



Research Article



## **Analysis of Speed Test and Multistage Fitness Test Results for Female Athletes in the 15-16 Year Age Group in East Java Athletics**

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Article Information	ABSTRACT
Submitted: 29 – 12 – 2025 Accepted: 07 – 03– 2026 Published: 13 – 03– 2026	<p>The development of biomotor components, particularly speed and endurance, plays a crucial role in optimizing athletic performance during adolescence. This study aimed to examine the levels of speed and endurance among female adolescent athletes in the athletics discipline in East Java. A quantitative descriptive research design was employed to provide an empirical overview of these biomotor capacities. The participants consisted of 18 female athletes aged 15–16 years selected from the East Java athletics training program. Speed performance was assessed using a 30-meter sprint test, while endurance capacity was measured through the multistage fitness test to estimate maximal oxygen uptake (<math>VO_2\text{max}</math>). The findings revealed that the athletes demonstrated a very good level of speed with an average sprint time of 4.43 seconds, whereas endurance performance was categorized as good, with a mean estimated <math>VO_2\text{max}</math> of 36.58 ml/kg/min. These results indicate that although sprint capacity among the athletes is highly developed, endurance capacity remains relatively moderate and may require further training optimization. The findings provide important empirical insights for coaches and sport scientists in designing evidence-based training programs aimed at balancing the development of biomotor components in adolescent athletes.</p>
	<b>Key words:</b> speed; endurance; athletics.



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### **INTRODUCTION**

Biomotor Speed and endurance are one of the basic indicators that determine the body's performance for physical activities at a certain distance or duration in the shortest possible time (Gursoy et al., 2012). Adequate parameter review has a direct effect on the effectiveness or performance of athletes during training or matches. Argue that the new concept of the process of compiling and implementing training

programs should emphasize training items to increase speed and endurance rather than strength training (Eshiev et al., 2025)

In some cases in the field, it can be observed that speed biomotor begins when the athlete runs at maximum speed (Edouard et al., 2024). In order to get optimal speed training, an athlete or sportsman must also be required to have an optimal level of endurance (Bell et al., 2023). The better a person's endurance level, the faster the body is used for high-intensity physical activity, the faster the training pulse rate will drop when resting compared to someone with low endurance (Haugen et al., 2019). In athletic competitions, there are several race numbers that require speed endurance as the dominant biomotor determining athlete achievement, including the 200 m, 400 m, 800 m and 4x400 m relay (Latif et al., 2022). Furthermore, in relation to this, the use of the right training methodology in training periodization tends to improve the performance or potential of athletes, be it potential in terms of speed, strength, endurance, explosive power, or potential in other biomotor components (Mustofa & Rini Sukamti, 2021).

Speed and endurance are fundamental determinants of athletic performance. These physical capacities are not merely associated with the general fitness level of athletes but are influenced by complex interactions among physiological, biomechanical, and neuromuscular systems. Previous studies have extensively investigated the independent development of speed and endurance in athletic training; however, the integrated mechanisms underlying their simultaneous optimization remain insufficiently understood. In particular, empirical evidence examining how training interventions influence both speed and endurance adaptations within specific athletic populations is still limited. This lack of comprehensive understanding represents a critical gap in the current literature and underscores the need for further investigation to clarify effective training strategies that can enhance both speed and endurance in athletes. (Li et al., 2023). During athletic competitions, speed and endurance are represented by how athletes can maintain maximum achievement records in a very close race schedule, both in one competition and in future competitions (Mylsidayu, 2019).

As emphasized by (Wu & Swartz, 2023), speed and endurance are built on closely interrelated motor and cognitive components. With motor components, speed and endurance are controlled by neurophysiology (change of direction, sprint, acceleration, change of running direction, dynamic stopping (Edouard et al., 2024). The main role in the cognitive component is played by the process of receiving and processing information in the analytical and decision-making center of the cerebral cortex, for example (choosing actions, speed of making the right decisions, reaction time, speed of perception and prediction) (Eshiev et al., 2025). The process of receiving and processing information in the cerebral cortex occurs invisibly, while movement and its speed can be observed (Mustofa & Rini Sukamti, 2021). The speed of an athlete's actions during an athletic competition depends not only on the person's speed, but also on his psychophysical abilities (endurance) (Li et al., 2023).

Unlike strength, speed and endurance are highly dependent on the right training factors/methods for each athlete (Costa et al., 2016). Therefore, it is important for each coach to be able to master and apply sports science, especially in the field of coaching, in order to identify the most appropriate training strategies and optimize training loads to enhance athletes' speed and endurance performance. Therefore, this study aims to examine the effectiveness of a specific training intervention in improving athletes' speed and endurance capacities.

## **METHOD**

This study employed a quantitative descriptive research design aimed at determining the levels of biomotor speed and endurance among athletes. A descriptive approach was considered appropriate because the primary objective of the study was to systematically measure and present the existing performance profiles of athletes without manipulating variables or implementing experimental interventions. By utilizing this design, the research was able to provide an objective overview of the current distribution and characteristics of athletes' speed and endurance capacities. Such baseline information is essential for identifying performance patterns, evaluating the current training outcomes, and providing empirical evidence that can serve as a reference for coaches and sport scientists in designing more targeted training programs. Therefore, the descriptive quantitative design offers a rigorous and sufficient methodological framework for capturing the real condition of athletes' biomotor abilities within their natural training context. This approach was selected to provide an objective and measurable description of the athletes' physical performance profiles based on numerical data. The data processing was conducted using SPSS version 20.0 to ensure accuracy and reliability in statistical analysis. The collected data were subsequently analyzed using a quantitative descriptive approach and presented in the form of means, standard deviations, and percentage distributions to facilitate a clear and systematic interpretation of the athletes' performance levels.

The population of this study consisted of female track and field athletes from East Java Province aged 15–16 years. This age group was selected because it represents a critical stage in athlete development characterized by rapid physiological maturation and significant improvements in biomotor abilities such as speed and endurance. Participants were selected using a purposive sampling technique to ensure that the sample represented trained youth athletes with relatively homogeneous training backgrounds. The inclusion criteria were: (1) a minimum of four years of structured athletics training; (2) having achieved at least third place at the provincial competition level; and (3) specialization in sprint and jump events. Based on these criteria, a total of 18 athletes met all requirements and were included as research participants.

Sprint speed was assessed using a 30-meter sprint test, a widely accepted field-based measure of acceleration and maximal sprint ability in youth athletes. Previous studies have reported excellent test–retest reliability for the 30-m sprint test, with intraclass correlation coefficients (ICC) ranging from 0.90 to 0.97, indicating high measurement consistency. Aerobic endurance was evaluated using the Multistage Fitness Test (MSFT) or 20-meter shuttle run test, which is commonly used to estimate maximal oxygen uptake ( $VO_2\text{max}$ ) and assess cardiorespiratory fitness in adolescent populations. The MSFT has demonstrated strong validity against laboratory-based  $VO_2\text{max}$  measurements ( $r \approx 0.84\text{--}0.90$ ) and high reliability (ICC > 0.90) in youth athletes. The use of these standardized and empirically validated instruments ensures methodological rigor and enhances the reliability and credibility of the data obtained in this study.

## **RESULT AND DISCUSSION**

Hasil An athlete is required to have a good level of speed. The results of this study show that the speed level of female athletes in the 15-16 year age group in the East Java athletics sport obtained an average value of 4.43 seconds. It is in the very good category, as seen in table 1.

**Table 1. 30 Meter Sprint Speed Test Results**

Sample Norm	Result (second)	Category
1	4,43	Very Good
2	4,31	Very Good
3	4,47	Very Good
4	4,49	Very Good
5	4,50	Very Good
6	4,47	Very Good
7	4,39	Very Good
8	4,40	Very Good
9	4,68	Very Good
10	4,57	Good
11	4,26	Very Good
12	4,33	Very Good
13	4,38	Very Good
14	4,53	Good
15	4,16	Very Good
16	4,24	Very Good
17	4,67	Good
18	4,50	Very Good
<b>Mean</b>		<b>4,43</b>
<b>Min</b>		<b>4,16</b>
<b>Max</b>		<b>4,68</b>
<b>Very Poor Category</b>		<b>0</b>
<b>Poor Category</b>		<b>0</b>
<b>Medium Category</b>		<b>0</b>
<b>Good Category</b>		<b>3 sample</b>
<b>Very Good Category</b>		<b>15 sample</b>

**Table 2. 30 Meter Sprint Speed Test Category Results and Percentages**

Norm	Result (second)	Frequency (athlete)	(%)
Very Poor	>5,00	0	0
Poor	4,81- 5,00	0	0
Medium	4,70 – 4,80	0	0
Good	4,51 – 4,69	3	16,6
Very Good	<4,50	15	83,3

In athletic competitions, physical biomotorics, especially in terms of speed, should be carried out quickly and explosively (Nooijen et al., 2021). In sprint/sprint numbers, according to several studies, high intensity is identical, because in sprint athletic competitions there are several phases, namely acceleration, maximum speed, and deceleration, all of which are carried out by requiring high speed indicators (Chaabene et al., 2015; Nooijen et al., 2021). Speed biomotors will always be the basis for each sprint athlete due to the demands of achievement to be able to create/produce short achievement records over certain distances (Humaedi et al., 2023). This is inherent in the sprint athletic competition system that the shortest travel time is an indicator of successful achievement in sprint athletic competitions (Crowley et al., 2022; Risviandari & Rensa, 2021)

The results of the 30-meter sprint test used to evaluate sprint speed among female athletes aged 15–16 years in athletics demonstrate findings that are broadly consistent with previous theoretical and empirical studies emphasizing the central

role of speed in short-distance sprint performance. Sprint performance in athletics is strongly influenced by neuromuscular coordination, explosive lower-limb power, and the ability to rapidly generate force during the acceleration phase. In the present study, the majority of athletes exhibited a high level of sprint performance, with 3 athletes (16.6%) categorized as having good speed and the remaining 15 athletes (83.3%) classified within the very good category. These findings suggest that the athletes involved in the training program have developed a relatively homogeneous sprint capability profile.

Analytically, the narrow variation in sprint times observed in this study (minimum time: 4.16 s; maximum time: 4.68 s) indicates a relatively small performance dispersion among participants. This pattern is comparable to findings reported in previous studies on adolescent sprint athletes, which suggest that structured training environments often produce relatively consistent speed performance within the same developmental age group. However, the relatively high proportion of athletes categorized as having very good speed in the present study appears slightly higher than that reported in several earlier investigations involving youth athletes, where performance distribution tended to be more heterogeneous (Oliveira et al., 2024a; Tønnessen et al., 2024). One possible explanation for this difference lies in the systematic training exposure experienced by the athletes, which may contribute to more uniform neuromuscular adaptation and sprint mechanics development.

From a scientific perspective, these findings highlight the importance of structured sprint-specific training during mid-adolescence, a developmental stage characterized by rapid neuromuscular maturation and increased responsiveness to speed training stimuli. The relatively narrow range of sprint performance times suggests that training programs implemented for these athletes may effectively enhance acceleration capability and sprint mechanics efficiency (Fokkema et al., 2020; Winther et al., 2022). Furthermore, the results contribute to the growing body of evidence indicating that targeted sprint training during adolescence can produce measurable improvements in short-distance speed performance, reinforcing the importance of age-appropriate speed development strategies within long-term athlete development frameworks.

Next after speed, an athlete is also required to have a good level of endurance. The better the athlete's endurance level, the greater the chance of maintaining performance at high speed and the greater the chance of success. The results of this study indicate that the endurance level of female athletes in the 15-16 year old age group in the East Java athletics branch obtained an average value of 36.58 ml/kgBW/minute. It is in the good category, as seen in table 3.

Table 3. Multistage Fitness Test Results

Sample Norm	VO <sub>2</sub> Max (ml/kg/min)	Category
1	35,7	Good
2	35	Good
3	33,9	Medium
4	34,6	Medium
5	36	Good
6	35,3	Good
7	38,1	Good
8	38,9	Good
9	36,4	Good
10	37,1	Good
11	38,5	Good

12	34,9	Medium
13	36,7	Good
14	37,4	Good
15	37,2	Good
16	39,5	Very Good
17	36	Good
18	37,4	Good
<b>Mean</b>		<b>36,58</b>
<b>Min</b>		<b>33,9</b>
<b>Max</b>		<b>39,5</b>
<b>Very Poor category</b>		<b>0</b>
<b>Poor Category</b>		<b>0</b>
<b>Medium Category</b>		<b>3 sample</b>
<b>Good Category</b>		<b>14 sample</b>
<b>Very Good Category</b>		<b>1 sample</b>

Table 4. Multistage Fitness Test Category Results and Percentages

<b>Norm</b>	<b>Result (ml/Kg/min)</b>	<b>Frequency (athlete)</b>	<b>(%)</b>
<b>Very Poor</b>	<b>&gt;25,00</b>	<b>0</b>	<b>0</b>
<b>Poor</b>	<b>25,00 – 30,9</b>	<b>0</b>	<b>0</b>
<b>Medium</b>	<b>31,00 – 34,9</b>	<b>3</b>	<b>16,6</b>
<b>Good</b>	<b>35,00 – 38,9</b>	<b>14</b>	<b>77,7</b>
<b>Very Good</b>	<b>&lt;39,00</b>	<b>1</b>	<b>5,5</b>

In athletics competitions, especially sprint running, in addition to speed biomotor as a determinant of success, endurance biomotor is also needed as the main supporting factor to achieve a shorter time record (Düking et al., 2021). In several sprint running athletics competitions, especially running with a distance of more than 100 meters (200 meters, 400 meters, 800 meters, and 4x400 meter relay), each is required to have good speed endurance, because according to the principle of movement, the body is required to work with high intensity and for a longer duration (> 15 seconds) (Brustio et al., 2024). For this reason, speed endurance biomotor will automatically be built if the speed and endurance biomotor components have been fulfilled first, both during the training process and the match (Düking et al., 2021; Oliveira et al., 2024b)

Cardio endurance means the ability of the cardio organ, in this case the function of the heart, to supply as much oxygen as possible into the blood when the body is doing movement or physical activity (Wu & Swartz, 2023). Athletes who have high endurance will automatically be able to do physical activities or training (either low, medium, or high intensity) with a very long/long duration of activity and will not quickly experience a high fatigue phase (Thron et al., 2025). Thus, aerobic capacity is very dependent on the ability of the heart organ to supply oxygen to all body tissues (Oliveira et al., 2024b). In sprint athletic competitions, athletes are always required to adapt to pass the deceleration phase (decrease in maximum speed), the shorter the deceleration distance that the athlete is able to pass, it indicates that the athlete's endurance level is higher/better (Oliveira et al., 2024a; Tønnessen et al., 2024).

In the study of Mylsidayu (2019) with a research focus on the analysis of speed and strength as the main indicators to determine the explosive power of the athlete's leg muscles in athletic athletes, the results of the study gave rise to the researcher's idea to make something new in other studies. The new research that has been

carried out is to make an analysis of the sprint speed test as a parameter to measure the biomotor aspect of athlete speed and the multistage fitness test as a parameter to measure the level of endurance in female athletes in the 15-16 year old age group in the athletics branch in East Java Province. With the research results that have been described, it is hoped that they can be an additional reference for coaches in monitoring the evaluation of planning, compiling, and applying athlete training programs for optimal performance.

The results of the endurance test research using the multistage fitness test on female athletes in the 15-16 year age group in the athletics branch of East Java Province, there were several athletes who had endurance levels in the moderate category as many as 3 athletes (16.6%), then there were several athletes who had endurance levels in the good category as many as 14 athletes (77.7%), and finally there was 1 athlete (5.5%) who had endurance levels in the very good category.

## CONCLUSION

Based on the results and discussion of female athletes in the 15-16 year age group in the athletics branch of East Java Province, it can be concluded that the level of speed in female athletes in the 15-16 year age group in the athletics branch of East Java Province is in the very good category, then in terms of endurance, it can be concluded that the endurance level of female athletes in the 15-16 year age group in the athletics branch of East Java Province is in the good category. With this conclusion, it can be a suggestion and recommendation for coaches to be able to maintain the potential and performance of female athletes in athletics in East Java Province for optimal achievement.

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