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Age-Related Differences in Physical Fitness Components of Youth Football Players

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Abstract

This study aimed to investigate differences in selected physical fitness components between U13 and U15 youth football players using standardized field-based tests. A cross-sectional comparative design was employed with 36 male youth football players (U13: n = 18, mean age 12.7 ± 0.4 years; U15: n = 18, mean age 14.6 ± 0.5 years) from organized training programs at university ground, Bengaluru. All participants had at least two years of systematic football training and were free from recent injuries. Physical fitness was assessed using the 30 m sprint test (linear speed), the standing long jump (lower-body explosive power), the Illinois agility test (change-of-direction ability), and the Yo-Yo Intermittent Recovery Test Level 1 (aerobic endurance). Data were analyzed using independent-samples t-tests and Cohen's d effect sizes ($p < 0.05$). Statistically significant differences were found between groups in all measured variables ($p < 0.001$). U15 players outperformed U13 players with faster 30 m sprint times (4.41 ± 0.27 s vs. 4.82 ± 0.31 s, t = 4.12, d = 1.38), greater standing long jump distances (1.95 ± 0.18 m vs. 1.72 ± 0.15 m, t = −3.89, d = 1.40), quicker Illinois agility test times (16.93 ± 0.69 s vs. 18.21 ± 0.74 s, t = 5.06, d = 1.45), and higher Yo-Yo IR1 distances (1420 ± 260 m vs. 910 ± 210 m, t = −6.01, d = 2.15). All effect sizes were larger.

Keywords: Youth Football, Age-Related Differences, Sprint Performance, Agility, Aerobic Endurance, Physical Fitness.

1. Introduction

Football performance relies heavily on physical fitness components, including linear speed, explosive power, change-of-direction ability, and aerobic endurance. During early adolescence, these attributes develop alongside biological maturation and systematic training exposure, which may differentially influence performance outcomes across age groups.

Physical fitness represents one of several key factors influencing performance in youth football, contributing to players' capacity to meet the physical and technical demands of training and competition across different stages of development. During adolescence, football-specific performance is shaped by a complex interaction of growth-related changes, neuromuscular development, and accumulated training stimuli, which together affect speed, power, agility, and endurance capacities. These components do not develop uniformly, and their expression may vary substantially between age groups even within relatively narrow chronological ranges. Consideration of how multiple physical fitness attributes

manifest across adjacent youth categories is important for interpreting performance differences and aligning training demands with players' developmental characteristics.

2. Review of Related Literature

During childhood and adolescence, players experience rapid physiological, neuromuscular, and morphological changes associated with growth and biological maturation. These changes strongly influence physical performance and may lead to substantial differences among players across age categories. Consequently, consideration of age-related variations in physical fitness is essential for coaches, physical education teachers, and sport scientists who aim to design appropriate training programs and to ensure healthy and sustainable development in young football players.

Youth football development systems are typically organized by chronological. While this classification is practical for competition and training organizations, it does not always reflect individual differences in biological maturation. Nevertheless, age-group-based analysis remains a widely used and valuable approach for examining developmental trends in physical fitness and performance. Research focusing on age-related differences can provide reference values that help practitioners evaluate player development and identify appropriate training priorities for each age group.

Speed and agility are particularly important physical attributes in football, as decisive game actions such as winning duels, creating space, and reacting to opponents often occur within very short time frames. Studies have indicated that sprint performance over short distances and change-of-direction ability improves markedly during early and mid-adolescence. Similarly, lower-body explosive power, commonly assessed through jumping tests, shows significant age-related progression. It is closely associated with sprinting and agility performance in youth soccer players.

From a practical perspective, a lack of age-specific reference data may lead coaches to apply similar training loads and physical demands across different age groups. This approach may increase the risk of overtraining or injury in younger players. Conversely, insufficient physical stimulus may limit performance development in older players. Therefore, research that identifies age-related differences in physical fitness can support more individualized and developmentally appropriate training approaches.

Analysis of research findings has shown that physical fitness components in youth football develop progressively with age, reflecting the combined influence of biological maturation and systematic training exposure. Researchers emphasize that attributes such as speed, power, agility, and aerobic endurance play a critical role in shaping performance during key developmental stages of adolescence. At the same time, the multifactorial nature of physical development and the close proximity of certain age categories highlight unresolved aspects related to the interpretation of age-related differences and their practical implications for training and assessment.

3. Methodology

A total of 36 male youth football players volunteered for the study. Participants were divided into two age groups based on chronological age: U13 (n = 18; mean age 12.7 ± 0.4 years) and U15 (n = 18; mean age 14.6 ± 0.5 years). All participants were actively involved in organized football training and

competition at the time of the study and had at least two years of systematic training experience. Players trained three to four times per week and regularly participated in weekend matches.

Testing Procedures

After completion of the warm-up exercise, physical fitness testing was conducted on an outdoor football field under standardized conditions. All tests were completed during the competitive season to ensure that players were in regular training condition. Testing sessions were scheduled in the afternoon to coincide with the players' usual training time. Environmental conditions, including temperature and surface type, were consistent for all participants.

Physical Fitness Tests

30 m Sprint Test: Linear sprint speed was assessed using the 30 m sprint test. Players performed two maximal sprints over a 30 m distance from a standing start. Electronic timing gates were installed at the start and finish lines to ensure accurate timing. The best time recorded from the two trials was used for statistical analysis. A rest period of at least three minutes was provided between trials.

Standing Long Jump: Lower-body explosive power was evaluated using the standing long jump test. Participants stood behind a take-off line with their feet shoulder-width apart and performed a maximal forward jump using a two-foot take-off. Arm swing was permitted. Two trials were performed, and the longest distance achieved was recorded to the nearest centimeter.

Illinois Agility Test: Change-of-direction speed and agility were assessed using the Illinois agility test. The test setup consisted of a rectangular course with cones placed according to standardized guidelines. Players were instructed to complete the course as quickly as possible while following the designated running pattern. Time was recorded using electronic timing gates. Two trials were conducted with adequate recovery, and the fastest time was selected for analysis.

Yo-Yo Intermittent Recovery Test Level 1 (Yo-Yo IR1) [17]. Aerobic endurance capacity was assessed using the Yo-Yo Intermittent Recovery Test Level 1. The test consists of repeated 20 m shuttle runs performed at progressively increasing speeds and interspersed with 10 s active recovery periods. An audio signal controlled the running pace. The test was terminated when a player failed to reach the finish line in time with the audio signal on two occasions. The total distance covered was recorded and used as the performance indicator.

4. Analysis and Interpretation of the Data

Data were analyzed using SPSS statistical software. Descriptive statistics, including the mean and standard deviation (mean ± SD), were calculated for all variables. The normality of data distribution was assessed using the Shapiro–Wilk test. Independent-samples t-tests were conducted to examine differences between U13 and U15 players for each physical fitness variable. The level of statistical significance was set at $p < 0.05$. Effect sizes (Cohen's d) were calculated to determine the magnitude of the observed differences between age groups.

Results

Descriptive statistics and results of between-group comparisons for all measured physical fitness variables in U13 and U15 football players are presented in Table 1. Differences in central tendency and variability were observed between the two age groups across all tested variables.

Table1. Comparison of physical fitness variables between U13 and U15 football players

Variable	U13 (Mean ± SD)	U15 (Mean ± SD)	t	p
30 m sprint (s)	4.82 ± 0.31	4.41 ± 0.27	4.12	< 0.001
Standing long jump (m)	1.72 ± 0.15	1.95 ± 0.18	−3.89	< 0.001
Illinois agility test (s)	18.21 ± 0.74	16.93 ± 0.69	5.06	< 0.001
Yo-Yo IR1 (m)	910 ± 210	1420 ± 260	−6.01	< 0.001

For sprint performance, the mean 30 m sprint time for U13 players was 4.82 ± 0.31s, whereas U15 players recorded a mean time of 4.41 ± 0.27s. Standing long jump performance showed a mean distance of 1.72 ± 0.15 m in the U13 group and 1.95 ± 0.18 m in the U15 group. In the Illinois agility test, U13 players completed the test in 18.21 ± 0.74s, while U15 players completed it in 16.93 ± 0.69s.

Aerobic endurance performance, assessed using the Yo-Yo Intermittent Recovery Test Level 1, indicated that U13 players covered a mean distance of 910 ± 210m. In contrast, U15 players covered 1420 ± 260m.

Independent-samples t-test results demonstrated statistically significant differences between U13 and U15 players for all measured physical fitness variables ($p < 0.05$). Significant between-group differences were observed for the 30 m sprint ($t = 4.12$, $p < 0.001$), standing long jump ($t = -3.89$, $p < 0.001$), and Illinois agility test ($t = 5.06$, $p < 0.001$). Analysis of Yo-Yo IR1 performance also revealed a statistically significant difference between age groups ($t = -6.01$, $p < 0.001$).

Effect size analysis of using Cohen's d revealed large effects for all variables. Effect sizes were 1.38 for the 30 m sprint, 1.40 for the standing long jump, 1.45 for the Illinois agility test, and 2.15 for the Yo-Yo IR1. These values indicate substantial differences between the age groups.

5. Conclusions

The findings of this study indicate that physical fitness characteristics in youth football players differ systematically between U13 and U15 age groups during early adolescence. Statistically significant differences were observed across all assessed variables, including sprint speed, lower-body explosive power, agility, and aerobic endurance, with higher values consistently recorded in the older age group. These results reflect age-related changes associated with biological maturation and accumulated training exposure, highlighting the non-uniform development of physical fitness components during adolescence. The observed differences emphasize that even relatively small age gaps may be accompanied by substantial variation in physical performance capacities among youth football players.

Overall, the study contributes to a clearer characterization of age-related physical fitness profiles in youth football and supports the use of standardized field-based testing to document developmental

trends across age categories. Such evidence may assist in improving the interpretation of physical performance outcomes within youth football development systems.

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