

The Effect of Arm Strength, Leg Muscles, Torso Flexibility on The Improvement of Butterfly Stroke Swimming Exercise

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Abstract

Butterfly stroke speed requires better muscle strength and flexibility from the swimmer than other swimming styles. This study aimed to analyze the effect of arm muscle strength, leg muscles, and torso flexibility on improving the results of butterfly swimming training in athletes. The research method used was the experiment with two groups, pretest-posttest design. The research sample consisted of 60 swimming athletes in Brebes Regency in 2019. Before being given the training program, the athletes were tested for the strength of the arm muscles, leg muscles, torso flexibility and butterfly speed of 50 meters, then given a butterfly swimming exercise with a frequency of 4x/week for 1 (one) month after participating in the training program and then tested the swimming speed to see an improvement in training results. The results showed that r count (0.787) > r table (0.632) so that Hypothesis 1 (H1) was accepted, then r count (0.907) > r table (0.632) so that Hypothesis 2 (H2) was accepted and r count (0.704) > r table (0.632) so that Hypothesis 3 (H3) was accepted. The conclusion of this research is the butterfly stroke speed of 50 meters is significantly influenced by the strength of the arm muscles, leg muscle strength, and the flexibility of the athlete's foot.

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INTRODUCTION

Swimming is a sport that is different from other sports in general. Swimming is done in water so that the earth's gravity influenced by the upward pressure of water. Swimming is important for human life, in terms of education (pedagogical), psychiatric (psychological), physical (physiological) and social aspects (sociologys) aspects. Swimming has a role in human growth and physical development. Doing regular exercise, the muscles will become strong, develop and make the body's organs function properly (Aditama, 2020). It is considering the role of exercise on human growth, and physical development is huge. By doing regular exercise, the muscles will become strength, develop and make the body's organs function properly (Gatta, Cortesi, Fantozzi, & Zamparo, 2015:23).

The butterfly stroke is one of the swimming styles contested in the Olympics and other official competitions. The butterfly footwork is also known as the dolphin or dolphin stroke. Compared to other swimming styles, butterfly swimming requires a lot of strength from the swimmer. Butterfly speed swimming is obtained from swinging both hands simultaneously, combined with the push of the legs together (Washino et al., 2019). Rhythm accuracy is important in the acceleration of this movement.

The butterfly stroke is the newest swimsuit in swimming competitions and has historically been a variation of the breaststroke (Ardha, 2019). Based on the observations of researchers, there were many athletes' achievements decline because the components of the physical condition are not in accordance with expectations, especially the components of physical conditions that considered in the butterfly number. Because in this number the swimming club athletes of Piber Brebes rarely achieve optimal achievements at the national level.

Swimmers aged 15-19 years belong to adolescent. The physical condition during this adolescent period is still experiencing growth and development. The boy grew physical form.

Children during adolescence, the organs inside the body has also got growth, the muscles torso, body, and pelvis already fully developed. Therefore strength training can be given intensively (Sukmawati & Hartoto, 2015).

This research aimed to analyze the relation of arm muscle strength, leg muscle strength, and torso flexibility on improving the results of 50 meters butterfly swimming training. The result of this research was useful to increase whether coaches or athletes in improving the speed of butterfly stroke.

METHODS

The research method reference in research. The type of research used is an experiment that aims to determine the relationship of the effect of leg muscle strength training, arm muscle strength and torso flexibility on the butterfly stroke speed of 50 m in swimming athletes. Experimental research used to find out whether there is change not in a tightly controlled condition, we need treatment in the condition, and this is what done in experimental research. Therefore experimental research regarded as the research methods used to find a specific treatment effect against the other in a runaway condition (Astyorini, 2016).

The method used is an experiment with a 2x2 factorial design. The population of this research was swimming athletes in Brebes, amount of 60 athletes swimming in Brebes. The independent variables in this study consisted of arm muscle strength, leg strength, and flexibility torso, with a bound variable speed swimming the butterfly stroke.

The research instrument to measure the strength of the arm muscles used hand dynamometer, to measure the strength of leg muscles used leg dynamometer, and to measure the flexibility to use flexibility meter torso. Measurement of the 50 meters butterfly stroke speed recorded during the 50 meters butterfly swimming championship or race in Brebes on January 5, 2020.

Quantitative descriptive data analysis techniques used to provide measurement tests, and statistical correlation tests to prove the relationship of arm muscle strength, leg muscles, and torso flexibility with a butterfly stroke speed of 50 meters.

RESULTS AND DISCUSSION

The research results on the influence of the arm muscle strength, leg muscle, and flexibility torso toward swimming speed of 50 meters butterfly.

Table 1
Description of Leg Strength, Arm Strength, Flexibility of Thunk and Butterfly Swimming Speed of 50 meters

Variable	N	Mean	SD
Leg Strength (Kg)	10	63.85	28.07
Arm Strength (Kg)	10	27.28	5.83
Flexibility of Thunk(Cm)	10	17.86	4.42
Swimming Speed 50 m (second)	10	33.66	2.28

The table above shows that the average arm muscle strength results are 63.85 with a maximum arm muscle strength of 123.00, a minimum of 41.50, and a standard deviation of 28.07. The results of the togok flexibility variable obtained an average result of 17.86, a maximum of 26.00, a minimum of 10.50 and a standard deviation of 4.42. The results of the variable leg

muscle strength obtained an average result of 27.27, with a maximum of 36.28, a minimum of 18.00 and a standard deviation of 5.83. The results of the variable speed of swimming butterfly style 50 meters with an average of 0.032.66, a maximum of 00.35.46, a minimum of 00.30.11 and a standard deviation of 00.02.27

Table 2
The Correlation of ArmStrength, Leg Strength, AndThunkFlexibility toward Swimming Speed of 50 Meters Butterfly

Variable	r -table	r - quantification
Arm muscle strength	0,632	0,787
Leg muscle strength	0,632	0,907
Torso flexibility	0,632	0,704

Based on table 2 above, the alternative hypothesis (Ha), which reads "there is a relationship between leg muscle strength and the 50 meter butterfly speed of swimming athletes in Brebes", is **accepted**. Because the calculated r

value (0.704), is greater than the r table (0.632), it concluded that the alternative hypothesis (Ha) which reads "there is a relationship between torso flexibility, and the 50 meters butterfly-style swimming speed of swimming athletes in

Brebes", **is accepted**. Because the calculated r value (0.787), is greater than the r table (0.632), it concluded that the alternative hypothesis (H_a), showed "There is a relationship between arm muscle strength and the swimming speed of 50 meters butterfly style swimming athletes in Brebes", **accepted**. Because the calculated r value (0.907) is greater than the r table (0.632), it concluded that the alternative hypothesis (H_a) which stated "there is a relationship between leg muscle strength, torso flexibility, arm muscle strength and the 50 meters butterfly stroke speed of athletes swimming in Brebes ", **accepted**.

Kolmogorov Smirnov test for the variable arm muscle strength (X_1) of 0.934 with a significance of $0.348 > 0.05$, Kolmogorov-Smirnov price for the hip joint flexibility variable (X_2) is 0.515 with a significance of $0.954 > 0.05$, Kolmogorov-Smirnov price for the variable leg muscle strength (X_3) is 0.530 with a significance of $0.942 > 0.05$ and Kolmogorov-Smirnov price for leg muscle strength variables (X_3) of Oharga Kolmogorov-Smirnov for variable speed butterfly style swimming 50 meters (Y) amounted to 0,556 with significance $0.917 > 0.942$ $0,05$, 530 significance > 0.05 . Because the significance values for the variables X_1 , X_2 , X_3 , and Y are all greater than 0.05, it explained that the data of the four variables normally distributed then it can be used for parametric statistic data analysis for further hypothesis testing.

Homogeneity test in research using the Chi-Square Test and provided that if the significance value or probability value > 0.05 means, that the data comes from populations that have the same or homogeneous variance, whereas moderate if the significance value or probability value < 0.05 means that the data comes from populations that have unequal or homogeneous variances.

The chi square result is 0.800 with a significance of 0.999 because the significance value of the leg muscle strength variable is $0.999 > 0.05$, the leg muscle strength data is homogeneous. The variable data of torso flexibility variable obtained chi square results of 0.800 with a significance of 0.999 because the

significance value is $0.999 > 0.05$; the variable data of torso flexibility variable is homogeneous. For the variable of arm muscle strength, the chi square result is 0,000 with a significance of 1,000, because the significance value is $1,000 > 0.05$, the arm muscle strength data is homogeneous. Then the variable data for the 50 meters butterfly stroke speed of swimming, the chi square result is 0.800 with a significance value of 0.999, because the significance value is $0.999 > 0.05$, the 50 meters butterfly style swimming speed data is homogeneous. Overall, the significance value of the four variables is > 0.05 , thus it can be concluded, that the data has the same variance or the sample taken from a population that has the same variance; in other words, data on leg muscle strength, slackness and arm muscle strength with a butterfly swimming speed of 50 meters as a whole is homogeneous.

The results of this study prove that a swimmer has a great arm muscle strength had a fast pace in the swimming pool backstroke 50 meters. Some experts claim that swimming is an aquatic sport with the main movements of the arms and legs to generate thrust so that the body as a whole moves or slides forward. When doing hand movements in performing the alignment movement in the water or the entry is the extensor muscles work elbow, namely triceps muscle, while moving a muscle movement of the hand is the ulnar flexor muscle carpio and palmaris longus (Aygün et al., 2019). The study results are in line with the theory that to produce maximum swimming speed requires strong arm muscle strength. Because of the proportion of regular and programmed exercises, the strength of the arm muscles that owned can be maximally utilized by swimmers in doing the 50 meters butterfly stroke. It indicated by the relationship between arm muscle strength and the butterfly speed of 50 meters of swimming athletes in Brebes

Leg muscle strength is the ability of the arm muscles to move its ability to produce maximum speed in swimming because of a 50 meters butterfly. Based on the study results showed that there was a relationship between leg

muscle strength and the 50 meters butterfly speed of swimming athletes in Brebes.

Leg muscle strength also plays an important role in achieving swimming performance. In the 50-meters butterfly swimming at high speed, namely in the short distance swimming number or sprint, the leg muscle strength together is the main source of movement to achieve optimal performance, meaning that arm movements done with high frequency. The results of this study are in accordance with the theory of leg muscle strength, which is significantly related to the swimming speed of 50 meters butterfly.

Leg muscle strength is an important component in improving your overall physical condition. Muscle strength is needed by the body because: 1) strength is the driving force of any physical activity; 2) strength has an important role in protecting athletes from possible injury; 3) by the strength, athletes will be able to help strengthen joint stability. The role importance of leg movements in swimming sports, so in addition to the correct swimming movement techniques, training also needed to increase leg muscle strength, which has an important role in creating thrust. The muscles that act as the main drivers of the swimming motion that move the arm, and wrist extensor, are the quadriceps extensor, gastrocnemius, and gluteus maximum.

The results of this study prove that athletes who have high torso flexibility produce fast swimming speeds as well. An athlete with good torso flexibility will produce swimming speed butterfly increasingly fast. Likewise, swimmers with low torso flexibility, the butterfly style swimming speed will also produce slow results. The torso flexibility is the ability of the nape to move its ability to produce maximum speed in the 50 meters butterfly stroke. Based on the the study results, it showed that there is a relationship between torso flexibility and the butterfly speed of 50 meters for swimming athletes in Brebes.

The results of this study illustrate that samples with high torso flexibility will produce a fast swimming speed as well. An athlete with good torso flexibility will result in a faster utterfly

swimming speed. Likewise, swimmers with low torso flexibility, the butterfly style swimming speed will also produce slow results. In the swimming, to produce a good performance, several physical components are needed. In line with the opinion of Counsilman stated that there The three main constituents of the physical conditions required for good performance are strength, endurance and flexibility. Flexibility, in this case, is torso flexibility.

Based on the results of the study, it proved that there was a significant relationship between arm muscle strength and the 50 meter butterfly speed of swimming athletes in Brebes. Arm muscle strength also plays a very important role in achieving swimming performance. In the 50 meter butterfly stroke at high speed, that is, in short distance swimming or sprints, the strength of the arm muscles together with the leg muscles is the main source of movement to achieve optimal performance, meaning that arm movements done with high frequency. The results are appropriate with the theory of the arm muscle strength was significantly associated with style swimming speed of 50 meters butterfly (Morouço et al., 2012).

CONCLUSION

According to the research and discussions, can be inferred as followed : 1) The leg muscle strength has a significant effect on the increase in the results of the 50-meter butterfly swimming speed exercise; 2) Torso flexibility has a significant effect on the increase in the results of the 50-meter butterfly swimming speed training result; 3) Arm muscle has a significant effect on the increase in the results of the speed of the 50 meters butterfly-style swimming; 4) Leg muscle strength, torso flexibility, and arm muscle have a significant effect on the increase in the results of the swimming speed of the 50 meters butterfly-stroke swimming athlete at Brebes.

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