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Genç Erkek Futbolcularda Kronolojik Yaşın Fiziksel Performans Üzerine Etkisi: U13, U14 ve U15 Kategorilerinin Karşılaştırılması

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Özet

Bu çalışmanın amacı, U13, U14 ve U15 yaş kategorilerindeki genç futbolcuların sürat (30 m sprint), yön değiştirme hızı (zigzag çeviklik testi) ve dikey sıçrama (counter-movement jump) performanslarını karşılaştırmaktır. Araştırmaya, aktif olarak futbol oynayan 56 erkek sporcu (U13: n=18, yaş: 12.72±0.57 yıl; U14: n=16, yaş: 13.81±0.40 yıl; U15: n=22, yaş: 14.59±0.50 yıl) dâhil edilmiştir. Katılımcıların vücut kompozisyonu (boy, vücut ağırlığı, beden kütle indeksi) ölçümlerini takiben performans testleri, en az 48 saat dinlenme ile üç ayrı günde standart protokollere uygun olarak gerçekleştirilmiştir. Sürat performansı fotosel sistemi ile 30 m mesafede, çeviklik performansı beş koni ile oluşturulmuş zigzag testinde, dikey sıçrama performansı ise kuvvet platformu (Hawkin Dynamics) kullanılarak counter-movement jump testi ile ölçülmüştür. Verilerin analizinde tanımlayıcı istatistikler kullanılmış, gruplar arası karşılaştırmalar normal dağılım gösteren parametreler için Tek Yönlü Varyans Analizi (ANOVA) ve Bonferroni post-hoc testi, normal dağılım göstermeyen parametreler için Kruskal-Wallis H testi ile yapılmış ve etki büyüklükleri hesaplanmıştır. İstatistiksel anlamlılık düzeyi $p<0.05$ olarak kabul edilmiştir. Bulgular, 30 m sürat performansının U13 (5.23±0.27 sn), U14 (4.93±0.32 sn) ve U15 (4.44±0.24 sn) grupları arasında istatistiksel olarak anlamlı ve kademeli bir iyileşme gösterdiğini ortaya koymuştur ($p=0.001$, $\eta^2=0.621$, büyük). Zigzag çeviklik testinde ise U15 grubu (6.50±0.25 sn), U13 (6.88±0.30 sn) ve U14 (6.92±0.31 sn) gruplarına kıyasla anlamlı derecede daha iyi performans sergilerken ($p=0.001$), U13 ve U14 grupları arasında fark bulunmamıştır. Counter-movement jump performansında da U15 grubu (30.38±6.44 cm), U13 (24.39±3.40 cm) ve U14 (26.13±4.81 cm) gruplarından anlamlı şekilde yüksek bir değer elde etmiştir ($p=0.002$). Sonuç olarak, genç futbolcularda temel fiziksel performans parametrelerinin yaşla birlikte geliştiği, ancak bu gelişimin parametrelere göre farklılaştığı görülmektedir. Sürat performansı doğrusala yakın ve sürekli bir ilerleme gösterirken, çeviklik ve dikey sıçrama gibi patlayıcı kuvvet gerektiren özelliklerde en kritik gelişim U15 döneminde olduğu tespit edilmiştir. Bu bulgular ışığında, antrenörlere U13-U14 döneminde temel sürat ve koşu tekniği üzerine odaklanmaları, U15 ve sonrasındaki hızlı biyolojik olgunlaşma döneminde ise çeviklik ve sıçrama performansını en üst seviyeye çıkarabilmek için nöromüsküler yükü yüksek ve yön değiştirmeli antrenmanları programlarına sistematik olarak eklenmesi önerilmektedir.

Anahtar Kelimeler: Kronolojik yaş, Futbol, Sürat, Çeviklik

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The Effect of Chronological Age of Young Male Football Players on Physical Performance: A Comparison of the U13, U14, and U15 Categories

Abstract

The purpose of this study is to compare the speed (30 m sprint), change of direction speed (zigzag agility test), and vertical jump (counter-movement jump) performance of young soccer players in the U13, U14, and U15 age categories. The study included 56 male athletes actively playing soccer (U13: n=18, age: 12.72±0.57 years; U14: n=16, age: 13.81±0.40 years; U15: n=22, age: 14.59±0.50 years). Following measurements of the participants' body composition (height, body weight, body mass index), performance tests were conducted on three separate days with at least 48 hours of rest between tests, in accordance with standard protocols. Speed performance was measured using a photocell system over a distance of 30 m, agility performance was measured using a zigzag test created with five cones, and vertical jump performance was measured using a counter-movement jump test with a force platform (Hawkin Dynamics). Descriptive statistics were used in the analysis of the data. Intergroup comparisons were performed using One-Way Analysis of Variance (ANOVA) and Bonferroni post-hoc test for parameters showing a normal distribution, and the Kruskal-Wallis H test for parameters not showing a normal distribution, and effect sizes were calculated. The level of statistical significance was set at $p<0.05$. The findings revealed a statistically significant and gradual improvement in 30 m sprint performance among the U13 (5.23±0.27 sec), U14 (4.93±0.32 sec), and U15 (4.44±0.24 sec) groups ($p=0.001$, $\eta^2=0.621$, large). In the zigzag agility test, the U15 group (6.50±0.25 sec) showed significantly better performance than the U13 (6.88±0.30 sec) and U14 (6.92±0.31 sec) groups ($p=0.001$), while no difference was found between the U13 and U14 groups. In the counter-movement jump performance, the U15 group (30.38±6.44 cm) also achieved a significantly higher value than the U13 (24.39±3.40 cm) and U14 (26.13±4.81 cm) groups ($p=0.002$). In conclusion, it was observed that basic physical performance parameters in young footballers developed with age, but this development varied depending on the parameter. While speed performance showed linear and continuous improvement, the most critical development in explosive strength-requiring characteristics such as agility and vertical jump was found to be in the U15 period. In light of these findings, it is recommended that coaches focus on basic speed and running technique during the U13-U14 period and systematically incorporate high neuromuscular load and direction-changing training into their programs during the rapid biological maturation period of U15 and beyond to maximize agility and jumping performance.

Keywords: Chronological age, Soccer, Speed, Agility

Introduction

Soccer is a high-intensity interval team sport involving a succession of numerous different activities such as high-intensity running, short sprints, jumps, turns, changes of direction at different angles, and high-intensity acceleration and deceleration (Soós et al., 2022). In modern soccer, players' ability to perform at a high level throughout training and matches is a key factor in achieving success. High performance is largely related to the development of physical capacity and technical skills for soccer players at all levels (Wrigley et al., 2014; Parpa & Michaelides, 2022). Young footballers cover an average distance of 8-9 km in a football match, and approximately 20-25% of this distance involves high and very high intensity activities (Buchheit et al., 2010).

The International Association of Football Federations (FIFA), the highest governing and regulatory body in international football, organizes competitions by categorizing players into groups (Ribeiro et al., 2024). This grouping generally uses the 6-18 age range to define young athletes, who are divided into pre-adolescent (under 12) and adolescent (12-18) athletes. Chronological age is used as the sole criterion for establishing these groupings and creating categories. Athletes are divided into different categories (U10, U14, U16, etc.) based on their chronological age (year of birth). These categories consist of a grouping in which those born between January of a given year and December of the following year are placed in the same category (Kilci et al., 2025a; Kirmizigil & Chauchat, 2021; Ribeiro et al., 2024).

The appropriate development of physical requirements during childhood and adolescence is crucial for athletes who aspire to compete at an elite level in later years. Considering that youth teams are categorized according to chronological age, identifying physical performance differences between age groups is critical for developing appropriate training plans (Tingelstad et al., 2025). In addition to developing biomechanical characteristics, especially in young soccer players, improving physical characteristics such as speed, change of direction, and jumping, which are required in the general structure of soccer, and monitoring them according to age groups should also be considered for performance tracking (Silva et al., 2022). At the same time, testing these performances at regular intervals is frequently used in the process of identifying differences between age groups (Parpa & Michaelides, 2022). In young players, physical performance has been found to be related to chronological age (Perroni et al., 2018), and sprinting, change of direction, and vertical jumping (counter movement jump, CMJ) performance have been shown to increase with age (Emmonds et al., 2018).

Previous scientific studies have examined the effects of chronological age on physical performance in young soccer players across different age categories (Perroni et al., 2018; Andrašić et al., 2021; Ramos et al., 2021; Kilci el al., 2025b; Kirmizigil & Chauchat, 2021; Klatt & Smeeton, 2022; Uslu

et al., 2022). When the study findings were examined, inconsistencies were observed among the results. In a study by Andrašić et al. (2021), the physical performance of young soccer players in different age categories (U15, U17, and U19) was compared, and it was found that players in the U15 category showed poorer change of direction and speed performance compared to the others. Similarly, Uslu et al. (2022) found differences in the physical performance (speed and vertical jump) of young soccer players in different groups (U13, U14, U15, and U16) and determined that performance increased with age. The study by Ramos et al. (2021) also stated that there was no significant difference in the vertical jump and sprint performance of young soccer players in different age categories (U15 and U17). In addition to these inconsistent results, it was observed that the number of studies comparing the performance of players in the U13, U14, and U15 categories was limited.

This study is unique in that it compares the U13, U14, and U15 age categories, which are very similar developmentally and have been examined in a limited number of studies in the literature, within the same sample and test protocol. Furthermore, the simultaneous consideration of sprint, change of direction speed, and counter-movement jump performances allows for a multidimensional evaluation of physical performance in these age groups. In this respect, the study aims to contribute to the development of age-specific performance profiles for young football players in Turkey. Therefore, the main objective of this study is to compare the sprint, change of direction speed (CoDs), and vertical jump (counter-movement jump, CMJ) performance of young soccer players in the U13, U14, and U15 age categories. Accordingly, the hypothesis of the study is that soccer players in the chronologically older age group will have better physical performance values compared to those in the younger age group.

Material and Methods

Participants

This study included 18 athletes (age = 12.72 ± 0.57 years; weight = 48.00 ± 2.86 kg; height = 152.83 ± 4.33 cm) actively playing soccer in the U13 category at Mersin Sports Club; 16 athletes in the U14 category (age = 13.81 ± 0.40 years; weight = 51.56 ± 3.42 kg; height = 158.75 ± 4.46 cm) and 22 athletes in the U15 category (age = 14.59 ± 0.50 years; weight = 54.99 ± 6.93 kg; height = 167.45 ± 6.25 cm), for a total of 56 athletes. To determine the sample size, the effect sizes reported by Wenger and Csapo (2025) for sprint performance in the U13-U15 categories (Cohen's f ≈ 0.45–0.55 range) were used as a reference. Using the G*Power (v3.1.9.7) program for one-way ANOVA (F test), calculations were performed with a 95% confidence level (α = 0.05), 80% statistical power, and a

medium-high effect size (f = 0.40). The results indicated that a total of 54 participants were required. The sample size of the current study (n = 56) was considered sufficient to detect moderate and large effect sizes. The inclusion criteria for the study were determined as follows: participants must be volunteers, have at least three years of licensed soccer experience, train regularly at least three days a week, have not experienced any injury or health problem that could affect their performance in the last six months, and participate in all test protocols. Exclusion criteria included athletes reporting acute injury, pain, or illness on test days, those unable to complete the measurement protocol fully, or those subjected to unusual physical exertion within 48 hours prior to testing. All participants were asked to complete a volunteer form and a parental consent form, and their written consent was obtained. During the current research period, actions were taken in accordance with the "Guidelines on Scientific Research and Publication Ethics for Higher Education Institutions." Furthermore, this study was conducted in accordance with the ethical principles of the Helsinki Declaration. Ethical approval for this study was obtained from the Mersin University Sports Sciences Ethics Committee with decision number 079 dated 20/10/2025.

Study Design

Participants were informed about all test protocols prior to the study and underwent a one-week familiarization session. Body composition measurements (height, body weight, body mass index) were taken during the familiarization process. Performance tests were conducted on three separate days, with at least 48 hours of recovery time between each test. The test sequence was as follows: 30-meter sprint on Monday, zig-zag agility on Wednesday, and countermovement jump (CMJ) measurements on Friday. Participants were given two attempts for each test, with full rest between attempts, and the best performance values were included in the analysis. To ensure that athletes' performance was not affected, the tests were conducted within the same time frame (2:00 PM to 4:00 PM). Additionally, the tests were performed on the same field (artificial turf) and under the same environmental conditions (20-22°C temperature). Athletes were required to wear the same shoes (soccer cleats) throughout the tests, and a standard warm-up protocol was applied before all tests. The warm-up protocol consisted of 5 minutes of low-intensity running and 10 minutes of dynamic stretching exercises. Participants were asked to refrain from training for at least 48 hours prior to each test day and to avoid consuming caffeine and food for at least two hours before the tests.

Data Collection Tools

Body Composition: Participants' body weights were measured using a digital scale (Tanita BC418, Japan), and their heights were measured using a height gauge (Holtain, UK). Measurements were taken while wearing sports clothing (shorts and T-shirt) and without shoes (Lewitt et al., 2012).

Sprint Performance Measurements: Participants' 30-meter sprint times were recorded using photocells (Fusion Sport Smart Speed, Australia) placed at the start and finish lines. When ready, athletes started the test by passing through the first photocell, and the test was completed when they passed through the second photocell, at which point the time was stopped. Each participant was given two attempts, and their best time was used in the analysis (Young et al., 2008).

Zig-Zag Agility Test: The zigzag running test is a valid and reliable field test used to evaluate athletes' agility performance. The test is based on passing through five cones placed at specific intervals on the ground in the shortest time and in the most accurate manner. The athlete starts from the starting photocell with maximum effort, follows a predetermined pattern between the obstacles, and completes the test by passing through the photocell. This test provides an objective measurement of functional agility skills in sports where changing direction is critical, such as soccer (Ortiz et al., 2005).

Counter-Movement Jump (CMJ) Test: Participants' vertical jump performance was assessed using a dual-plate force platform system (Hawkin Dynamics, Westbrook, USA). During the test, athletes were asked to stand on the platform with their hands on their hips, then perform a quick squat movement to their chosen depth and jump to the highest possible point. Each participant performed two trials with 1-minute rest intervals, and the highest value obtained was recorded in centimeters (cm) (Badby et al., 2023).

Statistical Analysis

SPSS (version 27, IBM SPSS Statistics, Chicago, USA) was used for data analysis. The normality of the obtained data was examined using the Kolmogorov-Smirnov test and skewness-kurtosis values. The mean and standard deviation (SD) were calculated for all data. For intergroup comparisons (U13, U14, and U15), data showing a normal distribution (sprint and CMJ) were analyzed using one-way analysis of variance (ANOVA), while data not showing a normal distribution (agility) were analyzed using the Kruskall Wallis H test. When a significant difference was detected, the group in favor of the difference was examined using the Bonferroni post hoc test for ANOVA and the Mann Whitney U test for Kruskall Wallis H. Effect size (ES) was calculated using eta square (η^2) for intergroup comparisons and Cohen's d (Bonferroni) and r (Mann Whitney U) values for pairwise comparisons. Eta squared (η^2) was interpreted as a small effect (0.01–0.059), medium effect (0.06–0.139), or large effect ($\geq$ 0.14); Cohen's d and r were interpreted as small ($\geq$ 0.10), medium ($\geq$ 0.30), or large ($\geq$ 0.50) (Lakens, 2013; Peres, 2025). The graphs used in the study were prepared using the Graphpad Prism (10.6.1) program. Statistical significance was set at $p < 0.05$.

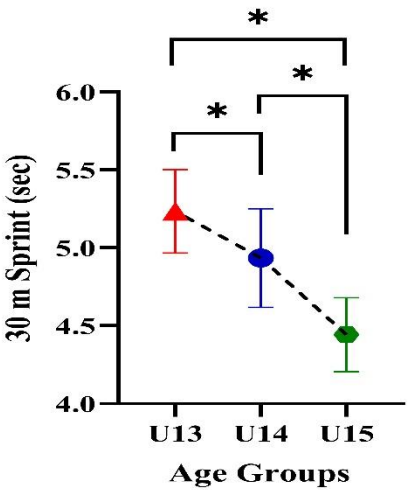
Results

Table 1. presents the descriptive characteristics of the participants.

Table 1. Descriptive characteristics of participants (mean ± standard deviation)

Variables	U13 (n = 18)	U14 (n = 16)	U15 (n = 22)
Age (year)	12.72 ± 0.57	13.81 ± 0.40	14.59 ± 0.50
Body mass (kg)	48.00 ± 2.86	51.56 ± 3.42	54.99 ± 6.93
Height (cm)	152.83 ± 4.33	158.75 ± 4.46	167.45 ± 6.25
BMI (kg/m^2)	20.55 ± 0.93	20.46 ± 1.03	19.58 ± 1.92
30 m Sprint (sec)	5.23 ± 0.27	4.93 ± 0.32	4.44 ± 0.24
Zigzag Agility (sec)	6.88 ± 0.30	6.92 ± 0.31	6.50 ± 0.25
CMJ (cm)	24.39 ± 3.40	26.13 ± 4.81	30.38 ±6.44

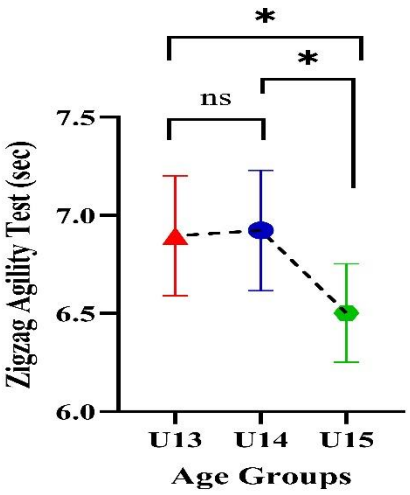
sec: seconds



*p < 0.05; sec = seconds

Figure 1. Comparisons of 30-m sprint performance among soccer players in different age categories.

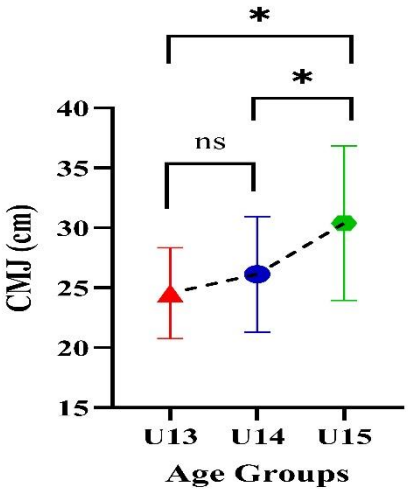
Figure 1 shows a comparison of the 30 m sprint performance of young soccer players in different age categories. The ANOVA test revealed statistically significant differences in sprint performance between players in the U13 (5.23 ± 0.27), U14 (4.93 ± 0.32), and U15 (4.44 ± 0.24) groups (F (2) = 43.435; p = 0.001; η^2 = 0.621, large). The sprint performance of the U14 group was significantly better than that of the U13 group (p = 0.007; d = 1.01, large), while the performance of the U15 group was significantly better than that of the U13 and U14 groups (p = 0.001, d = 3.09, large; p = 0.001, d = 1.73, large, respectively).



*p < 0.05; sec = seconds

Figure 2. Comparisons of zigzag agility test performance among soccer players in different age categories.

Participants' zigzag agility test results were found to differ significantly across age groups (U13, U14, and U15) (H (2) = 21.239; p = 0.001; η^2H = 0.36, large). The agility test averages of players in the U15 category were found to be significantly lower than those of players in the U13 (p = 0.001; r = 3.07, large) and U14 (p = 0.001; r = 3.42, large) categories (p < 0.05). No difference was found between the U13 and U14 categories (p > 0.05).



*p < 0.05; ns = no significant; cm = centimeter

Figure 3. Comparisons of CMJ performance among soccer players in different age categories.

In regard to CMJ performance, there was a statistically significant difference between players in the U13 (24.39 ± 3.40), U14 (26.13 ± 4.81), and U15 (30.38 ± 6.44) groups (F (2) = 7.188; p = 0.002; η^2 = 0.213, large). The Bonferroni post-hoc test revealed no significant difference between the U13 and

U14 groups ($p > 0.05$), but the mean CMJ performance of the U15 group was found to be higher than that of both the U13 ($p = 0.002$; $d = 1.16$, large) and U14 ($p = 0.046$; $d = 0.75$, large) groups ($p < 0.05$).

Discussion and Conclusion

This study was conducted to compare the 30-meter sprint, agility, and Countermovement jump (CMJ) performance of young soccer players in the U13, U14, and U15 age categories. The findings revealed a general improvement in the aforementioned physical performance parameters as the age category increased, but this improvement varied according to the performance tests. The most gradual improvement was observed in the 30-meter sprint performance, while the most significant superiority in agility and CMJ performance was found in the U15 group. It was determined that athletes in the U15 category performed significantly better in all three performance tests compared to the other two age groups.

Our study found that there was a statistically significant difference in 30-meter sprint performance between the U13 (5.23 ± 0.27 sec), U14 (4.93 ± 0.32 sec), and U15 (4.44 ± 0.24 sec) age groups, with a large effect size. This gradual improvement in performance resulted in the U15 group showing a clear superiority over both the U13 and U14 groups. These findings are largely consistent with the existing literature, which suggests that speed performance in young soccer players develops in a near-linear fashion with age and maturation. Yavaş and Akkuş (2021) reported values of 5.09 ± 0.35 sec and 4.53 ± 0.33 sec for the U14 and U16 groups, respectively, revealing a similar trend of decreasing time with increasing age. Similarly, Uslu et al. (2022) determined a significant decrease in 30 m sprint times in each age group from U13 to U16 (U13: 5.46 s, U14: 4.73 s, U15: 4.60 s, U16: 4.18 s). Şahin (2017) also reported values of 5.04 s and 4.73 s for the 13 and 14 age groups, respectively, which are consistent with our results. The average of 4.44 ± 0.24 sec obtained in our study for the U15 group is almost identical to the value of 4.50 sec reported by Eyuboğlu and Aslan (2016) for the same age group, which supports the reliability of our findings. On the other hand, Reilly, Bangsbo, and Franks (2000) reported lower times, such as 4.31-4.46 seconds, in their studies on elite adolescent soccer players. This difference is thought to stem from the training history, physical maturity levels, and elite status of the athletes in those studies. Current findings indicate that there is a significant improvement in speed performance with age-related development of the neuromuscular system, increased muscle strength, and increased technical capacity. Considering that high-level sprint capacity is decisive in athletic performance in soccer (Özgünen et al., 2021), it is recommended that training programs be structured to systematically develop speed and acceleration characteristics, especially in parallel with rapid physical development during early adolescence.

Our study found that there was a statistically significant difference in zigzag agility test performance between age groups. This difference stems from the U15 group (6.50 ± 0.25 sec) demonstrating significantly better performance compared to both the U13 (6.88 ± 0.30 sec) and U14 (6.92 ± 0.31 sec) groups. No significant difference was found between the U13 and U14 categories. The obtained average values are consistent with the results of similar age groups in the literature. Zileli (2024), reported a zigzag time of 6.63 ± 0.34 s in young soccer players, while respectively Canikli (2022) reported values of 6.90 ± 0.2 s and 6.80 ± 0.4 s in the U14 and U15 groups. Both studies present values parallel to our U13-U14-U15 averages (6.88-6.92-6.50 sec). Canikli's (2022) study, also revealed a more pronounced improvement in agility in the U16 (6.20 sec) and U17 (5.60 sec) groups. These findings support the view that the most critical development in agility performance occurs during late adolescence, a phase when the neuromuscular system matures rapidly and explosive strength and change-of-direction skills are optimized. Indeed, Deprez et al. (2015) noted in their large-sample studies that soccer players become more agile and explosive after the age of 15, while Towlson et al. (2019) emphasized that appropriate development programs can create significant differences in performance during this period. In conclusion, the findings of the present study indicate that significant development in agility performance becomes particularly evident during the U15 period and that this development can be explained by age-related neuromuscular maturation and the effects of long-term training.

Our study found statistically significant differences in CMJ performance between the U13 (24.39 ± 3.40 cm), U14 (26.13 ± 4.81 cm), and U15 (30.38 ± 6.44 cm) categories. Post-hoc analyses revealed that this difference was due to the U15 group demonstrating significantly higher jump performance compared to both the U13 and U14 groups. These CMJ values obtained are generally consistent with the findings of studies on similar age groups in the literature. Malina et al. (2004) reported average values of 29.3 ± 4.6 cm in 13-15-year-old soccer players, while Pienaar and Viljoen (2010), reported an average value of 29.4 cm in the 14-year-old group. Similarly, Kaplan et al. (2016) reported 24.0 cm in the 9-13 age range, while Kumartaşlı et al. (2014), reported 23.4 cm in the 10-12 age group. Our results for the U13 and U14 groups are parallel to these findings. On the other hand, some studies have reported higher results than those obtained in our study, especially for the U15 age group. Polat et al. (2003) reported CMJ performance of 47.78 cm in the U15 age group, while Eyuboğlu and Aslan (2016), reported CMJ test results of 53.0 cm in the same age group. Contrary to these results and in contrast to our study findings, Akkoç and Göksu (2020), reported 27.31 cm in their study, while Uslu et al. (2022) reported 30.03 cm. Williams et al. (2011), reported much higher averages (44.9 ± 3.2 cm and 47.9 ± 5.7 cm) in the 12-13 age group. These differences may be attributed to methodological and demographic factors such as the training history of the study populations, their level of biological

maturity, the measurement protocol used, and the positions played by the athletes. While the findings of the present study support the general trend of vertical jump performance increasing with age, the wide range of values in the literature emphasizes the importance of considering contextual factors when comparing this performance parameter.

In conclusion, this study reveals that speed, agility, and vertical jump performance values in young football players increase across chronological age groups, and the gradual improvement between age groups differs according to the performance parameter. The findings show that higher values are achieved in the U15 age group, especially in performance indicators related to explosive properties. Coaches can be advised to focus on basic speed and running technique in the U13–U14 period, taking into account age-related differences in the physical performance profiles of young football players; and to integrate training with higher neuromuscular load and change-of-direction focus to support agility and vertical jump performance in the U15 period and beyond. However, due to the cross-sectional design of the study, individual performance changes could not be monitored and the level of biological maturation could not be assessed; this should be considered an important limitation in interpreting the findings.

Ethics Committee Permission Information

Ethics review board: Mersin University Sports Sciences Ethics Committee
Date of ethics review document: 20/10/2025
Number of ethics review document: 079

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