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Analysis of 50 meters Sprint Speed Among Adolescent Track and Field Athletes

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Abstract

This study aimed to analyze the 50-meter sprint performance of adolescent track and field athletes aged 13–15 years in Tangerang City who trained at athletic clubs and development centers. A quantitative descriptive study with a cross-sectional approach was conducted involving 70 athletes (40 males and 30 females) selected using purposive sampling. Sprint performance was assessed using the standardized 50-meter sprint test from the Indonesian Physical Fitness Test (TKJI). The data were analyzed using descriptive statistics and independent-samples t-tests with a significance level of 0.05. The results showed that male athletes from development centers achieved a lower mean sprint time than athletes from athletic clubs (6.90 s vs. 7.60 s), with a statistically significant difference ($t(38) = 3.399$, $p = 0.002$; 95% CI = 0.22–0.88; Cohen's $d = 1.08$). In contrast, female athletes from development centers also recorded a lower mean sprint time than club athletes (8.00 s vs. 8.30 s), but the difference was not statistically significant ($p = 0.190$). These findings indicated differences in sprint performance among male athletes, whereas sprint performance among female athletes was comparable between the two groups. Because this study employed a cross-sectional observational design, the findings describe performance differences observed at the time of testing and should not be interpreted as evidence of the effectiveness or superiority of a particular training environment. This study provides baseline information on the sprint performance profile of adolescent athletes in Tangerang City that may support athlete monitoring and future research on factors associated with sprint performance.

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INTRODUCTION

Speed is one of the most important components of physical fitness in athletics, particularly in short-distance running events such as the 50 meter sprint (Cissik et al., 2016). Speed ability is closely related to the function of the neuromuscular system, which operates over very short periods of time through explosive muscle contraction mechanisms (Moran et al., 2018). For adolescents aged 13-15, the rapid growth phase involving the development of the nervous and muscular systems presents a golden opportunity to increase speed capacity (Lloyd & Oliver, 2012). Speed training conducted during this developmental stage has been shown to be effective in shaping long-term athletic performance (Faigenbaum & Myer, 2020).

However, achieving optimal speed is highly influenced by a structured and specific training program (Moran et al., 2018). Factors such as lower-body muscle strength, tendon reactivity, and movement coordination must be developed through a progressive and graded training approach (Cissik et al., 2016). Furthermore, individual training is crucial, as each adolescent athlete experiences biological development at a different rate (Lloyd & Oliver, 2012). The training environment, coaching quality, and training frequency also play a significant role in improving sprinting ability (Faigenbaum & Myer, 2020).

In Indonesia, data on the speed profiles of adolescent athletes based on the 50-meter sprint test is still limited (Kemenpora RI, 2021). his scarcity makes it difficult to design training programs that align with the athlete's actual strengths and weaknesses (Müller et al., 2024). The 50-meter sprint is a component of the Indonesian Physical Fitness Test (TKJI), which is designed to assess an individual's maximum speed over a short duration (Widiastuti, 2010). The 50-meter sprint test is often used as a key indicator of adolescent physical fitness, particularly in sports such as athletics that require explosive movements (Tomkinson et al., 2018).

The 50-meter sprint test reflects the ability of the ATP-PC, or anaerobic alactacid, energy system to rapidly produce energy for maximal intensity activity over a very short duration (McArdle et al., 2023). Superior results in this test often indicate the effectiveness of sprint training and the readiness of the athlete's neuromuscular system (Cissik et al., 2016). Furthermore, differences in sprint performance can serve as an indicator of differences in training quality between athletic clubs and training centers (Müller et al., 2024). Several studies have shown that speed training performed two to three times per week is sufficient to improve sprint performance in adolescents (Faigenbaum & Myer, 2020). However, this training must be integrated with running technique training, strength development, and strength training to achieve optimal results (Moran et al., 2018).

In practice, 50-meter sprint test results are often used as a basis for developing more specific training programs (Lloyd & Oliver, 2012). This evaluation is also important in identifying potential athletes who can be developed for higher-level competition (Cissik et al., 2016). Therefore, it is crucial to conduct a scientific study specifically examining the 50-meter sprint performance of adolescent athletes in Indonesia, particularly in Tangerang City. This study aims to analyze the 50-meter sprint performance of adolescent athletes aged 13-15 in Tangerang City who are members of athletic clubs or training centers.

This research is expected to provide an empirical contribution to the development of data-driven and locally-specific speed training (Müller et al., 2024). Using a quantitative descriptive approach, this study highlights performance differences between training groups and identifies factors that need improvement in the current training system. These findings will be useful for coaches, club managers, and sports policymakers in developing more targeted strategies for young athlete development (Kemenpora RI, 2021). Furthermore, these results can be used to assess the effectiveness of current training programs and encourage the optimization of adolescent sprint performance in Indonesia (Lloyd & Oliver, 2012).

METHODS

This study used a quantitative descriptive method designed to objectively and systematically describe the sprint speed levels of track and field athletes in Tangerang City (Creswell & Creswell, 2018). This method is considered appropriate because it allows researchers to obtain standardized quantitative data from sprint test results, thus allowing for

accurate and measurable interpretations of athletes' physical fitness (Sugiyono, 2019). The main focus of this study was to identify sprint performance in adolescents, particularly those affiliated with athletic clubs and training centers in the study area.

The research location was selected based on accessibility and the availability of subjects who met the research requirements (Creswell & Creswell, 2018). This research was conducted at several athletic clubs and training centers in Tangerang City. The study population included all adolescent athletes aged 13 to 15 who actively train in Tangerang City. To obtain a representative sample, a purposive sampling technique was used to select subjects who met the research criteria. Inclusion criteria included athletes who had been actively training for at least the past three months, were in good health as medically proven, and were willing to participate in all stages of the study. Exclusion criteria were used to exclude participants with a history of serious injury or other physical problems that would affect the testing process.

This study included a sample of 70 participants, consisting of 40 males and 30 females. In the club group, there were 20 males and 15 females, while in the training center group, there were 20 males and 15 females. This encompasses both genders.

The primary instrument used in the study was the Indonesian Physical Fitness Test (TKJI), a standard fitness measurement tool produced by the Ministry of Youth and Sports of the Republic of Indonesia. The test used was a 50-meter sprint, which measures running speed. The test was conducted according to the procedures outlined in the TKJI manual..

Prior to the test, the researcher collaborated with club administrators and coaches to obtain approval and explain the purpose of the study. Furthermore, parental consent was obtained in accordance with research ethics. All testing procedures were conducted with the safety, comfort, and confidentiality of the participants' data in mind. Data were collected through multiple tests, depending on the number of participants and their training schedules, to avoid fatigue that could impact test results (Association, 2013). The tests were conducted by the researcher with assistance from coaches who had been trained in physical fitness testing procedures to ensure consistent and accurate data collection. Test results were recorded in detail on observation sheets and then analyzed statistically. Data analysis was performed using SPSS with independent sample t-tests, while (Field, 2018).

Table 1. 50 meters sprint test norms

Male	Female	Score
S.d – 6,7”	S.d – 7,7”	5
6,8” – 7,6”	7,8” – 8,7”	4
7,7” – 8,7”	8,8” – 9,9”	3
8,8” – 10,3”	10,0” – 11,9”	2
10,4” - dst	12,0” – dst	1

RESULTS AND DISCUSSION

Table 2. Average results of the 50 meters sprint test for male and female athletes

Test component	Training center athletes (male)			Club athletes (male)			Training center athletes (female)			Club athletes (Female)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
50-Meters sprint	6,9	7,5	6,4	7,6	8,8	6,7	8,0	8,7	7,2	8,3	9,1	7,9

Results of the 50-meter sprint test showed that male athletes from the training center recorded a lower average sprint time than athletes from the athletics club (6.9 seconds vs. 7.6 seconds), indicating a statistically significant difference in sprint performance between the two groups ($p = 0.002$). Because this study used a cross-sectional observational design, these findings reflect differences in performance observed at the time of testing and should not be interpreted as evidence that one training regimen is more effective than another. The observed differences may be related to a variety of factors not measured in this study, including

biological maturity, training experience, weekly training volume, coach characteristics, technical proficiency, nutritional status, or other individual characteristics.

Similarly, the results of the 50-meter sprint test in female athletes aged 13 to 15 years showed significant differences in performance between the two grofups in several components. This indicates the importance of developing sprinting abilities through a structured training program for adolescent athletes. In the sprint test, the training center athletes were able to finish in 8.0 seconds, which was faster than the 8.3 seconds achieved by the club athletes. This indicates that the athletes from the training center had better sprint speed. Using the scoring criteria, the scores of the training center athletes would likely be in the lower range.

Table 3. Comparison test of 50-meter sprint performance – male athletes

Uji Independent sample t-test			
	F	Sig.	Sig. (2-tailed)
50-meter sprint	.144	.706	.002

The descriptive analysis revealed that the average 50-meter sprint time was lower for athletes from training centers (6.9 seconds) compared to athletes from athletic clubs (7.6 seconds). An independent-samples t-test indicated that this difference was statistically significant (p = 0.002), while Levene's test indicated homogeneity of variance between groups (p = 0.706). Thus, the findings indicate that sprint performance differed among male athletes from the two different training environments at the time of evaluation.

It should be noted that, because this study used a cross-sectional design, the findings should only be interpreted as describing differences in sprint performance and not as evidence of the superiority or effectiveness of one training environment over another (González-Gálvez, 2022). The study did not assess training program characteristics, including frequency, training load, training techniques, and technical instruction. Consequently, the differences found cannot be directly attributed to the specific training environment.

50-meter sprint performance is determined by a variety of physiological and biomechanical factors, including neuromuscular coordination, lower-extremity explosive force production, sprint mechanics, acceleration ability, and energy system efficiency during maximal short-duration (Moran et al., 2018) Because these variables were not measured in the present study, they remain possible explanations for the observed differences and should be investigated in future research.

Table 4. Comparison test of 50-meter sprint performance – female athletes

Uji Independent sample t-test			
	F	Sig.	Sig. (2-tailed)
50-meter sprint	3.941	.057	.190

Furthermore, the mean sprint time of female athletes from the training center was lower (8.0 s) than that of athletes from the athletics club (8.3 s). However, an independent samples t-test showed that the difference between the two groups was not statistically significant (p = 0.190), while Levene's test confirmed homogeneity of variance (p = 0.057). Therefore, it can be stated that, in terms of this study sample, the sprint performance of female athletes can be considered equivalent in both groups.

The lack of statistical significance should not be interpreted as evidence of equivalence of the results between the two training environments, as this study was not designed to evaluate training effectiveness. Several factors not included in this study may influence the sprint performance of adolescent female athletes, including biological maturity, anthropometric characteristics, neuromuscular function, training experience, and individual adaptation. Future studies should consider these variables(Powers & Howley, 2021).

These conclusions highlight the importance of conducting comprehensive evaluations to design training tailored to the needs and weaknesses of each group. Good performance in

one area can serve as a benchmark for highlighting abilities in other areas, with the goal of producing more balanced results overall. Furthermore, the significant differences in several parameters observed in the comparison of male and female groups also demonstrate the importance of training that takes into account gender differences, biological maturity, and individual physiological responses to training.

Practically, these conclusions support the importance of conducting regular evaluations in the 50-meter sprint. Through regular evaluations, trainers can make data-driven adjustments and design more efficient training. This aligns with the conclusions of Laakso (2024) which shows that adolescent physical fitness has long-term effects on cardiometabolic health and psychological well-being in adulthood.

CONCLUSION

This study aimed to describe the 50-meter sprint performance of adolescent athletes aged 13–15 years who train at athletic clubs and training centers in Tangerang City using a quantitative descriptive approach. The results showed that male athletes from training centers had faster average 50-meter sprint times than male athletes from athletic clubs (6.9 seconds vs. 7.6 seconds), with a statistically significant difference based on an independent samples t-test ($p = 0.002$). Meanwhile, in the female athlete group, although the average sprint time of athletes from training centers was faster than that of athletes from clubs (8.0 seconds vs. 8.3 seconds), the difference was not statistically significant ($p = 0.190$).

These findings indicate a difference in sprint performance between the two groups of male athletes, while no statistically significant difference was found in female athletes. However, because this study used an observational cross-sectional design, the results only describe differences in performance observed at the time of measurement and cannot be used to conclude that a specific training location or development program caused these differences. Various other factors, such as biological maturity, training experience, training volume and intensity, coaching quality, nutritional status, and individual athlete characteristics, can also influence the results.

Practically, the results of this study provide an overview of the 50-meter sprint speed profile of adolescent athletes in Tangerang City, which can be used as baseline data in the athlete development evaluation process. This information is expected to be useful for coaches, athletic clubs, training centers, and sports policymakers in monitoring athlete performance and developing training programs tailored to athlete characteristics. It is recommended that future research use a longitudinal or experimental design with control for confounding variables and involve a larger and more diverse sample to more comprehensively elucidate the relationship between training program characteristics and sprint performance.

AUTHOR CONTRIBUTIONS STATEMENT

Using the CRediT (Contributor Roles Taxonomy) framework:
SFK: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Visualization, Writing – original draft.
H: Supervision, Validation, Writing – review & editing.
All authors have read and agreed to the published version of the manuscript.

GENERATIVE AI USAGE STATEMENT

During the preparation of this work, the author(s) used DeepSeek in order to assist with language editing, paraphrasing, and improving the readability of the manuscript. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no financial interests or personal relationships that could be perceived as having influenced the work reported in this paper.

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