Physical performance disparities in elite Under-15 female soccer: a comparative study of Spanish and Cuban athletes

Diferencias en el rendimiento físico en el fútbol femenino de élite sub-15: un estudio comparativo entre atletas españolas y cubanas

Authors

Yarisel Quiñones-Rodríguez [1]
José Antonio Sánchez Fuentes [2]
Rui Miguel Silva [3]
Grzegorz Trybek [4]
Carlos López-Gutiérrez [5]
Alexis Juan Stuart-Rivero [6]
Ana Filipa Silva [7]

[1, 5] University of Granada (Spain)
[2] University of Murcia (Spain)
[3] Polytechnic Institute of Viana do Castelo (Portugal)
[4] University of Physical Education and Sport, Gdańsk (Poland)
[6] University of Cienfuegos (Cuba)
[7] School of Sport and Leisure, Polytechnic Institute of Viana do Castelo (Portugal)

Corresponding author:
José Antonio Sánchez Fuentes
jasfuentes@um.es

Received: 13-02-26
Accepted: 29-09-25

How to cite in APA

Quiñones-Rodríguez, Y., Sánchez Fuentes, J. A., Silva, R. M., Trybek, G., López-Gutiérrez, C., Stuart-Rivero, A. J., & Silva, A. F. (2026). Physical performance disparities in elite Under-15 female soccer: a comparative study of Spanish and Cuban athletes. *Retos, 78*, 220-231. https://doi.org/10.47197/retos.v78.117733

Abstract

Introduction: The development of physical performance in young female soccer players is crucial for their success in competitive sports.
Objective: This study aims to compare sprint speed, vertical jump height, and 505 COD performance between elite U15 female soccer players from Spain and Cuba, thereby investigating the physical performance disparities that exist between these two groups. A total of 30 elite Under-15 female soccer players were recruited, consisting of 15 athletes from Cuba and 15 from Spain.
Methodology: Participants underwent a series of physical performance evaluations, including countermovement jump height (CMJ), a 30-meter sprint, and the 505 COD test.
Results: The findings revealed significant performance differences, with Spanish athletes outperforming their Cuban counterparts in all assessments, achieving p-values of 0.001. Correlation analyses indicated significant relationships among performance metrics. Cuban players showed strong negative correlations between CMJ and both the 30-meter sprint (r = -0.66) and the 505 COD test (r = -0.59). A moderate negative correlation was also found between the 30-meter sprint and the 505 COD test (r = -0.52). Spanish players exhibited a strong negative correlation between CMJ and the 505 COD test (r = -0.51).
Conclusions: These results indicate that improvements in explosive strength, as measured by CMJ, are linked to enhanced sprinting and agility. This underscores the need for age-specific training programs that focus on developing power and speed, tailored to the unique needs of young female athletes.

Keywords

Change of direction; exercise; female soccer players; football; physical fitness.

Resumen

Introducción: El desarrollo del rendimiento físico en las futbolistas jóvenes es crucial para su éxito en los deportes de competición.
Objetivo: El objetivo de este estudio es comparar la velocidad de sprint, la altura del salto vertical y el rendimiento en el test 505 COD entre futbolistas femeninas de élite sub-15 de España y Cuba, investigando así las disparidades de rendimiento físico que existen entre estos dos grupos. Se reclutó a un total de 30 futbolistas femeninas de élite sub-15, 15 de Cuba y 15 de España.
Metodología: Las participantes se sometieron a una serie de evaluaciones de rendimiento físico, entre las que se incluían la altura del salto con contramovimiento (CMJ), un sprint de 30 metros y la prueba 505 COD.
Resultados: Los resultados revelaron diferencias significativas en el rendimiento, ya que los atletas españoles superaron a sus homólogos cubanos en todas las evaluaciones, con valores p de 0,001. Los análisis de correlación indicaron relaciones significativas entre los parámetros de rendimiento. Los jugadores cubanos mostraron fuertes correlaciones negativas entre el CMJ y tanto el sprint de 30 metros (r = -0,66) como la prueba 505 COD (r = -0,59). También se encontró una correlación negativa moderada entre el sprint de 30 metros y la prueba 505 COD (r = -0,52). Las jugadoras españolas mostraron una fuerte correlación negativa entre el CMJ y la prueba 505 COD (r = -0,51).
Conclusiones: Estos resultados indican que las mejoras en la fuerza explosiva, medida por el CMJ, están relacionadas con la mejora de la velocidad y la agilidad. Esto subraya la necesidad de programas de entrenamiento específicos para cada edad que se centren en el desarrollo de la potencia y la velocidad, adaptados a las necesidades únicas de las jóvenes atletas.

Palabras clave

Aptitud física; cambio de dirección; ejercicio; fútbol; futbolistas femeninas.

Introduction

Optimizing physical performance among developing athletes represents a pivotal domain within sports science, particularly in team sports such as soccer, where physiological attributes are intrinsically linked to competitive success. Globally recognized as a dominant sport, soccer demands a multifaceted physical skillset from its participants, encompassing crucial components such as sprint capability, change-of-direction speed, muscular power, and cardiorespiratory endurance (Komarudin et al., 2022; Luo et al., 2023). Given the escalating engagement of females in soccer, a comprehensive understanding of the physical performance profiles of young female players, spanning various competitive tiers, becomes indispensable for coaches, athletic trainers, and sports scientists (Costa et al., 2022; Randell et al., 2021). This knowledge is crucial for developing evidence-based training methodologies, talent identification strategies, and injury prevention programs specifically tailored to the unique physiological characteristics and developmental stages of young female footballers.

Youth soccer participants are typically organized into age-specific categories, with the Under-15 (U15) division representing a prevalent classification within competitive structures. This age group marks a critical developmental period, characterized by significant physiological and psychological transformations as athletes transition into adolescence (Nunes et al., 2021). These profound changes often manifest as considerable variability in physical performance capabilities, directly influencing on-field efficacy. Consequently, a thorough evaluation of the physical condition of U15 female soccer players is imperative for multiple reasons. Firstly, acquiring a comprehensive understanding of their unique physical profiles empowers coaches to develop age-appropriate and individualized training programs. This tailored approach is crucial for optimizing performance, fostering healthy development, and concurrently minimizing injury risk. Secondly, given that the U15 stage is a pivotal period for growth and maturation, systematic monitoring of physical capabilities supports effective talent identification and informs strategic decisions pertaining to player selection for competitive squads. Overall, profiling U15 female players can support performance development and evidence-based decision-making during a key maturation window.

Optimal performance in soccer is strongly associated with specific physical attributes, including sprinting speed, vertical jump height, and change of direction (COD) capabilities (Emmonds et al., 2019; Nygaard Falch et al., 2020). For example, robust sprinting ability is fundamental for executing effective offensive strategies and defensive plays, enabling athletes to gain an advantage over adversaries and generate goal-scoring chances (Caldbeck and Dos'Santos, 2022). Likewise, vertical jump performance serves as a proxy for an athlete's explosive lower-body power, a crucial factor in successful actions such as heading or contested aerial challenges (Washif and Kok, 2022). Conversely, COD measures an athlete's agility and capacity for rapid directional transitions, which is indispensable in soccer for eluding opposition players and retaining ball control (Young et al., 2015). Despite the acknowledged significance of these physical attributes, a substantial void exists in the current literature regarding research specifically delineating the physical performance profiles of female soccer players across various age cohorts. The majority of investigations to date have predominantly focused on male athletes, or have failed to adequately distinguish between elite and sub-elite female athletic populations (Fu et al., 2023). This literary lacuna underscores the urgent necessity for targeted research to explore the physical capabilities of female soccer players at different developmental stages, particularly as the sport continues its global expansion and recognition.

In this context, comparing elite U15 female players from different national settings (e.g., Spain and Cuba) may provide useful insights into how training and competitive environments relate to physical performance. By examining the physical performance differences between these two groups, the research seeks to identify significant variations in athletic capabilities that may arise from their distinct training environments and competitive contexts. Understanding the characteristics that distinguish these contexts, such as the availability of training facilities, the quality and experience of coaching staff, the intensity and frequency of competition, and the broader support for women's sport, will help justify this study. Specifically, differences between national development and competitive contexts may influence training exposure and performance outcomes.

Through the evaluation of key performance indicators, this research intends to reveal important distinctions in physical attributes between the two groups. Gaining insight into these differences can provide valuable information for coaches and trainers, enabling them to develop training programs tailored to the specific developmental needs of players at various stages. To ensure a thorough evaluation, the study will adopt a multi-testing approach that encompasses both sport-specific and general physical performance assessments. This methodology is consistent with recommendations from prior research, which underscores the necessity of comprehensive assessments of athletes' physical performance profiles (Caldbeck and Dos'Santos, 2022; Muñoz León et al., 2024).

Cross-national comparisons in elite U15 female soccer remain scarce, despite their potential to contextualize physical development across different training and competitive environments. Recent evidence in women's soccer highlights that talent identification and development are shaped by contextual and systemic factors (McEwan et al., 2026), whereas much of the broader talent-development literature in soccer has historically focused on male football samples, limiting direct transferability to female youth populations (Sarmento et al., 2018). In the Cuban context, research in women's soccer has emphasized the need to interpret methodological approaches and performance-related outcomes according to the specific conditions in which training and competition occur, supporting the relevance of contextualized comparisons (Bonora Peñalver et al., 2025).

Therefore, the aim of this study was to compare the physical performance profiles of elite U15 female soccer players from Spain and Cuba, focusing on sprint speed, vertical jump height, and COD ability.

Method

The parents of the participants were informed about the primary objectives of the research and provided signed informed consent. All players were treated by the guidelines set forth by the American Psychological Association (APA), ensuring the confidentiality of their responses. The study adhered to the ethical principles outlined in the 1964 Declaration of Helsinki regarding human research and was approved by the Research Ethics Committee of Granada (2024/4712)

Participants

A total of 30 elite female soccer players under the age of 15 were recruited for this study, comprising 15 players from Cuba (mean age = 14.80 ± 0.49 years, mean body weight = 49.90 ± 6.80 kg, mean height = 161.7 ± 6.03 cm) and 15 players from Spain (mean age = 14.70 ± 0.47 years, mean body weight = 52.35 ± 8.07 kg, mean height = 165.8 ± 6.03 cm). Participants were recruited using a convenience (intentional) sampling.

The inclusion criteria for participants were as follows: (i) normal vision and no history of neuropsychological disorders that could influence the study outcomes, (ii) active status as a player with a valid federation license, (iii) absence of injuries in the two months preceding the study, (iv) provision of informed consent, and (v) participation in at least 85% of training sessions throughout the study duration. Exclusion criteria were: (i) any current injury, pain, or medical condition limiting maximal effort, and (ii) any condition compromising test safety/performance.

Participants engaged in three weekly training sessions, each lasting 90 minutes, complemented by a weekly competitive match. The training regimen was structured to optimize skill development, tactical understanding, and physical fitness. Training sessions predominantly focused on the refinement of technical and tactical components, allocating approximately 70% of the session duration to these areas, ensuring players could develop strategic decision-making and advanced skill execution. An additional 10% of training time was dedicated to enhancing technical proficiency, such as ball control, passing, and shooting accuracy, through targeted drills. The remaining 20% was devoted to general physical conditioning, aiming to improve overall strength, endurance, and agility. Each training session was organized into three phases: a warm-up to prepare musculoskeletal systems and reduce injury risk, a main training segment emphasizing skill and tactical exercises, and a cool-down period designed to facilitate recovery and flexibility. This comprehensive structure aimed to balance technical demands with physical preparedness, fostering holistic athlete development. Such an approach aligns with contemporary sports science principles emphasizing periodized training that integrates technical, tactical, and physical aspects

to enhance performance sustainability and reduce injury susceptibility. These training strategies prioritize evidence-based methods to support athletic progression while maintaining player health and engagement

Procedure

Data Collection

During the three assessment sessions, tests were consistently conducted at the same time (4:30 PM) and on the same days of the week, with a 48-hour rest period following the last match or training session. Additionally, assessments two and three were preceded by identical microcycle training. Each assessment session was divided over three days, with a 24-hour interval between them.

In the first training session of the week, players underwent anthropometric measurements and a familiarization test. The second session focused on evaluating the CMJ, the 505 COD test, and the 30-meter linear sprint speed. The third session included the repeated sprint ability test and the Yo-Yo intermittent recovery test.

This test order was selected to prioritize neuromuscular assessments (CMJ, sprint, and COD) before more metabolically demanding tests (repeated sprint ability and Yo-Yo) to reduce the potential influence of accumulated fatigue on maximal-effort performance. In addition, distributing the battery across separate sessions and standardizing recovery periods was intended to minimize residual fatigue and improve test validity, consistent with previously published soccer testing protocols (Falces-Prieto et al., 2022; Clemente et al., 2022).

Before the first assessment of each day, a standardized warm-up protocol was implemented for groups of players, organized in sets of three to ensure uniformity in the duration between the end of the warm-up and the start of the tests. The warm-up lasted approximately 15 minutes and consisted of general aerobic activation, dynamic mobility exercises, and progressive sprint/change-of-direction drills to prepare for maximal efforts; a brief passive rest was allowed before the first test. All players followed the same sequence of tests, with a minimum rest period of three minutes between each test. Anthropometric measurements and the CMJ were conducted in a private room, while the sprinting and COD tests were performed on an external field. Weather conditions were favorable, with no rain occurring during the assessments.

Anthropometry

Body weight and height measurements were taken at two assessment points, consistently at the same time and on the same day of the week. Height was measured using a stadiometer (SECA 213, Birmingham, UK) with precision to the nearest 0.1 cm. Participants were instructed to remove their shoes and any accessories that might affect the measurements. They were required to stand in a vertical and stable position, with their arms extended alongside their bodies and their gaze directed straight ahead. Each measurement was recorded only once to ensure accuracy.

Countermovement Jump

The CMJ was assessed using the Chronojump-Boscosystem® (Barcelona, Spain), as developed by De Blas et al. (2012), which demonstrated intraclass correlation coefficients ranging from .821 to .949 for jump height measurements. This system was interfaced with a MacBook Pro running macOS Sur 11.1, and the data were analyzed using Chronojump software version 2.0.2. Following a warm-up, participants executed the CMJ test three times on a contact platform, with each jump load separated by a 20-second recovery period to reduce fatigue effects, and a three-minute rest between different load jumps. The highest jump recorded (in centimeters) was taken as the final result. Participants were instructed to jump as high as possible after achieving a knee angle of approximately 90 degrees while keeping their hands on their hips and landing with their legs fully extended and feet in maximal plantar flexion. Trials that did not meet these criteria were repeated.

30-m Linear Sprint

The 30-meter sprints were assessed using the MySprint application. To ensure optimal performance, the research team adhered to the protocol established by Samozino et al. (2016). To maintain interobserver reliability, sprint times were evaluated by two independent observers, who demonstrated nearly

perfect agreement, with no significant discrepancies noted between their measurements. The objective of this test was for the young soccer players to complete the 30 meters as fast as possible. Participants were instructed to sprint at their maximum speed and were allowed two attempts for each condition, with a one-minute recovery period between attempts to mitigate fatigue effects. The best time from the two attempts, recorded in seconds using the MySprint app on an iPad Pro (model A1673, iOS 13.3), was taken as the final result. Additionally, a high-definition camera (1080p at 60 frames per second) was utilized to capture and analyze all attempts.

505 COD test

The methodology for the 505 COD test was based on the established procedures outlined by Draper and Lancaster (1985). This test involved a 10-meter linear sprint initiated from a static position, followed by a 180° turn executed with either the right or left leg to halt the run, ensuring contact with a designated line, and concluding with a 5-meter return sprint to a specified finish line. The total time taken to complete the final 5 meters, including the initial 10-meter sprint, the turn, and the return sprint, was recorded, as noted by Carey et al. (2001). For speed assessment, participants performed two attempts with a recovery period of 2 minutes between each trial, and the average of the two attempts was used for further analysis, as recommended by Barbieri et al. (2016) and Hohmann & Siener (2021). Times were measured in seconds. The evaluation utilized FitLight Trainer® sensors (Ontario, Canada), which are designed to assess agility, reaction time, speed, and coordination in soccer (Rauter et al., 2018). The optoelectronic devices were calibrated to an appropriate hip height based on the average stature of the participants, standardized across participants to ensure consistent triggering conditions. The recorded times for each player were stored on a portable tablet running an Android operating system, and subsequent analysis was conducted using Microsoft Excel® on a Windows® platform (Redmond, Washington, USA).

Data analysis

Descriptive statistics were calculated for each variable to provide a detailed overview of the dataset. To assess the normality of distribution and the homogeneity of variances, the Kolmogorov–Smirnov test and Levene's test were employed. Various independent samples t-tests were conducted to compare the performance of U15 Cuban female soccer players with that of U15 Spanish female soccer players across three key physical performance metrics: CMJ, 30-meter sprint, and 505 COD test. This analysis aimed to identify any significant differences between the two groups in these performance measures. The results were interpreted using a significance threshold of $p < .05$. Cohen's d was used as the effect size indicator and interpreted as small (.20), medium (.50), and large (.80) (Ledesma et al., 2008). Additionally, Pearson's correlation coefficient (r) was employed to explore the relationships within each group (U15 Spanish and Cuban female soccer players) between CMJ and the 30-meter sprint, CMJ and the 505 COD test, as well as between the 30-meter sprint and the 505 COD test. The interpretation of the magnitude of these correlations followed established criteria: trivial (≤ .10), small (.10–.29), moderate (.30–.49), large (.50–.69), very large (.70–.89), and almost perfect (≥ .90) (Schober et al., 2018). All data analyses were performed using Statistica software (version 13.3; Statsoft, Inc., USA).

Results

Descriptive statistics were calculated for each variable (Table 1).

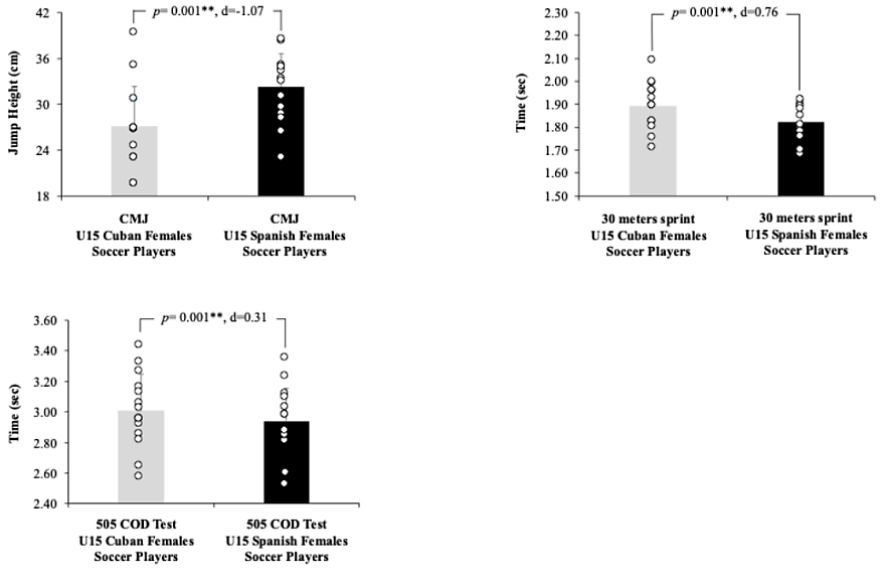
Table 1. Performance variables in both groups: U15 Spanish female soccer players and U15 Cuban female soccer players.

	U15 Cuban Females Soccer Players (*n*=15)			U15 Spanish Females Soccer Players (*n*=15)		
	CMJ (cm)	30-m LST (sec)	COD Test (sec)	CMJ (cm)	30-m LST (sec)	COD Test (sec)
Mean	27.08	1.89	3.01	32.28	1.82	2.94
SD	5.29	0.10	0.24	4.36	0.08	0.22
Range	19.76	0.38	0.86	15.48	0.24	0.81
Maximum	39.38	2.09	3.44	38.52	1.92	3.36
Minimum	19.62	1.71	2.58	23.04	1.68	2.55

Note: CMJ: Countermovement Jump; LST: Linear Sprint Test; COD: Change of Direction

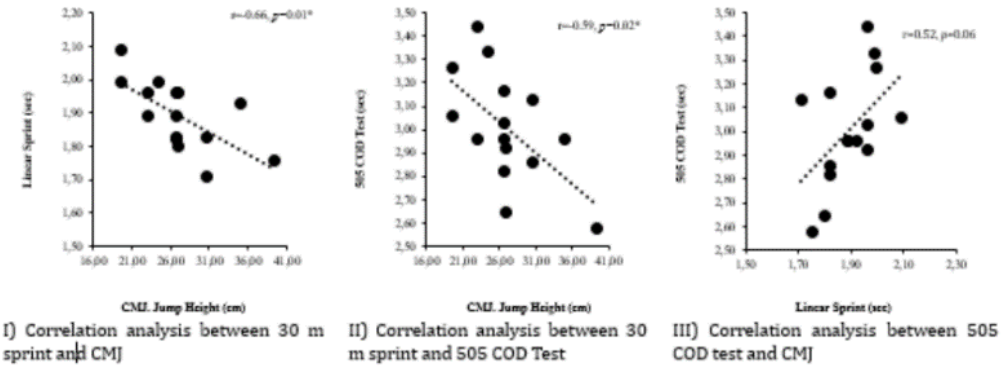
The analysis of the CMJ data indicated significant disparities between the two groups, yielding a p-value of .001 and a Cohen's d of -1.07. U15 Spanish female soccer players exhibited superior jump performance. Similarly, the t-test results for the 30-meter sprint times revealed significant differences, with a p-value of .001 and a Cohen's d of 0.76. The findings demonstrated that U15 Spanish female soccer players achieved faster sprint times, averaging 1.82 ± 0.08 seconds, while U15 Cuban female soccer players averaged 1.89 ± 0.10 seconds. Finally, the t-test for the 505 COD test also showed significant differences, with a p-value of .001 and a Cohen's d of 0.31. U15 Spanish female soccer players recorded faster times, averaging 2.94 ± 0.22 seconds, in contrast to U15 Cuban female soccer players, who averaged 3.01 ± 0.10 seconds (refer to Figure 1 for additional details).

Figure 1. Independent samples t-test between U15 Spanish female soccer players and U15 Cuban female soccer players.



Subsequently, a correlation analysis was performed to examine the relationships among the CMJ, the 30-meter sprint, and the 505 COD test for both groups of athletes. The analysis for U15 Cuban female soccer players demonstrated a strong negative correlation between the CMJ and the 30-meter sprint (r = -.66, p = .01), as well as between the CMJ and the 505 COD test (r = -.59, p = .02). Furthermore, a moderate positive correlation was identified between the 30-meter sprint and the 505 COD test (r = .52, p = .06). In a similar vein, the correlation analysis for U15 Spanish female soccer players revealed a strong negative correlation between the CMJ and the 505 COD test (r = -.51, p = .05). However, no significant correlations were observed for the other performance metrics. These results indicate that improvements in CMJ performance are associated with reductions in sprinting and change of direction times, emphasizing the interrelated nature of these physical attributes in young female soccer players (refer to Figure 2 for additional information). This analysis highlights the necessity of incorporating explosive strength and agility training into athletic development programs to enhance overall performance.

Figure 1. Correlation analsyis between performance variables.



I) Correlation analysis between 30 m sprint and CMJ

II) Correlation analysis between 30 m sprint and 505 COD Test

III) Correlation analysis between 505 COD test and CMJ

Note: U15 Cuban Female soccer players: I) Correlation analysis between 30-m sprint and CMJ, II) Correlation analysis between 30-m sprint and 505 COD Test and III) Correlation analysis between 505 COD test and CMJ. U15 Spanish Female Soccer players IV) Correlation analysis between 30-m sprint and CMJ, V) Correlation analysis between 30-m sprint and 505 COD Test and VI) Correlation analysis between 505 COD test and CMJ.

Discussion

The primary objective of this study was to evaluate and compare the physical performance profiles of elite U15 female soccer players from Spain and Cuba by analyzing key performance indicators. Correlations were examined among CMJ results, COD performance, and outcomes from linear sprint tests. The results revealed significant differences between the two teams. In the comparative analysis of the 30-meter sprint test, Spanish players demonstrated superior average performance and greater consistency in their results. Although the differences observed were modest, they were consistent and may indicate advantages in sprinting technique, explosive strength, or movement efficiency among the Spanish athletes. This advantage may be related to a training emphasis on technique and running economy. In contrast, the performance results for the Cuban players showed a higher degree of variability within the group, which may be due to differences in skill levels or physical development among the athletes.

In the CMJ test, Spanish players outperformed their Cuban counterparts, demonstrating not only higher average scores but also lower variability in their results. This finding is particularly significant given the essential role of lower-body explosive power in soccer, which is critical for actions such as jumping, sprinting, and rapid accelerations (Bimson et al., 2017; Meckel et al., 2018). The capacity to generate force swiftly and efficiently, as measured by the CMJ, is vital for aerial duels, shooting power, and initiating quick changes of pace during matches. The superior performance of Spanish players in this test may be linked to more structured training regimens that emphasize plyometric exercises and strength development. It has been suggested that multisegment coordination plays a more critical role in achieving better vertical jump performance compared to the ability to generate high peak forces (Dowling & Vamos, 1993). Additionally, the reduced variability in performance among Spanish players suggests a more uniform level of physical preparation across the team, which can enhance collective tactical execution. In contrast, the greater variability observed among Cuban players may reflect differing levels of physical development or access to specialized training resources.

The results from the COD test further illustrate the differences between the two teams. While both teams demonstrated commendable performance levels in the COD test, Spanish players held a slight edge in terms of speed and consistency. This advantage could significantly influence game situations, as the ability to change direction effectively is a crucial component of soccer performance. The greater variability among Cuban players indicates potential for improvement in the uniformity and development of this skill. These findings may be associated with variations in training methodologies, anthropometric and physiological characteristics, technical skills, and competitive experience. Gonçalves et al. (2021) highlight that change of direction serves as a sensitive indicator of physical condition in female soccer players, providing valuable insights, particularly regarding players' deceleration performance. The good news is that a longitudinal study spanning three years observed that systematic training can be associated with improvements in COD speed in girls (Wright & Atkinson, 2019). The authors suggested that

this enhancement may be attributed to improvements in technique, driven by advancements in straight-line speed, as well as a proportional increase in eccentric control during deceleration. Nevertheless, Fiorilli et al. (2017) emphasized that physical fitness also plays a significant role at those ages.

Importantly, given the U15 age category, inter-individual variability in growth and biological maturation may influence sprint, jump, and COD outcomes. Therefore, the between-group differences observed in this study should not be attributed solely to training-related factors, and maturation-related variability may have contributed to the performance profiles.

Correlation analyses between the 30-meter sprint and CMJ performance have been investigated across various sports disciplines (Baena-Raya et al., 2021). In the current study, a strong negative correlation was identified among Cuban female soccer players (r = -.66, p = .01*), which is consistent with findings from other research examining this relationship at different competitive levels (Barrera et al., 2023; Boraczynski et al., 2020; Morris et al., 2022). Conversely, while Spanish players also exhibited a negative correlation between the two performance measures, the relationship was weak and statistically insignificant (r = -.06, p = .84). However, it should be emphasized that the Spanish athletes exhibited lower performance variability, which may have influenced the correlation values. Loturco et al. (2015) propose that such negative correlations may arise from the dynamics of transitioning from lower to higher speeds, which can result in a reduced stance phase duration and an associated increase in maximal vertical force production. Furthermore, when analyzing the correlation between CMJ performance and the COD test, strong negative correlations were observed in both Cuban players (r = -.59, p = .02*) and Spanish players (r = -.51, p = .05*). These findings, however, do not align with results from other studies (Nygaard Falch et al., 2020; Castillo-Rodríguez et al., 2012; Vescovi & McGuigan, 2008). Nygaard Falch et al. (2020) note that the relationship between CMJ performance and the total time required to complete the COD test for inexperienced soccer players may be influenced by longer sprint distances and the involvement of similar muscle groups in both assessments.

To conclude the analysis, the correlation between the 30-meter sprint test and COD test was examined. The relationship between these two tests is interesting because the 30-meter sprint measures pure linear speed, while the COD test assesses agility and the ability to change direction. Both tests are linked by lower-body explosive power and movement technique. Theoretically, better sprint performance could positively influence COD performance, as both tests require rapid acceleration; however, the COD test introduces the added complexity of directional changes. Among Cuban players, a moderate correlation was observed between the 30-meter sprint and the COD test (r=.52, p=.06), suggesting some connection between the abilities required for both tests. In contrast, among Spanish players, the correlation was weaker and not statistically significant (r=.33, p=.22). Several studies have explored the relationship between the COD test and sprint performance in athletes across different sports (Pereira et al., 2018; Baena-Raya et al., 2021; Zhang et al., 2024). In soccer, Loturco et al. (2019a, 2019b) analyzed both tests in players from different age groups and highlighted the strong relationship between maximum speed over short distances and performance in direction changes. Our results are supported by the research of Muñoz León et al. (2024) and the theories of Beato et al. (2018) who emphasize the importance of high-intensity multidirectional movements to improve specific athletic skills. However, given that correlational analyses do not establish causality, these relationships should be interpreted as associations and may be considered as hypotheses to be tested in future studies.

Finally, future research should replicate these findings using larger samples and longitudinal designs, incorporating indicators of biological maturation and body composition, and accounting for training and match exposure (e.g., weekly load and minutes played) to better contextualize performance differences.

Limitations and strengths

This study presents several limitations that must be acknowledged when interpreting the findings. Firstly, the participant sample was confined to U15 female soccer players from only two countries, which may limit the applicability of the results to broader populations or different age groups. Furthermore, variations in training methodologies and physical development conditions between the two teams could have influenced the results.

Importantly, biological maturation was not assessed (e.g., maturity offset/age at peak height velocity or sexual maturation staging). Given the U15 age category, inter-individual differences in growth and mat-

uration may substantially influence sprint, jump, and COD performance; therefore, maturity-related variability could have contributed to the observed between-country differences and results should be interpreted with caution. This information was not collected, as standardized maturation data were not available for both squads during the testing period. In addition, body composition (e.g., skinfolds or bioelectrical impedance) was not measured. As body composition may be associated with sprint, jump, and COD performance, its absence limits the interpretation of the findings and should be considered in future research. Another significant limitation is the absence of a long-term follow-up, which hinders the ability to evaluate the players' performance trajectories over time.

In terms of strengths, this study contributes valuable insights into the comparative physical performance profiles of elite U15 female soccer players from different cultural backgrounds. The use of multiple performance tests, including the 30-meter sprint, CMJ, and change-of-direction assessments, provides a well-rounded evaluation of key athletic attributes. Additionally, the rigorous statistical analysis employed enhances the reliability of the findings, allowing for a nuanced understanding of the performance disparities between the two groups. The study also underscores the importance of personalized training programs tailored to the specific needs of athletes, which can inform coaching practices and improve player development in women's soccer. Overall, these strengths contribute to the growing body of literature on female soccer performance and highlight areas for future exploration.

Practical Implications for Training.

Understanding the interrelationships between performance metrics such as sprinting, COD tests, and CMJ is essential for developing effective training programs tailored to the needs of young female soccer players. Coaches and trainers can utilize these insights to create personalized strength and conditioning regimens that specifically target the enhancement of critical athletic attributes, including explosive power, speed, and agility. By focusing on these interconnected performance areas, training can be optimized to yield significant improvements in overall on-field performance. For instance, incorporating plyometric exercises that emphasize explosive movements can enhance CMJ performance, which is directly linked to improved sprinting speed and agility during gameplay. Additionally, agility drills that simulate game scenarios can help athletes develop the necessary skills to execute quick directional changes effectively, thereby improving their performance in COD tests. Moreover, it is vital to integrate sport-specific conditioning that reflects the demands of soccer, such as interval training that mimics the stop-and-go nature of the game. This approach not only enhances physical and coordinative capabilities but also fosters better tactical awareness and decision-making under pressure.

Furthermore, regular assessments of physical performance should be conducted to monitor progress and adjust training programs accordingly. This iterative process ensures that athletes are continually challenged and that their training remains aligned with their developmental needs. Ultimately, a comprehensive training strategy that encompasses these elements will not only enhance individual performance but also contribute to the overall success of the team. By prioritizing a holistic approach to athlete development, coaches can cultivate well-rounded players who are prepared to excel in competitive environments.

Conclusions

This study aimed to compare the physical performance profiles of elite U15 female soccer players from Spain and Cuba by utilizing key assessments, including the CMJ, COD test, and the 30-meter sprint. The results revealed significant differences, with Spanish players exhibiting superior and more consistent performance in both the 30-meter sprint and CMJ, indicating potential advantages in running technique and explosive force production. Although both teams demonstrated commendable performance in the COD test, Spanish players showed a slight advantage in terms of speed and consistency. These findings underscore the necessity of tailored training programs to enhance specific attributes such as speed, agility, and change of direction.

References

Baena-Raya, A., Soriano-Maldonado, A., Conceição, F., Jiménez-Reyes, P. and Rodríguez-Pérez, M.A. (2021). Association of the vertical and horizontal force-velocity profile and acceleration with change of direction ability in various sports. *European Journal of Sport Science, 21:* 1659-1667. https://doi.org/10.1080/17461391.2020.1856934

Barbieri, R. A., Zagatto, A. M., Milioni, F., & Barbieri, F. A. (2016). Specific futsal training program can improve the physical performance of futsal players. *Sport Sciences for Health, 12*(2), 247–253. https://doi.org/10.1007/s11332-016-0283-z

Barrera, J., Figueiredo, A. J., Duarte, J., Field, A., & Sarmento, H. (2023). Predictors of linear sprint performance in professional football players. *Biology of Sport, 40*(2), 359–364. https://doi.org/10.5114/biolsport.2023.114289

Beato, M., Bianchi, M., Coratella, G., Merlini, M., & Drust, B. (2018). Effects of Plyometric and Directional Training on Speed and Jump Performance in Elite Youth Soccer Players. *Journal of Strength and Conditioning Re-search*, *32*(2), 289-296. https://doi.org/10.1519/JSC.0000000000002371

Bimson, L., Langdown, L., Fisher, J. P., & Steele, J. (2017**).** Six weeks of knee extensor isometric training improves soccer related skills in female soccer players. *Journal of Trainology, 6*(2), 52–56. https://doi.org/10.17338/trainology.6.2_52

Bonora Peñalver, R., Noa Cuadro, H., & Medina Durán, E. L. (2025). Indicadores para contextualizar el modelo de juego, en el fútbol femenino cubano. *PODIUM - Revista de Ciencia y Tecnología en la Cultura Física*, *20*(1), e1763. Recuperado a partir de https://podium.upr.edu.cu/index.php/podium/article/view/1763

Boraczyński, M., Boraczyński, T., Podstawski, R., Wójcik, Z., & Gronek, P. (2020). Relationships between measures of functional and isometric lower body strength, aerobic capacity, anaerobic power, sprint and countermovement jump performance in professional soccer players. *Journal of Human Kinetics, 75*, 161–175. https://doi.org/10.2478/hukin-2020-0045

Caldbeck, P., & Dos'Santos, T. (2022). A classification of specific movement skills and patterns during sprinting in English Premier League soccer. *PLoS ONE 17*(11): e0277326. https://doi.org/10.1371/journal.pone.0277326

Carey, D. P., Smith, G., Smith, D. T., Shepherd, J. W., Skriver, J., Ord, L., & Rutland, A. (2001). Footedness in world soccer: an analysis of France '98. *Journal of Sports Sciences, 19*(11), 855–864. https://doi.org/10.1080/026404101753113804

Castillo-Rodríguez, A., Fernández-García, J. C., Chinchilla-Minguet, J. L. & Carnero, E. A. (2012). Relationship Between Muscular Strength and Sprints with Changes of Direction. *Journal of Strength and Conditioning Research 26*(3), 725-732. DOI: 10.1519/JSC.0b013e31822602db

Clemente, F. M., González-Fernández, F. T., García-Delgado, G., Silva, R., Silva, A. F., Nobari, H., & Falces-Prieto, M. (2022). Leg dominance and performance in change of directions tests in young soccer players. *Scientific Reports, 12*, 12900. https://doi.org/10.1038/s41598-022-17245-5

Costa, J. A., Rago, V., Brito, P., Figueiredo, P., Sousa A., Abade, E. & Brito, J. (2022). Training in women soccer players: A systematic review on training load monitoring. *Frontiers in Psychology.* 13:943857. doi: 10.3389/fpsyg.2022.943857

De Blas, X., Padullés, J.M., Del Amo, J.L.L., & Guerra-Balic, M. (2012). Creation and Validation of Chronojump-Boscosystem: A Free Tool to Measure Vertical Jumps. *Revista Internacional de Ciencias del Deporte 8*, 334-356. http://dx.doi.org/10.5232/ricyde2012.03004

Dowling, J. J., & Vamos, L. (1993). Identification of Kinetic and Temporal Factors Related to Vertical Jump Performance. *Journal of Applied Biomechanics*, *9*(2), 95-110. Retrieved Feb 12, 2026, from https://doi.org/10.1123/jab.9.2.95

Draper, J. A. & Lancaster, M. G. (1985). The 505 test: A test for agility in the horizontal plane. Aust. J. Sci. Med. Sport. 17(1), 15–18

Emmonds, S., Nicholson, G., Begg, C., Jones, B., & Bissas, A. (2019). Importance of physical qualities for speed and change of direction ability in elite female soccer players. *Journal of Strength & Conditioning Research, 33*(6), 1669-1677. DOI: 10.1519/JSC.0000000000002114

Falces-Prieto, M., González-Fernández, F. T., García-Delgado, G., Silva, R., Nobari, H., & Clemente, F. M. (2022). Relationship between sprint, jump, dynamic balance with the change of direction on young soccer players' performance. *Scientific Reports, 12*, 12272. https://doi.org/10.1038/s41598-022-16558-9

Fiorilli, G., Mitrotasios, M., Iuliano, E., Pistone, E. M., Aquino, G., Calcagno, G., & Di Cagno, A. (2017). Agility and change of direction in soccer: Differences according to the player ages. *Journal of Sports Medicine and Physical Fitness, 57*(12), 1597–1604. https://doi.org/10.23736/S0022-4707.16.06562-2

Fu, H., Li, Z., Zhou, X., Wang, J., Chen, Z., Sun, G., ... & Zheng, J. (2023). The profiles of single leg countermovement jump kinetics and sprinting in female soccer athletes. *Heliyon, 9*(8). https://doi.org/10.1016/j.heliyon.2023.e19159

Gonçalves, L., Clemente, F. M., Barrera, J. I., Sarmento, H., González-Fernández, F. T., Palucci Vieira, L. H., Figueiredo, A. J., Clark, C. C. T., & Carral, J. M. C. (2021). Relationships between Fitness Status and Match Running Performance in Adult Women Soccer Players: A Cohort Study. *Medicina, 57*(6), 617. https://doi.org/10.3390/medicina57060617

Hohmann, A. & Siener, M. (2021). Talent identification in youth soccer: Prognosis of U17 soccer performance on the basis of general athleticism and talent promotion interventions in second-grade children. *Frontiers. Sports Active. Living 3*, 625-645. doi: 10.3389/fspor.2021.625645

Komarudin, K., Suharjana, S., Yudanto, Y., & Kusuma, M. N. H. (2022). The different influence of speed, agility and aerobic capacity toward soccer skills of youth player. *Pedagogy of Physical Culture and Sports, 26*(6), 381-390. doi:10.15561/26649837.2022.0604

Ledesma, R. D., Macbeth, G., & Cortada de Kohan, N. (2008). Tamaño del efecto: Revisión teórica y aplicaciones con el sistema estadístico ViSta. *Revista Latinoamericana de Psicología, 40*(3), 425–439.

Leon Muñoz, C., Ramírez-Campillo, R. ., Traver Gil, P. ., & Saéz de Villarreal Sáez, E. . (2024). Effects of combined plyometric, speed and change of direction training on female soccer players on physical performance. *Retos*, *59*, 1081-1091. https://doi.org/10.47197/retos.v59.104527

Loturco, I., A. Pereira, L., T. Freitas, T., E. Alcaraz, P., Zanetti, V., Bishop, C., & Jeffreys, I. (2019b) Maximum acceleration performance of professional soccer players in linear sprints: Is there a direct connection with change-of-direction ability? *PLoS ONE 14*(5): e0216806. https://doi.org/10.1371/journal.pone.0216806

Loturco, I., Jeffreys, I., Abad, C. C. C., Kobal, R., Zanetti, V., Pereira, L. A., & Nimphius, S. (2019a). Change-of-direction, speed and jump performance in soccer players: a comparison across different age-categories. *Journal of Sports Sciences*, *38*(11–12), 1279–1285. https://doi.org/10.1080/02640414.2019.1574276

Loturco, I., Pereira, L. A., Abad, C. C. C., D'Angelo, R. A., Fernandes, V., Kitamura, K., Kobal, R., & Nakamura, F. Y. (2015). Vertical and horizontal jump tests are strongly associated with competitive performance in 100-m dash events. *Journal of Strength & Conditioning Research, 29*(7), 1966-1971. *DOI:* 10.1519/JSC.0000000000000849

Luo, S., Soh, K.G., Zhang, L., Zhai, X., Sunardi, J., Gao, Y., & Sun, H. (2023). Effect of core training on skill-related physical fitness performance among soccer players: A systematic review. *Frontiers in Public Health* 10:1046456. https://doi.org/10.3389/fpubh.2022.1046456

McEwan, G. P., Unnithan, V. B., Carter, M., Dugdale, J. H., & Datson, N. (2026). Talent identification and development strategies in elite women's soccer: a pan-European perspective. *Science and Medicine in Football*, *10*(1), 96-104. https://doi.org/10.1080/24733938.2024.2404920

Meckel, Y., Doron, O., Eliakim, E., & Eliakim, A. (2018). Seasonal variations in physical fitness and performance indices of elite soccer players. *Sports, 6*(1), 14. https://doi.org/10.3390/sports6010014

Morris, C. G., Weber, J. A., & Netto, K. J. (2022). Relationship Between Mechanical Effectiveness in Sprint Running and Force-Velocity Characteristics of a Countermovement Jump in Australian Rules Football Athletes. *Journal of Strength and Conditioning Research 36*(3), 59-65, DOI: 10.1519/JSC.0000000000003583

Nunes, H., Faria, E., Martinez, P. & Oliveira-Júnior, S. (2021). Cardiovascular health indicators in soccer exercise during adolescence: systematic review. *International Journal of Adolescent Medicine and Health, 33*(3), 53-63. https://doi.org/10.1515/ijamh-2020-0301

Nygaard Falch, H., Guldteig Rædergård, H., & Van den Tillaar, R. (2020). Relationship of Performance Measures and Muscle Activity between a 180° Change of Direction Task and Different Countermovement Jumps. *Sports*, *8*(4), 47. https://doi.org/10.3390/sports8040047

Pereira, Lucas A., Nimphius, S., Kobal, R., Kitamura, K., Turisco, L. A. L., Orsi, R. C., Cal Abad, C. C., & Loturco, I. (2018). Relationship Between Change of Direction, Speed, and Power in Male and Female National Olympic Team Handball Athletes. *Journal of Strength and Conditioning Research 32*(10), 2987-2994. DOI: 10.1519/JSC.0000000000002494

Randell, R. K., Clifford, T., Drust, B., Moss, S. L., Unnithan, V. B., De Ste Croix, M. B., ... & Rollo, I. (2021). Physiological Characteristics of Female Soccer Players and Health and Performance Considerations: A Narrative Review. *Sports Medicine* 51, 1377–1399. https://doi.org/10.1007/s40279-021-01458-1

Rauter, S., Coh, M., Vodicar, J., Zvan, M., Krizaj, J., Simenko, J. ... & Mackala, K. (2018). Analysis of reactive agility and change-of-direction speed between soccer players and physical education students. *Human Movement, 19*(2), 68-74. https://doi.org/10.5114/hm.2018.74061

Samozino, P., Rabita, G., Dorel, S., Slawinski, J., Peyrot, N., Saez de Villarreal, E., & Morin, J.B. (2016). A simple method for measuring power, force, velocity properties, and mechanical effectiveness in sprint running. *Scandinavian Journal of Medicine & Science in Sports, 26*, 648–658. https://doi.org/10.1111/sms.12490

Sarmento, H., Anguera, M. T., Pereira, A., & Araújo, D. (2018). Talent Identification and Development in Male Football: A Systematic Review. *Sports medicine (Auckland, N.Z.)*, *48*(4), 907–931. https://doi.org/10.1007/s40279-017-0851-7

Schober, P., Boer, C., & Schwarte, L. A. (2018). Correlation coefficients: Appropriate use and interpretation. *Anesthesia & Analgesia, 126*(5), 1763–1768. https://doi.org/10.1213/ANE.0000000000002864

Vescovi, J. D., & Mcguigan, M. R. (2008). Relationships between sprinting, agility, and jump ability in female athletes. *Journal of Sports Sciences*, *26*(1), 97–107. https://doi.org/10.1080/02640410701348644

Washif, J. A., & Kok, LY. (2022). Relationships Between Vertical Jump Metrics and Sprint Performance, and Qualities that Distinguish Between Faster and Slower Sprinters. *Journal of Science in Sport and Exercise 4,* 135-144 https://doi.org/10.1007/s42978-021-00122-4

Wright, H. A., & Atkinson, G. (2019). The effects of resistance training on change of direction speed in female athletes: A longitudinal study. *Journal of Sports Science & Medicine, 18*(3), 537–542. https://doi.org/10.1080/02640414.2019.1597319

Young, W. B., Dawson, B., & Henry, G. J. (2015). Agility and Change-of-Direction Speed are Independent Skills: Implications for Training for Agility in Invasion Sports. *International Journal of Sports Science & Coaching*, *10*(1), 159-169. https://doi.org/10.1260/1747-9541.10.1.159

Zhang, Z., Jiang, M., Jing, Y., Li, M., Li, Y., & Yang., X. (2024). Associations Between Sprint Mechanical Properties and Change of Direction Ability and Asymmetries in COD Speed Performance in Basketball and Volleyball Players. *Life, 14*, 1434. https://doi.org/10.3390/life14111434

Authors and translators' details:

Yarisel Quiñones-Rodríguez	yquignones_l@ugr.es	Author
José Antonio Sánchez Fuentes	jasfuentes@um.es	Author
Rui Miguel Silva	rui.s@ipvc.pt	Author
Grzegorz Trybek	grzegorz.trybek@awf.gda.pl	Author
Carlos López-Gutiérrez	cjlopez@ugr.es	Author
Alexis Juan Stuart-Rivero	stuart@ucf.edu.cu	Author
Ana Filipa Silva	anafilsilva@gmail.com	Author