ACPES Journal of Physical Education, Sport, and Health 4 (2) (2024)

ACPES Journal
of Physical Education, Sport, and Health

http://journal.unnes.ac.id/journals/ajpesh

Effect of Parachute Training with Constant vs Varied Widths on 100-Meter Sprint at North Medan Athletics Club

Hariadi Hariadi*, Muhammad Fauzi, Ibrahim Ibrahim, M. Irfan, Zulaini Zulaini

Universitas Negeri Medan, Indonesia

DOI: https://doi.org/10.15294/ajpesh.v4i2.19973

Keywords

parachute training, 100-meter sprint, athletic training

Abstract

Objective: To investigate the effects of constant-width and varied-width parachute running training on the 100-meter sprint performance of athletes from the North Medan Athletic Club in 2023 and to determine which training method is more effective. Methods: The entire population of 10 athletes from the North Medan Athletic Club was analyzed. The athletes underwent pretest and post-test measurements for their 100-meter sprint times. They were divided into two groups: one group was trained with constant-width parachute running, and the other group was trained with varied-width parachute running. Pretest and post-test data were analyzed using SPSS 21. Normality tests were conducted to ensure data distribution. Homogeneity of variance was tested to compare the variances between the two groups. A t-test was used to determine the significance of the differences in sprint times before training and after training, as well as the difference between constant and varied-width training. Results: All data were normally distributed and showed homogeneity. The t-test showed a statistically significant improvement in sprint times for athletes in both the constant-width ($p < 0.05$) and varied-width ($p < 0.05$) parachute running groups. Furthermore, a significant difference was found between the constant-width and varied-width training methods, with varied-width training showing a greater effect in increasing the sprint speed of athletes at the North Medan Athletic Club.

*Correspondence Author:
E-mail: hariadi@unimed.ac.id

e-ISSN 2797-0426

INTRODUCTION

The progressive increase in load from day to day enhances the physical abilities and quality of athletes. Harsono (2015: 103) states that to improve athletes' efficiency, they must consistently strive to handle loads greater than they currently can. Sprint-resisted training using parachute The utilization of the parachute enhances body control through its dynamic movement, minimizes the risk of performance plateauing, and facilitates the creation of sport-specific drills across multiple sports (Paulson & Braun, 2011). This technique helps runners augment their speed and power (Tabachnik, 1992), typically used to target the high-speed training zone and overload athletes specific to sprint technique in later acceleration or maximal speed phases (Gleadhill & Nagahara, 2023). This study aims to examine the effect of parachute running training with a constant width on 100-meter sprint speed at the North Medan Athletics Club in 2023. It aims to investigate the impact of parachute running training with varying widths on 100-meter sprint speed at the constant club. Finally, the study seeks to determine whether varied-width parachute running training is more effective than constant-width training in improving 100-meter sprint speed at the North Medan Athletics Club in 2023.

LITERATURE REVIEW

Parachute Running

Parachute running involves running with a parachute attached to the body to provide resistance during the exercise (Gleadhill et al., 2020). Parachute resistance training is a method of resistance training that uses external equipment, such as a parachute, to create drag during sprinting. This approach, known as parachute resistance training, offers several benefits, including the ability for athletes to work on their sprinting technique while also adjusting the level of resistance (Kusuma et al., 2021). The use of a parachute during running involves attaching the end of the parachute's cord to the runner's waist so that the parachute deploys while running, creating resistance or a load during the sprinting process. However, a general drawback of sprint training with resistance is that the application of external loads or resistances may not always effectively challenge the runner's speed development. One notable advantage is that this method can help increase the duration of foot contact with the ground, as discussed by Paulson & Braun (2011). Parachute running was first introduced by Tabachnik (1992) which highlighted the major advantage of athlete's experience in both resisted and assisted conditions, improved body balance, and its applications for other types of running exercises.

100-meter Sprint

The 100-meter sprint is one of the sprint types in athletics which is considered the fastest sprinting event in athletics (Majumdar & Robergs, 2011). A 100-meter sprinter must be able to run the distance and possess excellent physical attributes such as endurance and speed (Jiménez-Reyes et al., 2022). It also needs strength (Cui, 2017), agility, dynamic balance, jumping ability (Jouira et al., 2024), and running techniques (Balandin et al., 2022). The 100-meter dash is a category of sport that involves short, intense, and anaerobic exertion. As one of the important athletic, considering the sprint training type is important. Sprint training with systematic variation is recommended for high-performance level for athletes as (Kraemer et al., 2002a) suggested progressive training, including overload, specificity, variation, and periodization. In addition, resisted sprint training becomes an effective tool to improve horizontal force and power production compared with traditional strength and power training performed in the gym (Haugen et al., 2019).

METHODS

Research Design

The research methodology employed was a quasi-experimental design. Initially, baseline data (Pre-Test) were collected from the sample to assess their initial capabilities. The sample was then ranked and divided into two groups, with matched pairing according to their rankings to ensure balance between the groups. The sample underwent 18 training sessions, after which final data (Post-Test) were collected (Figure 1). This study was conducted at SMP N 20 Medan, located at Jl. Kapten Rahmat Buddin 2023 No. 2256 Medan Marelan and spanned 6 weeks.

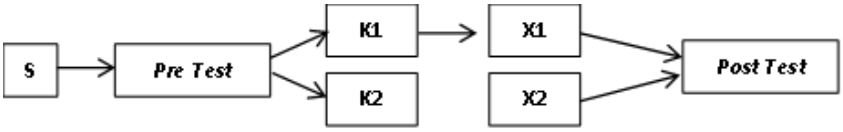

Figure 1. Pretest-Posttest Control Group Design

Note:
S : Sample
Pre Test : Pre-test of 100-meter sprint speed
K1 : Group 1 (parachute running constant-width)
K2 : Group 2 (parachute running varied-width)
X1 : Treatment Group 1
X2 : Treatment Group 2
Post Test : Post-test of 100-meter sprint speed

Data Collection

Population and Samples

The population in this study comprises all athletes in the 100-meter event who participate in the Medan Utara Athletics Club, totaling 10 individuals. All population was assessed and divided into 2 groups with five athletes for each. One group was assigned to do constant-width while another was assigned to do varied-width parachute running.

Data Collection Methods

This study assessed the differences between the constant and varied-width in parachute training, thus, pre-tests were conducted to observe the initial speed of athletes. The training treatment of constant and varied width was given to each group under 18 sessions held three times a week on Tuesdays, Thursdays, and Saturdays from 16:00 to 18:00 WIB. The post-tests were conducted to assess the speed of the 100-meter sprint.

Data Analysis

Normality Test

The normality test was analyzed by using SPSS. The normality test was conducted by the Kolmogorov-Smirnov test. The *p*-value > 0.05 shows the normal distribution of the data, rejecting the null hypothesis which indicates non-normal data distribution.

Homogeneity Test

A homogeneity test was conducted to show the variability of the population. The decision criterion is that if the p-value > 0.005, the test is considered homogeneous; otherwise, if p < 0.005, the test is not homogeneous. Data processing was carried out using SPSS 21.

Hypothesis Test

T-test was conducted to analyze the significant differences between constant and varied-width of parachute training. T-statistics show the difference between the groups, while the *p*-value indicates the significance of the difference. This study used a 95% Confidence Interval (CI), so if the *p*-value obtained less than 0.05, the null hypothesis was rejected. The overall hypotheses of this study were:

H_0 = There is no significant difference between the constant and varied-width parachute running for the 100-meter sprint at North Medan Athletics Club.

H_1 = There is a significant difference between the constant and varied-width parachute running for the 100-meter sprint at North Medan Athletics Club.

RESULTS AND DISCUSSION

Pre-Test and Post-Test Result

Constant Width Parachute Running Training for 100-Meter Sprint Speed.

Table 1 shows the constant-width parachute on the 100-meter running speed of North Medan Athletic Club athletes in 2023. The sample consisted of five athletes for both the pre-test and post-test. The total pretest score was 65.29 seconds, while the total post-test score was 65.16 seconds. The mean pretest time was 13.06 seconds, and the mean post-test time was 13.03 seconds. Overall, the time required for the 100-meter sprint obtained in the post-test was less than pre-test, highlighting the increase of the athletes' speed after the constant-width training.

Table 1. Result of athletes' time in constant-width training (n=5)

Metric	Pretest (seconds)	Posttest (seconds)
Total Time	65.29	65.16
Average Time	13.06	13.03
Median Time	13.02	13.01
Mode Time	13	13
Standard Deviation	0.41	0.42
Maximum Time	13.55	13.51
Minimum Time	12.44	12.29

Varied Width Parachute Running Training for 100-Meter Sprint Speed

Table 2 shows the varied-width parachute on the 100-meter running speed of North Medan Athletic Club athletes in 2023. The sample consisted of five athletes for both the pre-test and post-test. The total pretest score was 65.27 seconds, while the total post-test score was 65.91 seconds. The mean pretest time was 13.05 seconds, and the mean post-test time was 12.78 seconds. Overall, the time required for the 100-meter sprint obtained in the post-test was less than pre-test, highlighting the increase of the athletes' speed after the varied-width training.

Table 2. Result of athletes' time in varied-width training (n=5)

Metric	Pretest (seconds)	Posttest (seconds)
Total Time	65.27	63.91
Average Time	13.05	12.78
Median Time	13.24	13.05
Mode Time	13	13
Standard Deviation	0.44	0.51
Maximum Time	13.58	13.21
Minimum Time	12.54	12.01

Effect of Parachute Running Training on 100-Meter Running Speed

Constant-Width Parachute Running Training on 100-Meter Running Speed

Table 3 depicts the normality test results on the effect of constant-width parachute running training on the 100-meter running speed of North Medan Athletic Club athletes in 2023. The criterion used to determine whether a distribution is normal is if $p > 0.005$, it is considered normal; otherwise, if $p < 0.005$, it is considered not normal. The test results show that the speed data and the criterion used to determine normality have p-values > 0.005. Specifically, the p-value for the pretest is 0.200 > 0.005, indicating normal distribution and the p-value for the post-test is 0.200 > 0.005, also indicating normal distribution. The researcher used Kolmogorov- Smirnov Z in SPSS 21 to calculate and analyze the data. Therefore, it can be concluded that the results from the effect of constant-width parachute running training on the 100-meter running speed of athletes from the North Medan Athletic Club in 2023 show that both the pretest and post-test data are normally distributed.

Table 3. Normality test of Constant-Width Training

Class Statistic		Kolmogorov-Smirnov		
		Df	Sig.	
Constant-width to 100-meter sprint speed	Pretest	0.235	5	0.2
	Posttest	0.241	5	0.2

The homogeneity test was conducted to determine the variance similarity of the study population as shown in Table 4. The pretest and post-test values have a p-value of 0.994 > 0.005, indicating that the data is homogeneous. Since all data is homogeneous, further data analysis can proceed using

parametric statistics.

Table 4. Homogeneity Test of Variance in Constant-Width Training

	Class	Levene Statistic	df1	df2	Sig.
Constant-width to 100-meter sprint speed	Based on Mean	0	1	8	0.996
	Based on Median	0.001	1	8	0.982
	Based on Median and with adjusted df	0.001	1	7.999	0.982
	Based on trimmed mean	0	1	8	0.994

A t-test was conducted to test the hypothesis that "there is a significant effect of constant-width parachute running training on the 100-meter running speed of athletes from the North Medan Athletic Club in 2023," based on the pre-test and post-test results. If the analysis shows a significant difference, it indicates that the constant-width parachute running training has an impact on improving the 100-meter running speed of the athletes. If the calculated t-value is smaller than the critical t-value (t-table), then the alternative hypothesis (H_1) is rejected. Conversely, if the calculated t-value is greater than the critical t-value, H_1 is accepted.

The t-test results (Table 5) show a calculated t-value of 24.93 and a critical t-value of 2.78 (df = 4) with a significance level (p-value) of 0.000. Since the calculated t-value of 24.93 is greater than the critical t-value of 2.78, and the significance level of 0.000 is less than 0.05, this indicates a significant difference. The pretest data shows an average time of 13.06 seconds, while the post-test average is 13.03 seconds. The speed improvement is reflected in the average time difference of 0.03 seconds. Thus, the alternative hypothesis (H_1) that "there is a significant effect of constant-width parachute running training on the 100-meter running speed of athletes from the North Medan Athletic Club in 2023" is accepted. This means that constant-width parachute running training affects the 100-meter running speed of North Medan Athletic Club athletes in 2023.

Table 5. T-Test in Constant-Width Training

Group	Mean	t-test for Equality of Means			
		Calculated t-value	Critical t-value	Sig.	Difference
Pretest	13.06	24.93	2.78	0.000	22.15
Posttest	13.03				

Varied-Width Parachute Running Training on 100-Meter Running Speed

Table 6 shows the test results on the effect of varied-width parachute running training on the 100-meter running speed of North Medan Athletic Club athletes in 2023. The test results show that the speed data and the criterion used to determine normality have p-values > 0.005. Specifically, the p-value for the pretest is 0.200 > 0.005, indicating a normal distribution and the p-value for the post-test is 0.158 > 0.005, also indicating a normal distribution. Therefore, it can be concluded that the results from the effect of varying-width parachute running training on the 100-meter running speed of athletes from the North Medan Athletic Club in 2023 show that both the pretest and post-test data are normally distributed.

Table 6. Normality test of Varied-Width Training

Class Statistic		Kolmogorov-Smirnov		
		Df	Sig.	
Varied-width to 100-meter sprint speed	Pretest	0.263	5	0.2
	Posttest	0.472	5	0.158

The homogeneity test was conducted to determine the variance similarity of the study population as shown in Table 7. The decision criterion is that if the p-value > 0.005, the test is considered homogeneous; otherwise, if p < 0.005, the test is not homogeneous. The pretest and post-test values have a p-value of 0.663 > 0.005, indicating that the data is homogeneous. Since all data is homoge-

neous, further data analysis can proceed using parametric statistics.

Table 7. Homogeneity Test of Variance in Varied -Width Training

	Class	Levene Statistic	df1	df2	Sig.
Varied-width to 100-meter sprint speed	Based on Mean	0.25	1	8	0.631
	Based on Median	0.031	1	8	0.865
	Based on Median and with adjusted df	0.31	1	7.39	0.866
	Based on trimmed mean	0.204	1	8	0.663

The t-test results (Table 8) show that the calculated t-value is 29.128 and the critical t-value is 2.78 (df = 4) with a significance level (p-value) of 0.000. Since the calculated t-value of 29.128 is greater than the critical t-value of 2.78, and the significance level of 0.000 is less than 0.05, this indicates a significant difference. Therefore, the alternative hypothesis (H_1), which states that "there is a significant effect of varied-width parachute running training on the 100-meter running speed of North Medan Athletic Club" is accepted. This means that varied-width parachute running training has a significant effect on the 100-meter running speed of athletes from the North Medan Athletic Club in 2023.

Table 8. T-Test in Varied-Width Training

Group	Mean	t-test for Equality of means			
		Calculated t-value	Critical t-value	Sig.	Difference
Pretest	13.05	29.128	2,78	0.000	25.078
Posttest	12.78				

Differences in the Effects of Constant-Width vs. Varied-Width Parachute Training

This study found a significant effect of constant-width parachute running training on the 100-meter running speed. Furthermore, it was determined that varied-width parachute running training also affects the 100-meter running speed. Statistical evidence from the t-test was conducted to observe differences between the time required for a 100-meter sprint in constant and varied-width parachute training. The t-test indicates that if the p-value (sig (2-tailed)) < 0.05, there is a significant difference. Conversely, if the p-value (sig (2-tailed)) > 0.05, there is no significant difference. The t-test results show a significance value (sig) of 0.000, which is less than 0.05. Thus, it can be concluded that there is a significant difference between the effects of constant-width and varying-width parachute running training on the 100-meter running speed of athletes from the North Medan Athletic Club in 2023.

Based on these findings, it can be concluded that varying-width parachute running training is more effective than constant-width parachute running training for improving the 100-meter running speed of athletes from the North Medan Athletic Club. This conclusion is supported by the fact that the time achieved with varying-width parachute running training is lower compared to the time achieved with constant-width parachute running training, demonstrating greater effectiveness in improving 100-meter sprint performance in the North Medan Athletic Club.

Based on the previous research, this study also shows a significant effect of parachute training as one of the resistance-based training. Previous studies concluded that resistance-based training has a positive effect on sprinting performance (Bolger et al., 2015; Kusuma et al., 2021; Tabachnik, 1992). Resistance training is also suggested by national health organizations for incorporation into a comprehensive fitness program that includes aerobic and flexibility exercises (Kraemer et al., 2002b). Based on different types of distance used in the training, this study is aligned with previous research by Rumpf et al. (2016) which provided a brief review of the effects of specific, nonspecific, and combined sprint training methods and their TE on sprint times over different distances. Rumpf et al. (2016) highlighted the effects of various speed training methods related to distance traveled when sprinting, as our findings also show the more significant result of varied-width parachute training on athletes' speed.

CONCLUSION

The research conducted with athletes from the North Medan Athletic Club in 2023 reveals that both constant-width and varying-width parachute running training have significant effects on improving the 100-meter running speed. However, varying-width parachute running training demonstrates greater effectiveness compared to constant-width parachute running training. The t-test analysis confirms a statistically significant difference, with a p-value of 0.000 indicating that varying-width parachute training results in a more substantial improvement in sprint performance. Specifically, athletes who underwent varying-width parachute training showed a greater reduction in 100-meter running time compared to those who underwent constant-width parachute training. Therefore, it can be concluded that varying-width parachute running training is a more effective method for enhancing the 100-meter running speed of athletes from the North Medan Athletic Club.

REFERENCES

Balandin, S. I., Balandina, I. Yu., Zayko, D. S., & Dmitriev, I. V. (2022). Biomechanical parameters of running technique in the distance of sprinter finalists of the world championship. *Teoriya i Praktika Fizicheskoy Kultury*, *2022*(8), 3–5.

Bolger, R., Lyons, M., Harrison, A. J., & Kenny, I. C. (2015). Sprinting Performance and Resistance-Based Training Interventions: A Systematic Review. *The Journal of Strength & Conditioning Research*, *29*(4). https://journals.lww.com/nsca-jscr/fulltext/2015/04000/sprinting_performance_and_resistance_based.38.aspx

Cui, Z. (2017). An experimental research on the core strength training of male 100-meter sprint. *Agro Food Industry Hi-Tech*, *28*(1), 3460–3463.

Gleadhill, S., Kai, T., & Nagahara, R. (2020). Resist-and-release sprint running using parachute towing causes detrimental changes to performance, kinematics, and kinetics. *Journal of Physical Education and Sport*, *20*(6), 3411–3419. https://doi.org/10.7752/jpes.2020.06461

Gleadhill, S., & Nagahara, R. (2023). Kinetic and kinematic changes during resisted sprinting due to towing three common parachute sizes. *Journal of Sports Medicine and Physical Fitness*, *63*(2), 256–263. https://doi.org/10.23736/S0022-4707.22.14068-5

Haugen, T., Seiler, S., Sandbakk, Ø., & Tønnessen, E. (2019). The Training and Development of Elite Sprint Performance: an Integration of Scientific and Best Practice Literature. In *Sports Medicine - Open* (Vol. 5, Issue 1). Springer. https://doi.org/10.1186/s40798-019-0221-0

Jiménez-Reyes, P., Cuadrado-Peñafiel, V., Párraga-Montilla, J. A., Romero-Franco, N., & Casado, A. (2022). Anaerobic Speed Reserve, Sprint Force–Velocity Profile, Kinematic Characteristics, and Jump Ability among Elite Male Speed-and Endurance-Adapted Milers. *International Journal of Environmental Research and Public Health*, *19*(3). https://doi.org/10.3390/ijerph19031447

Jouira, G., Alexe, D. I., Toh□nean, D. I., Alexe, C. I., Tomozei, R. A., & Sahli, S. (2024). The Relationship between Dynamic Balance, Jumping Ability, and Agility with 100 m Sprinting Performance in Athletes with Intellectual Disabilities. *Sports*, *12*(2). https://doi.org/10.3390/sports12020058

Kraemer, W. J., Adams, K., Cafarelli, E., Dudley, G. A., Dooly, C., Feigenbaum, M. S., Fleck, S. J., Franklin, B., Fry, A. C., Hoffman, J. R., Newton, R. U., Potteiger, J., Stone, M. H., Ratamess, N. A., & Triplett-McBride, T. (2002). Progression Models in Resistance Training for Healthy Adults. *Medicine & Science in Sports & Exercise*, *34*(2). https://journals.lww.com/acsm-msse/fulltext/2002/02000/progression_models_in_resistance_training_for.27.aspx

Kraemer, W. J., Ratamess, N. A., & French, D. N. (2002). Resistance Training for Health and Performance. In *Current Sports Medicine Reports* (Vol. 1).

Kusuma, K. C. A., Kardiawan, I. K. H., & Satyawan, I. M. (2021). Parachute resistance training: A method to improve the running speed of football players. *Journal Sport Area*, *6*(1), 44–50. https://doi.org/10.25299/sportarea.2021.vol6(1).5698

Majumdar, A. S., & Robergs, R. A. (2011). The Science of Speed: Determinants of Performance in the 100 m Sprint. In *International Journal of Sports Science & Coaching* (Vol. 6, Issue 3).

Paulson, S., & Braun, W. A. (2011). The Influence of Parachute-Resisted Sprinting on Running Mechanics in Collegiate Track Athletes. *The Journal of Strength & Conditioning Research*, *25*(6). https://journals.lww.com/nsca-jscr/fulltext/2011/06000/the_influence_of_parachute_resisted_sprinting_on.28.aspx

Rumpf, M. C., Lockie, R. G., Cronin, J. B., & Jalilvand, F. (2016). Effect of Different Sprint Training

Methods on Sprint Performance Over Various Distances: A Brief Review. *The Journal of Strength & Conditioning Research*, *30*(6). https://journals.lww.com/nsca-jscr/fulltext/2016/06000/effect_of_different_sprint_training_methods_on.35.aspx

Tabachnik, B. (1992). STRENGTH TRAINING MODALITIES: The Speed Chute. *Strength & Conditioning Journal*, *14*(4). https://journals.lww.com/nsca-scj/fulltext/1992/08000/strength_training_modalities__the_speed_chute.13.aspx