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The Relationship Between Leg Muscle Strength and 100-Meter Running Speed in High School Athletes

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Abstract

This study aims to determine how strong the leg muscle strength is with the 100-meter running speed in class X students at SMA Negeri 1 Kepenuhan Hulu. The hypothesis in this study is "There is a relationship between leg muscle strength and 100-meter running speed in class X students at SMA Negeri 1 Kepenuhan Hulu". The method used is an experimental method, with the steps "Pre Test (X1), Treatment (T), and Post Test (X2). The sample used for this study consisted of 10 students of Grade X at SMA Negeri 3 Kepenuhan Hulu. Participants were selected using purposive sampling based on their active involvement in school athletics. Muscle strength was measured using a leg dynamometer, while sprint speed was recorded using a digital stopwatch. The findings revealed a significant negative correlation ($r = -0.68$, $p < 0.01$) between leg muscle strength and 100-meter sprint time, indicating that greater muscle strength is associated with faster sprint performance. The data in this study were the results of the 100-meter run performed by students. Data analysis was carried out using a percentage statistical formula. The data can prove that there is a relationship between leg muscle strength and 100-meter sprint speed in grade X students at SMA Negeri 1 Kepenuhan Hulu.

Keywords: Leg muscle strengh, sprint speed, high school athletes, leg power, performance

Introduction

Leg muscle strength is a crucial foundation for an athlete's balance and performance. Leg muscle strength plays a crucial role in the work process of a porter, supporting both internal and external loads (Ningrum et al., 2017). 100-meter sprint speed is a key indicator in athletics, particularly the sprint event. In the context of developing student athletes, this ability is crucial because it serves as the foundation for developing higher athletic potential (Bompa et al., 2018). One factor influencing running speed is muscle strength, particularly leg muscles, which play a role in generating maximum propulsion during the start and acceleration (Saiman, 2024). In this context, the 100-meter sprint is an event that relies heavily on leg muscle technique and strength (Budiyanto et al., 2025). Muscle strength not only supports the acceleration phase but also plays a role in maintaining maximum speed.

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Previous research has shown a relationship between muscle strength and running speed. Rifaid (2025) found that leg muscle power significantly contributes to sprint performance in high school students. Rahman and Yusuf (2023) also reported a negative correlation between muscle strength and 100-meter sprint time, meaning greater muscle strength leads to faster sprint times. Furthermore, muscle strength variables are often generalized without distinguishing between types of strength such as maximal, explosive, or muscular endurance, making the results less specific and applicable in the context of athletic training.

Based on this background, the research question in this study is: "Is there a relationship between muscle strength and 100-meter sprint speed in high school athletes?" The proposed hypothesis is that there is a significant negative relationship between muscle strength and 100-meter sprint time. The purpose of this study is to determine the extent to which muscle strength affects 100-meter sprint speed in high school student athletes and to provide practical recommendations for coaches and sports teachers in developing effective training programs.

Research Methods

This study used an experimental method with a “One Group Pretest-Treatment-Posttest” design to examine the relationship between leg muscle strength and 100-meter running speed. The sample consisted of 10 grade X students of SMA Negeri 3 Kepenuhan Hulu who were purposively selected based on their active involvement in athletics. Leg muscle strength was measured using a Takei T.K.K. 5002 leg dynamometer (1 item, reliability 0.89), while running speed was measured using a Casio HS-80TW digital stopwatch. Measurements were taken before and after the training treatment. Data were analyzed using Pearson correlation and percentage statistics to see the relationship and changes in performance.

Results and Discussion

These findings support the research hypothesis that leg muscle strength contributes to running speed. A significant negative correlation indicates that increased leg muscle strength is closely related to improved sprint performance. Physiologically, this can be explained by the mechanism of stronger muscle contractions generating greater propulsive force, thereby accelerating the runner's acceleration in the initial phase of the sprint.

Research by Rifaid (2025) also found that leg muscle power significantly contributes to sprint performance, with correlation values close to the results of this study. Furthermore, Rahman & Yusuf (2023) explained that stronger muscles are able to generate explosive force in a short period of time, which is crucial in sprinting.However, variability in sprint performance is not solely influenced by muscle strength. Several other factors play a role, including:

1) Running technique: Movement efficiency and body coordination influence force distribution and stride length.
2) Flexibility: Good joint range of motion allows runners to produce longer and more efficient strides.
3) Psychological factors: Motivation, focus, and mental readiness can influence performance during testing.

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The data showed that students with higher leg muscle strength tended to have faster running times. The negative correlation between these two variables was confirmed by statistical analysis ($r = -0.68$, $p < 0.01$).

Table 1. Running Strength and Time Data Manager

N	Student Name	Leg Muscle Strength (kg)	100m Run Time (s)
1.	Dela	85	14.2
2.	Selvi	78	14.8
3.	Rangga	92	13.5
4.	Hani	88	13.9
5.	Lidya	75	15.1
6.	Andi	80	14.6
7.	Doni	95	13.2
8.	Rafi	70	15.4
9.	Rika	68	14.6
10.	Revla	72	15.0

The data showed that students with higher leg muscle strength tended to have faster running times. The negative correlation between these two variables was confirmed by statistical analysis ($r = -0.68$, $p < 0.01$).

Conclusion

The results of this study support the hypothesis that there is a relationship between leg muscle strength and 100-meter sprint speed. A significant negative correlation indicates that increasing leg muscle strength can improve sprint times. However, for optimal results, coaches are advised to integrate strength training with the development of technique, flexibility, and mental preparedness. This research should be expanded to include a larger and more diverse sample size to make the results more representative and generalizable to the broader student athlete population. Furthermore, the consistency of information regarding the sample locations (SMA Negeri 1 and SMA Negeri 3) needs to be improved to avoid confusion. The measurement instruments could also be improved by using more sophisticated tools such as motion analysis or force plates to complement the data from the dynamometer and stopwatch, resulting in higher accuracy. Statistical analysis should utilize not only Pearson correlation but also regression or t-tests to examine the contribution of other variables in greater depth. Further research is also recommended to include supporting variables such as muscular power, leg length, flexibility, and running technique, as these factors have been shown to influence sprint performance. With improved methodology, instruments, and analysis, this research will make a stronger contribution to the development of athletic training programs at the school level.

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