UNIVERSITY ARENA – Journal of Physical Education, Sport and Health, vol. 8, issue 5, 2025, p. 80-86
ISSN 2602-0440, ISSN-L 2602-0440
DOI: https: //doi.org/10.62229/UaViii_5_25-11

RELATIONSHIP BETWEEN WAIST CIRCUMFERENCE AND PHYSICAL PERFORMANCE IN YOUTH SOCCER PLAYERS AGED U9–U13 IN TIRANA

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Abstract. *Purpose:* This study aimed to investigate the relationship between waist circumference and two key physical performance indicators (agility and sprint speed) among youth soccer players aged U9 to U13 in Tirana, Albania.
Methods: A total of 68 male youth soccer players were assessed for waist circumference, agility using the 10×5 meter shuttle run, and speed through a 20-meter sprint test. Pearson correlation analysis was conducted for the entire sample (Table 2) and separately by age groups.
Results: In the total sample, waist circumference showed a weak and non-significant correlation with both agility (r = 0.234, *p* = 0.055) and sprint performance (r = 0.086, *p* = 0.484). However, age-specific analysis revealed stronger associations. In the U11 group, waist circumference was significantly correlated with slower agility (r = 0.447, *p* = 0.017) and sprint times (r = 0.542, *p* = 0.003). In the U13 group, a significant correlation was observed with agility (r = 0.488, *p* = 0.025) and a near-significant trend with sprint (r = 0.399, *p* = 0.073). No significant correlations were found in the U9 group.
Conclusion: While waist circumference does not appear to strongly influence agility or sprint performance in the overall sample, its impact becomes more evident in older age groups. These findings highlight the importance of monitoring body composition as part of physical development and performance assessment in youth soccer training programs.

Keywords: youth soccer, waist circumference, agility, sprint performance, physical fitness,

Introduction

The relationship between waist circumference and physical performance in youth soccer players aged U9–U13 is a significant consideration in the development and assessment of young athletes. Waist circumference serves as an important indicator of body composition, which has been shown to influence athletic performance across various measures, including strength, speed, and overall agility. In the context of youth soccer players, studies have investigated how anthropometric characteristics correlate with physical performance (Muca. 2022), providing valuable insights into how these factors can influence the development of players aged 9 to 13 years. Firstly, waist circumference is an anthropometric measurement associated with body fat percentage and lean body mass, both of which are essential for athletic performance. Research indicates that higher levels of fat-free mass are associated with improved physical capabilities such as agility and explosive power among youth soccer players (Chauchat et al., 2023). This relationship suggests that excessive waist

circumference may correspond to diminished physical performance, particularly in dynamic sports like soccer where agility and sprinting are vital. Furthermore, metrics such as body fat percentage have been shown to negatively affect aspects like sprint performance and vertical jumping–key components for soccer players looking to excel (Bongiovanni et al., 2020; Leão et al., 2022).

Moreover, findings have demonstrated that physical performance metrics including the Yo–Yo test and Counter Movement Jump (CMJ) can significantly predict tactical performances of soccer players as these assessments correlate with physiological factors, including waist circumference and overall body composition (Borges et al., 2018). Elevated body fat, often reflected by increased waist circumference, can impair an athlete's agility and endurance, thus affecting their overall performance on the field (Rice et al., 2022). Studies have also highlighted factors such as relative age, physical maturity, and training load in the development of youth players. Research indicates that younger and less mature players may face challenges due to their physical composition (Towlson et al., 2017; Kaľata et al., 2021). As players mature, the impact of waist circumference on their physical capabilities may evolve. This underscores the importance of developing strength and conditioning programs that specifically address and monitor body composition metrics, ensuring players maintain appropriate physical profiles for optimal performance (Goto & Saward, 2020; Ateş, 2018).

Finally, the relationship between waist circumference and physical performance may also intertwine with cognitive and technical development, as improved physical readiness often correlates with better decision-making in tactical scenarios during matches (Baccouch et al., 2024; Notarnicola et al., 2019). Thus, a multi-faceted approach that addresses both physical and psychological domains is necessary to optimize performance and development in youth soccer players.

This study aimed to investigate the relationship between waist circumference and two key physical performance indicators (agility and sprint speed) among youth soccer players aged U9 to U13 in Tirana, Albania.

Methods

Participants

This study included 68 male youth soccer players aged 8 to 13 years, recruited from soccer teams in Tirana, Albania. The participants were grouped according to their age category: U9 (n = 19), U11 (n = 28), and U13 (n = 21). All participants had at least one year of structured soccer training experience. Parental consent and child assent were obtained prior to participation, and the study was conducted in accordance with the ethical standards of the Declaration of Helsinki.

Measurements

Three key variables were assessed: Waist Circumference (WC**)**: Waist circumference was measured using a non-elastic flexible tape at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest. Measurements were taken to the nearest 0.1 cm, with participants standing upright and breathing normally. Agility – 10×5 m Shuttle Run**:** This test assessed the players' ability to change direction rapidly. Participants sprinted back and forth over a 5-meter distance 10 times as quickly as possible. Timing was recorded using a stopwatch to the nearest 0.01 second. This test is widely accepted as a valid indicator of agility in youth athletes (Santos et al., 2011). Speed – 20 m Sprint Test: Straight-line sprinting speed was assessed over 20 meters using a manual stopwatch. Each participant completed the sprint from a standing start, and the best time from two trials was recorded in seconds.

Procedures

All measurements were conducted during regular training sessions on artificial turf under similar weather conditions. Participants were instructed to wear athletic clothing and football boots.

A standardized warm-up consisting of light jogging, dynamic stretching, and short sprints was conducted before testing. Each physical test was explained and demonstrated before administration.

Statistical Analysis

Data were analysed using IBM SPSS Statistics version 25. Descriptive statistics (mean and standard deviation) were calculated for each variable. Pearson's correlation coefficients (2-tailed) were used to examine the relationships between waist circumference and both agility and sprint performance, first for the total sample and then separately for each age group (U9, U11, U13). Statistical significance was set at $p < .05$, with results also noted at the $p < .01$ level where applicable. Effect size interpretations for correlation coefficients followed Cohen's (1988) guidelines, where $r = .10–.29$ indicates a small effect, .30–.49 a moderate effect, and ≥.50 a large effect.

Results

Table 1. Descriptive Statistics of Physical Fitness Measures in Youth Soccer Players (U9–U13) in Tirana

	Mean	Std. Deviation	N
Waist Circumference	68.103	9.8982	68
Agility 10x5m	21.756	1.6452	68
Sprint 20m	4.426	.5187	68

Table 1 presents descriptive statistics for three key physical fitness indicators–waist circumference, agility (10×5 meter shuttle run), and sprint performance (20 meters)–among 68 youth soccer players aged U9 to U13 in Tirana. The average waist circumference was 68.10 cm, reflecting general body size within this age and athletic group. The mean agility time was 21.76 seconds, with a relatively small standard deviation, indicating consistent performance across players. The average 20-meter sprint time was 4.43 seconds, showing a good level of speed typical for trained children in this age group.

Table 2. Correlation Between Waist Circumference and Physical Performance Measures in Youth Soccer Players (U9–U13) in Tirana

		Agility 10x5m	Sprint 20m
Waist Circumference	Pearson Correlation	.234	.086
	Sig. (2-tailed)	.055	.484
	Sum of Squares and Cross-products	254.960	29.721
	Covariance	3.805	.444
	N	68	68

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2 shows the correlation analysis between waist circumference and two performance measures–agility (10×5 meter shuttle run) and sprint (20 meters)–in 68 youth soccer players aged U9 to U13 in Tirana. A weak positive correlation was observed between waist circumference and agility ($r = 0.234$), approaching statistical significance ($p = 0.055$), suggesting a trend where greater waist circumference may be associated with slightly slower agility performance, though the result is not statistically conclusive at the 0.05 level. The correlation between waist circumference and sprint

performance was very weak (r = 0.086) and not statistically significant (p = 0.484), indicating no meaningful relationship in this sample.

Table 3. Descriptive Statistics of Physical Measures by Age Group (U9, U11, U13) in Youth Soccer Players in Tirana

Age Group		Mean	Std. Deviation	N
U9	Waist Circumference	64.632	7.8117	19
	Agility 10x5m	22.474	2.0419	19
	Sprint 20m	4.945	.3032	19
U11	Waist Circumference	67.607	9.6469	28
	Agility 10x5m	21.917	1.3902	28
	Sprint_20m	4.424	.4547	28
U13	Waist Circumference	71.905	10.9859	21
	Agility 10x5m	20.890	1.1799	21
	Sprint 20m	3.959	.2334	21

Table 3 presents the mean and standard deviation of waist circumference, agility, and sprint performance across three age groups (U9, U11, and U13) of youth soccer players in Tirana. A clear trend is observed in all three variables with increasing age. Waist circumference increases steadily from U9 (mean = 64.63 cm) to U13 (mean = 71.91 cm), reflecting natural growth and development. Agility performance, as measured by the 10×5 meter shuttle run, improves with age (lower times indicate better performance), decreasing from a mean of 22.47 seconds in U9 to 20.89 seconds in U13. Similarly, sprint performance over 20 meters improves significantly with age, with the average time dropping from 4.95 seconds in U9 to 3.96 seconds in U13.

Table 4. Correlation Between Waist Circumference and Performance Measures in U9 Youth Soccer Players in Tirana

Age Group			Agility 10x5m	Sprint 20m
U9	Waist Circumference	Pearson Correlation	.298	.389
		Sig. (2-tailed)	.216	.100
		Sum of Squares and Cross-products	85.479	16.563
		Covariance	4.749	.920
		N	19	19

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4 displays the correlation between waist circumference and two physical performance variables–agility and sprint speed–among U9 youth soccer players in Tirana. A moderate positive correlation was found between waist circumference and agility time (r = 0.298) and sprint time (r = 0.389), suggesting a tendency for players with larger waist circumferences to perform slightly worse (i.e., have higher times) in these tasks. However, these correlations did not reach statistical significance at the conventional 0.05 level (p = 0.216 for agility and p = 0.100 for sprint), likely due to the small sample size (N = 19).

Table 5. Correlation Between Waist Circumference and Performance Measures in U11 Youth Soccer Players in Tirana

Age Group			Agility 10x5m	Sprint 20m
U11	Waist Circumference	Pearson Correlation	.447*	.542**
		Sig. (2-tailed)	.017	.003
		Sum of Squares and Cross-products	161.822	64.199
		Covariance	5.993	2.378
		N	28	28

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table 5 presents statistically significant correlations between waist circumference and physical performance measures in U11 youth soccer players in Tirana. A moderate positive correlation was observed between waist circumference and agility time (r = 0.447, p = 0.017), as well as between waist circumference and 20-meter sprint time (r = 0.542, p = 0.003).

Table 6. Correlation Between Waist Circumference and Performance Measures in U13 Youth Soccer Players in Tirana

Age Group			Agility 10x5m	Sprint 20m
U13	Waist Circumference	Pearson Correlation	.488*	.399
		Sig. (2-tailed)	.025	.073
		Sum of Squares and Cross-products	126.410	20.457
		Covariance	6.320	1.023
		N	21	21

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table 6 shows the correlation between waist circumference and physical performance among U13 youth soccer players in Tirana. A statistically significant moderate positive correlation was found between waist circumference and agility time (r = 0.488, p = 0.025), indicating that players with larger waist circumferences tend to perform worse in agility tasks. The correlation between

waist circumference and sprint performance (r = 0.399) was also moderate but did not reach statistical significance (p = 0.073), although it suggests a similar trend.

Discussion

The findings of this study indicate that waist circumference, a common anthropometric indicator of central adiposity, is modestly associated with physical performance measures such as agility and sprinting ability in youth soccer players, particularly in older age groups. While the overall correlation across the full sample (U9–U13) was weak and statistically non-significant, age-specific analyses revealed stronger and more significant relationships, particularly among U11 and U13 players. These results align with previous literature suggesting that increased adiposity can negatively impact physical performance in youth athletes. Excess body fat, especially around the abdomen, contributes to a higher inertial load during movement, which can impair sprinting and agility–two key components in soccer performance (Ortega et al., 2008; Malina et al., 2004). The moderate and significant correlations found in the U11 and U13 groups support the notion that as children age and the demands of sport increase, the influence of body composition on physical capacity becomes more evident (Faigenbaum et al., 2009). Interestingly, no significant correlations were observed in the U9 group, which may be attributed to lower biological maturity levels, reduced training exposure, or smaller variation in body composition within this age category. This finding is consistent with studies suggesting that the relationship between anthropometric traits and physical performance strengthens with age and training experience (Malina et al., 2000).

The stronger association in older children also suggests that waist circumference could serve as a practical screening tool for coaches and sports scientists aiming to monitor fitness and tailor conditioning programs. In particular, central adiposity may not only reflect excess fat but could also be a marker of overall health risk, even in athletic populations (Katzmarzyk et al., 2004). However, this study has some limitations. The sample size within each age group was relatively small, potentially affecting the statistical power of correlation estimates. Moreover, only waist circumference was used as a proxy for body composition; more comprehensive assessments such as body mass index (BMI), skinfold thickness, or body fat percentage would provide a clearer picture of how adiposity relates to physical performance. Additionally, factors such as training history, nutrition, and maturity status were not controlled for, which may confound the observed relationships. Despite these limitations, the present findings offer valuable insight into how body composition relates to athletic performance in youth soccer and emphasize the need for age-specific monitoring strategies. Longitudinal studies with larger and more diverse samples are recommended to explore causal relationships and track changes over time.

Conclusion

The analysis revealed a weak, non-significant positive correlation between waist circumference and both agility (r = 0.234, p = 0.055) and sprint performance (r = 0.086, p = 0.484). These results suggest that, across the full sample of youth soccer players (U9–U13), waist circumference has limited predictive value for agility and sprinting ability. When analysed by age group, stronger and more meaningful correlations emerged. In the U11 group, waist circumference was significantly associated with both slower agility (r = 0.447, p = 0.017) and sprint performance (r = 0.542, p = 0.003). Similarly, in the U13 group, waist circumference showed a significant correlation with reduced agility (r = 0.488, p = 0.025) and a near-significant trend with sprint (r = 0.399, p = 0.073). In contrast, no significant correlations were found in the U9 group. These findings suggest that the negative impact of increased waist circumference on agility and speed becomes more pronounced with age in youth soccer players.

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