



## **Contribution of Arm and Leg Muscle Power to The Results of Swimming 50 Meter Breaststroke Swimming Siger Sembilan Swimming Lessons**

**Wilailia Shofi<sup>1</sup>, Surisman<sup>2</sup>, Suwarli<sup>3</sup>, Candra Kurniawan<sup>4</sup>**

<sup>1,2,3,4</sup> Physical Education Study Program, Faculty of Teacher Training and Education,  
Lampung University, Indonesia.

### **Abstract**

This study aims to determine the contribution of arm and leg muscle power to the results of 50-meter breaststroke swimming in male athletes from Siger Sembilan Swimming Lessons. The method used is a quantitative descriptive method with a correlational approach. The research sample consisted of 40 people. The research instruments used included a two-hand medicine ball throw test to measure arm muscle power, a vertical jump test to measure leg muscle power and a 50-meter breaststroke swimming test using a stopwatch. The research hypothesis: 1) there is a contribution of arm muscle power to the 50-meter breaststroke swimming result, 2) there is a contribution of leg muscle power to the 50-meter breaststroke swimming result, 3) there is a contribution of arm and leg muscle power to the 50-meter breaststroke swimming result. The research results showed that: 1) there is a significant contribution of arm muscle power to the 50m breaststroke swimming (calculated  $r = 0.343 > \text{table } r = 0.320$ ) with a contribution of 11.81%, 2) there is a significant contribution of leg muscle power to the 50m breaststroke swimming (calculated  $r = 0.556 > \text{table } r = 0.320$ ) with a contribution of 30.94%, 3) Simultaneously, the contribution of arm muscle power and leg muscle power to the 50m breaststroke swimming (calculated  $r = 0.508 > \text{table } r = 0.320$ ) with a contribution of 25.48%.

**Keywords:** *Arm Muscle Power, Leg Muscle Power, Swimming.*

Correspondence author: Wilailia Shofi, University of Lampung, Indonesia.  
Email: [shfwilailia@gmail.com](mailto:shfwilailia@gmail.com)



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## **INTRODUCTION**

Exercise is a structured physical activity that is carried out consciously with the aim of developing body capacity, improving fitness, and improving the quality of life of individuals and society. Sport is any activity that involves the mind, soul, and body in an integrated and systematic manner to encourage, foster, and develop a person's physical, spiritual, and cultural potential. This definition is stated in Law Number 11 of 2022 concerning Sports Article 1 which stipulates sports as a comprehensive activity that is not only physical, but also includes mental and socio-cultural aspects in its implementation.

Swimming is a type of outdoor activity that uses the body to move and cross the water with feet and hands. There are several types of swimming styles, including breaststroke, free (crawl stroke), back stroke, and butterfly (butterfly). According to the International Swimming

Federation (FINA), there are several freestyle categories for men and women, as well as according to Indonesian Aquatics, between 50, 100, 200, 400, 800, and 1500 meters.

Based on the results of the pre-research or observation stage carried out at the Siger Sembilan Swimming Lessons swimming coaching, many athletes are still lacking in pulling their arms towards the chest optimally so that athletes tend to be less fast in swimming, when moving the leg thrust is seen using the instep so that the movement of the leg thrust when breaststroke swimming is not optimal, the coordination of head movements when taking the breath with the hands is not aligned so that at the time of the Doing the breaststroke swim movement cycle is not right so that when participating in the competition, the time limit achieved is not in accordance with the target, as well as climatic conditions or weather conditions that sometimes rain so that the temperature becomes colder, making the body muscles less flexible and stiff so that breaststroke swimming is not optimal. Cold temperatures can also reduce muscle response, making it difficult for arm muscles and leg muscles to work optimally to produce strong power when swimming.

The ability to swim breaststroke is not only by swimming, but also by programmatic weight training, and the most important thing is the addition of training weights to improve the body's muscle performance ability. Swimming achievements are determined by the fastest time limit, so that physical abilities related to speed greatly determine the achievement of swimming sports, especially in breaststroke swimming, it will not all be formed if it is not supported by other physical conditions. One power to hold it is called the resistance caused by water that must be pushed forward, the second power is the power that pushes it forward called the thrust obtained from the movement or pull of the arm and the thrust of the legs, simultaneously playing a role in producing forward movement in breaststroke swimming.

Based on the description above, the researcher is interested in conducting a study entitled *The Contribution of Arm and Leg Muscle Power to the Results of 50-Meter Breaststroke Swimming Coaching Siger Sembilan Swimming Lessons*. The thing that distinguishes this research from previous studies is that this research was carried out at the Siger Sembilan Swimming Lessons swimming coach.

## **METHOD**

This type of research is correlational, which aims to analyze trends as well as measure the degree of correlation between two or more variables. Correlated variables include one or more independent variables and one bound variable. The method used in this study is the Quantitative Descriptive method. (Merlina Sari, 2022).

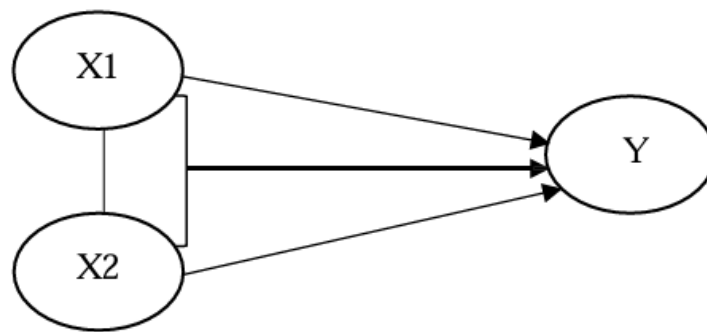


**Figure 1.** Research Design

Description:

X1 : Arm Muscle Strength

X2 : Leg Muscle Strength

Y : Breaststroke Swim 50M

In this study, the population to be studied is 60 beginner athletes in the Siger Sembilan Swimming Lessons swimming program. Population criteria to meet:

1. Male.
2. Age range 10-15 years.
3. Swim training 3x a week.

In this study, the researcher used a sampling technique with a random sampling step which is a sampling technique that provides an equal opportunity or opportunity for each population to be selected as a sample (Sugiyono 2019:82). So the sample used in this study is 40 people.

In this study, there are two types of variables used, namely independent variables and bound variables. The independent variables in this study used were arm muscle power (X1) and leg muscle power (X2). While the Bound Variable in this study was the breaststroke swimming speed of 50 meters (Y).

In this study, three variables were involved, namely two independent variables and one bound variable. In this study, the independent variables themselves consisted of arm muscle strength and leg muscle strength, while the bound variable was the result of a 50-meter breaststroke swim. Each variable has research instruments, namely:

1. Tes Power Otot Lengan (Two Hand Medicine Ball Throw)

To find out how much power a person's arm muscles are capable of in a short period of time, use the Two-Hand Medicine Ball Throw, which is to throw the medicine ball as far as possible.

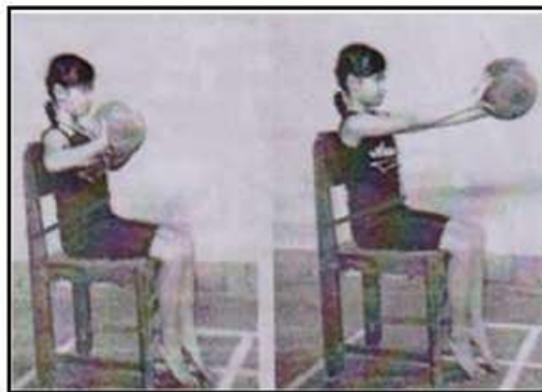


**Figure 2.** *Tes Two-Hand Medicine Ball Throw*

## 2. Leg Muscle Power Test (Vertical Jump)

The best jumping distance from the two attempts will be recorded as a score in cm. With a Validity of 0.989 and Reliability of 0.977 (Nurhasan & Cholil, 2013). To measure the strength of the leg muscles.



**Figure 3.** *Digital Vertical Jump*

## 3. 50 Meter Breaststroke Swimming Ability Test

The 50-meter breaststroke swim ability test aims to measure the speed of athletes in doing breaststroke swimming from the start of the beam.



**Figure 4.** *Stopwatch*

In this study, the data collection technique used is a test, which is an assessment process that is carried out based on data or information obtained through the test procedure.

### **Data Analysis Techniques**

#### **1. Normality Test**

Data is carried out as a prerequisite for conducting a differentiation test; Based on these prerequisite results, it will be possible to determine whether the data is normal and homogeneous or not, as well as to identify the type of statistics to be used on the data (Setyo Budiwanto & Kes, 2017). If  $L_{cal} > L_{table}$ , then the data is normal, and if the opposite is true, then the data does not have a normal distribution.

#### **2. Linearity Test**

The purpose of linearity is to determine whether there is a significant linear relationship between two variables. The linearity test is calculated by comparing the values of the F calculation and the F of the table. The relationship between the variables in question can be expressed as follows if F is calculated  $< F$  table.

### **Uji Hypothesis**

#### **1. Korelasi *Product Moment***

The Person Product Moment correlation is denoted (r) provided that the value is no more than the price ( $-1 \leq r \leq +1$ ). If the value  $r=-1$  means that the negative correlation is perfect;  $r=0$  means there is no correlation;  $r=1$  means that the correlation is very strong. Meanwhile, the meaning of the price r will be consulted with the interpretation table of the value of r as follows:

**Table 1.** Interpretation of Correlation Coefficients

| <b>Correlation Coefficient (KK) Value</b>        | <b>Correlation Rate</b> |
|--------------------------------------------------|-------------------------|
| $-0.199 \leq < 0$ or $0 < \leq 0.199$            | Very weak               |
| $-0.399 \leq \leq -0.2$ or $0.2 \leq \leq 0.399$ | Weak                    |
| $-0.599 \leq \leq -0.4$ or $0.4 \leq \leq 0.599$ | Medium                  |
| $-0.799 \leq \leq -0.6$ or $0.6 \leq \leq 0.799$ | Strong                  |
| $-1 < \leq -0.8$ or $0.8 \leq < 1$               | Very Powerful           |
| $-1$ or $1$                                      | Sempurna                |

#### **2. Double Correlation**

Of the two ways to test the significance above, the author takes by taking method number 1. Multiple correlation analysis to test the hypothesis is, whether or not there is

a simultaneously significant relationship between arm muscle strength (X1) and leg muscle strength (X2) and freestyle swimming speed (Y).

### 3. Contribution Test

Coefficient of Determination (KD) is a test to determine the amount of contribution of an independent variable to a bound variable.

## RESULTS AND DISCUSSION

### Results

#### 1. Description of Research Data (sub sub chapters parallel to sub chapters)

**Table 2.** Data on the Results of Research on Power Arm Muscles, Power Leg Muscles and 50 Meter Breaststroke Swim Results

| Yes | Results            | Variabel             |                       |                                        |
|-----|--------------------|----------------------|-----------------------|----------------------------------------|
|     |                    | Power Arm Muscle (M) | Leg Muscle Power (cm) | 50 Meter (s) Breaststroke Swim Results |
| 1   | Mean               | 2,79                 | 41,02                 | 50                                     |
| 2   | Median             | 2,9                  | 39                    | 46                                     |
| 3   | Mode               | 3                    | 30                    | 38                                     |
| 4   | Standard Deviation | 0,5                  | 11,55                 | 10                                     |
| 5   | Min                | 1,8                  | 10                    | 38                                     |
| 6   | Max                | 3,9                  | 61                    | 65                                     |

#### a. Arm Muscle Power Data

**Table 3.** Arm Muscle Power Frequency Distribution

| No    | Category  | Frequency (f) | Presentase (%) |
|-------|-----------|---------------|----------------|
| 1     | Perfect   | 0             | 0%             |
| 2     | Very good | 1             | 2,5%           |
| 3     | Good      | 18            | 45%            |
| 4     | Enough    | 11            | 27,5%          |
| 5     | Less      | 10            | 25%            |
| Total |           | 40            | 100%           |

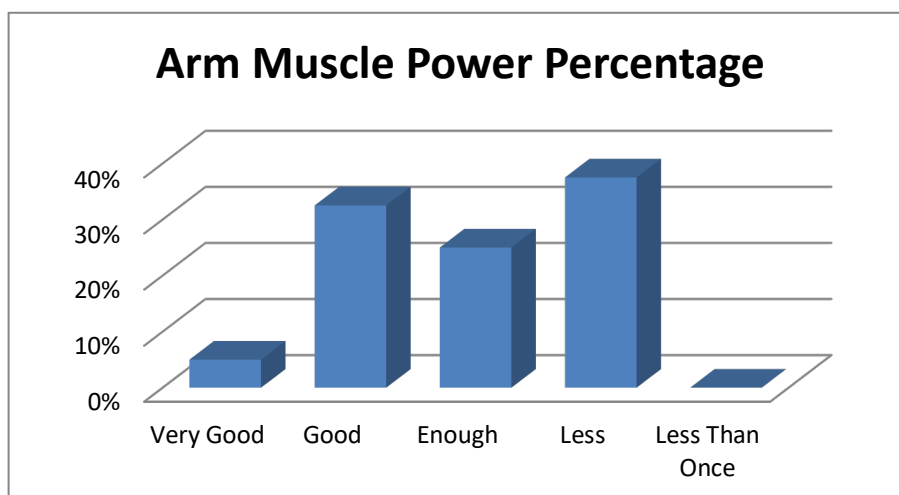


**Figure 5.** Arm Muscle Power Percentage Diagram

b. Leg Muscle Power Data

**Table 4.** Leg Muscle Power Frequency Distribution

| No           | Category       | Frequency (f) | Presentase (%) |
|--------------|----------------|---------------|----------------|
| 1            | Very good      | 1             | 2,5%           |
| 2            | Good           | 10            | 25%            |
| 3            | Enough         | 8             | 20%            |
| 4            | Less           | 20            | 50%            |
| 5            | Less Than Once | 1             | 2,5%           |
| <b>Total</b> |                | <b>40</b>     | <b>100%</b>    |

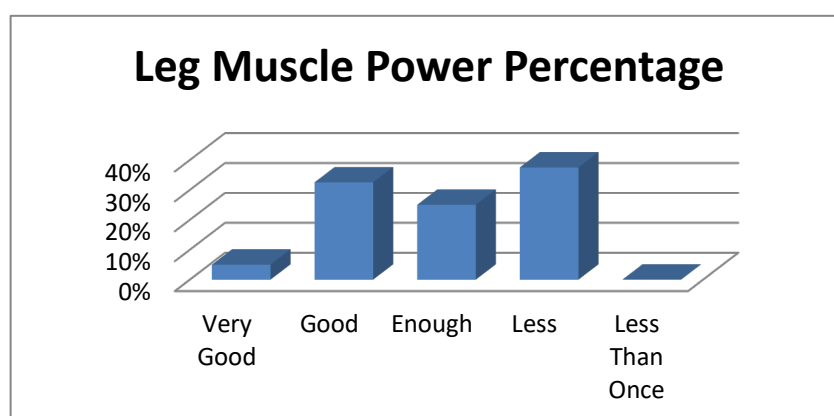


**Figure 6.** Leg Muscle Power Percentage Diagram

c. 50 Meter Breaststroke Swim Results

**Table 5.** Frequency Distribution of 50 Meter Breaststroke Swim Results

| No           | Category       | Frequency (f) | Presentase (%) |
|--------------|----------------|---------------|----------------|
| 1            | Very good      | 2             | 5%             |
| 2            | Good           | 13            | 32,5%          |
| 3            | Enough         | 10            | 25%            |
| 4            | Less           | 15            | 37,5%          |
| 5            | Less Than Once | 0             | 0%             |
| <b>Total</b> |                | <b>40</b>     | <b>100%</b>    |

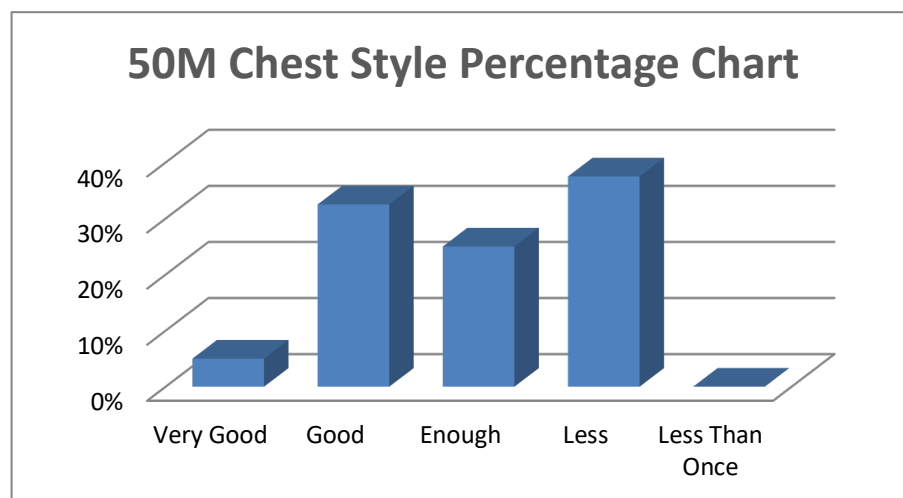


**Figure 7.** 50M Chest Style Percentage Chart

**Data Analysis**

1. Normality Test

**Table 6.** Normality Test

| No. | Variabel                           | L Count | L table | Conclusion |
|-----|------------------------------------|---------|---------|------------|
| 1   | Power Arm Muscles                  | 0,076   | 0,242   | Normal     |
| 2   | Power Otot Tungkai                 | 0,189   | 0,193   | Normal     |
| 3   | 50 Meter Breaststroke Swim Results | 0,155   | 0,227   | Normal     |

2. Linearity Test

**Table 7.** Linearity Test

| No. | Variabel                                              | F count | F table | Conclusion |
|-----|-------------------------------------------------------|---------|---------|------------|
| 1   | Power arm muscles- 50 meter breaststroke swim results | 0,239   | 0,05    | Linear     |
| 2   | Leg muscle power- 50 meter breaststroke swim results  | 0,174   | 0,05    | Linear     |

The decision-making criteria in the linearity test are:

- 1) If  $F_{\text{calculates}} > F_{\text{table}}$ , then the conclusion is that there is a linear relationship between the two variables.
- 2) If  $F_{\text{calculates}} < F_{\text{table}}$ , then the conclusion is that there is no linear relationship between the two variables.

#### Uji Hypothesis

##### 1. Hipotesis 1

Arikunto (2010: 175) stated that to find the contribution of each predictor to the variable is not free in order to test the hypothesis between  $X_1$  and  $Y$  using statistics through product moment correlation.

**Table 8.** Correlation of Arm Muscle Power with 50 Meter Breaststroke Swim Results

| Correlation | R count | R Table | Criteria | Remarks    |
|-------------|---------|---------|----------|------------|
| $X_1 - Y$   | 0,343   | 0,320   | Weak     | Signifikan |

The correlation coefficient significance test was carried out by consulting the price  $r_{x1.y} = 0.343$  with  $r(0.05)(38) = 0.320$ . Since the correlation coefficient between  $r_{x1.y} = 0.343 > r(0.05)(38) = 0.320$ , it means that the correlation coefficient is significant. Thus the hypothesis that "There is a significant contribution between arm muscle power to the results of 50-meter breaststroke swimming in male athletes with nine swimming lessons" was accepted.

##### 2. Hipotesis 2

**Table 9.** Correlation of Leg Muscle Power with 50 Meter Breaststroke Swim Results

| Correlation | R count | R Table | Criteria | Remarks    |
|-------------|---------|---------|----------|------------|
| $X_2 - Y$   | 0,556   | 0,320   | Medium   | Signifikan |

The significance test of the correlation coefficient was carried out by consulting the price  $r_{x2.y} = 0.556$  with  $r(0.05)(38) = 0.320$ . Since the correlation coefficient between  $r_{x2.y} = 0.556 > r(0.05)(38) = 0.320$  means that the correlation coefficient is significant. Thus the hypothesis that reads "There is a significant contribution between leg muscle power to the results of 50-meter breaststroke swimming in male athletes with nine swimming lessons" was accepted.

### 3. Uji Hypothesis 3

**Table 10.** Power correlation of arm muscles and leg muscles against  
50 Meter Breaststroke Swim Results

| Correlation   | R count | R Table | F count | F Table | Remarks    |
|---------------|---------|---------|---------|---------|------------|
| X1 and X2 - Y | 0,508   | 0,320   | 4,008   | 3,422   | Signifikan |

Because the value of F is calculated  $> F$  table (  $>$  ) then H3 is accepted, meaning simultaneously / together "There is a significant contribution between arm muscle power and leg muscle power to the results of 50-meter breaststroke swimming in male athletes siger nine swimming lessons".

### Discussion

Based on the results of the correlation analysis between arm muscle power and the results of the 50-meter breaststroke swim, the calculated  $r$  value was 0.343 and the table  $r$  was 0.320. Since the calculated  $r$  value is greater than the  $r$  of the table ( $0.343 > 0.320$ ), the first hypothesis is accepted. This shows that arm muscle power has contributed to the results of the 50-meter breaststroke swim at Bina Renang Siger Sembilan Swimming Lessons. The value of the correlation coefficient was in the low category, which indicates that although arm muscle power contributed to the results of the 50-meter breaststroke swim, the contribution was not dominant. This means that arm muscle power is not the only determining factor for the success of breaststroke swimming, but it still has a role in supporting athletes' performance.

Based on the results of the double correlation analysis, the calculated  $r$  value was 0.508 and the table  $r$  was 0.320. Since  $r$  is calculated larger than  $r$  in the table ( $0.508 > 0.320$ ), the third hypothesis is accepted. This shows that arm muscle power and leg muscle power together contribute to the 50-meter breaststroke swim results of 25.8% while the other 74.2% are influenced by other factors such as technique, coordination, flexibility, endurance, and other psychological factors. The correlation value is in the medium category, which indicates that the combination of arm muscle power and leg muscles has a significant influence on the performance of the 50-meter breaststroke swim. These findings show that the success of breaststroke swimming is not only determined by one component of physical condition, but by the synergy between arm and leg movements.

Physiologically, breaststroke is a force that relies heavily on simultaneous coordination between the stages of arm pull, breathing, leg kick, and skating phases. If one of the

components is not optimally developed, the efficiency of movement will decrease and this affects travel time. Therefore, the results of multiple correlations in the intermediate category show that the combination of arm and leg muscle power makes a significant contribution, but does not yet fully determine achievement. There are other factors such as technique, movement efficiency, stroke frequency, and anaerobic endurance that also affect the results of the 50-meter breaststroke.

Based on the results of the analysis, it can be concluded that although both variables have a significant contribution, the small percentage of contribution shows that the performance of the 50-meter breaststroke swim is the result of the interaction of various biomotor components and techniques that support each other. Therefore, training programs should not only focus on increasing power, but also developing technique and movement efficiency in the water.

## **CONCLUSION**

Based on the results of the research, it can be concluded that some of the results of hypothesis testing are as follows: There was a significant contribution between arm muscle power to the results of the 50-meter breaststroke swim in the nine-course swim athletes. There was a significant contribution between leg muscle power to the results of the 50-meter breaststroke swim in nine-meter swim athletes. There was a significant contribution between arm muscle power and leg muscle power to the results of the 50-meter breaststroke swim and nine swimming lessons.

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