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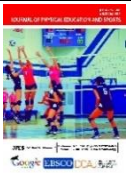

The Effect of Weight Training, Leg Power, on the 50M Freestyle Swimming Speed of Semarang PSC Athletes

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Abstract

Swimming fins with various innovative shapes have been designed, among which is the use of swimming fins that has become popular, while the influence of the characteristics of the fins on swimming performance is still being debated. The purpose of this study was to analyze the effect of weight training using long fins, short fins and leg power on the 50 meter freestyle swimming speed of Semarang PSC athletes. This experimental study used a 2x2 factorial design, the research sample of 20 athletes was taken by purposive sampling. Data analysis used Analysis of Variance (ANOVA). The results of the study shows the difference in the effect of weight training with long fins and short fins on the speed of 50 meters crawl style swimming Fcount 4.637> Ftable 4.494, the difference in the effect of high and low leg power on the speed of 50 meters crawl style swimming Fcount 15,973> F table 4,494, interaction of weight training methods and leg power on speed of 50 meters crawl style swimming Fcount 8,780> F table 4,494. The conclusion proved that the long fins weight training method gave better results than the short fins. The speed of 50 meters crawl style swimming in the high leg power group was better than the low leg power group, the long fins weight training method in the high leg power group was better than the low leg power group.

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INTRODUCTION

Competitive swimming has a long history and is currently one of the greatest and most popular Olympic sport, many swimming organizations or associations are formed in an area, one of which is the PSC (Paradise Swimming Club) association. PSC is a swimming association located in Semarang city, Gunung Pati district. Training is expected to help the process of change for the better, namely to improve the physical quality and functional abilities of body's equipment. To obtain a fast swimming technique, high physiological abilities are required. So there needs to be an effort to improve leg performance, namely by training with weights, to support weight training, it is necessary to use auxiliary tools. Weight training is a form of training that uses weight media to support the training process with the aim of increasing fitness, muscle strength, speed, muscle tightening, muscle hypertrophy, rehabilitation, as well as weight gain and reduction (Djoko Pekik, 2000: 59). There are several training methods that can increase swimming speed, namely by training muscle strength through the use of weight training or weight training using the Fins tool.

The use of assistive devices in swimming trainings such as fins is a form of weight training to improve athletes' abilities in terms of swimming muscle power and swimming technique abilities. This cannot be separated from the function of muscle strength and the speed of muscle contraction. One of the objects or aids used in swimming training is fins. The wider the fins used, the greater the resistance or force that is released by the swimmer. A huge potential in future researchers regarding fins is to determine the size of the fins used for training so that researchers can find out the benefits of fins of different sizes. From the guidelines for the size of the fins below, it is generally for humans, which is determined by the length of the foot. However, the length of the fins obtained from the observations of the researchers found that the size that was rarely used in training at swimming clubs, one of which was the long fins with fins size 17.5 cm, weight 2000 gr and short fins with a fins size of 5.5 cm, weight 1500 gr, full elastic rubber material. with different foot sizes. So in general, the purpose of giving training using fins tools is part of weight training to increase leg strength and power so that it can support swimming speed, especially in swimming short distances or with short duration. In freestyle swimming, leg performance is very helpful in increasing swimming speed.

The styles that can be used in swimming are quite varied. Each style has a unique movement and a different difficulty level. In Yogi Maulana's research (2018) it is written that in competitive swimming there are four numbers that are contested, namely freestyle, breast stroke, back stroke and butterfly. All competing styles are rated based on time records, which means swimming athletes need speed.

Swimming achievements are not easy to achieve, because many factors determine. According to Rumini, (2015: 1) in research at PPLP that supporting factors such as funding and adequate infrastructure will also be a side effect of achieving high performance. Through good coaching management, sports performance in PPLP can be improved. In addition, factors that determine swimmer performance, such as anatomical factors (arm length, height, leg length); physiological factors (ability to breathe oxygen, agility, balance, coordination, strength, power, flexibility); biomechanical factors (speed of motion and frequency of pedaling); psychological factors (personality, attribution, achievement motivation, aggression, arousal, anxiety, stress, activation, leadership, communication, commitment, imagery, concentration, self-concept, and self-confidence). Mulyana (2013: 3). The neuroscience approach emphasizes the psychological effects of Physical Education on movement or physical activity which then creates synaptic relationships between

neurons, while social cognitive theory emphasizes the psychological effects of Physical Education on the consequences of social interactions between students and students, and students and teachers, when they play or participate in games / games, or sports. Eunike R. Rustiana, (2011: 1).

Leg muscles power have an important role in various sports. The power of the leg muscles contributes to moving quickly, so it has a very large role in achieving creation (Yogi Maulana, Deni Mudia, Gempar Al-Hadis, 2018). Power is a component in the study of sports physiology. Power is an element of energy that is very much needed in various sports, especially swimming, although not all sports do not require power as its main energy component. In the research of Nur Amin, Hadi Setyo Subiyono, Sri Sumartiningsih, (2012), this research shows that leg muscle power gives a big contribution.

One of the factors that support the success of a swimmer is to pay attention to biomechanical factors. If a swimming athlete has proper and correct biomechanical and movement techniques, he will support his achievement. In the research of Bambang Ferianto Tjahyo Kuntjoro (2015), it is written that one that needs to be mastered first by swimming sports coaches is the principle of biomechanical principles.

Mastery of biomechanical principles really helps coaches in the process of forming swimming techniques, so that athletes' techniques are more effective and efficient. According to Mulyana (2013) biomechanical factors in swimming include movement speed and pedaling frequency.

Swimming techniques that must be considered in freestyle swimming are: 1) body position as parallel and as level as possible. 2) Arm movement during recovery. 3) Leg movements should start from the groin, alternating vertical movements between the right and left legs. 4 foot kicks in 1 swimming round (Dinata Marta, 2003: 20).

Mastery of swimming motion techniques needs to be balanced with maximum movement speed. Speed in swimming is very important in determining the travel time or the success of the athlete, the faster the athlete swims the less time it takes.

Different sizes of fins can respond differently to legs and this still needs to be studied from the aspect of fins size with long and short fins. Long fins with a length of 17.5 cm and short fins 5.5 cm. The bottom line is that using different lengths of fins has different effects. In Edo Prasetyo1's research, Moch. Yunus2, (2017) that there is a significant relationship between the frequency of foot movement and the 50 meter crawl style swimming achievement. So Fins or short fins help the swimmer develop the correct tempo and kicking technique. The weight of the two fins is different, long-fin fins are heavier than short-fin fins. The two models have different impacts when using it. Long-fin model fins will generate higher thrust, while short-finned fins have lower thrust than long fins. Then the resulting weight in long fins is greater than short fins. The frequency of leg movement is higher using short fins than long fins. Using fins will get a further glide forward than normal swimming. The weight obtained is from the movement of the legs up and down to move the water backward. Both forms of training were investigated for their effect on the 50m freestyle swimming speed. The author assumes that long and short fins have a good effect in increasing the 50 m freestyle swimming speed. Thus, it is hoped that this research can help improve the performance of swimming athletes at the regional, national and international levels.

METHOD

This research is a quasi-experimental research which aims to compare two different treatments to the research subjects using factorial design techniques. Factorial experiments are experiments in which almost or all levels of a factor are combined or crossed with all levels of each other factor that is in the experiment (Sudjana, 2005: 148). In the 2 x 2

factorial design, it is explained about the factorial experiment that what is measured is not only the influence of the main factor of each independent variable on the dependent variable, but also the influence of the interaction between the independent variables.

The research design is a description or a plan to collect, analyze, and conclude data so that it can be carried out in accordance with research objectives and as a reference in conducting research. Nazir (2005: 84) states that: "Research Design is all the processes involved in planning and implementing research.

Table 1. Factorial Research Design

Weight Training (A)	Leg power (B)	
	High power (B1)	Low power (B2)
Long fins (A1)	A1B1	A1B2
Short Fins (A2)	A2B1	A2B2

Speed of 50 meters freestyle swimming

Information:
A1B1: training using long fins with high power groups.
A1B2: practice using long fins with low power groups.
A2B1: practice using short fins with high power groups
A2B2: practice using short fins with low power groups

The first measurement is done through the pre-test and the second measurement through the post-test or final test. The pre-test is used to collect sample data before being given training and the final test is used to retrieve data that has been given training. The steps taken in this study are as follows: 1) Determining the population, 2) Selecting and determining the sample, 3) Dividing the two sample groups, 4) Conducting the initial test, 5) Carrying out the training, 6) Carrying out the final test, 7) Obtaining data, 8) Analyzing data and testing hypotheses, 9) Drawing conclusions.

Table 2. Study design

Pre test	Treatment (Swimming Weight Training)	Post test
50 meter freestyle swimming test Leg power test	Using long fins Using short fins	50 meter freestyle swimming test

The population of this study were all 24 students of the PSC Semarang swimming club. The sample in this study was 20 students of the Semarang PSC club who were proficient in swimming 50 meters freestyle. The sample technique in this study used purposive sampling, namely the sampling technique with certain considerations (Sugiyono, 2009: 68). The data analysis used was analysis of variance (ANOVA) or F-test with a significance of $\alpha = 0.05$. To test for differences, if the Anova results show significant differences, the next step to find out which one is better, is the Tukey test. To fulfill the assumptions in the ANOVA technique, the normality test (Liliefors test) and the Homogeneity Variance test (with the Bartlet test) were carried out (Sudjana, 2002: 261-264). The normality test aims to determine whether the data used in the study comes from

normally distributed samples or not. The homogeneity test aims to determine whether the variance in each group is homogeneous or not.

RESULTS AND DISCUSSION

The results of the research and discussion are presented as follows. This study intends to test The Difference of the Effect of Weight Training Using Long Fins and Short Fins on the Increase of 50M Freestyle Swimming Speed . The test of the difference in the effect of high leg power and low leg power on the speed of 50 meters of crawl style swimming was used. This research was conducted to analyze Two Way analysis of variance was used. The results of this calculation were then consulted with table F with Dk numerator = 1 and Dk denominator = 16, with a significance level of α 0.05 obtained Ftable = 4.494, because Fcount> Ftable or 4.637> 4.494, stating: "There is a significant difference in the effect of weight trainings by means of long fins and short fins to the speed of 50 Meter Crawl Style Swimming

Table 3. Analysis of Two-Way Variance Test for the Difference of Swimming Speed for Long and Short Fins

Source of Variation	dk	JK	JKT	Fh	Ft	Sig	information
Between Lines	1	119.46	119.46	4,637	4,494	0.05	There is a difference
Inter	3	411.51	137.17				
In	16	412.21	25.76				
Total	19	1169.38					

The results of this study indicate that there is a significant difference in the effect of weight trainings with long and short fins on the leg speed of 50 meters crawl style swimming. This can be seen from the results of the leg speed of 50 meters swimming, the crawl style in the group with the weight training method with the long fins tool has a better speed rate than in the group with the weight training method with the short fins tool. Leg power is very important in obtaining the leg velocity results in a 50 meter swim for Crawl style namely the existence of a training method. In this study, researchers focused on weight trainings with the fins tool. According to Sukadiyanto (2010: 10), training is a burden, so a combination between training and weight is needed to achieve optimal physical appearance. This can be seen from the results of the swimming leg velocity of 50 meters, the crawl style in the group with the weight training method with the long fins tool has a better speed rate than the group with the weight training using short fins. In swimming sports, these fins are often used by swimming coaches for training activities of competitive swimmers. Swim fins help in developing muscles both above the leg and lower part, fins help increase surface area and resistance to the ankle and increase overall speed. In a study conducted by Farizal Imansyah, (2016) it was proven that training using fins got significant test results on the swimming speed of 50 meters freestyle. Fins help swimmers to expand a good amount of leg motion by getting multiple kicks efficiently. The power used in using long fins will be more, this can increase the ability or leg strength to obtain high power if swimming normally. So long fins can increase leg speed when swimming.

After that test The difference between the influence of high leg power and low leg power on the speed of 50 meters crawl style swimming. The test of the difference in the effect of high leg power and low leg power on the speed of 50 meters of crawl style swimming used Two Way analysis of variance.

Based on the results of the calculation of the two-way analysis of variance, the Fcount of 15,973 is obtained. The results of this calculation were then consulted with the F table with the numerator Dk = 1 and the denominator Dk = 16, and a significance level of 0.05 was obtained F table 4,494, because F count> F table or 15,973> 4,494, stating: "High leg power and low leg power to the speed of 50 meters crawl style swimming". Based on the first hypothesis testing, it turns out that there is a significant difference between high leg power and low leg power on the speed of 50 meters crawl style swimming. The group that had high leg power had a better swimming speed compared to the group with low leg power. It can be seen that the average group with high leg power has a swimming leg speed of 50 meters with an average crawl style of 37.68 while the group with low leg power with a swimming speed of 50 meters has an average crawl style of 46.76. This illustrates that leg power has an influence on the results of the swimming leg speed of 50 meters. Leg power is important in swimming, because athletes with high leg power have the main driving component in the swimming leg speed of 50 meters crawl style. Meanwhile, athletes who have low leg power have the main driving component in the swimming leg speed of 50 meters crawl style, but the impulse or acceleration at low leg power in doing the acceleration is not maximal compared to athletes who have high leg power. From the results of Muhamad Ukon Prawirakusuma's research, Pamuji Sukoco (2019) shows that there is a contribution of leg power to the 50 M. crawl style swimming achievement.

Table 4. Analysis of Two-Way Variance Test for the Difference of Swimming Speed for High and Low Legs Power Groups

Source of Variation	Dk	JK	JKT	Fh	Ft	Sig	information
Between Columns	1	411.51	411.51	15,973	4,494	0.05	There is a difference
Inter	3	411.51	137.17				
In	16	412.21	25.76				
Total	19	1169.38					

After testing the differences in weighting exercises and leg power, then the next analysis is knowing The Difference The Effect of High Leg Power With Long and Short Fins Weight Training on The Speed Of 50 Meters Freestyle Swimming

Sample group of A1B1 with sample of A2B1, Q count = -5.1164> 3.81 = different, so it can be said that the two sample groups have a significant difference in score

Table 5. Tukey Test Data Swimming Speed 50 Meters Crawl Style of Sample Group with High Power

	Weight Trainings	Swimming Speed (Seconds)	
High power	Long fins	Total score	159.38
		Average	31.88
		SD	2.20
	Short Fins	Total score	217.45
		Average	43.49
		SD	6.67

Based on the analysis test with the Tukey formula above, the group using long fins weight in the high leg power group had a better effect on the swimming leg speed of 50 meters in the crawl style than the group using short fins weight on the high leg power group. The writer concluded that the group with the long fins weight training method in the high leg power group would be better assigned to students with high leg power compared to those with low leg power.

The next analysis is to find out The Difference Of The Effect Of Low Leg Power With Long Fins And Short Fins Weight Training On The Freestyle Swimming Speed Of 50 Meters Sample group of A1B2 with sample of A2B2, Q count = 0.810 <3.81 Not different. So it can be said that the two sample groups do not have a significant difference in scores

Table 6. Tukey Test Data Swimming Speed 50 Meter Crawl Style Sample Group with Low Power

	Weight Trainings	Swimming Speed (Seconds)	
Low Power	Long Fins	Total score	238.37
		Average	47.67
		SD	6.71
	Short Fins	Total score	229.18
		Average	45.84
		SD	2.95

The group that used long fins weight in the low leg power group did not have a better effect on the swimming leg speed of 50 meters in the crawl style than the group using short fins weight on the low leg power group. Group with the long fins weight training method in the high leg power group would be better given to students with high leg power compared to those with low leg power. Whereas in the group with low leg power, the training method could use the weight training method with both long and short fins.

The Interaction Between The Method of Weight Training And Leg Power To The Speed Of 50 Meters Leg Swimming. The interaction between the interaction of the training method of weight and leg power on the leg velocity of 50 Meter Crawl Style Swimming, used a two-way analysis of variance. Based on the results of the calculation of the two-way analysis of variance, the obtained F count = 8.780. The results of this calculation were then consulted with the F table with the numerator Dk = 1 and the denominator Dk = 16, and the significance level of 0.05 was obtained Ftable = 4.494, because Fcount> Ftable or 8.780> 4.494, stated: "There is an interaction between the method of weight training and leg power on swimming speed 50 meters crawl style.

Table 7. Results of Two-Way Variant Analysis of the Interaction of Leg Weight and Power Trainings

Source of Variation	dk	JK	JKT	Fh	Ft	Sig	ket
Interaction (Columns x Rows)	1	226.20	226.20	8,780	4,494	0.05	There is a difference
Inter	3	411.51	137.17				
In	16	412.21	25.76				
Total	19	1169.38					

The results of the two-way analysis of variance prove that there is an interaction of training weight and leg power on the swimming leg speed of 50 meters crawl style. This illustrates that freestyle leg training using the fins tool is very suitable for weight training in water and giving weight to the legs, if the weight training uses long fins and short fins is done repeatedly, it can be possible to form or increase leg power and is expected to increase the freestyle leg swimming speed with a fast travel time. If an athlete trainings using long and short fins routinely and systematically, the increased leg performance ability and having good leg muscle power will give a greater contribution to the 50 meter freestyle swimming speed. The method of weight training with fins and leg power to the speed of 50 meters crawl style swimming.

CONCLUSIONS AND SUGGESTIONS

There was a significant difference in the effect of the long and short fins weight training on the speed of 50 meters crawl style swimming. The long fins weight training method gave better results compared to the weight training method with short fins. The swimming speed of 50 meters crawl style in the group with high leg power was better than the group with low leg power. There is an interaction between the weight training method and leg power on the swimming speed of 50 meters crawl style. The long fins weight training method in the high leg power group is better than the low leg power group. Suggestions for swimming coaches from the results of this study, is that leg power can be used as a basis for selecting swimming athletes, because athletes who have high leg power are proven to have better results, and it is advisable to provide weight trainings with long fins to increase the speed of 50 meters crawl style swimming. For other researchers, these results can be used as a reference for further research.

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