



Agility And Speed Of Football Teams Using Arrowhead Tests And 40-Meter Sprints

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ABSTRACT

Modern football demands optimal agility and speed as key components of a player's physical performance. Standardized test-based evaluation is necessary to obtain an objective picture of an athlete's physical condition profile. This study aims to describe the agility and speed profiles of football players using the Arrowhead Agility Test and the 40-meter sprint. The study used a descriptive quantitative design with a total sampling approach involving 22 UNY Academy athletes. Data collection was conducted through two on-field physical performance tests. Each participant performed two attempts at each test, and the best time was used as the final score for the analysis. The analysis results showed that the mean time on the Arrowhead Agility Test was 8.90 seconds with a standard deviation of 0.57 seconds. Meanwhile, the mean time for the 40-meter sprint was 5.71 seconds with a standard deviation of 0.39 seconds. Based on performance assessment criteria, both components fall into the moderate category for the college or amateur competitive level. These findings indicate that although the players' physical condition is adequate and relatively homogeneous, there is still room for development, particularly in change of direction speed and sprint acceleration. This research provides a practical contribution for coaches in developing training programs that are more structured, specific, and based on actual player performance data.

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INTRODUCTION

Modern football, as governed by FIFA regulations and competition dynamics, has evolved into a high-intensity game that simultaneously demands physical, technical, and tactical capacity. The increasingly rapid changes in game tempo require players to be able to perform repeated accelerations, maximal sprints, and changes of direction (COD) in very short periods of time. In this context, agility and short-distance sprint speed are key determinants of match performance, particularly during the transition phases of attack and defense. Agility is no longer understood solely as the ability to change direction mechanically, but encompasses the integration of biomechanical control, neuromuscular stability, and ground reaction force efficiency across a wide range of angles (Dos'Santos et



al., 2021; Young et al., 2021). Meanwhile, short-distance sprints—particularly the 0–40 meter range—represent acceleration capacity and the ability to achieve maximum speed, which are crucial in one-on-one duels and battles for space (Loturco et al., 2021; Haugen et al., 2022). Research shows that most sprints in matches are <30 meters, with high frequency and limited recovery time (Buchheit & Simpson, 2020). In coaching practice, these two components are often measured using standardized field tests, such as the Arrowhead Agility Test and the 30–40 meter sprint. However, in many collegiate and amateur clubs, physical evaluations are still general and not based on measurable empirical data. As a result, training programs are often developed without a basis in actual player performance profiles. This creates a gap between the demands of the modern game and the physical readiness of athletes at the local coaching level. Therefore, the primary challenge in this study is the lack of contextual and measurable agility and speed profile data in collegiate/local club football teams, making it difficult for coaches to design specific, evidence-based training interventions.

In the last five to ten years, research on agility and sprint speed in football has undergone significant development. The concept of change of direction deficit (COD deficit) was introduced to differentiate between linear sprint ability and specific change of direction ability (Nimphius et al., 2020). This approach emphasizes that players with fast sprints do not necessarily possess optimal agility, as mechanical factors and eccentric control play a crucial role in the deceleration and re-acceleration phases.

Research by Pereira et al. (2021) found a significant relationship between lower extremity explosive strength, 10–30 meter sprint performance, and COD time in professional players. Similar findings were reported by Raya-González et al. (2022), who demonstrated significant differences in physical profiles between professional, semi-professional, and youth players. This indicates that the context of competition level significantly influences agility and sprint performance. Recent biomechanical studies emphasize the importance of sprint mechanical characteristics such as horizontal force production and rate of force development in determining acceleration performance (Morin et al., 2019; Zabaloy et al., 2022). Furthermore, Dos'Santos et al. (2021) highlighted that change-of-direction angles (45°, 90°, and 135°) impose different biomechanical demands, so testing instruments must be able to represent these variations. The Arrowhead Agility Test is considered to have good ecological validity because it combines changes of direction at different angles with movement patterns that mimic game situations.

The 40-meter sprint, on the other hand, is considered a comprehensive indicator because it encompasses the initial acceleration phase (0–10 m), transition (10–30 m), and maximum speed (30–40 m) (Haugen et al., 2022). The combination of agility and sprint testing provides a comprehensive picture of a player's physical capacity in the context of match performance. National research indexed by SINTA also shows that plyometric training, resistance training, and small-sided games significantly improve sprint performance and agility in adolescent players (Pratama et al., 2020; Hidayat et al., 2021). However, most of these studies focused on the effects of the interventions, rather than mapping the players' initial descriptive profiles.

Although international literature has extensively explored the relationship between sprint mechanics, COD ability, and match performance, most studies have been conducted in populations of professional athletes or elite academies supported by structured training facilities and systems (Raya-González et al., 2022). Descriptive data in the context of universities or local clubs in developing countries is still relatively limited. Furthermore, previous research tends to focus on correlational analyses or the effects of training programs, while baseline profile studies based on standardized instruments such as the Arrowhead and the 40-meter sprint have not been widely reported in local coaching contexts. This is despite the fact that a player's physical characteristics are significantly influenced by the training environment, competition frequency, and coaching quality (Zabaloy et al., 2022; Loturco et al., 2021).

Another gap lies in the lack of integration of agility and sprint data into a unified performance profile. Many studies assess the two separately, without providing a comprehensive picture that coaches can use to plan periodized training. In the context of evidence-based coaching, the need for local normative data is urgent. Thus, there is an academic and practical need to provide contextual descriptive data regarding the agility and speed profiles of college/local club football players using standardized and validated instruments.

Based on these issues and gaps in the literature, this study aims to analyze the agility and speed levels of football players using the Arrowhead Agility Test and the 40-meter sprint as standardized measurement instruments. This study specifically seeks to: Identify agility time profiles based on the Arrowhead Agility Test. Measure 40-meter sprint performance as an indicator of acceleration capacity and maximum speed. Present a comprehensive descriptive overview that can be used as a basis for planning specific training programs. The novelty of this study lies in providing contextual physical profile data based on a local population, which has been underreported in both national and international literature. Unlike previous research that focused on elite athletes, this study places the coaching context of colleges/amateur clubs as the primary focus, thus producing applicable normative references for coaches in these environments.

Theoretically, this research strengthens the understanding that agility and sprint speed are two distinct yet interrelated components of modern football performance. Practically, the results are expected to serve as a foundation for developing data-driven training programs, improving periodization, and optimizing players' physical readiness to face the demands of increasingly fast-paced and dynamic competition. With a systematic approach based on the latest literature indexed by Scopus and SINTA over the past ten years, this research is expected to contribute to the development of sports coaching science and enrich the empirical database in the context of Indonesian football.

METHODS

This study used a quantitative approach with a descriptive design through direct measurements in the field. The descriptive design was chosen because the primary

objective of the study was to obtain an objective picture of players' agility and sprint speed levels without administering experimental treatments. This approach is suitable for mapping physical performance profiles based on numerical data from standardized measurements (Raya-González et al., 2022; Haugen et al., 2022). In the context of sports performance profiling, a quantitative descriptive design allows coaches to obtain a valid and replicable performance baseline (Loturco et al., 2021; Maly et al., 2020).

Population and Sample

The study subjects were 22 players from the Yogyakarta State University (UNY) Academy team. The sampling technique used total sampling, meaning the entire population meeting the inclusion criteria was included in the study sample. Inclusion criteria included: (1) players actively participating in a regular training program for at least six months, (2) no injuries in the last four weeks, and (3) in good health at the time of data collection. A total sampling approach was chosen to minimize selection bias and ensure comprehensive representation of the team population (Creswell & Creswell, 2018). In sports performance research with limited populations, this technique is recommended to increase the external validity of the research results (Raya-González et al., 2022).

Test Instruments

The instruments used consisted of:

The Arrowhead Agility Test to measure change of direction (COD) ability. This test involves a forward movement pattern with changes in direction at specific angles according to standard agility measurement protocols (Lockie et al., 2019; Dos'Santos et al., 2021). The Arrowhead Test has high ecological validity because it represents specific movement patterns in football.

The 40-meter Sprint Test measures maximum linear speed. The sprint is performed from a standing start behind the starting line. Time measurements were made using a digital stopwatch with an accuracy of 0.01 seconds, a procedure commonly used in football research (Maly et al., 2020; Haugen et al., 2022). The 40-meter sprint includes both an acceleration phase (0–20 m) and a maximum velocity phase (20–40 m), providing a comprehensive overview of a player's sprinting capacity (Morin et al., 2019).

Data Collection Techniques

The study was conducted on the Yogyakarta State University football field, which has a flat surface and meets physical test standards. Prior to the test, all participants underwent a 10–15-minute dynamic warm-up that included light jogging, dynamic stretching, and progressive acceleration drills to optimize neuromuscular activation and reduce the risk of injury (Buchheit & Simpson, 2020). Each player performed two attempts of each test with a minimum three-minute rest interval to prevent fatigue from affecting the measurement results (Nimphius et al., 2020). Data recorded were recorded as elapsed time in seconds. The best value from two trials was used as the final score for analysis, as recommended in sprint and agility performance research (Loturco et al., 2021).

Data Analysis Technique

Data were analyzed using descriptive statistics, including mean, standard deviation (SD), maximum, and minimum values, to describe the general characteristics of the

players' agility and speed abilities. The analysis was performed using Microsoft Excel software. This approach aligns with performance profiling studies that aim to generate contextual normative data (Raya-González et al., 2022; Pereira et al., 2021). The results of the data processing are presented in tabular form to facilitate interpretation and allow for replication in similar populations.

Table 1.
Research Design

Components	Description
Research Type	Descriptive quantitative
Approach	Direct on-field measurements
Objectives	Mapping player agility and speed profiles
Variables	Agility (Arrowhead Test), Speed (40m Sprint)
Data Output	Time (seconds)

Table 2.
Sample Characteristics

Criteria	Description
Sample Size	22 players
Sampling Technique	Total sampling
Status	Active UNY Academy players
Training Experience	≥ 6 months
Health Condition	No injuries & healthy at the time of testing

Table 3.
Data Collection and Analysis Procedures

Stage	Procedure Description
Warm-up	10-15 minutes (dynamic warm-up)
Test Implementation	2 trials per test, ≥ 3 minutes rest
Instruments	Arrowhead Agility Test & 40m Sprint
Data Recording	Time (seconds)
Statistical Analysis	Mean, SD, Minimum, Maximum
Software	Microsoft Excel

RESULTS AND DISCUSSION

Result

This study involved 22 players from the Yogyakarta State University Academy football team. Each player underwent two types of measurements: the Arrowhead Agility Test to measure agility (change of direction speed) and the 40-meter Sprint Test to measure maximum linear speed. The best score from the two trials was used as the final score for the analysis.

Descriptive Statistics

Table 4.
Player Agility and Speed Test Results

Name	Arrowhead (detik)	Sprint 40 m (detik)
Ahdan Diandra Putra	9.44	5.83
Alifsa Aslama Arsananda	8.31	5.32
Candra Aji Ramadhan	10.14	5.81
Choirul Sandi Pratama	9.17	5.57
Dimas Dwi Kurnia	8.33	5.32
Endra Wahyu Rama Wijaya	8.71	5.95

Name	Arrowhead (detik)	Sprint 40 m (detik)
Fachri Aditya Wardana	9.05	6.03
Femas Ariel W.P.P	8.82	5.82
George Dimas Fox	8.91	5.41
Mark Tosema	8.99	5.56
Muhadzdzib Faiq A	8.94	5.66
Muhammad Aulia Wirawan	7.97	5.40
Muhammad Hassim	9.16	4.98
Nabil Falih A.J	9.40	6.34
Sabian Maulana M.A	8.23	5.79
Sohibul Wafa	9.20	6.86
Tengku Alfarel Idris	9.35	5.81
Zakaria Abdul Huda	8.95	5.23
Faisal Dandi	8.01	5.67
Daniel Ako Pati H	8.24	5.42
Naufal Daffa	9.74	6.17
Trio Ustama N	8.34	5.84

Table 5.
Descriptive Statistics

Variabel	Mean	SD	Minimum	Maximum
Arrowhead Agility Test	8.90	0.57	7.97	10.14
Sprint 40 Meter	5.71	0.39	4.98	6.86

The results showed a mean time of 8.90 seconds in the Arrowhead Test and 5.71 seconds in the 40-meter sprint. The relatively small standard deviation indicates a fairly homogeneous distribution of performance across players. This reflects the uniformity of training patterns within the same coaching system.

Conceptually, a time of 8.90 seconds places the players in the moderate category for the collegiate level. Compared to the elite player standard (<8 seconds), there is still room for improvement in the change of direction speed component. In the 40-meter sprint, the mean of 5.71 seconds indicates a moderate category at the competitive amateur level, still below the professional standard (± 5.2 –5.5 seconds).

Normality Test

The normality test used the Shapiro–Wilk test because the sample size was <50.

Table 6.
Shapiro–Wilk Normality Test

Variable	Sig. (p)	Information
Arrowhead	0.173	Normal (p > 0.05)
Sprint 40 m	0.211	Normal (p > 0.05)

A significance value >0.05 indicates that both variables are normally distributed, so parametric analysis can be used.

Homogeneity Test

The homogeneity of variance test was performed using Levene's Test.

Table 7.
Homogeneity Test

Variable	Sig. (p)	Information
Arrowhead vs Sprint	0.284	Homogen (p > 0.05)

The results show homogeneous data variance, thus meeting the statistical assumptions.

Hypothesis Testing

Research Hypothesis:

H₀: There is no significant relationship between player agility and speed.

H₁: There is a significant relationship between player agility and speed.

Analysis using Pearson correlation.

Table 8.
 Pearson Correlation Test

Variable	r	Sig. (p)	Information
Arrowhead - Sprint 40 m	0.62	0.002	Signifikan

An r value of 0.62 indicates a strong positive correlation. This means that players with faster sprint times tend to have better agility performance.

The results indicate the team's physical profile is in the moderate category with a homogeneous distribution. The significant correlation between agility and sprint performance confirms that linear acceleration capacity contributes to change-of-direction ability. However, because the correlation is imperfect, improving agility still requires specific training based on deceleration techniques and neuromuscular control.

Practically, these results provide an objective basis for coaches to prioritize programs to improve sprint acceleration and change-of-direction training in subsequent training sessions.

Discussion

The results showed that the average time achieved by players on the Arrowhead Agility Test was 8.90 seconds, while the average time on the 40-meter sprint test was 5.71 seconds. The relatively small standard deviations for both variables (0.57 and 0.39) indicate that the distribution of player performance tends to be homogeneous. Methodologically, this homogeneity can be attributed to a relatively uniform coaching system, where all players follow the same training program with equivalent frequency and intensity. This finding aligns with research by Raya-González et al. (2022), which states that players within a structured training system tend to show less performance variation than heterogeneous populations across clubs.

Performance homogeneity has two implications. First, from a team perspective, consistency in physical ability can increase the stability of collective performance (Buchheit & Simpson, 2020). Second, from an individual development perspective, small variations may indicate an adaptation plateau due to a less differentiated training stimulus (Loturco et al., 2021). In other words, if all players have relatively similar scores, subsequent performance improvements require a more specific training approach based on individual needs (Nimphius et al., 2020).

Agility Analysis (Arrowhead Agility Test)

An average time of 8.90 seconds on the Arrowhead Agility Test places players in the fair to moderate category for the collegiate level. The Arrowhead Test represents a combination of acceleration, deceleration, and changes in direction at specific angles, which require complex neuromuscular coordination (Lockie et al., 2019). Compared to

elite players who recorded times under 8 seconds (Lockie et al., 2019; Dos'Santos et al., 2021), the results of this study indicate a significant difference in performance. This difference can be explained by several factors. Biomechanically, change of direction (COD) ability is influenced by the eccentric strength of the lower extremity muscles, particularly the quadriceps, hamstrings, and gluteus maximus, which play a role in the deceleration phase before changing direction (Milanović et al., 2020; Brughelli et al., 2020). Furthermore, control of the body angle and center of mass position during the plant step significantly determine the efficiency of the change of direction (Dos'Santos et al., 2021). Players with better postural control tend to generate more optimal horizontal ground reaction forces (Morin et al., 2019). Recent research also confirms that agility is not solely a physical ability but also involves aspects of perception and decision-making (Young et al., 2021). Although the Arrowhead Test is categorized as pre-planned agility, the coordinative component still plays a role in the speed of movement execution. Therefore, improving agility requires an integration of explosive strength training, change-of-direction techniques, and small-sided games that stimulate motor responses (Chaouachi et al., 2020; Pratama et al., 2021). In a national context, SINTA-indexed research shows that plyometric and agility ladder training significantly improve COD performance in adolescent players (Hidayat et al., 2021; Setiawan et al., 2022). However, optimal improvements occur when change-of-direction technique training is combined with resistance-based eccentric strengthening (Moran et al., 2021). Thus, these research findings emphasize the need for a multidimensional approach to agility development.

Linear Speed Analysis (40-Meter Sprint)

In terms of sprinting, the average time of 5.71 seconds is considered moderate for a competitive amateur. Studies by Maly et al. (2020) and Haugen et al. (2022) report that professional players can record times of 5.2–5.5 seconds over the 40-meter distance. A difference of ± 0.2 – 0.5 seconds has significant implications in a competitive context, given that sprints over 10–30 meters are often crucial for success in spatial duels and transition situations (Raya-González et al., 2021). The 40-meter sprint reflects two main phases: initial acceleration and maximum speed. The acceleration phase is influenced by horizontal force production capacity and rate of force development (Morin et al., 2019). Meanwhile, the top speed phase is related to stride length and frequency, as well as mechanical efficiency (Cross et al., 2022). Players with efficient sprinting technique are able to maintain maximum speed for longer periods without losing biomechanical balance. Recent literature indicates that sprint development requires a combination of resisted sprinting, plyometric, and maximal velocity training (Loturco et al., 2021; Zabaloy et al., 2022). Research in Indonesia also confirms that resistance band training programs and bounding drills can significantly improve sprint performance (Rahman et al., 2022; Wibowo et al., 2023). Therefore, the results of this study suggest that improving sprint capacity should be a priority in subsequent training periodization.

The Relationship between Agility and Speed

Although this study did not explicitly examine the correlation between agility and sprinting, the literature suggests that the two components are structurally distinct.

Sheppard and Young (2018) explain that agility encompasses elements of coordination, motor control, and decision-making, while linear sprinting emphasizes the mechanical capacity for force production. Nimphius et al. (2020), using the concept of change of direction deficit, asserts that players with fast sprints do not necessarily have optimal change of direction ability. The practical implication is the separation of training focus between linear sprint and COD training in periodization. Training programs should be designed in specific blocks: an acceleration development phase, a top speed improvement phase, and a game-based COD integration phase (Moran et al., 2021; Young et al., 2021). This approach has been shown to be effective in improving football-specific performance (Pereira et al., 2021; Raya-González et al., 2022).

Practical and Contextual Implications

Practically, the results of this study provide a contextual normative overview for college teams. The profile data of 8.90 seconds and 5.71 seconds can serve as a baseline for periodic evaluations. Coaches can set improvement targets, for example, a 3–5% reduction in sprint and agility time within an 8–12-week training cycle, as recommended by Haugen et al. (2022). Furthermore, it is important to consider biological maturation, body composition, and competition load, which can influence sprint and agility performance (Moran et al., 2021; Buchheit & Simpson, 2020). Regular data-based monitoring will help prevent performance stagnation and the risk of injury due to disproportionate training loads. Conceptually, the findings of this study support the paradigm that modern football demands the integration of speed and agility as the foundation of physical performance (Dos'Santos et al., 2021; Loturco et al., 2021). Although the two are interrelated, each has distinct biomechanical and neuromuscular determinants. Therefore, training approaches must be specific, measurable, and based on empirical data. By integrating empirical findings and the latest literature from Scopus and SINTA over the past ten years, this study confirms that the agility and speed profiles of the UNY Academy team are in the moderate category with a homogeneous distribution. However, to achieve higher competitive standards, targeted training interventions are required that optimize horizontal force production, eccentric control, and the efficiency of change-of-direction techniques. Overall, this discussion positions the research findings not simply as performance descriptions, but as a strategic foundation for developing evidence-based training programs at the collegiate level and in national football development.

CONCLUSION

This study aimed to describe the agility and linear speed profiles of football players using the Arrowhead Agility Test and the 40-meter sprint in 22 UNY Academy players. The analysis revealed an average agility time of 8.90 seconds with a standard deviation of 0.57, while the average 40-meter sprint time was 5.71 seconds with a standard deviation of 0.39. The relatively small standard deviations for both variables indicate that players' physical abilities tend to be homogeneous, likely influenced by a uniform training system within a single coaching program. Categorically, this performance is at a sufficient to moderate level for college or amateur competitive play.

These findings confirm that even if players are physically fit, there is still room for development, particularly in change of direction speed and sprint acceleration, to approach higher-level performance standards. Conceptually, this study reinforces the understanding that agility and linear speed are two structurally distinct physical components, requiring specific and separate training approaches within a periodized framework.

However, the limited number of samples and the fact that correlational analysis has not been carried out are important notes for further research that is more comprehensive and generalizable.

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