



**Research Article**

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## The up hill and down hill exercises effect on the improvement of 100 meter running

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### Abstract

This study aimed to determine the effect of Up Hill and Down Hill exercises on increasing the 100 m run. The respondents of this study were 30 male athletes aged 16-17 years with a height of  $\pm 157.4$  cm and a weight of  $\pm 56$  kg. Samples were taken from extracurricular athletes who met the following criteria: they had been doing club training for 4-5 years, had done anatomical adaptation exercises before doing uphill and downhill exercises for 1 month, could carry out treatment for 16 meetings, and were in good health and not injured. Exclusion criteria are those that do not include requirements for inclusion. This research is an experimental study with a One Group Pretest-Posttest design as this research has a Pre-Test before being given treatment and a Post-Test after being given treatment. To test one's ability to run a 100 m sprint, one uses an instrument that measures one's ability to perform a 100 m sprint. An athletic track and a stopwatch are used as the tools in the 100-meter sprint ability test. The results showed that the average scores on the Pre-Test and Post-Test were  $\pm 11.80$  and  $\pm 11.40$ , respectively. Based on the results of the analysis of the T-Test Paired Sample, the results of the Pre-Test and Post-Test were found at a significance of  $p > 0.05$  so it can be concluded that there are no significant effects on Up Hill and Down Hill exercises on increasing the 100-meter run.

**Keywords:** Exercise, Up Hill, Down Hill, 100 m Running.

### INTRODUCTION

Athletes' ability to efficiently accelerate and achieve maximum running speed is critical to their success [1]. Most strength and conditioning programs include exercises to improve speed, which usually focus on the two most important aspects of speed, namely acceleration, and speed [1]. Acceleration is defined as the rate of change of pace and is frequently assessed by evaluating the performance of a short distance sprint, such as 5 or 10 yards [2], whereas speed is defined as the rate of movement over a specific distance and is typically assessed by evaluating the performance of a 40-yard sprint [2]. The three main phases of the 100-meter sprint are acceleration, maximum speed, and deceleration [3,4]. The physical, metabolic, and neurological components associated with sprinting are increased to increase acceleration and speed [5]. Obstacles or assistance are used as a special technique for increasing running speed [6]. In short distance runners, the determination of the quality of speed-strength and speed-strength endurance accompanied by an increase in movement speed is carried out using the elastic properties of muscles that lead to increased joint mobility [7]. A good training method to apply to weight training is on an uphill trail [8]. In Up-Hill running, athletes are required to run uphill with moderate speed which is done repeatedly considering that this exercise aims to develop dynamic strength in the leg muscles [9]. Running Downhill can also train isometric nervous system contraction because running downhill for an athlete indirectly trains a constant speed and full swing movement, allowing athletes to get a fast frequency stimulus [8].

Running at maximum speed on an inclined surface is a widely used training method to create additional stimulus in increasing running speed in athletes [10]. Exercise on a descending slope (3°) for 6 weeks resulted in a significant increase ( $p > 0.05$ ) in Maximum Running Speed (1.1%) and stride speed (2.3%) [11]. However, sprint training on an uphill slope did not result in a significant change in Maximum Running Speed under the same training conditions (duration, volume, intensity) [11]. When compared to other methods on inclined surfaces, 6 to 8 weeks of training with uphill-downhill combined training resulted in significant improvements ( $p > 0.05$ ) in Maximum Running Speed (from 3.5 percent to 5.9%) and stride speed (from 3.4 percent to 7.4%) [11-13]. Thus, the uphill and downhill training methods are more effective in increasing maximum running speed than the horizontal running method [10]. Positive claims for training benefits on a combined uphill and downhill slope surface have also been found, though these claims have

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yet to be backed up with published experimental data. The horizontal exercise group did not produce statistically significant changes, and neither did the control group <sup>[13]</sup>.

The purpose of this study was to determine the effect of uphill and downhill training on increasing the 100 meter run in athletes aged 16-17. The current study would confirm findings from previous studies using appropriate group sizes.

## MATERIAL AND METHODS

This research is an experimental study to determine the outcome of a treatment. The One Group Pretest-Posttest Design was used in this study, which is a research design that includes a pretest before treatment and a posttest after treatment.



Figure 1: Research Design

Where:

R1: Pre-test, R2: Post-test, X: Treatment

The population of this study was 30 male athletes aged 16-17 years with a height of  $\pm 157.4$  cm and a weight of  $\pm 56$  kg. Samples were taken from athletic extracurricular participants by referring to the inclusion criteria. Athletes included in the inclusion criteria were those who had been doing club training for 4-5 years, had done anatomical adaptation exercises before doing uphill and downhill exercises for 1 month, were able to carry out treatment for 16 meetings, participants were in good health and not injury. Criteria that are not included in the inclusion criteria are referred to as exclusion criteria. The instrument used to measure the 100 m sprint ability is the 100 m sprint ability test. The tools used in the 100-meter sprint ability test are an athletic track and a stopwatch.

Respondents were given instructions on the training method to be used before entering the core exercise. Following the procedure, respondents were instructed to warm up and continue with an exercise program. The exercise program lasted 16 meetings, and the participants exercised three times per week.

The trainer first instructed on how to perform the treatment, which includes jogging, stretching, and this exercise. To make it clearer, the program will be presented below:

Table 1: The uphill and downhill training program

Material	Dosage	Description
<b>Introduction</b> • Material Explanation	5 minutes	• An explanation of the exercise material that is clear and concise.
<b>Warm-up</b> • Jogging back and forth • Static stretching • Dynamic stretching • Foot coordination	3 minutes 10 minutes 5 minutes 5 minutes	• Jogging back and forth to raise body temperature • Do static stretching from head to toe • Perform dynamic stretching with more emphasis on the lower extremities • Perform coordination movements of lifting the front, back, and side thighs
<b>Core Training</b> • Uphill	3-4 reps 5-6 sets 20 seconds/interval 3-5 minutes/full	• Participants run optimally up an incline with a slope angle of approximately 30° with a running distance of 30 meters

	rest 1-4 <sup>th</sup> meeting	
<b>Core Training</b> • Downhill	3-4 reps 5-6 sets 20 seconds/interval 3-5 minutes/full rest 5-8 <sup>th</sup> meeting	• Participants run optimally down an incline with a slope angle of approximately 30° with a running distance of 30 meters.
<b>Core Training</b> • Uphill	4-5-6 reps 3-4 sets 20 seconds/interval 5 minutes/ full rest 9-12 <sup>th</sup> meeting	Participants run optimally up an incline with a slope angle of approximately 30° with a running distance of 30 meters.
<b>Core Training</b> • Downhill	4-5-6 reps 20 seconds/interval 5 minutes/full rest 13-16 <sup>th</sup> meeting	• Participants run optimally down an incline with a slope angle of approximately 30° with a running distance of 30 meters.
<b>Relaxation and evaluation</b> • Static and dynamic stretching • Providing direction and evaluation of each training session	10 minutes	• Relax muscles by stretching, followed by evaluation and motivation

## RESULTS

In descriptive statistics, frequency distribution and presentation of mean and standard error are used. The data analysis used was T-Test Paired Sample which was applied to the significance of the pre-test and post-test data. Normal distribution data and homogeneity were determined before distribution to statistical procedures. The basis for decision making as referred to in the Paired Sample T-Test test is as follows: 1) if the significance value or *asymmp.sig* (2-tailed) < 0.05 then the hypothesis is accepted; 2) if the significance value or *asymmp.sig* (2-tailed) > 0.05, then the hypothesis is rejected.

Table 2: Descriptive statistical data

Paired Samples Statistics		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Test	11.8007	30	1.44777	0.26433
	Post Test	11.4007	30	1.26957	0.23179

The average value for the Pre-Test is 11.80, and the average value for the Post-Test is 11.40, with the Pre-Test data having a Standard Deviation of 1.44 and the Post-Test data having a Standard Deviation of 1.26. It is known that all average Post-Test scores after treatment get better results than the average Pre-Test scores based on the average value.

**Table 3:** Pre-Test and Post-Test data on 100 meters running ability

		Paired Differences			95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	PreTest-PostTest	0.40000	1.07860	0.19692	-0.00276	0.80276	2.031	29	0.051

According to the table above, if the  $p > 0.05$ , the hypothesis is rejected, so it can be concluded that uphill and downhill training has no significant effect on the ability to run 100 meters.

## DISCUSSION

The purpose of this study was to determine the effect of uphill and downhill exercise on increasing the 100 m run. The results of this study did not find any significant effect of the treatment applied, but the athletes were known to have an increase in the average score on the pre-test ( $\pm 11.80$ ) and post-test ( $\pm 11.40$ ). In the same previous study, there was no significant difference between pre-test and post-test for all variables analyzed in the control group<sup>[11,13,14]</sup>. The effects of the uphill and downhill methods were independent of the participants' pre-training status, according to previous studies, because the pattern and magnitude of adaptation were similar<sup>[10]</sup>.

During sprint running, two parameters affect running speed, namely stride length and stride frequency<sup>[15]</sup>. To avoid jeopardizing biomechanical efficiency, speed training should aim to increase these two components (energy input required to run at a high speed). Regardless of the athlete's level of physical fitness, a person's body mass and height have a significant impact on stride length and frequency when increasing sprint distance running<sup>[16]</sup>. Muscle mass is also considered important for the acceleration phase of speed because of its ability to overcome inertia and increase stride length<sup>[17]</sup>. Height has a greater impact on maintaining speed and stride length<sup>[15]</sup>. In an extensive study of elite 100 m runners, it was found that stride length had the most dominant impact on male athletes, whereas, in female athletes, superior sprint performance was based on high stride frequency rather than long strides<sup>[18]</sup>.

The main determinants of performance in the 100 m<sup>[19-23]</sup> sprint are sprint-specific strength, technique, and endurance. According to previous research, the Maximum Running Speed decreases by about 3% during a sprint uphill and increases by about 8% during a sprint downhill, resulting in an increase in the average running speed over the entire distance when compared to the maximum horizontal run<sup>[24]</sup>.

The findings of this study showed a difference in the increase in the average score in the pretest and posttest but did not have a significant value as a result of the many influencing factors for increasing the 100-meter running speed.

## CONCLUSION

In conclusion, the average value shows an increasing difference between the pretest (11.80) and posttest (11.40) scores, as shown in the results and discussion above. However, there is no significant difference between uphill and downhill training when it comes to improving 100 meter running times.

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## Conflicts of interest

None declared.

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