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The Effect of Resistance Training Using Used Car Tires On The Improvement of 100-Meter Sprint Speed

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ABSTRACT

This study aims to analyze the effect of resistance training using used car tires as a training medium on the improvement of 100-meter sprint speed among students of MTs Darul Ulum, Kotabaru Regency. The research employed a quantitative approach with an experimental method using a one-group pretest-posttest design. The research subjects consisted of 17 male students selected through purposive sampling. Sprint speed was measured using a 100-meter running test conducted during the pretest and posttest stages. Data were analyzed using descriptive statistics, normality tests, homogeneity tests, and paired sample t-tests with the assistance of SPSS version 21. The results showed an improvement in sprint speed after students participated in the resistance training program. The average running time decreased from 15.2988 seconds in the pretest to 14.0894 seconds in the posttest, with an average difference of 1,2094 seconds or an improvement of 7,91%. The paired sample t-test results indicated a calculated t-value of 4,949 with degrees of freedom (df) = 16 and a significance value (Sig. 2-tailed) < 0.05. Therefore, H_0 was rejected and H_1 was accepted, indicating that resistance training using used car tires had a significant effect on improving the 100-meter sprint speed of students at MTs Darul Ulum. This study confirms that the utilization of simple and economical training media can serve as an effective alternative strategy in physical education learning to enhance students' physical abilities. The findings also contribute theoretically to the development of resistance sprint training models in the context of school-based physical education.

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A. Conception and design of the study;
B. Acquisition of data;
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INTRODUCTION

Running speed is one of the primary components of physical fitness that plays a crucial role in various sports activities, particularly in short-distance sprint events in athletics (Lamusu et al., 2022). In the context of physical education, speed ability is not only associated with sports achievement but is also closely related to motor skill quality, physical fitness levels, and the effectiveness of students' neuromuscular systems (Sari et al., 2024). Therefore, the development of running speed among students should be regarded as an integral part of physical education learning that aims to optimize physical and motor competence (Hasniah & Burhanuddin, 2021).

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Conceptually, speed is defined as an individual's ability to perform movements or a series of movements within a relatively short time. Speed results from a complex interaction of physiological, biomechanical, and psychological factors, including muscle strength, explosive power, neuromuscular coordination, movement technique, stride length and frequency, and individual motivation (Ahmad et al., 2024). In sprint running, speed is determined not only by acceleration during the initial phase but also by the ability to maintain maximum speed in subsequent phases (Putra, 2011). Consequently, improving running speed requires a systematic, structured, and scientifically grounded training approach.

In sports coaching science, speed is considered a biomotor component that is specific to the characteristics of particular sports disciplines (Humaedi et al., 2023). Sprint speed is strongly influenced by muscle characteristics, especially the dominance of fast-twitch muscle fibers, the central nervous system's capacity to recruit motor units, and the ability to coordinate body segments effectively. Furthermore, running technique factors such as body posture, arm swing, stride pattern, and push-off angle also determine sprint performance (Maheswari et al., 2025). Thus, training programs aimed at improving sprint speed must be designed by integrating physiological, biomechanical, and pedagogical aspects (Jusran et al., n.d.).

During early adolescence, such as among students of MTs Darul Ulum, individuals experience rapid physical growth and significant neuromuscular development. This phase is often referred to as a sensitive period, during which the body is highly responsive to physical training stimuli (Eko Yulianto et al., 2025). At this stage, the central nervous system develops rapidly, making appropriate training interventions particularly effective in enhancing biomotor abilities, including speed. In junior secondary school physical education, this developmental phase represents a strategic opportunity to cultivate students' physical potential through training programs tailored to their age characteristics and ability levels (Suryani et al., 2023).

However, the reality of physical education learning in schools often faces various constraints that hinder the development of students' running speed. Preliminary observations revealed that some students had relatively low leg muscle strength, ineffective running techniques, and suboptimal movement coordination. In addition, monotonous teaching methods tended to reduce students' motivation to participate in training activities. Limited sports facilities and infrastructure also restricted teachers' creativity in designing innovative and effective training programs.

These conditions indicate a gap between theoretical demands for physical ability development and practical implementation in the field. Therefore, alternative training models that are not only scientifically effective but also practical, economical, and suitable for school conditions are needed. One approach that can be applied is resistance sprint training using simple media, such as used car tires.

Resistance training in sprinting is a training method that provides external resistance while individuals perform running activities (Suyoko, 2025). This resistance aims to enhance the muscles' ability to generate greater force, particularly during the acceleration phase. Physiologically, resistance training can improve muscle strength,

explosive power, and neuromuscular efficiency. Additionally, it can enhance running technique by improving movement control and body stability. In sports coaching practice, resistance training is commonly used to improve sprint performance, both with modern equipment and simple training media.

The use of used car tires as a resistance training medium offers unique advantages in the context of school-based physical education. This medium is easily accessible, cost-effective, and can be modified according to students' ability levels. Moreover, the use of unconventional training media can provide more engaging and contextual learning experiences for students. Thus, resistance training using used car tires is not only physiologically relevant but also pedagogically valuable in increasing students' motivation and participation in learning activities.

From the perspective of training theory, improvements in sprint speed through resistance training can be explained by the principles of overload and adaptation (Rusdiawan et al., 2024). The overload principle states that the body adapts when it is subjected to training loads that exceed its normal capacity (Solissa, 2025). These adaptations may include increased muscle strength, improved neural efficiency, and enhanced movement coordination. In sprinting, such adaptations are reflected in improved acceleration, maximum speed, and running efficiency. Therefore, progressively designed resistance training can serve as an effective strategy for enhancing students' sprint performance.

In addition to the overload principle, the principle of specificity is also fundamental in designing training programs (Solissa, 2025). This principle asserts that physiological adaptations are specific to the type of training performed. In this regard, resistance sprint training using used car tires closely resembles the movement characteristics of sprinting, thereby producing adaptations that are highly relevant to sprint performance. In other words, training media that align with the biomechanical characteristics of sprinting are more likely to produce optimal performance improvements compared to general training methods.

Previous studies have demonstrated that resisted sprint training positively influences sprint speed, leg muscle explosive power, and acceleration ability. However, most of these studies utilized modern training equipment that is relatively difficult to implement in schools with limited facilities. Furthermore, research examining the effectiveness of simple training media in physical education contexts remains limited. Therefore, more empirical investigations are needed to explore the effectiveness of simple training media, particularly used car tires, in improving students' sprint speed.

Based on the above considerations, this study was conducted to empirically examine the effect of resistance training using used car tires on the improvement of 100-meter sprint speed among students of MTs Darul Ulum. This study is expected to contribute to the development of effective, simple, and applicable training models in physical education and to serve as a reference for teachers in designing innovative and contextual training programs.

METHODS

This study employed a quantitative approach with an experimental method. The research design applied was a one-group pretest-posttest design, which involves a single group of subjects without a control group. In this design, subjects were first

administered a pretest to determine their initial sprint speed ability, followed by an intervention in the form of resistance training using used car tires, and finally a posttest to assess changes in sprint speed after the intervention. This design was chosen because it allows researchers to identify the direct effect of the intervention on the dependent variable by comparing pretest and posttest results.

The population of this study consisted of all seventh-grade students of MTs Darul Ulum in the 2025/2026 academic year. The sample comprised 17 male students selected through purposive sampling, based on criteria such as good physical health, consistent participation in the training program, and relatively homogeneous characteristics in terms of age and physical ability. Purposive sampling was applied to ensure that the research subjects met criteria relevant to the study's objectives.

This study involved two main variables: an independent variable and a dependent variable. The independent variable was resistance training using used car tires, while the dependent variable was 100-meter sprint speed. The relationship between these variables was analyzed to determine the extent to which resistance training using used car tires influenced students' sprint speed improvement.

The training program was conducted over 12 sessions with a frequency of three sessions per week. Each training session lasted approximately 60 minutes. The main training activity consisted of sprint running with resistance using used car tires attached to the students' bodies with ropes or simple harnesses. This training model was designed to provide external resistance during running, thereby enhancing leg muscle strength, acceleration ability, and sprint speed.

The training program was designed progressively. During the adaptation phase (sessions 1-4), training was conducted over a distance of 20 meters with 4-6 repetitions and light to moderate intensity. This phase aimed to help students adapt to resistance training and improve basic running techniques. During the development phase (sessions 5-8), training distances were increased to 30-40 meters with 6-8 repetitions and moderate to high intensity, aiming to enhance leg muscle strength and acceleration ability. During the stabilization phase (sessions 9-12), training distances were increased to 40-50 meters with 8-10 repetitions and high intensity, aiming to optimize speed and explosive power.

Overall, the training program was designed based on physical training principles, namely overload and progressive loading, with gradual increases in distance, intensity, and volume according to students' abilities. Through systematic and progressive training, optimal physiological and neuromuscular adaptations were expected to occur, leading to improvements in students' sprint speed.

RESULTS AND DISCUSSION

Result

Measurement of 100-meter sprint speed was conducted in two stages: before the intervention (pretest) and after the intervention (posttest). The intervention consisted of a resistance training program using used car tires. The measurement data were presented anonymously to maintain the confidentiality of the research subjects.

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Table 1.
Pretest and Posttest Results of 100-Meter Sprint Speed

Sample	Pretest (s)	Posttest (s)	Difference (s)
Student 1	15,12	14,20	0,92
Student 2	14,09	13,95	0,14
Student 3	14,87	14,58	0,29
Student 4	14,51	13,98	0,53
Student 5	15,19	14,23	0,96
Student 6	13,91	12,50	1,41
Student 7	13,07	12,25	0,82
Student 8	15,19	13,70	1,49
Student 9	18,09	17,56	0,53
Student 10	13,91	13,54	0,37
Student 11	16,81	14,12	2,69
Student 12	18,85	16,00	2,85
Student 13	13,62	13,28	0,34
Student 14	15,27	14,42	0,85
Student 15	17,91	14,59	3,32
Student 16	15,17	12,70	2,47
Student 17	14,50	13,92	0,58

Based on Table 1, all research subjects experienced a decrease in running time at the posttest stage compared to the pretest. This decrease indicates an improvement in sprint speed after participating in the resistance training program using used car tires.

Descriptive statistical analysis was conducted to determine data characteristics, including mean, standard deviation, minimum, and maximum values.

Table 2.
Descriptive Statistics of Pretest and Posttest

	N	Minimum	Maximum	Mean	Std. Deviation
Nilai Pretest	17	13.07	18.85	15.2988	1.66068
Nilai Posttest	17	12.25	17.56	14.0894	1.25841
Valid N (listwise)	17				

The analysis results indicate that the average running time decreased from 15,2988 seconds in the pretest to 14,0894 seconds in the posttest. The mean difference of 1,2094 seconds demonstrates an improvement in sprint speed descriptively. Furthermore, the smaller standard deviation in the posttest indicates that students' sprint abilities became more homogeneous after the training intervention.

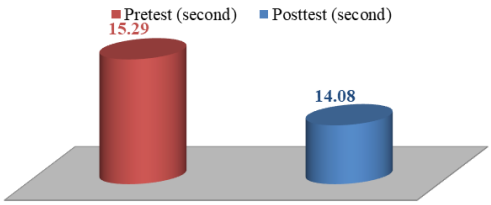

Figure 1.
Comparison of Mean Running Time in Pretest and Posttest

The figure illustrates a reduction in the average running time after the training intervention, indicating that resistance training using used car tires contributed to improvements in students' sprint speed.

Normality tests were conducted using the Kolmogorov-Smirnov test with SPSS version 21.

Table 3.
Normality Test Results (Kolmogorov-Smirnov)

		Pretest Value	Posttest Value
N		17	17
Normal Parameters[a,b]	Mean	15.2988	14.0894
	Std. Deviation	1.66068	1.25841
Most Extreme Differences	Absolute	.272	.228
	Positive	.272	.228
	Negative	-.119	-.096
Kolmogorov-Smirnov Z		1.120	.939
Asymp. Sig. (2-tailed)		.163	.341

The results show that the significance values (ρ-values) of the pretest and posttest data were greater than 0.05 (ρ > 0.05). Therefore, the data were normally distributed and met the requirements for parametric statistical analysis.

Homogeneity tests were conducted to examine the equality of variance between pretest and posttest data.

Table 4.
Homogeneity Test Results

Sig. (ρ-value)	Keterangan
> 0,05	Data homogen

The homogeneity test results indicate that the significance value was greater than 0.05 (ρ > 0.05), meaning that the variances of the pretest and posttest data were homogeneous. Thus, the data met the assumptions for conducting a paired sample t-test.

Hypothesis testing was conducted to determine the effect of resistance training using used car tires on students' 100-meter sprint speed.

Table 5.
Paired Sample t-Test Results

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Value	Pretest - Posttest	1.20941	1.00753	.24436	.69139	1.72744	4.949	16	.000

The analysis results show that the calculated t-value of 4,949 was greater than the t-table value of 2.120 at a significance level of α = 0.05. Moreover, the significance value (Sig. 2-tailed) was less than 0.05 (ρ < 0.05).

Based on these results, the null hypothesis (H_0) was rejected and the alternative hypothesis (H_1) was accepted. This indicates that resistance training using used car tires had a significant effect on improving the 100-meter sprint speed of students at MTs Darul Ulum. Quantitatively, sprint speed improvement was indicated by a reduction in average running time of 1,2094 seconds, equivalent to an improvement of approximately 7,91%.

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Discussion

The results of this study indicate that resistance training using used car tires significantly improved the sprint speed of students at MTs Darul Ulum. This finding is evidenced by the decrease in average running time from 15,2988 seconds in the pretest to 14,0894 seconds in the posttest. The mean difference of 1,2094 seconds, or a speed improvement of 7,91%, indicates that the implemented training program effectively enhanced students' sprint performance in a measurable and meaningful way. Thus, resistance training can be regarded as an effective method for developing sprint speed among students.

From a physiological perspective, resistance sprint training provides greater stimuli to the muscular system, particularly the leg muscles that play a dominant role in sprinting. The resistance generated by used car tires forces muscles to work at higher intensity compared to running without resistance, thereby triggering physiological adaptations in the neuromuscular system. These adaptations include increased motor unit recruitment, improved muscle synchronization, and enhanced intra- and intermuscular coordination. Additionally, resistance training contributes to improvements in muscle strength, explosive power, and contractile capacity. These adaptations ultimately lead to enhanced acceleration ability and maximum sprint speed among students. This finding aligns with training principles proposed by (Anwar, 2025), which emphasize that progressive load training can improve physical performance through continuous physiological and neuromuscular adaptation.

Beyond physiological factors, improvements in sprint speed were also influenced by enhancements in running technique during the training process. Resistance training encourages students to adjust their movement patterns to overcome the applied resistance, resulting in improvements in running mechanics. These improvements were observed in more stable and forward-leaning body posture during acceleration, increased stride length and frequency, and more effective coordination between arm and leg movements. According to (Victoria & Mustafa, 2025), sprint performance is determined by a combination of muscle strength, movement coordination, and technical efficiency. Therefore, resistance sprint training using used car tires not only improves students' physical capabilities but also enhances the overall quality of their running technique, leading to optimal sprint performance.

In the context of physical education, the use of used car tires as training media has high practical and pedagogical value. This training medium is easy to obtain, economical, and adaptable to students' abilities and characteristics, making it a viable alternative to overcome limitations in school sports facilities. Moreover, the application of varied and innovative training methods can increase students' motivation, interest, and participation in physical education activities. This demonstrates that resistance training using used car tires is not only effective in improving physical aspects but also relevant in supporting active, creative, and enjoyable learning processes.

The findings of this study also reinforce previous research indicating that resisted sprint training positively influences sprint speed, leg muscle explosive power, and

acceleration ability (Firmansyah & Rumini, 2022). The results suggest that providing resistance during sprint training can serve as an effective stimulus to enhance running performance, particularly among early adolescent students. Therefore, resistance training using used car tires can be considered an effective, economical, and applicable alternative training model in physical education, especially for students at the junior secondary school level.

Nevertheless, this study has several limitations. First, the research design employed a quasi-experimental approach without a control group, meaning that the influence of external variables could not be fully controlled. Second, the sample size was relatively limited, so the findings cannot be generalized broadly. Therefore, future studies are recommended to employ stronger experimental designs, such as true experimental designs with control groups, and involve larger and more diverse samples. Additionally, further research could examine variations in resistance training forms, training intensity, and program duration to develop more effective and comprehensive models for improving students' sprint speed.

CONCLUSION

Based on the research findings and statistical analysis, it can be concluded that resistance sprint training using used car tires significantly improves 100-meter sprint speed among students at MTs Darul Ulum. These findings demonstrate that simple resistance-based training approaches can effectively and measurably enhance students' sprint performance within the context of school-based physical education.

Empirically, performance improvement was indicated by a decrease in average running time from 15,2988 seconds in the pretest to 14.0894 seconds in the posttest, with a mean difference of 1,2094 seconds or a speed improvement of 7,91%. Statistical assumption testing showed that the research data were normally distributed and homogeneous, fulfilling the requirements for parametric analysis. Furthermore, the paired sample t-test revealed a significant difference between pretest and posttest scores, confirming that the improvement in students' sprint speed was not coincidental but rather a direct result of the applied resistance training intervention.

Theoretically, this study strengthens the principles of resistance training, emphasizing the importance of neuromuscular adaptation and enhanced muscular capacity in improving movement performance, particularly in sprinting activities. These adaptations were reflected in improvements in strength, explosive power, coordination, and efficiency of leg muscle performance, which collectively contributed to enhanced acceleration and maximum sprint speed.

Practically, the use of used car tires as training media has high applicability due to its economical nature, ease of access, and flexibility in implementation. This training model is highly relevant for physical education learning in schools, particularly in environments with limited sports facilities. Moreover, this innovative training approach has the potential to increase students' motivation, engagement, and active participation in learning activities.

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Therefore, resistance training using used car tires can be recommended as an effective, contextual, and applicable alternative training model for improving short-distance sprint speed among students, particularly in early adolescence (ages 12-15). These findings also imply that creative utilization of local resources can serve as a relevant strategy in developing more varied, efficient, and sustainable training models in physical education.

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