COMPETITOR: Jurnal Pendidikan Kepelatihan Olahraga
Volume 14 Number 3 Year 2022
e-ISSN: 2657-0734 & p-ISSN: 2085-5389

The Methods of Uphill Sprint and Downhill Sprint Training Against 100 Meters Running Speed Viewed From the Strength of the Leg Muscles in son Athletes

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2], Sulistiono[3]
[1,2,3]Postgraduate Program / Nusantara PGRI Kediri University / East Java / Indonesia
[1,2,3]Street. KH. Ahmad Dahlan No. 76, Mojoroto, District. Mojoroto, Kediri City, East Java, 64112
[1*]kuncoro.hadi43@gmail.com, [2]himasis_23@unpkediri.ac.id, [3]sulistiono@unpkediri.ac.id

Received: September 17, 2022; ***Reviewed:*** September 30, 2022; ***Accepted:*** October 12, 2022; ***Published:*** October 28, 2022

ABSTRACT

The purpose of this study is to find the truth about: (1) To find out the difference in the influence between the Uphill sprint and Downhill Sprint training methods on the improvement of 100-meter sprint achievement. (2) To find out the difference in the improvement of 100-meter sprint achievement between students who have high and low leg muscle strength. (3) To determine the effect of the interaction between the Uphill sprint and Downhill Sprint training methods with the strength of the high and low leg muscles on the improvement of the 100-meter sprint performance. Experimental method in one group without comparison using pretest-posttest design. The population of this study was athletes from SMP Negeri 1 Rejoso, Nganjuk Regency, class VIII. The sample size used in this study was 32 Men athletes. The sampling technique in this study was Purposive random sampling. The variables studied are free variables consisting of two reactors, namely manipulative variables and attributive variables and one dependent variable. Manipulative variables have two treatments, including giving Uphill sprint exercises, and Downhill sprints. While the attributive variable in this study is the strength of the leg muscles which are distinguished by high and low. The dependent variable of the study is the increase in sprints of 100 meters. Data collection techniques with tests and measurements, leg *muscle strength data with leg and back dynamometers. The data analysis techniques used for hypothesis testing are the 2-lane design Variance Analysis (ANOVA) and the Newman-Keuls range test, at a significance level of 95%. The results of the study that Uphill sprint training has a different improvement from Downhill sprint training. From the calculation results obtained Fhit = 12.5641 greater than Ftabel = 2.95 (F0 > Ft) at a signification level of 5%. This means that the null hypothesis (Ho) is rejected. This means that the Uphill sprint practice has different improvements than the Downhill sprint practice is acceptable. The results of this study showed that* players who had low leg muscle strength had *a 100-meter sprint increase which was different from players who had high leg muscle strength. This is evidenced by the value of Fhit = 4.2619 greater than Ftabel = 2.95 (F0 > Ft) at a signification level of 5%. This means that the null hypothesis (H0) is rejected. This means that athletes who have low* leg muscle strength *have a 100-meter sprint that is different from high leg muscle strength players, it is acceptable. The results of this study also showed* that there was an interaction between the influence of plyometric exercise and a significant level of leg muscle strength, which was shown by F0 = *23.4810 greater than Ft = 2.95 at a signification level of 5% so that H0 was rejected, so it can be concluded that there was a significant interaction between the influence of plyometric exercise and the level of leg muscle strength. Players who have low leg muscle strength are more appropriately given the Uphill sprint training treatment to increase the sprint by 100 meters. Downhill sprint training treatment is more appropriately given to athletes who have high leg muscle strength.*

Keywords: *Exercise; Uphill Sprint; Downhill Sprint; running speed; Leg Muscle Strength.*

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

INTRODUCTION

In Indonesia, athletics is taught in learning in schools since children are still in lower school (SD) to high school (SMA). This athletic learning is given and taught systematically and gradually from the skill of understanding the lower movements to the achievement of achievements. The long jump as an athletic sport taught in schools can be raised into a sporting achievement as a form of long-term coaching of athletes. Students of his special junior high school are generally 12 to 15 years old. The age at which time is right to start coaching achievement sports, as revealed by (Farida, 2016) when childhood, the growth of intertwined movements is in the form of an increase in the quality of the ability of movement patterns that have been biased to be tried in toddlerhood and an increase in the alteration of various patterns of lower motion. Next, (Sugito et al., 2020) stated that "in each branch of exercise aged 8 to 11 years is a mature age to be able to do exercises in coaching sports achievements".

In the application of the 100-meter sprint with the movements not so complex, students should master faster and achieve success rates. (Sukadiyanto, 2011) The techniques in the 100-meter sprint athletics that students must master are (1) Techniques for making starts, (2) techniques when doing pushes, (3) techniques when running starting from hand swings and footsteps, and (4) techniques for entering the finish line, with the correct technique.

Students carrying out a 100-meter sprint with the right technique with the fastest travel time will be able to produce a good runner. The fact is that the results of achievements in athletic competitions held by PASI Nganjuk Regency showed poor results, by looking at the time record produced. The resulting time was unable to pass the set 100-meter sprint pass time limit of 14.00 seconds. Some of the obstacles that are the cause include the lack of initiative of fostered athletes to increase the portion of training and the ineffectiveness of the methods used to improve these achievements. Students generally have not been able to process the correct 100-meter sprint technique so the time obtained is less than optimal. SMP Negeri 1 Rejoso which is located at Jl. Ki Hajar Dewantara No.108, Tutul, Banjarejo, Kec. Rejoso, Nganjuk Regency. SMP Negeri 1 Rejoso is one of the schools that has special sports classes in the Nganjuk Regency. However, the coaching provided for athletes is still not good, so they cannot compete in terms of achievements and the continuity of training is not well-planned, systematic, and lasting. Currently, athletics athletes at SMP Negeri 1 Rejoso are experiencing a decline in several tournaments organized by PASI Nganjuk Regency. This can be seen from the achievements achieved by the men's athletics athletes of SMP Negeri 1 Rejoso in the 100-

meter dash at the championships held by PASI Nganjuk regency, especially short-distance running or sprint numbers.

The achievement of achievements in sports in athletics requires great effort through scientific training methods and is inseparable from several supporting factors (Sahabuddin et al., 2020). Because sports achievements can be achieved as the result of a combination of various efforts that involve many parties such as coaches, facilities, exercise programs, and theories that support the training itself (Ishak et al., 2022). Sports coaching and improving the quality of training are also factors that can help spur the development of achievements in sports. This includes the achievement of sports achievements in the 100-meter dash. A coach in preparing his athletes also requires various considerations and calculations as well as careful analysis of the factors that determine and support achievements in athletics in the 100-meter run. T. O. Bompa & Haff, (2009) states that; training performed by players is an activity that can improve their abilities provided by the coach. Training is one of the factors in determining achievements in sports, so the training carried out must be as needed in the sport according to the characteristics of the 100-meter run (Cahyono et al., 2017). The exercise program carried out is a systematic effort in improving physical function and skills (Sahabuddin, 2017). Select specific exercises suitable for certain branches and ages should be carefully analyzed. T. Bompa, (2012) states that; the training program should be structured based on the age of the athletes, while its success depends in part on the quality and ability of the athlete in question. In providing the training program Sugito et al., (2020) must pay attention to the condition of the athlete himself, the athlete must be ready to receive the training program, meaning that the athlete must be in good health and not experience injuries when doing exercise. In athletics running numbers, Sprint or other terms of short-distance running is a run that is carried out at full speed from the starting line to the finish line in the shortest possible time (Jaliusril et al., 2012). Sprinting is a sprint because of the close distance, so a sprinter runner is required to expend all his body's strength to run as fast as possible to the finish line (Fadillah, 2009). Achieving the 100-meter sprint achievement requires a form of the proper training program (Satun, 2018). A teacher or coach must have a lot of knowledge about sprint training programs, besides being supported by field experience (Johan Cahyo B., Musyafari Waluyo, 2012).

Efforts to achieve achievements in sports must go through exercises carried out with a scientific approach to the related sciences (Ferry & Welis, 2019). Various sciences related to sports and sports health include exercise physiology, sports biomechanics, sports

pedagogy, sports sociology, sports psychology and sports health (Sahabuddin, 2020). With the support of these various disciplines, a good training theory will be developed, so that sports achievements can be improved properly (Sudirman et al., 2022). The achievement of this achievement is inseparable from the support of the community and sports people as well as experts in the field of sports. Athletic achievements cannot be achieved in a short time but must go through intensive training with the correct exercise program. In the 100-meter sprint, the exercises carried out must of course be special in developing the necessary components in it (Bagia, 2015). Various considerations and calculations and careful analysis of the factors that determine and support the improvement of the 100-meter sprint performance (R. & Furkan, 2014) are needed. These determining and supporting factors can be used as a basis in the preparation of training programs (Faizah, 2016). A sprint athlete must have speed, strength, explosive power, balance and coordination of movements, in addition to intelligence and science Budiwanto, (2012). Thus, to get a 100-meter sprint achievement must be supported by good physical abilities, especially speed and supported by good movement techniques and posture skills (Umah et al., 2016).

The decline in the achievement of athletes in the special sports class of SMP Negeri 1 Rejoso requires good technical training to increase maximum speed, the function of the technique is to increase the frequency of motion and accelerate the reaction time of Sukadiyanto, (2005). For this reason, the engineering factor provides a greater role in learning motion skills that require an element of speed (Balsalobre-Fernández et al., 2013). The short-distance running technique is divided into three, namely squat start, running movement, and finish line entry technique (Taufik Hidayat, Ramadi, 2016).

Sprint training there are several training methods used to develop energy systems to improve the performance of the 100-meter sprint (Giyatno, 2017). In this study, two training methods were used to improve the performance of the 100-meter sprint including the Uphill sprint and the Downhill Sprint. Uphill sprint training is one of the exercises that is expected to increase running speed, this exercise is done using hill running exercises. Running using a riding track can increase the strength of the leg muscles to achieve maximum running speed. Whereas Downhill is a full-body exercise model used to investigate the physiological consequences of eccentric muscle action and or muscle damage due to exercise (Juliyanto, 2016). Another supporting factor in the increase in 100-meter sprint results, of which is when viewed from the physical shape related to anthropometrics which is a variable that has a significant impact on the achievement of 100-meter sprint results (Nuryadi & Firmansyah, 2018). The comparison of the length of body parts with the height of each individual or briefly

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

called the ratio of anthropometric measurements, which can provide a relative value for each individual that can be compared with other individuals. (Rahadian, 2018). The size of the parts of the body is a lot to compare. Leg muscle strength is an anthropometric measure that biomechanically is thought to be an independent variable for improving 100-meter sprint performance. Because 100-meter sprint movement, muscle strength is one of the determining factors in the achievement of the 100-meter sprint.

METHOD

The variables in this study consisted of one independent variable and one dependent variable. Independent variables consist of manipulative variables in the form of sprint exercise methods and attribute variables in the form of leg muscle power, while dependent variables, namely long jump performance. The approach used in this study is quantitative because the data obtained is in the form of numbers and then the data is processed and analyzed to displace statistics. This study used an experimental method in one group without comparison using a pretest-posttest design where the pretest is the initial measurement and the posttest is the final measurement by being given treatment, namely weight training using the Circuit training method. Experimental research is a scientific study in which the researcher manipulates and controls one or more free variables and observes related variables to find variations that appear along with the manipulation of these free variables (Kerlinger, 2006). Meanwhile, Sugiyono, (2012) experimental research is a research method used to find the influence of certain treatments on others under controlled conditions. In this study, the test was carried out twice, namely before and after the treatment (treatment). The difference between the pretest and posttest is said to be the effect of treatment. So that the results of the treatment are expected to be known more accurately because there is a comparison between the conditions before and after being treated. The research design is as follows:

Table 1.
Research Design

Dependent Variables / Independent Variables		Leg Muscle Strength (B)	
		High Leg muscle strength (B1) 16 Men's Athletes	**Low Leg muscle strength (B2) 16 Men's Athletes**
Sprint Running Training Method (A)	Up Hill Method (A_1)	a 1 b_1 8 Men's Athletes	a_1b_2 8 Men's Athletes
	Downhill Sprint Method (A_2)	a_2b_1 8 Men's Athletes	a 2 b_2 8 Men's Athletes

COMPETITOR: Jurnal Pendidikan Kepelatihan Olahraga
14 (3) 2022 | 457 – 477| doi : 10.26858/cjpko.v14i3.38870. - ISSN : (E)2657-0734 & (P)2085-5389

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

The population in this study was students of SMP Negeri 1 Rejoso, Nganjuk Regency, class VIII for the 2021/2022 Academic Year, totalling 32 male students who participated in extra athletics activities in the 100-meter run. The sample used in this study is the overall number of populations that are the subject of the existing study. The sample used in this study was saturated. The sample used in this study was the entire study population, which amounted to 32 male students of SMP Negeri 1 Rejoso, Nganjuk Regency, class VIII for the 2021/2022 academic year. The data used in this study are 100-meter running speed data and leg muscle strength data. Leg muscle strength data were used to determine and divide the experimental group, while the 100-meter sprint running speed data was used to determine the improvement in the performance of the 100-meter sprint as a result of the treatment given. The 100-meter running speed uses the 100-meter running test, and the leg muscle strength uses the leg and back dynamometer. The data analysis technique used for hypothesis testing is the 2-lane Design Variance Analysis (ANAVA). Hypothesis testing was carried out with a signification level of $\alpha = 0.05$. Considering that the analysis of research data is carried out using ANOVA.

RESULTS AND DISCUSSION

Results

The description of the results of the data analysis of the results of the 100-meter sprint on students of SMP Negeri 1 Rejoso, Nganjuk Regency, class VIII which was carried out according to the compared groups is presented in the form of a table as follows:

Table 2.
100-meter sprint score results in students of SMP Negeri 1 Rejoso Nganjuk District class VIII

Leg Muscle Strength	Statistics	Plyometric exercise method		
		Uphill Sprint Practice	Downhill Sprint Practice	Total
Low	N	8	8	16
	SY	00:23	00:18	00:42
	SY^2	00:47	00:37	01:24
	Mean	00:02	00:02	00:02
Tall	N	8	8	16
	SY	00:25	00:05	00:31
	SY^2	00:50	00:11	01:02
	Mean	00:03	00:00	00:01
Total	N	16	16	32
	SY	00:48	00:24	01:13
	SY^2	01:37	00:49	02:26
	Mean	00:03	00:01	00:02

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

Data on the results of the 100-meter sprint of athletes who have low leg muscle strength with the provision of *Uphill sprint training exercises*. The description of the results of the analysis of 100-meter sprint data performed following the strength of the leg muscles is presented as follows:

Table 3.
Data Results of the 100-meter sprint Group of athletes who Have Low Leg Muscle Strength with Uphill sprint exercise

Plyometric Exercises	Leg Muscle Strength	Statistics	Initial Test Results	Final Test Results	Increased
Uphill sprint exercises	Low	Sum	05:32	05:08	00:23
		Average	00:41	00:38	00:05
		Sd	0:00:53	0:01:53	0:01:13

Description of the 100-meter sprint data of the group of athletes who have high leg muscle strength and the provision of uphill sprint exercises.

Data on 100-meter sprint results Group of athletes Who Have High leg muscle strength and Uphill sprint exercises. Description of the results of the analysis of 100-meter sprint data The group of athletes Who Have high leg muscle strength is presented as follows:

Table 4.
Description of Data Results of the 100-meter sprint Group of athletes Who Have High Leg Muscle Strength and Uphill sprint exercise Administration

Plyometric Exercises	Leg Muscle Strength	Statistics	Initial Test Results	Final Test Results	Increased
Uphill Sprint Practice	Tall	Sum	05:53	05:28	00:25
		Average	00:44	00:41	00:03
		Sd	0:00:52	0:01:14	0:01:48

Description of the 100-meter sprint data of the group of athletes who have the low leg muscle strength and the provision of *downhill sprint exercises.*

100-meter sprint data The group of athletes who have the low leg muscle strength and *downhill sprint exercises*. Description of the results of the analysis data sprint 100 meters The group of athletes Who Have Low leg muscle strength is presented as follows:

Table 5.
Description 100-meter sprint data Group of athletes Who Have Low leg muscle Strength and Exercise *Administration Downhill sprint*

Plyometric Exercises	Leg Muscle Strength	Statistics	Initial Test Results	Final Test Results	Increased
Downhill sprint exercises	Low	Sum	**05:40**	**05:21**	**00:18**
		Average	**00:42**	**00:40**	**00:02**
		Sd	**0:00:56**	**0:00:46**	**0:00:33**

COMPETITOR: Jurnal Pendidikan Kepelatihan Olahraga
14 (3) 2022 | 457 – 477| doi : 10.26858/cjpko.v14i3.38870. - ISSN : (E)2657-0734 & (P)2085-5389

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

Description of the 100-meter sprint data of the group of athletes who have the high leg muscle strength and the provision of downhill exercises.

100-meter sprint data The group of athletes Who Have Low leg muscle strength and Downhill Exercise Administration. Description of the results of the analysis Data of the 100-meter sprint The group of athletes Who Have Low leg muscle strength is presented as follows:

Table 6.
Description 100-meter sprint data Group of athletes Who Have Low Leg Muscle Strength and *Downhill Workouts*

Plyometric Exercises	Leg Muscle Strength	Statistics	Initial Test Results	Final Test Results	Increased
Downhill sprint exercises	Tall	Sum	05:59	05:55	00:05
		Average	00:44	00:44	00:00
		Sd	0:00:49	0:01:34	0:00:42

From the table above, the description of the 100-meter sprint data classified according to the muscle strength group of the legs can be seen from the description of each group in each table. This section presents information in the form of tables regarding the description of the data on the results of the initial test and the final test of the results of the 100-meter sprint as well as the average scores of each treatment group. Description data sprint 100 meters performed according to the group compared. Based on the administration of plyometric exercises (Uphill sprint exercises and Downhill sprint exercises) as well as the level of leg muscle strength (high and low) are presented in the following table:

Table 7.
Description of 100-meter sprint results in each group of athletes based on the provision of plyometric exercises and strength levels.

Treatment	Leg Muscle Strength	Statistics	Initial Tests	Final Test	Increased
Latihan Uphill sprint	Low	Sum	05:32	05:08	00:23
		Average	00:41	00:38	00:05
		Sd	0:00:53	0:01:53	0:01:13
	Tall	Sum	05:53	05:28	00:25
		Average	00:44	00:41	00:03
		Sd	0:00:52	0:01:14	0:01:48
Latihan Downhill sprint	Low	Sum	05:40	05:21	00:18
		Average	00:42	00:40	00:02
		Sd	0:00:56	0:00:46	0:00:33
	Tall	Sum	05:59	05:55	00:05
		Average	00:44	00:44	00:00
		Sd	0:00:49	0:01:34	0:00:42

COMPETITOR: Jurnal Pendidikan Kepelatihan Olahraga
14 (3) 2022 | 457 – 477| doi : 10.26858/cjpko.v14i3.38870. - ISSN : (E)2657-0734 & (P)2085-5389

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

Description of the 100-meter sprint results based on *Plyometric* exercises.

Uphill Sprint Exercise Group

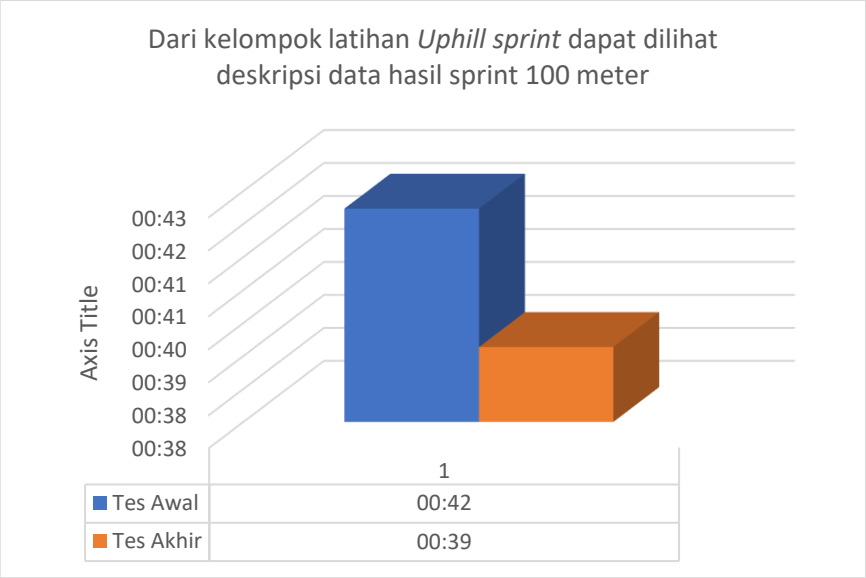


Figure 1.
Average Histogram Initial test and 100-meter sprint final test *Uphill sprint* exercise group.

Downhill sprint practice group

Figure 2.
Average Histogram Initial test and 100-meter sprint final test Downhill sprint exercise group

Description of 100-meter sprint results Based on leg muscle strength.

The tests that are the subject of research based on the strength of the leg muscles are divided into 2 groups, namely the group High leg muscle strength and low leg muscle

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

strength. Of the testee, 32 athletes from SMP Negeri 1 Rejoso, Nganjuk Regency, class VIII were divided into 16 athletes who had high leg muscle strength, and 16 athletes who had low leg muscle strength. From the two groups, you can see the description of the data from the 100-meter sprint as follows:

Low leg muscle strength group with Uphill sprint workouts

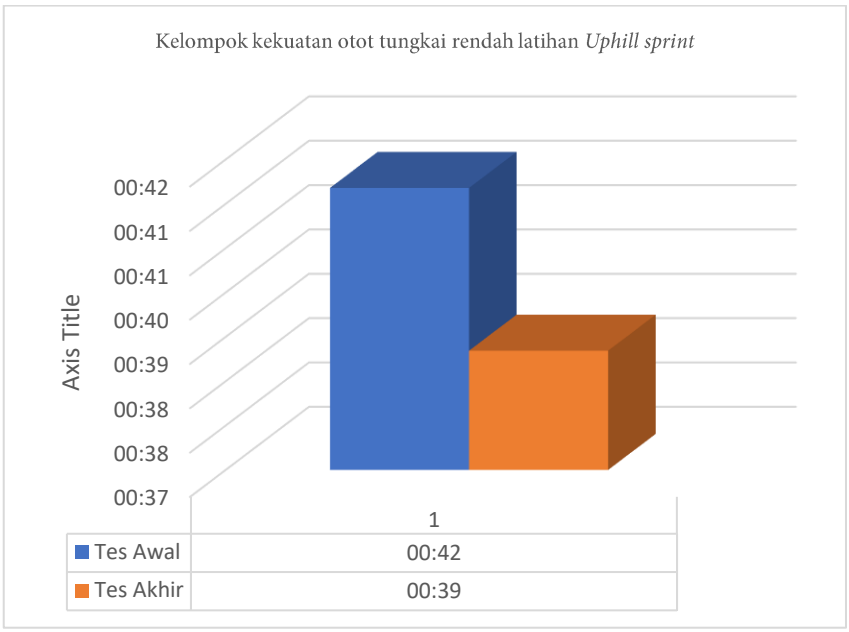


Figure 3.
Histogram Average Initial test and Final test of 100-meter sprint Low leg muscle strength group.

High leg muscle strength group with Uphill sprint workouts

Figure 4.
Average Histogram Initial test and 100-meter sprint end test High leg muscle strength group

COMPETITOR: Jurnal Pendidikan Kepelatihan Olahraga
14 (3) 2022 | 457 – 477| doi : 10.26858/cjpko.v14i3.38870. - ISSN : (E)2657-0734 & (P)2085-5389

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

Description of 100-meter sprint results based on plyometric exercises in terms of leg muscle strength.

The total testee in this study amounted to 32 athletes from SMP Negeri 1 Rejoso, Nganjuk Regency, class VIII divided into 4 groups and each group containing 8 athletes. This division is based on the high-leg muscle strength group and the low-leg muscle strength group, as well as the Uphill sprint and *Downhill sprint* exercise treatment groups. From the four groups, you can see the description of the data from the 100-meter sprint as follows:

Uphill *Training* Group **sprint for athletes who have low leg muscle strength.**

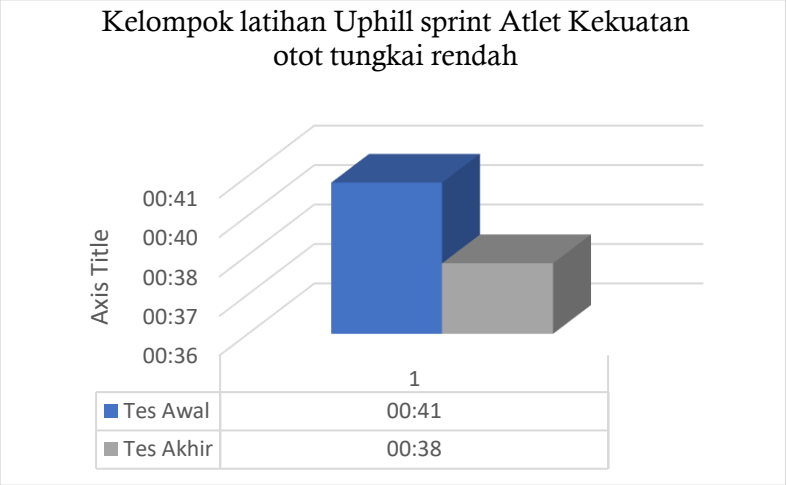


Figure 5.
Histogram sprint 100-meter Training Group *Uphill sprint* in Athletes Who Have Low leg muscle Strength

Uphill Training Group sprint For Athletes Who Have High Leg Muscle Strength.

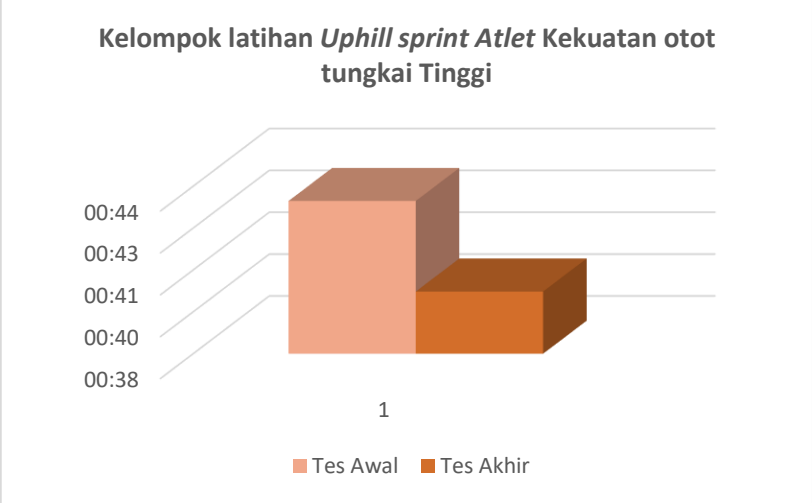


Figure 6.
Histogram sprint 100-meter Training Group *Uphill sprint* in Athletes Who Have High Leg Muscle Strength

COMPETITOR: Jurnal Pendidikan Kepelatihan Olahraga
14 (3) 2022 | 457 – 477| doi : 10.26858/cjpko.v14i3.38870. - ISSN : (E)2657-0734 & (P)2085-5389

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

Group *Downhill Workout Sprint* For Athletes Who Have Low Leg Muscle Strength.

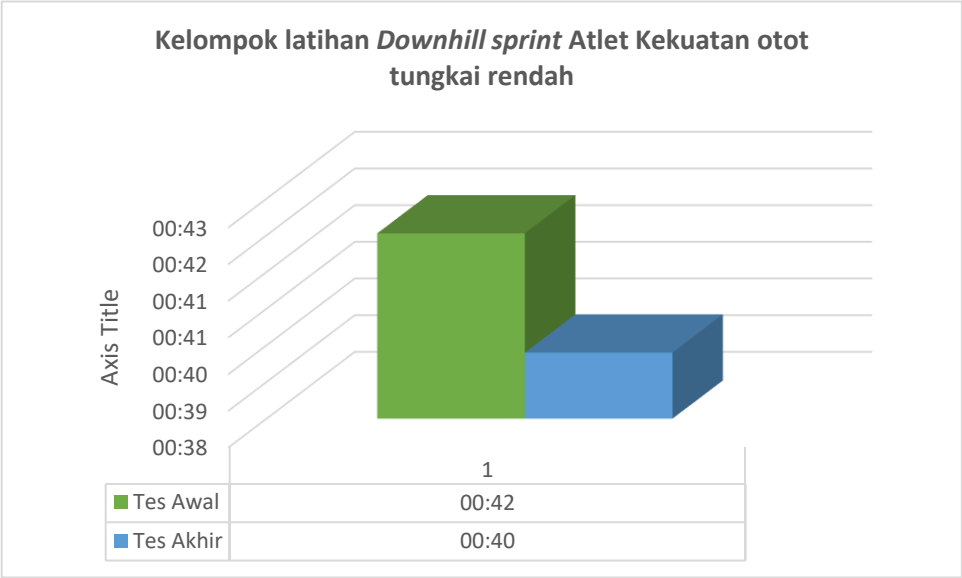


Figure 7.
100-meter sprint histogram *Downhill sprint* Training Group in Athletes Who Have Low leg muscle Strength

***Group Downhill Training sprint* for athletes who have the high leg muscle strength**

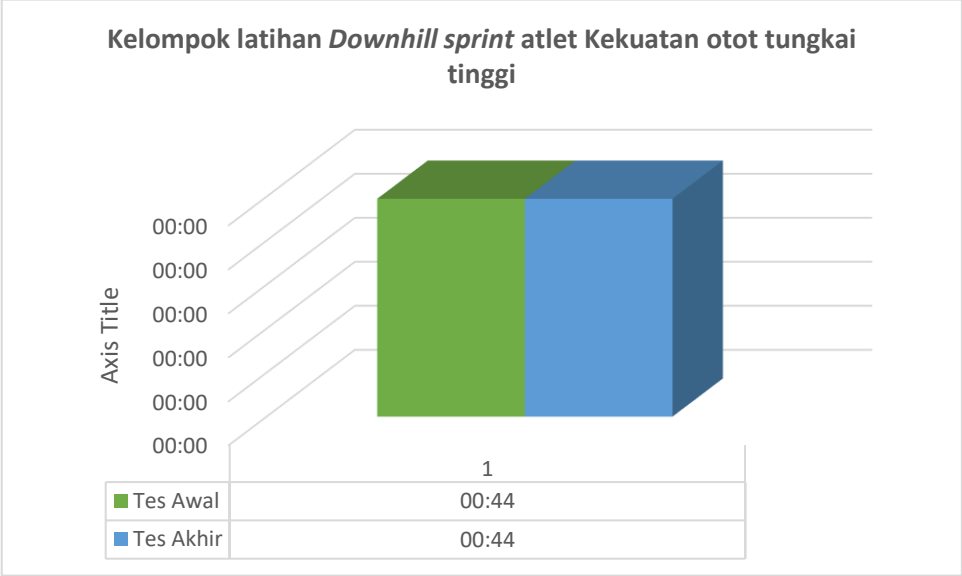


Figure 8.
Histogram Sprint 100 meter *Downhill sprint* Training Group For Athletes Who Have High Leg Muscle Strength

A comprehensive overview of the average value of the 100-meter sprint results can be made through a histogram of value comparison as follows:

COMPETITOR: Jurnal Pendidikan Kepelatihan Olahraga
14 (3) 2022 | 457 – 477| doi : 10.26858/cjpko.v14i3.38870. - ISSN : (E)2657-0734 & (P)2085-5389

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

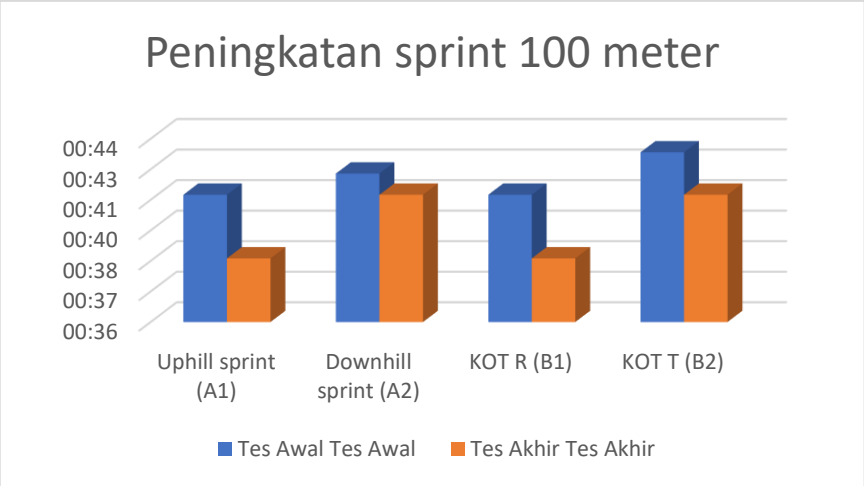


Figure 9.
Histogram Average Value of Initial Test Results and Final Test of 100-meter sprint of Each Group Based on Plyometric Exercises and Leg Muscle Strength Level (KOT).

The things that receive attention from the values contained in the table above are as follows: (1) If the group of athletes who received training in the form of giving Uphill sprint training and Downhill sprint training were compared, then it can be seen that the group given treatment in the form of *Uphill sprint* training had an increase in the sprint of 100 meters by 00:03 higher than the *Downhill* training group *sprint*; and (2) If the group of athletes who have low and high leg muscle strength are compared, then it can be known that the group of athletes who have low leg muscle strength has an increase in the 100-meter sprint by 00:03 higher than the group of athletes who have high leg muscle strength.

For the average value of the 100-meter sprint achieved by each group to be easily understood, the value of the 100-meter sprint increase in each group needs to be presented in the form of a diagram as follows:

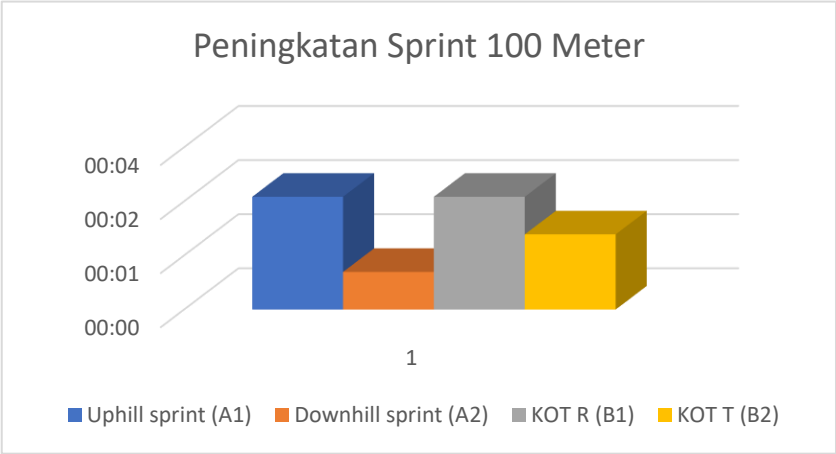


Figure 10.
Histogram Average Value of 100-meter sprint increase in each exercise group and leg muscle strength

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

Normality Test

Before analyzing the data, it is necessary to test the distribution of normality. The normality test of the population frequency distribution carried out in each group is as follows :

Table 8.
Normality Test Results with Lilies.

Group	N	Prob	L_{count}	L_{table}	Conclusion
KP_1	8	0,05	0.115	0.285	Normal Distribution
KP_2	8	0,05	0.221	0.285	Normal Distribution
KP_3	8	0,05	0.237	0.285	Normal Distribution
KP_4	8	0,05	0.112	0.285	Normal Distribution

Homogeneity Test

With the same sample analyzed using *the Barlett* test, the test results listed in the table are obtained as follows:

Table 9.
Homogeneity Test Results With *Barlett* Test

Σ Group	Ni	S^2gab	X^2_{hits}	X^2_{tables}	Conclusion
4	8	0.4151	6.12	7.14	Homogeneous

Hypothesis Testing

Concerning the results of the analysis and the *Newman Keuls* range test, several hypotheses must be tested. The results of the data analysis can be viewed as listed in the following table:

Table 10.
Mean Increase in Leg Muscle Strength Based on Plyometric Exercises and Leg Muscle Strength Levels before and after treatment

Average	Research Variables			
	a_1		a_2	
	b_1	b_2	b_1	b_2
Initial test results	00:41	00:44	00:42	00:44
Final test results	00:38	00:41	00:40	00:44
Increased	00:05	00:03	00:02	00:00

Table 11.
Summary of Analysis Results for Plyometric Exercises (a_1 and a_2)

Sources of Variation	Dk	JK	RJK	F_o	F_t
A	1	3. 268	3. 4115	11. 5807	2. 95
Mistake	28	16. 3388	0.198		

COMPETITOR: Jurnal Pendidikan Kepelatihan Olahraga
14 (3) 2022 | 457 – 477| doi : 10.26858/cjpko.v14i3.38870. - ISSN : (E)2657-0734 & (P)2085-5389

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

The results of the ANOVA calculation in the table above show that the price F_o = 11. 5807 and F t = 4.11, thus $F_o > F_t$ (F_{count} greater than F_{table}).

Interpretation:

If F o $> F_t$ then with = 0.05, H_o is rejected, meaning that there is a difference between the Uphill sprint and *Downhill sprint exercises*. This is evidenced by F_{count} = 11. 5807 > F_{table} = 4.11. from the advanced analysis, it was obtained that it turned out that the Uphill sprint exercise had a better improvement than the *Downhill sprint.*

Table 12.
Summary of Analysis Results for leg muscle strength (b_1 and b_2)

Sources of Variation	Dk	JK	RJK	F_o	F_t
B	1	1,4229	1,418	4.3413	2. 91
Mistake	31	18. 2641	0.578		

The results of the ANOVA calculation in the table above show that the price of F_o = 4.2619 and F_t = 2. 91, thus $F_o > F_t$ (F_{count} greater than F_{table}).

Interpretation:

If F o $> F_t$ then with = 0.05, H_o is rejected, meaning that there is a difference between low-leg muscle strength and high-leg muscle strength. This is evidenced by F_{count} = 4.2619 > F_{table} = 2. 91. From the follow-up analysis it was obtained that it turns out that the muscle strength of low legs has a better increase than the muscle strength of high legs.

Table 13.
Results of Two-Factor Variance Analysis

Sources of Variation	Dk	JK	RJK	F_{count}	F_t
Treatment	1	136. 1214	132. 225		
A	1	4. 4296	3.141	11,3411 *	2. 91
B	1	1.4176	1,428	4.2789 *	
Ab	1	8.4429	8,338	21.251	
Mistake	28	19.3275	0.248		
Total	**31**	**180.0998**			

The ANAVA calculation results in the table above show that the price of F_o = 2 1.251 and F_t = 2. 91 thus $F_o > F_t$ (F_{count} greater than F_{table}).

Interpretation:

If F o $> F_t$ then with = 0.05, H_o is rejected, meaning that there is an interaction between Uphill sprint and *Downhill sprint* exercises with low leg muscle strength and high leg muscle strength . This is evidenced from F_{count} = 2 1.33 10 > F_{table} = 2. 91.

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

The next step that needs to be considered is proof with the *Newman Keuls* range test, which is to find out whether there is a difference between the treatment averages. In detail can be seen in the table below.

Table 14.
Newman Keuls Range Test Results

Kp		A2B2	A1B2		A2B1		A1B1		RST
	Average	0. 001	0. 002		0. 002		0. 002		
A2B2	0,001	-	0. 002	*	0. 001	*	0. 002	*	0.5088
A1B2	0,002		-		0. 001		0. 000	*	0.6127
A2B1	0,002				-		0. 000	*	0.6761
A1B1	0,002						-		

Information:
* : Signification Mark at P < 0.05.
a 1 b_1 : *Uphill sprint* exercises with Low leg muscle strength
a_2b_1 : *Downhill sprint* exercises with Low leg muscle strength
a_1b_2 : *Uphill sprint* exercises with High Leg Muscle Strength
a 2 b_2 : *Downhill sprint* exercises with high leg muscle strength

Hypothesis Testing I

From the results of the study, it shows that the Uphill sprint exercise has a different improvement from *the Downhill sprint* exercise. From the calculation results obtained F_{hit} = 11. 5807 is greater than F_{table} = 2.91 ($F_0 > F_t$) at a signification rate of 5%. This means that the null hypothesis (H_o) is rejected. Whichmeans that the Uphill sprint exercise has a different improvement than *the Downhill sprint* exercise is acceptable. From the follow-up analysis, it is known that the Uphill sprint exercise has a better improvement than *the Downhill sprint* exercise. S iswa SMP Negeri 1 Rejoso Kabupaten Nganjuk class VIII who received Uphill sprint training had an average increase of 00:03, while student athletes of SMP Negeri 1 Rejoso Kabupaten Nganjuk class VIII who received *Downhill sprint* training had an average increase of 00:01.

Hypothesis Testing II

The results showed that athletes who had low leg muscle strength had a 100-meter sprint increase in contrast to athletes who had high leg muscle strength. This is evidenced from the value of F_{hit} = 4.2619 greater than F_{table} = 2.91 ($F_0 > F_t$) at a signification rate of 5%. This means that the null hypothesis (H_0) is rejected. This means that athletes who have low leg muscle strength have a 100-meter sprint increase in contrast to athletes who have high leg muscle strength, it is acceptable. From the follow-up analysis, it was obtained that

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

athletes who had low leg muscle strength had a 100-meter sprint increase in contrast to athletes who had high leg muscle strength, with an average increase of 00:03 and 00:02, respectively.

Hypothesis Testing III

From the results of the data analysis that has been carried out shows that there is an interaction between the influence of the exercise method and the significant strength of the leg muscles, which is indicated by F_0 = 23. 4810 is greater than F_t = 2.91 at a signification level of 5% so that H_0 is rejected, so it can be concluded that there is a significant interaction between the influence of the exercise method and the level of leg muscle strength. Athletes who have low leg muscle strength are more appropriately given the treatment of *Uphill* sprint exercises to increase the 100-meter sprint. Downhill *sprint* training treatment is more appropriately given to athletes who have high leg muscle strength.

Discussion

Effect between Uphill sprint and *Downhill sprint* Exercise On 100-meter Sprint

Based on testing the first hypothesis it turned out to show that, there was a significant influence between the group of athletes who got the Uphill sprint training approach and the group of athletes who got the *Downhill* sprint training approach to the increase in the 100-meter sprint. In the group of athletes who got the Uphill sprint training approach, they had a better 100-meter sprint increase compared to the group that got the *Downhill sprint* training approach.

This exercise requires the athlete to concentrate on the strength of the leg muscles against the training method, so as to train the strength of the athlete. *Uphill sprint* training is a running exercise done by cleging hills. The purpose of this exercise is to increase the strength of the muscles of the leg legs. In other words, the exercise of cleging hills to develop the muscles of footwork is called *an uphill sprint*.

Effect of Increased 100-meter sprint Between athletes who Have **low and high leg muscle strength.**

Based on testing the second hypothesis it turned out to show that there was a significant influence between the group of athletes who had low leg muscle strength and athletes who had high leg muscle strength against the 100-meter sprint. In the group of athletes who have low leg muscle strength have an increase in sprint 100 meters better than the group of athletes who have high leg muscle strength.

Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

Leg muscle strength is a person's ability to perform strength in the legs which is a locomotor in a 100-meter sprint. The result of the 100-meter sprint is greatly influenced by the level of muscle strength of the legs, The muscle strength required is The strength of the leg muscles. The strength of the leg muscles is an obligation that athletes have to be fast in running. The strength of the leg muscles is the underlying ability of the movements that a runner performs. The strength of the leg muscles can support the success of achieving a 100-meter sprint by controlling the movements of the technique performed. Athletes who have low leg muscle strength have the ability to sprint 100 meters than athletes who have high leg muscle strength. The success of achieving a 100-meter sprint is influenced by the athlete's ability to perform movements in an integrated and aligned manner.

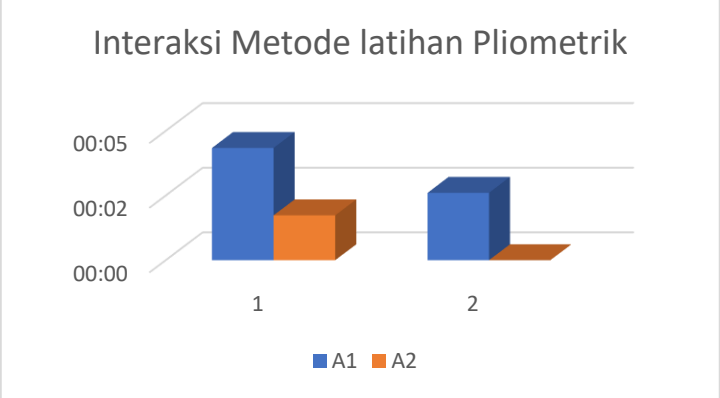
Effect of Interaction between Training Method and Leg muscle Strength on 100-meter Sprint Increase**.**

From the summary table of the results of the two-factor variance analysis, it appears that the main factors of the study in the form of two factors showed a significant interaction. For the purposes of testing the form of interaction AB is formed the table below.

Table 15.
Simple Influence, Main Influence and Interaction of Factors, A and B on 100-meter Sprint Increase.

	A1	A2	Average	| B2-B1 |
B1	00:05	00:02	00:03	00:02
B2	00:03	00:00	00:01	00:02
Average	00:04	00:01		
| A2-A1 |	00:02	00:01		

The interaction between the two research factors can be seen in the following figure:



Kuncoro Hadi Kusumo[1]*, Wasis Himawanto[2*], Sulistiono[3]
kuncoro.hadi43@gmail.com

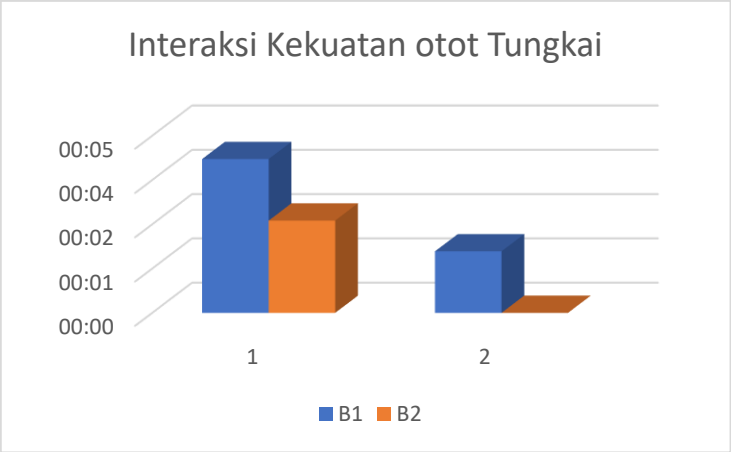


Figure 11.
Interaction of Changes in the Magnitude of the 100-meter Sprint Increase

CONCLUSIONS AND SUGGESTIONS

Based on the results of the study and the results of the data analysis that has been carried out, the following conclusions are obtained; (1) There is a significant difference in influence between Uphill sprint and *Downhill sprint* exercises on the leg power of athletes from SMP Negeri 1 Rejoso, Nganjuk Regency, class VIII. The Uphill sprint training group is higher (fast) compared to *the Downhill sprint* training group; (2) There is a significant difference in influence between athletes who have low leg muscle strength and high leg muscle strength against the 100-meter sprint. Athletes who have low leg muscle strength are higher (fast) compared to players who have high leg muscle strength; and (3) There is a significant interaction between *the Uphill* sprint and *Downhill* sprint exercise methods with leg muscle strength against the 100-meter sprint. The results showed that the Uphill sprint training group is a more effective method used for players who have low leg muscle strength and *the Downhill sprint* training group is more effectively used for athletes who have high leg muscle strength.

Suggestion

Based on the results of research that has been carried out, it proves that the Uphill sprint exercise method is more effectively used than *the Downhill sprint* exercise. It is recommended to the coach, to use the *Uphill* sprint training method to increase the 100-meter sprint. The results of this study proved that the Uphill sprint training group is a more effective method used for players who have high front and back leg muscles and *the Downhill sprint* training group is more effectively used for players who have high leg muscle

strength. This is an empirical study that can be used by researchers in innovating to improve the 100-meter sprint. For those researchers who intend to continue or replicate this study it is advisable to exercise more stringent control in the entire set of experiments. Such control is carried out in order to avoid threats from

REFERENCES

Bagia, I. M. (2015). Pelatihan Lari Akselerasi Jarak 40 Meter 10 Set dan 50 Meter 8 Set Terhadap Peningkatan Kecepatan Lari Siswa Putra Kelas VII SMP Ganesha Denpasar. *International Journal of Soil Science*, *1*(2), 96–105. https://ojs.ikippgribali.ac.id/index.php/jpkr/article/view/249

Balsalobre-Fernández, C., Tejero-González, C. M., Del Campo-Vecino, J., & Alonso-Curiel, D. (2013). The effects of a maximal power training cycle on the strength, maximum power, vertical jump height and acceleration of high-level 400-meter hurdlers. *Journal of Human Kinetics*, *36*(1), 119–126. https://doi.org/10.2478/hukin-2013-0012

Bompa, T. (2012). Annual Planning , Periodisation and Its Variations. *FISA Coaching Development Programme*.

Bompa, T. O., & Haff, G. G. (2009). Periodization: Theory and Methodology of Training. 5th ed. In *Champaign, Ill. : Human Kinetics;*

Budiwanto, S. (2012). Metodologi Latihan Olahraga. In *FIK Universitas Negeri Malang*.

Cahyono, I. T., Sugiarto, T., & Amiq, F. (2017). Pengaruh Latihan Ladder Drill Terhadap Peningkatan Kecepatan Lari Peserta Ekstrakurikuler Sepakbola SMA. *Gelanggang Pendidikan Jasmani Indonesia, Jurusan Pendidikan Jasmani Dan Kesehatan, Fakultas Ilmu Keolahragaan, Universitas Negeri Malang*, *1*(2), 282–290. https://doi.org/http://dx.doi.org/10.17977/um040v1i2p282-290

Fadillah. (2009). *Kenapa Atletik Disebut Induk Semua Cabang Olahraga.* Buana Citra Publisher.

Faizah, A. (2016). Analisis Gerak Akselerasi Sprint 100 Meter (Studi pada Atlet Lari Sprint 100 Meter Putra Pelatnas B, Ditinjau dari Aspek Biomekanika). *Jurnal Sporta Saintika*, *1*(2), 1–10. https://doi.org/https://doi.org/10.24036/sporta.v1i2.34

Farida, A. (2016). Urgensi Perkembangan Motorik Kasar Pada Perkembangan Anak Usia Dini. *Jurnaltarbiyah.Uinsu.Ac.Id*, *IV*(2).

Ferry, M. W., & Welis, W. (2019). Hubungan Kadar Hemoglobin Terhadap Kemampuan VO2 Max Pada Pemain Sekolah Sepkabola (SSB) Tunas Inti Kecamatan Sungai Bungkal Kota Sungai Penuh. *Jurnal Stamina, Jurusan Kesehatan Dan Rekreasi Fakultas Ilmu Keolahragaan Universitas Negeri Padang*, *2*(1), 425–436. https://doi.org/https://doi.org/10.24036/jst.v2i1.77

Giyatno. (2017). Penerapan Latihan Akselerasi Untuk Meningkatkan Kecepatan Lari 100 Meter Pada Siswa Kelas IV di SD Negeri IV Giriwoyo. *Jurnal Sportif*, *3*(1), 29–43. https://doi.org/https://doi.org/10.29407/js_unpgri.v3i1.615

Ishak, M., Asmawi, M., Tangkudung, J., Dlis, F., & Sahabuddin. (2022). Smash Training Model in Badminton Game in College Students of the Faculty of Sports Science, Makassar State University. *International Journal of Science and Society*, *4*(2), 209–221. https://doi.org/10.54783/ijsoc.v4i2.463

Jaliusril, Asyar, R., & Harjono, H. S. (2012). Pengembangan Media Audia-Visual Pembelajaran Lari Jarak Pendek untuk Siswa SMP. *Tekno-Pedagogi, Jurnal Teknologi Pendidikan*, *2*(1), 1–21. https://online-journal.unja.ac.id/pedagogi/article/view/1395

Johan Cahyo B., Musyafari Waluyo, S. R. (2012). Pengaruh Latihan Lompat Kijang Terhadap Kecepatan Lari. *JSSF (Journal of Sport Science and Fitness)*, *1*(1), 17–21. http://journal.unnes.ac.id/sju/index.php/jssf%0APENGARUH

Juliyanto, O. D. (2016). Pengaruh Latihan Ladder Drill Icky Shuffle Terhadap Peningkatan Kecepatan. *Jurnal Kesehatan*, *7*(3), 45–52. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwinwebxuv7pAhUWXisKHbhWBvkQFjAAegQIARAB&url=https%3A%2F%2Fjurnalmahasiswa.unesa.ac.id%2Findex.php%2Fjurnal-kesehatan-olahraga%2Farticle%2Fdownload%2F17838%2F16252&usg=

Kerlinger. (2006). *Asas–Asas Penelitian Behaviour*. Gadjah Mada University Press.

Nuryadi, A., & Firmansyah, G. (2018). Pengaruh Latihan Ladder Drill Terhadap Kecepatan Lari 60 Meter Pada Siswa Sekolah Bola Basket Loc Sidoarjo. *JP.JOK (Jurnal Pendidikan Jasmani, Olahraga Dan Kesehatan)*, *2*(1), 63–69. https://doi.org/10.33503/jpjok.v2i1.191

R., I. A. A., & Furkan, I. (2014). Perbedaan Pengaruh Metode Latihan Terhadap Peningkatan Prestasi Lari 100 Meter Ditinjau dari Rasio Panjang Tungkai dan Tinggi Badan. *Penerapan IPTEK Dan Penguatan Ilmu Keolahragaan Dalam Mendukunug Prestasi Olahraga Nasional*, 110–124. fik.um.ac.id/wp-content/uploads/2014/11/11.PROCEEDINGS-PERTEMUAN-ILMIAH-ILMU-KEOLAHRAGAAN-NASIONAL-2014-MALANG.Ika-Ahmad.pdf

Rahadian, A. (2018). Aplikasi Analisis Biomekanika Untuk Mengembangkan Kemampuan Lari Jarak Pendek (100 M) Mahasiswa PJKR UNSUR (Kinovea Software). *Jurnal Maenpo*, *8*(1), 1–14. https://doi.org/https://doi.org/10.35194/jm.v8i1.912

Sahabuddin. (2017). Evaluation Program Regional Training Center (Pelatda) PON XIX South Sulawesi. *JIPES, Journal of Indonesian Physical Education and Sport. Universitas Negeri Jakarta*, *3*(1), 85–99. https://doi.org/https://doi.org/10.21009/JIPES.031.011

Sahabuddin. (2020). Hubungan Koordinasi Mata Tangan, Kelincahan, Dan

Keseimbangan Terhadap Kemampuan Dribble Bolabasket. *JCE SPORTS: Journal Coaching Education Sport*, *2*(2), 133–144. https://doi.org/https://doi.org/10.31599/jces.v1i2.372

Sahabuddin, Bismar, A. R., & Ad'dien. (2020). Pengaruh Latihan Akselerasi Terhadap Kemampuan Lari 50 Meter. *Jurnal SPEED, Program Studi Pendidikan Jasmani, FKIP, Universitas Singaperbangsa Karawang*, *3*(1), 51–57. https://doi.org/http://dx.doi.org/10.35706/jurnal%20speed.v3i1.3574

Satun. (2018). Peningkatan Hasil Belajar Lari Cepat 100 M Melalui Metode Latihan Akselerasi. *Jurnal Pendidikan: Riset & Konseptual*, *2*(1), 24–29. https://doi.org/https://doi.org/10.28926/riset_konseptual.v2i1.19

Sudirman, Syahruddin, & Sahabuddin. (2022). Tingkat Keterampilan Gerak Dasar Sepakbola Pada Siswa SMA Negeri 2 Majene. *JOKER, Jurnal Olahraga Kebugaran Dan Rehabilitasi*, *2*(1), 43–52. https://doi.org/https://doi.org/10.35706/joker.v2i1.6479

Sugito, S., Allsabah, M. A. H., & Putra, R. P. (2020). Manajemen kepelatihan klub renang Kota Kediri tahun 2019. *Jurnal SPORTIF : Jurnal Penelitian Pembelajaran*. https://doi.org/10.29407/js_unpgri.v6i1.14021

Sugiyono. (2012). Statistik Untuk Pendidikan. In *Statistika Untuk Penelitian*.

Sukadiyanto. (2005). *Pengantar Teori Dan Melatih Fisik.* FIK Uiversitas Negeri Yogyakarta.

Sukadiyanto. (2011). Tori dan Metodologi Melatih Fisik. In *Bandung: Lubuk Agung*.

Taufik Hidayat, Ramadi, A. J. (2016). Pengaruh Latihan Koordinasi Berlari Dengan Lutut Tinggi dan Diiukuti Dengan Sprint Terhadap Kecepatan Lari 50 M Pada Atlit Sprint 100 M PPLP Riau. *Jurnal Online Mahasiswa Fakultas Keguruan Dan Ilmu Pendiidkan Universitas Riau*, 1–12. https://www.neliti.com/publications/200326/pengaruh-latihan-koordinasi-berlari-dengan-lutut-tinggi-dan-diikuti-dengan-sprin

Umah, R. T., Raharjo, S., & Adi, S. (2016). Pengaruh Latihan Pliometric Skipping dan Split Jump Terhadap Hasil Kecepatan Lari Sprint 60 Meter Untuk Peserta Ektrakurikuler Usia 15-17 Tahun di SMAN 1 Turen. *Jurnal Sport Science*, *6*(2), 1–13. http://journal2.um.ac.id/index.php/sport-science/article/view/5268