



The relationship of arm muscle strength, limb muscle explosive and movement coordination with swimming speed bracelet on students of physical education, health and recreation

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ABSTRACT

This study aims to determine the relationship of arm muscle strength, limb muscle explosive and movement coordination with swimming speed bracelet on students of PENJASKESREK at Serambi Mekkah University. The population in this study were all students of PENJASKESREK at Serambi Mekkah University. Based on the purposive sampling technique, the samples totaling 30 students who had passed the T.P. Basic Swimming and T.P. Advanced Swimming. Based on the results of data analysis, it was found that arm muscle strength gave a relationship of 0.52 to the speed of breaststroke swimming in students, limb muscle explosive gave a relationship of 0.44 to the speed of breaststroke swimming to students, movement coordination gave a relationship of 0.42 with the speed of breaststroke swimming to students. It is concluded that arm muscle strength, limb muscle explosive and movement coordination were related by 0.79 with the breaststroke swimming speed on Students at Serambi Mekkah University. So the hypothesis that the author proposed was accepted as true.

INTRODUCTION

In creating professional athletes, athletes must have Strength, Flexibility, Agility, and Resilience, and to get all of that, of course, athletes need adequate supporting tools, and the last obstacle is the lack of attention from the local government, in this case the Dispora to seek and developing athletes who have potential in swimming this causes many athletes who actually have the potential to eventually leave swimming clubs. To improve the achievements of swimming athletes in Aceh, the local government must minimize the impact of the three obstacles above, also provide supporting facilities and facilities and carry out continuous coaching, besides that there must also be a professional coach, meaning that coaches who not only master theory and practice but must know the latest techniques of swimming, both national and international, professional coaches must also be able to read the condition of athletes in order to find and develop potential athletes, increasing the achievement of swimming is very demanding on the strength of the limb muscles, arm muscles. The role of strength in the sport of swimming is different, some are demanding in general and some are demanding in particular. Breaststroke swimming according

to Mielke (1993) "The body must be parallel to the surface of the water, the hands extend forward as the body advances, then the hands return back under the water surface to encourage the body to go faster then the legs are bent and pulled towards the body, then circled out, until the legs are close together and straight back. The speed of gliding in breaststroke swimming is influenced by strength factors and technical factors. The technical factors are influenced by elements of body position on the surface of the water, foot movements, hand movements, breath taking, and movement coordination. The five elements mentioned above can be done well if the swimmer or athlete has good physical abilities, especially greater arm and leg muscle strength.

Swimming is one of the courses in the Physical Health and Recreational Education Study Program at the Serambi Mekkah University, in studying this subject apart from being a subject, students are also required to master swimming theory and techniques in all styles. can contribute to the world of swimming if in the future he becomes an educator and or also a coach. In the learning curriculum, swimming courses are divided into two stages,

namely in the second semester students are required to take T.P. Basic Swimming as well as a prerequisite for taking the T.P. Advanced Swimming in the third semester. To further strengthen the theory learned in the lecture hall, students are also given the speed to directly practice in the swimming pool, so it is hoped that when students graduate from these two courses they can immediately practice themselves or can transfer their knowledge to students in the future. In order to improve the performance of swimming, it is very necessary to have good arm muscle strength, leg muscles and coordination of movements in order to achieve results that are in accordance with what is expected.

Swimming is a branch of sport that in carrying out its activities requires adequate physical ability, the styles in swimming that are competed are freestyle, breaststroke swimming, butterfly swimming, and backstroke swimming (Amicta & Maidarman 2019).

Breaststroke swimming is swimming with the chest position facing the water surface in a streamlined state. Both legs kick outward, while both arms are straightened in front. Both hands are opened to the side like a water splitting motion so that the body moves forward faster. The breaststroke technique consists of several movements, namely: start, body position, arm movements (external and internal sweeps), leg movements, breath taking, and coordination between arm movements, leg movements and breathing movements (Rulianto, 2017).

Freestyle swimming is a number that is competed in swimming sports to achieve achievements supported by the ability of physical conditions. With a strong physical fitness condition and excellent physical condition, it will help in the process of developing abilities and carrying out daily routine activities. Apart from being in excellent physical condition, the training process determines the results of the achievements to be obtained, training is a repeated activity carried out in a planned manner to obtain the targets that have been set (Argantos 2019)

Swimming does not specify a pattern of hand or foot movements that must be done, but swimming can use hand or foot movements at will so that it can float and move from one place to another. A certain combination of several types of movement can be more efficient than other combinations. The swimmers group the combination of these movements into swimming styles (Saripin, 2014).

In the freestyle technique, many factors influence to be able to produce maximum swimming speed, including height, arm power and leg muscle strength. In the ability of freestyle swimming, especially at a distance of 100 meters, the leg muscles and arm muscles of a swimmer will affect the speed of the freestyle swimming. Good swimmer's leg movements and arm movements during freestyle swimming will be able to act as a driving force forward from behind so that swimmers can glide well. To move with

speed, it takes a high mastery of basic techniques. Adequate physical condition is a support for high technical mastery (Maulana, 2018). Excellent physical condition must be owned by every athlete or athlete in accordance with the sports activity or sport they are engaged in (Adhi, 2017).

Strength is a basic component in carrying out any physical activity, including sports. To be able to perform good physical skills, muscle strength is one of the important components that must be possessed first. In other words, strength is a basic component that must be possessed before developing other physical abilities (Irawan, 2017). In other words, strength is a basic component that must be possessed before developing other physical abilities (Irawan, 2017).

LITERATURE REVIEW

Arm Muscle Strength

All movement activity originates from muscle contraction and muscle contraction itself is strength. Many definitions of strength put forward by experts including, Fox and Matthews (1981) stated: Strength is the maximum power that a muscle or group of muscles exerts against a certain load. Then Singer (1990) states: Strength is the capacity of a muscle, a group of muscles that performs maximum resistance against a certain load in a certain time. Bompaa (1999), defines strength as the ability of muscles and nerves to cope with internal and external loads.

According to (Harman 2019) Explosive power of leg muscles is the accuracy of muscles directing force in a short time to give the object the best momentum for the body or object in a complete explosive movement to achieve the desired goal. Then according to (Ridwan 2017) Explosive power of leg muscles is a person's strength to use his leg muscles. Meanwhile, according to (Herdadi 2018) the explosive power of the athlete's arm muscles is not formed through continuous programmed physical exercise. From some of the definitions above, the author can conclude that strength is defined as part of the ability to use force in the form of lifting or holding a load. Strength is an important biomotor component and is needed to increase muscle endurance in overcoming loads during sports activities. Strength is the neuromuscular ability to withstand external and internal loads.

Limb Muscle Explosive Power

Then according to Harsono (1988) states actually strength, power and muscle endurance or muscle endurance, the three have a relationship with the dominant factor, namely strength. Strength remains the basis or basis of muscle endurance power. Strength is the ability of a muscle to generate tension against a resistance. Muscle strength is a very important component or if not the most important to improve overall physical condition.

Explosive power or also called power, Harsono (1982) that "Power is the result of force x velocity or the product of strength and speed." Power is also called the ability of muscles to move maximum force in a very fast time. Power training should not only emphasize the load, but must also be on speed, lifting, pushing, or pulling weights. In breaststroke swimming, the explosive power of the leg muscles, which is often called power, is the most important physical element.

Explosive power in sports is one of the components that must be owned in some sports, because it relates to the results of all performance both individually and in groups who are carrying out sports activities as the most important component in sports (Rahmawati et al., 2019). Explosive power is a person's ability to perform maximum power according to (Ambarwati et al., 2017). While strength is the force of muscle contraction achieved in one maximum effort. This maximum effort is made by a muscle or group of muscles to overcome a resistance. according to (Fenanlampir & Fairuq, 2015). Several types of strength such as general strength, special strength, maximum strength, absolute strength and relative strength according to (Fenanlampir & Fairuq, 2015).

Strength endurance is the ability of muscles to overcome or maintain fatigue caused by loading forces in a relatively long time (Erison, 2019). Strength endurance is a combination of elements of endurance with strength, endurance of arm muscle strength is a very important component in sports especially in swimming, and more specifically in freestyle swimming because freestyle is a swimming style that is more demanding on the arm muscles where the speed of style swimming The free movement is caused by the strong push of the upper and lower arms so that swimming athletes can move quickly. Here the endurance of arm muscle strength greatly contributes to the achievement of swimming athletes, because the element of endurance is needed so that athletes do not get tired quickly. because the swimming competition athletes do not only do one race number.

With good arm muscle strength, swimmers will quickly swim. Understanding arm muscle strength is a person's ability to bring out all the potential or existing strength in a short period of time. Thus, a good arm muscle strength, a swimmer especially freestyle will be able to swim faster. With good arm muscle strength, a swimmer will be able to handle water resistance well (Sugito, 2013). Arm muscle strength has an important role in swimming, although not as strong as the legs. But the arm muscles are one of the supporters of strength in swimming (Rasyid, 2017). Speaking of endurance issues, arm muscle strength is one of the components of physical condition that is very decisive in the 100 meter freestyle swimming speed, especially in the movement of the swimmer's arm.

Movement Coordination

In breaststroke swimming, movement coordination is needed to be able to integrate various movements into an effective movement. Movement coordination is a harmonious relationship of various factors that occur in a movement.

According to Booer and Zarnike in Harsono's book (1988), coordination is the ability to combine several movements without tension, in the correct order and perform complex movements smoothly without expending excessive energy.

In breaststroke swimming, swimmers are required to be able to coordinate movements of hand, foot, and good breathing. From the coordination of this movement, it is expected to be able to perform a series of correct and good breaststroke swimming techniques. The breaststroke swimming movement begins with the movement of both hands from the front and continues to be pulled under the chest, when the hands are under the chest followed by a movement to raise the head to take a breath, then both hands are straightened forward simultaneously followed by pulling both legs to the side until the thighs are almost parallel, then hands are straightened forward and both feet are pushed back with both hands straight ahead, then there is a gliding movement.

The Relationship of Arm Muscle Strength, Limb Muscle Explosive Power and Coordination of Movement to Breaststroke Swimming Speed

Soejoko (1992) argues that arm strength is the power or ability of the arm muscles expressed by the ability to pull, lift or press an object. Therefore, it is also said that in swimming skills in pulling or pushing water resistance is one of the factors that causes the body to move forward. Arm swing in swimming is carried out continuously throughout the distance traveled, therefore arm muscle strength has an important meaning in the appearance of breaststroke swimming. Arm movement, in the implementation of breaststroke swimming is also supported by leg swing movements. This requires strength to move the limbs. By having arm muscle strength, good leg muscle strength is expected to produce maximum glide movement. In addition to the arm muscles and leg muscles, it is also necessary to pay attention to the coordination of hand and foot movements. Coordination of motion will affect the speed of the swimmer. Uncoordinated arm and leg movements can hinder the swimmer's own pace of movement.

Suharno (1990) says that in swimming, speed is a very important factor, because the indicator of a swimming athlete's victory is his ability to quickly touch the final wall of the swimming pool. For this reason, a swimming athlete must have good speed to support his performance during training and also his performance when competing.

Based on the description above, it can be concluded that for breaststroke swimming, arm muscle strength, good leg strength and good movement coordination are needed to get maximum speed.

METHODS

The approach in this study used a quantitative approach with type of research is a experiment research.

Population and Sample

The population is the entire subject to be studied, the population in the study is the Students of PENJASKESREK at Serambi Mekkah University, totaling 159 peoples.

Research Instrument

The instruments used in this research are:

1. Arm muscle strength was measured using a Pull and Push Dynamometer. Amir (2010).
2. The explosive power of the leg muscles using the Standing Broad Jump test (Long Jump Without Prefix).
3. Coordination of motion using the Hexagonal Obstacle test. Gaines (1984)
4. The speed of the breaststroke swimming using the 20 meter breaststroke swimming speed test. Sarwoto (1992).

Data Collection Technique

The measurement techniques in this study were arm muscle strength tests, limb muscle explosive tests, motion coordination tests, breaststroke swimming speed tests.

Data Analysis Technique

To prove the hypothesis that has been formulated and to answer the problems that arise in this study, all the data obtained were analyzed statistically. The steps taken are as follows:

1. Calculating the average

$$\bar{X} = \frac{\sum X}{N}$$

Description:

X : Searched average

$\sum X$: Total score X

N : Number of samples

2. Standard Deviation Calculation

According to Johnson (1991) to calculate the standard deviation can be used the formula:

$$SD = \sqrt{\frac{N(\sum X^2) - (\sum X)^2}{N(N-1)}}$$

Description:

SD : Standard Deviation

X^2 : Total score X times X

X : Total score X

N : Number of Research Samples

3. Calculating the correlation coefficient between variables

To find the correlation, researchers used the Pearson Product Moment correlation formula proposed by Sudjana (1989) is:

$$r = \frac{N \sum xy - (\sum x)(\sum y)}{\sqrt{\{N \sum x^2 - (\sum x)^2\} \{N \sum y^2 - (\sum y)^2\}}}$$

Description:

r : Calculated correlation coefficient

xy : Sum of products x and y

N : Number of research samples

x : Variable Value x

y : Value of Variable y

The formula to test the significance of the correlation using the statistical formula as follows:

$$\frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

4. Multiple Contribution Test (Sutrisno Hadi, 1992).

$$rx_{123} y = \sqrt{\frac{rx_1 y^2 + rx_2 y^2 + rx_3 y^2 - 2(rx_1 y \cdot rx_2 y \cdot rx_3 y)rx_{123}}{1 - rx_{123}^2}}$$

5. Hypothesis test

$$F = \frac{R^2 / K}{(1 - R^2)(n - k - 1)}$$

Description:

R^2 : Multiple correlation coefficient

K : Number of independent variables

N : Number of samples

RESULTS AND DISCUSSIONS

The results of a series of field research conducted on student PENJASKESREK at Serambi Mekkah University, obtained research data in the form of test data for arm muscle strength, leg muscle explosive power, movement coordination, and the ability to swim the 20-meter breaststroke.

Normality Test Results

The normality test used in this study is the Shapiro-Wilk test. Santoso (2002) which states that if the significance value is > 0.05 then the data is normally distributed, otherwise if the significance value is < 0.05 then the data is not normally distributed. The results of the data normality test using the Shapiro-Wilk test as shown in the output below:

Table 1. Table of Normality Test Calculation Results Using SPSS Statistic Software 20

	Kolmogorov-Smirnov ^a		Shapiro-Wilk			
	Statistic	Df	Sig.	Statis	df	Sig.
Arm muscle strength	.122	34	.200*	.976	30	.709
Limb Muscle Explosive	.141	34	.086	.940	30	.876
Movement Coordination	.137	34	.103	.953	30	.177
Swimming Speed Bracelet	.095	34	.200*	.959	30	.781

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on table 1, it can be seen that the sig values for the four data groups are 0.709 for arm muscle strength, 0.876 for leg muscle explosive power, 0.177 for movement coordination and 0.781 for breaststroke swimming speed. The four sig values are greater than 0.05. If the value of the SPSS test results is greater than 0.05 then the data is normally distributed. Then it can be interpreted that the data relating to arm muscle strength, leg muscle explosive power, motion coordination and breaststroke swimming speed are normally distributed, therefore a correlation t-test can be performed between variables.

Homogeneity Test Results

Homogeneity test is intended to show that two or more groups of sample data come from populations that have the same variance. Homogeneity can be met if the homogeneity test value is greater than = 0.05. Same as for normality test, homogeneity test can be done using SPSS Statistics software, in the Sig column homogeneity test using SPSS Statistics, there are numbers that indicate the level of significance obtained. To determine homogeneity, the following guidelines are used:

1. Set the test significance level, for example = 0.05.
2. Compare p with the obtained significance level.
3. If the obtained significance is >α, then the variance of each sample is the same (homogeneous).
4. If the obtained significance is <α, then the variance of each sample is not the same (not homogeneous).

Test of Homogeneity of Arm Muscle Strength Data

Table 2. Homogeneity Test Results of Arm Muscle Strength Data Using SPSS Statistic

Levene Statistic	df1	df2	Sig.
.353	8	23	.445

Based on the table 2, it is known that the results of the significant homogeneity test of the arm muscle strength variable are 0.445. If the value of the SPSS homogeneity test results is greater than 0.05 then the data has a homogeneous test value, it can be stated that the value significant 0.445 > 0.05 so that the data value of the arm muscle strength has a homogeneous test value.

Homogeneity Test of Limb Muscle Explosive Data

Table 3. Results of Homogeneity Test of Limb Muscle Explosive Data by Using SPSS Statistic

Levene Statistic	df1	df2	Sig.
3.806	8	23	.750

Based on table 3, it is known that the results of the significant homogeneity test of the limb muscle explosive power are 0.750. If the value of the SPSS homogeneity test results is greater than 0.05 then the data has a homogeneous test value, it can be stated that the value significant 0.750 > 0.05 so that the data value of leg muscle explosive power has a homogeneous test value.

Test of Homogeneity of Motion Coordination Data

Table 4. Results of Homogeneity Test of Motion Coordination Data Using SPSS Statistic.

Levene Statistic	df1	df2	Sig.
0.306	8	23	.334

Based on table 4, it is known that the results of the significant homogeneity test of the Motion Coordination variable are 0.334. If the value of the SPSS homogeneity test results is greater than 0.05 then the data has a homogeneous test value, it can be stated that the significant value is 0.334 > 0.05 so that the data value from Motion Coordination has a homogeneous test value.

Test of Homogeneity of Breaststroke Swimming Speed Data

Table 5. Results of Homogeneity Test of Breaststroke Swimming Speed Data Using SPSS Statistic

Levene Statistic	df1	df2	Sig.
0.306	8	23	.548

Based on table 5, it is known that the results of the significant homogeneity test of the Breaststroke Swimming Speed variable are 0.548. If the value of the SPSS homogeneity test results is greater than 0.05 then the data has a homogeneous test value, it can be stated that the value significant 0.548 > 0.05 so that the data value of the Breaststroke Swimming Speed has a homogeneous test value.

Calculating the Average and Standard Deviation of Each Variable

After the Row Score and Row Score Square values are known, the next step is to calculate the average value and standard deviation, which values will later be used to calculate the T score for each variable. Based on the results of data processing, the average arm muscle strength was 32.43 and the standard deviation value was 5.97.

Based on the results of the above data processing, the average Limb Muscle Explosive Power is 21.15 and the Standard Deviation value is 0.3. Based on the results of the above data processing, the average movement coordination is 2.15 and the standard deviation value is 0.3. Based on the

results of the above data processing, the average Breaststroke Swimming (Y) is 8.26 and the Standard Deviation value is 3.7. Then calculate the T-Score value of Breaststroke Swimming Speed.

Correlation Test Between Variables

Arm Muscle Strength with Breaststroke Swimming Speed

The squaring of arm muscle strength with breaststroke swimming speed according to the auxiliary table to calculate the contribution after being calculated with Microsoft excel 2007 is obtained as follows: $\Sigma X_1 = 1598.98$, $\Sigma Y = 1599.98$, $\Sigma X_1^2 = 77900.00$, $\Sigma Y^2 = 77900.00$ and $\Sigma X_1.Y = 74502.38$. Based on the correlation between arm muscle with breaststroke swimming, the contribution found is $r = 0.52$. The calculated price is then compared with the r_{table} price. For the significant level of significance = 0.05 and $n = 16$ which is 0.374, then $r_{count} = 0.52$ and $r_{table} = 0.374$. It can be concluded that $r_{count} > r_{table}$ ($0.52 > 0.374$) means that there is a variable relationship between arm muscle strength (X_1) and breaststroke swimming speed (Y).

Limb Muscle Explosive with Breaststroke Swimming Speed

As for squaring the value of the explosive power of the leg muscles with the speed of the breaststroke swimming according to the auxiliary table to calculate the correlation after being calculated with Microsoft excel 2007 it is obtained as follows: $\Sigma X_1 = 1500.00$, $\Sigma Y = 1599.98$, $\Sigma Y^2 = 77900.00$, $\Sigma Y^2 = 77900.00$ and $\Sigma X_1.Y = 75778.66$. Based on the correlation table above, the correlation coefficient found is $r = 0.44$. The calculated price is then compared with the r_{table} price. For the significant level = 0.05 and $n = 16$, that is 0.374, then $r_{count} = 0.44$ and $r_{table} = 0.374$. It can be concluded that $r_{count} > r_{table}$ ($0.44 > 0.374$) means that there is a relationship between the explosive power of the leg muscles (X_3) and the speed of breaststroke swimming (Y).

Movement Coordination With Breaststroke Swimming Speed

According to the auxiliary table to calculate the correlation after it is calculated with Microsoft excel 2007 the following is obtained: $\Sigma X_1 = 1599.89$, $\Sigma Y = 1599.98$, $\Sigma X_1^2 = 77900.00$, $\Sigma Y^2 = 77900.00$ and $\Sigma X_1.Y = 76212.04$. Based on the correlation between movement coordination with breaststroke swimming speed, the correlation coefficient found is $r = 0.42$. The calculated price is then compared with the r_{table} price. For the significant level of significance = 0.05 and $n = 16$, that is 0.374, then $r_{count} = 0.42$ and $r_{table} = 0.374$. It can be concluded that $r_{count} > r_{table}$ ($0.42 > 0.374$) means that there is a relationship between the variable coordination of motion (X_2) and the speed of breaststroke swimming (Y).

Hypothesis Proving

Testing the Hypothesis of the Relationship between Arm Muscle Strength and Breaststroke Swimming Speed

Based on the above calculations, the value of $t_{count} = 3.20$ with a significant level of significance = 0.05 and $dk = n - 2 = 30 - 2 = 28$. Furthermore, H_a is accepted if $t_{count} > t_{table}$. Based on the list of $t_{table} = 1.701$, it can be seen that $t_{count} > t_{table}$ is $3.20 > 1.701$. So, it can be concluded that H_a is accepted and H_o is rejected.

Testing the Hypothesis of the Relationship between Explosive Power of the Limb Muscles and the Speed of Breaststroke Swimming

Based on the above calculation, it is obtained that the value of $t_{count} = 2.60$ with a significant level of significance = 0.05 and $dk = n - 2 = 16 - 2 = 14$. Furthermore, H_a is accepted if $t_{count} > t_{table}$. Based on the list of $t_{table} = 1.701$, it can be seen that $t_{count} > t_{table}$ is $2.60 > 1.701$. So, it can be concluded that H_a is accepted and H_o is rejected.

Testing the Hypothesis of the Correlation of Motion Coordination with the Speed of Breaststroke Swimming

Based on the above calculations, the value of $t_{count} = 2.43$ with a significant level of significance = 0.05 and $dk = n - 2 = 16 - 2 = 14$. Furthermore, H_a is accepted if $t_{count} > t_{table}$. Based on the list of $t_{table} = 1.701$, it can be seen that $t_{count} > t_{table}$ is $2.43 > 1.701$. So, it can be concluded that H_a is accepted and H_o is rejected.

Correlation Test Between X_1, X_2, X_3 with Y

The relationship between arm muscle strength, leg muscle explosive power and coordination of motion with breaststroke swimming speed has a strong relationship with the value of $r = 0.953$. With $t_{count} > t_{table}$ ($0.953 > 0.374$). so it can be concluded that there is a significant relationship between arm muscle strength, leg muscle explosive power and coordination of motion with breaststroke swimming speed on studentsPENJASKESREK at Serambi Mekkah University.

Hypothesis testing

The results of data analysis processing obtained that the significance test value with the F_{count} formula is one way to prove the truth to prove the research hypothesis that has two or more X variables, the calculation is as follows:

$$F = \frac{\frac{R^2}{k}}{\frac{(1-R^2)}{n-k-1}} = \frac{\frac{0,79^2}{3}}{\frac{(1-0,79^2)}{30-3-1}} = \frac{0,21}{0,01} = 14,26$$

From the calculation above, it is obtained that $f_{count} 14.26 > f_{table} = 2.98$. The description shows that the hypothesis is accepted as true. Thus, it can be concluded that there is a significant relationship between arm muscle

strength, leg muscle explosive power and coordination of motion with breaststroke swimming speed on students PENJASKESREK at Serambi Mekkah University.

DISCUSSIONS

Based on the results of the study showed that arm muscle strength, leg muscle explosive power and coordination of motion showed a significant relationship with the speed of breaststroke swimming on students PENJASKESREK at the university of Serambi Mekkah.

The relationship between arm muscle strength and swimming speed in the breaststroke obtained an r value of 0.52, with $t_{\text{count}} (3.20) > t_{\text{table}} (1.701)$, then H_a was accepted and H_o was rejected. The relationship between limb muscle explosive power and breaststroke swimming speed has a correlation coefficient of 0.44, with $t_{\text{count}} (2.60) > t_{\text{table}} (1.701)$ then H_a is accepted and H_o is rejected. The relationship between motion coordination and breaststroke swimming speed has a correlation coefficient of 0.42, with $t_{\text{count}} (2.43) > t_{\text{table}} (1.701)$, then H_a is accepted and H_o is rejected. The correlation between arm muscle strength, leg muscle explosive power and coordination of motion with the speed of breaststroke swimming has a correlation coefficient of 0.79, with $f_{\text{count}} (14.26) > f_{\text{table}} (2.98)$ then H_a is accepted and H_o is rejected.

From this study, it can be seen that arm muscle strength, leg muscle explosive power and coordination of motion have a relationship with the speed of breaststroke swimming. Related to the findings obtained from this study, it can be used as a guide for a trainer in providing an exercise program that is still paying attention to training programs to increase arm muscle strength and leg muscle explosive power on a regular basis in addition to technical training programs. Besides that, it is also inseparable from coordinating the movements of athletes to develop more in swimming.

Muscle strength in swimming has an important role (Muliarta, 2015). Muscle strength in this case the strength of the arm muscles, leg muscles. Not only muscle strength, arm power and leg power together play an important role in producing forward movement in swimming (Wicaksono, 2017). Arm muscles, leg muscles, arm power and leg power each contribute to forward movement when swimming (Putra & Witasryah, 2019). In this regard, the question arises how much of the contribution of each arm muscle strength, leg muscle, arm power and leg power in providing a significant contribution to the 25 meter crawl style swimming speed. The research will answer questions and discuss and describe in detail how much the contribution of each of these factors is. This research is in line with research conducted by Nursalam (2020) on the contribution of endurance of leg muscle strength and endurance of arm muscle strength to swimming speed of 100 meters freestyle shows (1) there is a contribution of

endurance of leg muscle strength to swimming speed of 100 meters freestyle of deepening swimming students of FIK UNP of 77.97%. (2) there is a contribution of endurance of arm muscle strength to the swimming speed of 100 meters freestyle in-depth swimming FIK UNP students by 46.10%. there is a joint contribution of endurance of leg muscle strength and endurance of arm muscle strength to the swimming speed of 100 meters freestyle in-depth swimming FIK UNP students of 69.06%

This is supported by the opinion of Sajoto (1995) which states that elements of physical condition must be improved as optimally as possible for each athlete and strength is an element that is more dominant than others, needs to be given top priority in the implementation of training programs. In addition, a coach should also provide special training programs for athletes who have arm muscle strength and leg muscle explosive power so that they can make breakthroughs that have the opportunity to get big numbers, in this case movement coordination is an important factor to improve athlete achievement.

This result is in line with research conducted by Rona (2020) which states that there is a relationship between abdominal muscle strength, leg muscle explosive power and arm muscle explosive power in free swimming, which shows the results show abdominal muscle strength contributes to the ability to swim 100 freestyle. meters of GSC swimming athletes, with a contribution of 33%, limb muscle explosive power contributed to the 100 meter freestyle swimming ability of GSC swimmers, by 57%, arm muscle explosive power contributed to the 100 meter freestyle swimming ability of GSC swimmers 14% and strength Abdominal muscles, leg muscle explosive power and arm muscle explosive power together contribute to the 100 meter freestyle swimming ability of GSC swimmers by 87%. Recommendations for further authors to examine more deeply the variables to be studied aims to provide information from the results of research on the development of swimming.

The result of another similar study is a study conducted by Falaahudin (2021) which states that there is a significant relationship between arm muscle strength and the achievement of 25-meter crawl style swimming, there is no significant relationship between leg muscle strength and 25-meter crawl style swimming achievement. meters, there is a significant relationship between arm power and 25-meter crawl swimming performance, there is no significant relationship between leg power and 25-meter crawl swimming performance. Overall there is no significant relationship between arm muscle strength, leg muscle strength, arm power and leg power to the achievement of swimming in the 25 meter crawl style.

The other result from Kasmadi (2021) that is (1) there is a connection flexibility on the ability of swimming breaststroke of students at FIK UNM Makassar values

obtained regression coefficient of determination 0.158 with a significant level of $0.000 < \alpha 0.05$, for determination coefficient of 0.303. This means that 30.3% flexibility relationship to the ability of swimming breaststroke of students at FIK UNM Makassar. (2) there is a connection arm muscle strength in the ability of swimming breaststroke of students at FIK UNM Makassar values obtained regression coefficient of determination 0.307 with a significant level of $0.000 < 0.05$, for determination coefficient of 0.739. This means that 73.9% of muscle strength relations arm of the ability of swimming breaststroke at Fik UNM Student Makassar. (3) there is a connection limb explosive power of the ability of swimming breaststroke of students at FIK UNM Makassar values obtained regression coefficient of determination 0.129 with a significant level of $0.000 < 0.05$, for determination coefficient of 0.490. This means 49% correlation explosive power of the legs of the ability of swimming breaststroke in Student Fik UNM Makassar (4) There is a connection of flexibility, muscle strength of arms, explosive leg with the ability of swimming breaststroke of students at FIK UNM Makassar obtained regression value (Ro) 0.906 with the level of significance in the column sig, the amount of $(0.000) < \alpha 0.05$ for the value of R Square (coefficient) 0.821. This means that 82.1% relations flexibility, arm muscle strength, explosive power leg together on the ability of swimming breaststroke of students at FIK UNM Makassar.

According to (Evenetus et al., 2019) the increase in swimming speed can also be influenced by the quality of the muscles of the swimmer. In addition to arm muscles, to obtain maximum swimming speed results, of course, it is also necessary to contribute from several synergistic muscle groups that support movement in swimming so that swimming speed can increase. Of the many muscle groups found in the body, the muscles that play a role in the most dominant swimming movements are the muscles of the arms, shoulders, abdomen and legs. The strength of these muscle groups has been shown to have a significant role in increasing swimming speed.

Arm muscle explosive power according to (Syukur et al., 2019) is a series of work some elements of muscle movement that can support the ability of explosive power to swimming style skills in the presence of strength and speed that can produce good explosive power. Explosive power has two muscle work systems to increase explosive power, namely: acyclic power and cyclic power, acyclic power is a muscle movement system that plays an important role in muscle strength while cyclic power is a muscle system that can increase agility (Rizal & Kasrman, 2020).

Endurance of leg muscle strength greatly determines the speed of style swimming free, if the swimmer's leg has the endurance of muscle strength, it will be able to avoid the rapid onset of fatigue on the use of force for a long time

while doing swimming. Strength endurance is the ability of a group of muscles to overcome or maintain loads without experiencing fatigue for a relatively long time. Strength endurance referred to here is leg muscle strength endurance" (Ihkwai, 2019).

Swimming is a sport that is competed individually and in groups. Freestyle swimming is one of the fastest styles in swimming, where this style is one style that is often used by all ages, both adults and children. Basically, freestyle swimming is taken from the English translation, namely "free style".

Freestyle swimming is considered an advanced swimming style, meaning that the swimmers themselves can swim freestyle if they can swim with other swimming styles, such as breaststroke. Indeed, there is no theory that requires it, but based on experience that the freestyle is taught to swimmers after mastering swimming techniques with other styles. Therefore, in freestyle swimming, there are movement techniques that need to be known to be easily mastered.

One of the basic components of the human physical condition is speed. Speed has a very big role in the sport of swimming. Physical condition is a unified whole of components that cannot be separated, either improvement or maintenance. Physical condition in terms of physiology is a person's ability to know the extent of his ability as a supporter of sports activities. Physical condition can also be interpreted as the condition of a player's body. The physical condition is one of the unified whole of the components that cannot be separated just like that, whether its improvement or maintenance (Wiwoho, 2014).

CONCLUSION

The results of research with data processing and analysis, some conclusions can be drawn as follows:

1. Based on data analysis, the correlation coefficient of arm muscle strength with the speed of swimming in the breaststroke of students is 0.52 so it can be concluded that "there is a relationship between arm muscle strength and swimming speed of the breaststroke of students with a moderate level of relationship"
2. Based on data analysis, the correlation coefficient of leg muscle explosive power with breaststroke swimming speed for students is 0.44 so it can be concluded that "there is a relationship between leg muscle explosive power and breaststroke swimming speed in students with a moderate level of relationship"
3. Based on data analysis, the correlation coefficient of motion coordination with breaststroke swimming speed in students is 0.42 so it can be concluded that "there is a relationship between motion coordination and breaststroke swimming speed in students with a moderate level of relationship"

4. Based on data analysis, the collective correlation coefficient of arm muscle strength, leg muscle explosive power and coordination of motion with breaststroke swimming speed is 0.79 So it can be concluded that "there is a relationship between arm muscle strength, leg muscle explosive power and movement coordination with breaststroke swimming speed in students with a moderate level of relationship.

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Conflict of Interest

The authors declare that they have no competing interests.

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