = 0.12 p = 0.46	r = -0.32 p = 0.04*	r = -0.13 p = 0.41	r = -0.22 p = 0.16
Height (cm)	r = 0.34 p = 0.03*	r = -0.34 p = 0.03*	r = -0.11 p = 0.49	r = -0.06 p = 0.69
Body Fat (%)	r = -0.30 p = 0.05*	r = -0.03 p = 0.85	r = 0.04 p = 0.80	r = -0.30 p = 0.05*
BMI (kg/m ²)	r = -0.30 p = 0.05*	r = -0.08 p = 0.63	r = 0.06 p = 0.70	r = -0.33 p = 0.03*

Note: BMI: Body Mass Index; CMJ: Counter-movement Jump; COD: Change of Direction; VO₂max: Maximum Oxygen Volume. The values presented are expressed as means and standard deviations, with the minimum, range, and maximum values included in parentheses. VO₂max (in milliliters per minute per kilogram) = IRI distance (in meters) x 0.0084 + 36.4 (Bangsbo et al., 2008) * Denotes significance at p < 0.05 and ** denotes significance at p < 0.01.

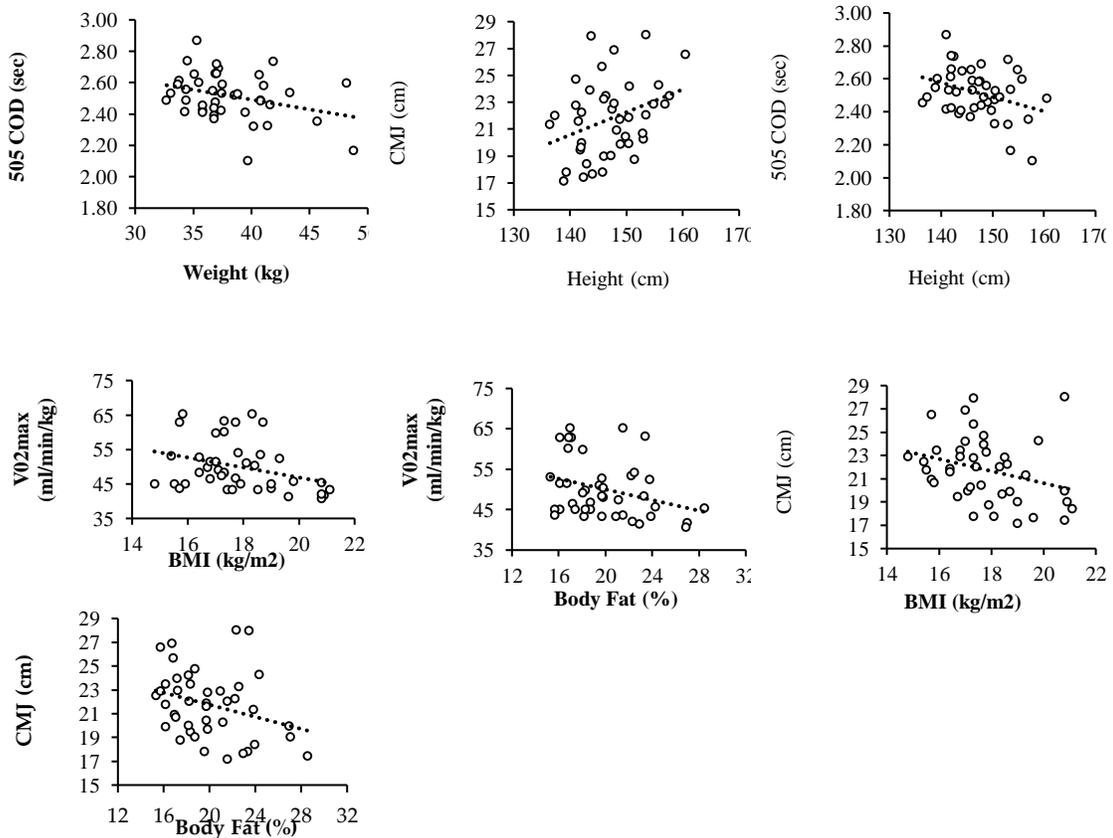


Figure 4. Significant correlation analysis from body composition and physical fitness test

Finally, a multiple regression analysis was carried out to determine which metrics of body composition, consistent with the earlier correlation analysis findings, could most effectively elucidate the significance of physical fitness values. (Refer to Table 3 for details).

Table 3. Values of regression analysis explaining the relevance of body composition metrics to better explain physical fitness values

Body composition metrics	Physical fitness values	R	R ²	AR ²	F	P	SE
Weight (km)	505 COD test (sec)	0.32	0.10	0.08	4.47	0.04 *	0.14
Height (cm)	CMJ (cm)	0.34	0.12	0.10	5.37	0.03 *	2.70
	505 COD test (sec)	0.34	0.12	0.09	5.23	0.03 *	0.14
Body Fat (%)	CMJ (cm)	0.30	0.09	0.07	3.92	0.05 *	2.75
	V _O 2max (ml/kg/min)	0.30	0.09	0.07	4.10	0.05 *	6.97
BMI (kg/m ²)	CMJ (cm)	0.30	0.09	0.07	3.92	0.05 *	2.75
	V _O 2max (ml/kg/min)	0.33	0.11	0.09	6.91	0.03 *	1.57

Note: R: Multiple R; R²: R square; AR²: Adjusted R square; BMI: Body Mass Index; CMJ: Countermovement Jump; COD: Change of Direction; V_O2max: Maximum Oxygen Volume. * Denotes significance at $p < 0.05$ and ** denotes significance at $p < 0.01$

4. DISCUSSION

This study focused on comparing Spanish male football players in the U11 and U12 age categories regarding their anthropometric measurements and physical performance, revealing significant differences across several parameters. Body mass, body fat percentage, and BMI are key indicators that can influence athletic performance (Nicolaidis et al., 2012; Toselli et al., 2022). Previous studies have demonstrated that body composition and anthropometric characteristics are critical factors in sports performance, particularly in physically demanding disciplines such as football (Manila, 2001; Malina et al., 2015), related to the sport success (Cárdenas-Fernández, 2019).

Standardized physical tests, including the Yo-Yo Intermittent Recovery Test Level 1, countermovement jumps (CMJ), 10-meter sprint tests, and the 505 change-of-direction (COD) test, were used to evaluate players' physical performance. The results showed significant differences between U11 and U12 players in body weight ($p = 0.04$), height ($p = 0.001$), body fat percentage (%BF) ($p = 0.05$), and performance metrics such as CMJ ($p = 0.04$), the 505 test ($p = 0.03$), 10-meter sprint ($p = 0.03$), and Yo-Yo IR1 ($p = 0.04$). However, no significant differences were observed in BMI between the two age groups, suggesting that although U12 players are taller and heavier, their BMI does not differ significantly from that of U11 players.

These findings underscore the importance of considering age and physical development when designing training programs (Miranda, 2013). As young athletes grow, they undergo substantial changes in their physical capacities, highlighting the need for individualized training programs tailored to these developmental variations (Buchheit et al., 2010; Macías García, 2023). Body weight and fat mass were directly related to strength performance in children at these ages (Fernández-García et al., 2019). Therefore, implementing age-specific training regimes could help optimize athletic performance by focusing on improving strength, speed, and agility. Furthermore, future studies should include longitudinal designs to track these changes over time and assess the impact of specific training interventions. It would also be beneficial to investigate the relationship between physical performance and injury risk (Johnson, 2022), which could provide valuable insights for safer training practices (Gabbett, 2014). Ultimately, understanding these dynamics will not only aid in talent identification (González-Víllora et al., 2025) but also support the development of effective strategies to enhance the growth and performance of young football players.

One of the main strengths of this study lies in its comparative approach between two closely related age groups, allowing for a more precise assessment of changes in anthropometric and physical performance characteristics. The use of standardized and validated tests provides a robust foundation for the findings, thereby enhancing the study's credibility. Including multiple performance metrics, such as CMJ and sprint tests, offers a comprehensive overview of the players' physical capacities (Di Mascio et al., 2020). This information is valuable for coaches and sport professionals when designing training programs tailored to the specific needs of youth football players.

Nevertheless, the study also has several limitations. First, the relatively small sample size may restrict the generalizability of the results to the broader population of youth footballers. Additionally, the exclusive focus on male players limits the ability to make gender comparisons, which could offer a more complete perspective on performance in youth football. Another notable limitation is the lack of a longitudinal component, which prevents an understanding of how physical characteristics and performance evolve over time—an essential aspect for comprehending the influence of maturation on athletic development.

Based on the findings of this study, it is recommended that youth football coaches implement individualized training programs that account for physical differences among players of different ages. These programs should emphasize the development of specific skills such as strength, speed, and agility, while adapting to each player's individual needs. For instance, 12-year-old players who demonstrated superior performance in speed and agility tests may benefit from training that

incorporates sprinting and change-of-direction exercises (Castillo-Rodríguez, 2012). Conversely, 11-year-old players might focus more on improving endurance and technique. Regular assessments of physical and anthropometric performance are also advised to monitor progress and adjust training accordingly. Ensuring a safe training environment is equally essential to minimize injury risk. This could include educating players on the importance of proper warm-up routines and post-training recovery. By optimizing athletic performance and promoting holistic development, coaches can contribute not only to sporting success but also to the overall well-being of young football players, better preparing them for future challenges both on and off the field.

5. CONCLUSIONS

The findings of this study showed the importance of implementing age-appropriate training programs for young soccer players, with a particular focus on developing strength, speed, and agility. As coaches focus on these key areas, players' athletic performance is expected to be optimized. However, it is critical that future research focuses on longitudinal studies that allow us to observe how these characteristics evolve over time and how specific interventions could influence performance and injury risk. Delving deeper into these dynamics will not only improve training safety but also facilitate more effective talent identification, which is an innate ability of young soccer players, and the development of strategies that benefit young athletes throughout their sporting journey.

6. REFERENCES

1. Cárdenas-Fernández, V., Chinchilla-Minguet, J. L., & Castillo-Rodríguez, A. (2019). Somatotype and body composition in young soccer players according to the playing position and sport success. *Journal of Strength & Conditioning Research*, 33(7), 1904-1911. <https://doi.org/10.1519/jsc.0000000000002125>
2. Castillo-Rodríguez, A., Fernández-García, J. C., Chinchilla-Minguet, J. L., & Carnero, E. Á. (2012). Relationship between muscular strength and sprints with changes of direction. *Journal of Strength & Conditioning Research*, 26(3), 725-732. <https://doi.org/10.1519/jsc.0b013e31822602db>
3. Di Mascio, M., Ade, J., Musham, C., Girard, O., & Bradley, P. S. (2020). Soccer-specific reactive repeated-sprint ability in elite youth soccer players: maturation trends and association with various physical performance tests. *Journal of Strength & Conditioning Research*, 34(12), 3538-3545. <https://doi.org/10.1519/jsc.0000000000002362>
4. Fernández-García, J. C., Castillo-Rodríguez, A., & Onetti-Onetti, W. (2019). Influencia del sobrepeso y la obesidad sobre la fuerza en la infancia. *Nutrición Hospitalaria*, 36(5), 1055-1060. <https://doi.org/10.20960/nh.02596>
5. França, C., Gouveia, É. R., Martins, F., Ihle, A., Henriques, R., Marques, A., Sarmiento, H., Przednowek, K., & Lopes, H. (2024). Lower-Body Power, Body Composition, Speed, and Agility Performance among Youth Soccer Players. *Sports*, 12(5), 1-9. <https://doi.org/10.3390/sports12050135>

6. Gabbett, T. J., Whyte, D. G., Hartwig, T. B., Wescombe, H., & Naughton, G. A. (2014). The relationship between workloads, physical performance, injury and illness in adolescent male football players. *Sports Medicine*, 44, 989-1003. <https://doi.org/10.1007/s40279-014-0179-5>
7. González-Víllora, S., Machado, G., Gualda, A., & Teoldo, I. (2025). The effect of 14 training sessions on the development of decision-making skills in U-13 soccer players. *International Journal of Performance Analysis in Sport*, 25(5), 995-1012. <https://doi.org/10.1080/24748668.2025.2481691>
8. Johnson, D. M., Cumming, S. P., Bradley, B., & Williams, S. (2022). The influence of exposure, growth and maturation on injury risk in male academy football players. *Journal of Sports Sciences*, 40(10), 1127-1136. <https://doi.org/10.1080/02640414.2022.2051380>
9. Kovačević, E., Čaušević, D., Spicer, S., Kovač, S., Doder, I., Likić, S., & Metikoš, B. (2023). Body composition of young soccer players. *Annales Kinesiologiae*, 13(2), 131-141. <https://doi.org/10.35469/ak.2022.367>
10. Miranda, R. E. E. P. C., Antunes, H. K. M., Pauli, J. R., Puggina, E. F., & Da Silva, A. S. R. (2013). Effects of 10-week soccer training program on anthropometric, psychological, technical skills and specific performance parameters in youth soccer players. *Science & Sports*, 28(2), 81-87. <http://dx.doi.org/10.1016/j.scispo.2012.02.005>
11. Portella, D.L., Vidal-Espinoza, R., Sulla-Torres, J., Castelli Correia de Campos, L.F., Gomez-Campos, R., & Cossio-Bolaños, M. (2023). Reference values for body composition and physical fitness of young Brazilian elite soccer players. *Frontiers in Physiology*, 14, 1-10. <https://doi.org/10.3389/fphys.2023.1285952>
12. Sun, Z., Liu, X., Fu, H., Shen, S., Zhou, X. (2025). Comparisons of the anthropometric and physical characteristics of young elite Chinese male soccer players by age and playing position. *BMC Sports Science, Medicine and Rehabilitation*, 17(1), 1-10. <https://doi.org/10.1186/s13102-025-01070-0>

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research has been funded by Unite of Excellence of the University Campus of Melilla (University of Granada, Spain). Reference: UCE-PP2024-02. O.S.-A. was supported by a grant from the Ministerio de Universidades (FPU 23/00586).

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