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The Contribute of Arms Power and Leg Power Towards Ability to Swim Crawl

Sahabuddin [1A-E], **Syahruddin** [2A-D], **Nurul Musfira Amahoru** [3B-D], **Imam Suyudi** [4B-D], **Muhammad Nur** [5B-D]

[1,3]Education of Sports Coaching, Faculty of Sports Science, Makassar State University, Indonesia
[2,4]Penjaskesrek KeSD-an, Faculty of Sports Science, Makassar State University, Indonesia
[5]Penjaskesrek, Faculty of Sports Science, Makassar State University, Indonesia

*Corresponding Author: sahabuddin@unm.ac.id

ABSTRACT
The problem in this research is "how much influence arm power and leg power on the ability to swim crawl". This study aims to determine the influence of arm power and leg power on crawl swimming ability. The population of this research is the swimming athlete of Garuda Laut Makassar. The sample was taken by purposive sampling. Data collection methods using test and measurement techniques. The test instruments used were: 1) Medicine Ball Push to measure arm power, 2) vertical jump to measure leg power, and 3) stopwatch to measure crawl swimming speed. The variables of this research include arm power and leg power as independent variables, and swimming ability as the dependent variable. The data analysis technique used regression and correlation tests through the SPSS.22 program with a significance level of 95% (α = 0.05). Based on the results of the data analysis, this study shows that: (1) there is a significant effect of arm power on crawl swimming ability in athletes Garuda Laut Makassar seen from r / R count = 0.623, a significance level of 0.00 (0.00 <0.05), and a contribution of 38,8% (2) there is a significant effect of leg power on crawl swimming skills in athletes Garuda Laut Makassar seen from r / R count = 0.777, a significance level of 0.00 (0.00 <0.05), and a contribution of 60,4% (3) There is a significant effect of arm power and leg power together on crawl swimming skills in athletes Garuda Laut Makassar seen from r / R count = 0.784, a significance level of 0.00 (0.00 <0.05), and a contribution of 61,4%.

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INTRODUCTION

Swimming is a different sport when compared to sports in general. Swimming is carried out in the water (Yeni et al., 2019), so in addition to the gravity factor, the earth is also influenced by the upward compressive force of the water. Under normal circumstances (on land) the human body can move freely under the influence of gravity, while in the water we must learn to adapt movement to water (Dewi, 2021). This gives rise to movements that seem strange, then creates movements that are considered the most profitable. The movements later became styles in swimming. The styles in

swimming are crawl stroke, breaststroke, butterfly style, and backstroke (Wicaksono & Putri, 2020).

In the sport of swimming, there are various types of swimming styles, one of which is crawling. Crawl is the fastest swimming style compared to other swimming styles because this swimming style has good coordination and the obstacles are the least (Mahardika, 2010). A distinctive feature of the crawl is that the movement of its arms rotates similar to that of an airplane propeller, and the movement of its legs up and down crosswise (Wardhani, 2022).

In the city of Makassar, there are many places to swim and there are also many associations that conduct intensive training for those who want to become an athlete. In Makassar itself, 2 swimming associations are quite famous in South Sulawesi, namely the Paotere Swimming Association which is located at the Andi Mattalatta Swimming Pool and the Garuda Laut Swimming Association which is located at the UNHAS Swimming Pool. In some of the last PORDA, these two swimming societies contributed many athletes to going down in PORDA. At PORDA in 2018, the Garuda Laut Swimming Association fielded all its athletes but saw the results from the PORDA PR. Garuda Laut did not achieve the target set. This is what encourages researchers to research Makassar sea garuda athletes

The crawl swimming technique, in principle, can be viewed as the output of the unity of processes consisting of body and biomotor proportions (Sefriana, 2020). Swimmers with good body proportions have good biomotor potential than those with resources strength, explosive power, speed, flexibility, agility, reaction time, hip balance, and strict coordination, the number of strokes can be influenced (Mulyawati & Indraswari, 2018). This is because swimming techniques are the result of body and biomotor proportions whose training requires nutritional intake, and adequate oxygen supply by the lungs. To achieve achievement in each sport it must be based on modern principles and a scientific approach.

The success of winning a race or accelerating the force boils down to the swimmer's ability to generate thrust while reducing drag (Sefriana, 2020). Thrust can be improved by increasing strength training and explosive muscle strength power, especially leg muscle strength and arm muscle explosive strength (Syam & Bismar, 2020).

Reducing resistance can be achieved by swimming with that style correctly and following the biomechanics of human movement to create an effective movement to reduce water resistance when swimming. Daya explosive plays a very important role in swimming speed (Dewi, 2021).

Every athlete should consider physical condition requirements such as strength, flexibility, speed, coordination, balance, muscle explosiveness and body composition. Similar to swimming, physical condition is a very important part of achieving achievements. To achieve good physical condition, you also need good exercise. This training program is a reference for actions that are carried out permanently (Rachman, 2013). Programs are designed from large macro activities and then put together with smaller activities to become more and more detailed, often called micro-plans. Efforts to achieve success or results in any sport (including swimming) require the implementation of various elements that support success such as speed (Rona et al., 2020). Speed is the time it takes for the body to perform certain physical work. Speed is a property that allows performing movements in the shortest possible time (Prayuda, 2011).

In swimming races, speed is very important to win a race. Increasing swimming speed is influenced by many factors, including muscle explosive power. A good start makes the swimmer look the fastest. A good beginner needs three qualities: reaction time, muscle strength, and movement mechanics (Siregar & Syahara, 2019).

One form of physical condition ability that a swimmer must have to get a kick that leads to a faster forward thrust is high explosiveness in the leg muscles because good technique alone is not enough to achieve maximum swimming speed if it is not supported by good physical condition (Wicaksono & Putri, 2020). Therefore, the explosive power of the leg muscles needs to be trained through strength and speed training to increase more, so that the thrust achieved by good leg motion techniques increases faster (Kusmita et al., 2022). Therefore, the explosive power of the leg muscles is directly proportional to the speed of crawl swimming, the greater the explosive power of the leg muscles, the faster the swimming speed. Therefore, the explosive power of the leg muscles is in a dominant relationship with the backward distance at the time of launch. So in a crawl, pushing foot movement also requires the explosive power of the leg muscles to support good foot movement techniques and produce a faster forward push (Hasanuddin, 2019).

The explosive power of the arm muscles affects the thrust of the entire forward movement, when performing hand movements in vertical movements, the muscle that works in the water is the extensor of the elbow, namely the triceps muscle. When the explosive power of the arm muscles is paddled to the maximum, the pivot point is wider, so that the force exerted by the water pushed back becomes greater, with high strength automatically the forward thrust is greater (Son, 2017). This refers to the law of Newton three, namely the law of action and reaction, that the greater the force exerted on an object, the greater the force exerted by the object. So in conclusion a good swimming technique supported by arms and legs will increase faster thrust (Sobriyanyo et al., 2020).

The important role of arm and leg movements in swimming, in addition to the correct swimming movement techniques, is also necessary to need exercises to increase the power of the leg muscles which play an important role in creating thrust (Sefriana, 2020). The muscles that play a role as the main drivers of swimming movements that move the legs and extensors of the ankles are the quadriceps, gastrocnemius and gluteus maximus (Syarifuddin et al., 2019). Some experts state that swimming is an aquatic sport with the main movement of the arms and legs to produce thrust so that the body as whole moves or slides forward (Rasyid et al., 2017). When doing hand movements in doing alignment movements in water or entry the muscles that work are the extensor elbow, namely the triceps muscle, while to move the muscles the movement of the hand is with the flexor carpi ulnaris and Palmaris longus muscles. To move the arm as a rower is latisimus dorsi, pectoralis major, teres minor. When performing recovery movements, the muscles that work are the latisimus dorsi muscle, teres major, subscapularis and pectoralis major (Kurniawan & Winarno, 2022).

In swimming, strength is dominant in leg movements and arm movements. Then the physical condition of the legs and arms such as arm power and leg power must be considered. Leg muscle power is required when performing a starting line kicking movement and when providing thrust when starting to perform crawl swimming movements. While arm

power is needed during push movements and recovery movements. Specifically, recovery movements need arm power for short-range swimmers or sprints.

Based on research conducted by Lekso (2013) regarding the influence of training methods and leg power on the swimming speed of 50 meters breaststroke in age group IV athletes of the Spectrum Semarang swimming association that there is a relationship between the explosive power (power) of the legs and the speed of swimming. In his research, it was shown that athletes who have leg power get better results compared to athletes with low power.

In crawl swimming, leg power and arm power can affect the results of crawl swimming speed, especially leg power because it helps to give a boost or speed when kicking crawl legs. Thus, swimming athletes with high arm power and leg power have better abilities compared to swimming athletes with low arm power and leg power, because athletes with high arm power and leg power can produce maximum encouragement when swimming crawl.

METHODS

In this study, a type of correlation descriptive research was used. The population in this study was all PR men's swimmers. Garuda Laut Makassar. Research samples were obtained from a subset of PR men's swimmers. Garuda Laut Makassar as many as 20 athletes. To determine the research sample, a purposive-sampling technique is used, namely by selecting a sample based on predetermined criteria. The variables in this study consist of free variables, namely arm power and leg power, as well as crawl-swimming bound variables. The data collected are data from the test results of arm power, leg power and the ability to swim 20 meters crawl.

The data collected is the result of tests and measurements made by researchers in the field. The form of data in the study is the form of numbers, namely numbers from the results of measuring arm power, leg power and the ability to swim 20 meters crawl. The data that went through the test is still rough. The data were further analyzed using correlational statistical tests using the SPSS application version 22.00 with a significant rate of 95% (α = 0.05)

RESULTS

A descriptive analysis was carried out on the data of arm and leg power analysis of crawl swimming ability in Garuda Laut Makassar athletes. The descriptive analysis includes; total value, average, range, maximum and minimum. From these statistical values, it is hoped that it can provide an overview of the state of arm and leg power analysis data on crawl swimming ability in Garuda Laut Makassar athletes. The results of the descriptive analysis of each research variable can be seen in table 1.

Table 1. The results of the descriptive analysis of each variable.

Variable	N	Mean	Std.	Max	Min
Power arm (X_1)	20	400,25	30,58	460	355
Power Legs (X_2)	20	33,15	7,22	45	20
Renang Crawl (Y)	20	13,98	1,66	16,20	10,40

The results of table 1 above which is an overview of the data on the analysis of arm power and leg power on the ability of crawl swimming in Garuda Laut Makassar athletes. can be put forward as follows:

a. For the power arm data from 20 total samples, an average value of 400.25 with a standard deviation of 30.585 and a minimum value of 355 was obtained and for a maximum value of 460
b. For leg power data from 20 total samples, an average value of 33.15 was obtained with a standard deviation

of 7.220 and a minimum value of 20 and a maximum value of 45

c. For swimming ability data from 20 total samples obtained an average value of 13.9850 with a standard deviation of 1.66521 and a minimum value of 10.40 and a maximum value of 16.20.

Normality tests are performed to test whether, in a regression model, an independent variable and a dependent variable or both have a normal or abnormal distribution (Ghozali 2016). One of the assumptions that must be met for parametric statistics to be used in research is that the data must follow the normal distribution. To determine the distribution of arm and leg power data, a data normality test was carried out using the Kolmogorov Smirnov Test (KS-Z). The results of the data normality analysis can be seen in the following summary of table 2:

Table 2. Normality test results for each variable.

Variable	KS - Z	P	A	Information
Power arm (X_1)	0,146	0,20	0,05	Usual
Power Legs (X_2)	,197	0,41	0,05	Usual
Renang Crawl (Y)	0,188	0,63	0,05	Usual

Based on table 2 above, shows that the results of the analysis of the normality test, the power of the leg power and the ability to swim crawl using the Kolmogorov Smirnov Test showed the following results:

a. In the normality test of the power arm data, the Kolmogorov-Smirnov Test-test value was obtained at 0.146 with a probability level (P) of 0.20 greater than the value of α:0.05 or (0.0>0.05) Thus the arm power data obtained followed the normal or normal distribution.

b. In the normality test, the leg power data obtained a Kolmogorov-Smirnov Test value of 0.197 with a probability level (P) of 0.41 greater than the value of α:0.05 or (0.41>0.05) Thus the leg power data obtained followed the normal or normal distribution.

c. In the normality test, the crawl swimming ability data obtained a Kolmogorov-Smirnov Test-test value of 0.188 with a probability level (P) of 0.63 greater than the value of α:0.05 or (0.63>0.05). Thus the crawl swimming ability data obtained follow the normal or normal distributed distribution.

The inferential analysis is a statistical technique used to analyze sample data and the results are applied to a clear population and the sampling technique of that population is carried out randomly. (Sugiyono 2012). The hypothesis proposed in this study needs to be tested and proven through empirical data obtained in the field through tests and measurements of the variables studied, and then the data will be processed statistically. Because the research data follows a normal distribution, to test the research hypothesis, parametric statistical analysis is used.

For testing the hypothesis, correlation and regression tests of arm power, leg power, and crawl swimming ability was carried out on 20 athletes.

There is a contribution of arm power to crawl swimming ability

The results of hypothesis testing based on data processing through correlation and regression analysis from the SPSS program on the effect of arm power on crawl swimming ability are obtained according to the following summary of table 3:

Table 3. Results of correlation and regression analysis for the first hypothesis

Variable	r/R	Rs	F	t	Sig
Power arm (X_1)					
Renang Crawl (Y)	0,623	0,388	11,421	6,842	0,00

Statistical hypotheses to be tested:
H 0:$r_{x1.y}$ = 0

$H_1 : r_{x1.y} \neq 0$

Test results:

Based on the test results of correlation analysis and data regression between arm power and crawl swimming ability. A correlation value of 0.623 was obtained with a probability level (0.00< α:0.05, for an R square value (coefficient of determination) of 0.388. This means that 38.8% of crawl swimming ability is explained by arm power From the Anova test or t-test, the calculated t is 6.842 with a significance level of 0.00 Therefore the probability (0.00) is much smaller than α:0.05, and the regression model can be used to predict crawl swimming ability (applicable to where population sample taken). The t-test obtained 6.842 with a significance level of 0.00. Since the probability (0.00) is much smaller than α:0.05 H_o is rejected and H_1 is accepted or the regression coefficient is significant, or true arm power has a significant effect on crawl swimming ability. Thus it can be concluded that there is a significant influence of arm power (X_1) with swimming ability (Y) proven observation correlation value (r_o) 0.623 with probability level (0.00) < α:0.05 with a percentage of 38.8%

There is a contribution of leg power to crawl swimming ability.

The results of hypothesis testing based on data processing through correlation and regression analysis of the SPSS program on the influence of leg power on crawl swimming ability are obtained according to the following summary of table 4:

Table 4. Results of correlation and regression analysis for the second hypothesis

Variable	r/R	Rs	F	T	Sig
Power Legs (X_2)	0,777	0,604	27,464	17,192	0,00
Renang Crawl (Y)					

Statistical hypotheses to be tested:

H0 :$r_{x1.y} = 0$
$H_1 : r_{x1.y} \neq 0$

Test results:

Based on the test results of correlation analysis and data regression between power legs and crawl swimming ability obtained a correlation value of 0.777 with a probability level (0.00)< α:0.05, for an R, squared value (coefficient of determination) of 0.604. This means that 60.4% of crawl swimming ability is explained by arm power From the Anova test or t-test, the calculated t is 17.192 with a significance level of 0.00 Therefore the probability (0.00) is much smaller than α:0.05, and the regression model can be used to predict crawl swimming ability (enforceable for populations where samples taken). The t-test obtained 17.192 with a significance level of 0.00. Since the probability (0.00) is much smaller than α:0.05 H_o is rejected and H_1 is accepted or the coefficient regression is significant, or the leg power is significantly affected by crawl swimming ability. Thus it can be concluded that there is a significant influence of leg power (X_2) with crawl swimming ability (Y) proven observation correlation value (r_o) 0.777 with probability level (0.00) < α:0.05 with a percentage of 60.4%.

There is a contribution of arm power and leg power to crawl swimming ability.

The results of hypothesis testing based on data processing through correlation analysis from the SPSS program on the relationship between arm power and leg power to crawl swimming ability are obtained according to the following summary of table 5:

Table 5. Regression analysis results for the third hypothesis

Variable	r/R	Rs	F	T	Sig
Power arm (X_1)					
Power Legs (X_2)					
Renang Crawl (Y)	0,784	0,614	13.525	6,018	0,00

Statistical hypotheses to be tested:
H_o: $Rx_{1.2.\ y} = 0$
H_1 : $Rx_{1.2.y} \neq 0$

Test results:

Based on regression test results and data correlation between arm power and leg power to crawl swimming ability. Obtained a regression value of 0.784 with a probability level (0.00) of < α:0.05, for an R-value squared (coefficient of determination) of 0.614 This means that 61.4 % of crawl swimming ability is explained by arm power and leg power. From the Anova test or F test, it was found that the F count was 13.525 with a significance level of 0.00 Therefore the probability (0.006) is much smaller than α:0.05, and the regression model can be used to predict crawl swimming ability (applicable to the population in which the sample was taken). The t-test obtained 6.018 with a significance level of 0.00 Therefore, the probability (0.00) is much smaller than α:0.05. Then H_o is rejected and H_1 is accepted or significant regression efficiency or arm power and leg power have a significant effect on crawl swimming ability. Thus it can be concluded that there is a significant influence of arm power and leg power on crawl swimming ability, proven by the value of the observed correlation coefficient (Ro) 0.784 with a probability level (0.00) < α:0.05 with a percentage of 61.4%

DISCUSSION

There is a contribution of arm power to crawl swimming ability

It can be explained that if the athlete has good arm power then the athlete can perform a good hand pull and produce a good slide in the crawl swimming style. Thus, the power of the arms affects the ability to swim and crawl. Research conducted by Yustinus Laia (2017) "The Relationship of Arm Muscle Power and Leg Muscle Power to the Ability to Swim 50m Crawl in Female Athletes in the Age Group of 12 Years to 15 Years Tirta Prima Swimming" Thesis Medan State University. The sample used was 15 people. The instruments used in this study were a medicine ball throw for arm muscle power, a standing broad jump for leg muscle power and a 50M crawl swimming test instrument. The results of the first statistical analysis showed a correlation coefficient of -0.5386. The coefficient of determination explains that arm muscle power has an influence of 29% on the ability to swim in the 50M crawls while 71% is influenced by other variables. Based on the results of a significant test, namely the one-way t-test, it is known that the calculation of the > t-Table where (-2.30 > 1.77) so it is concluded that there is a significant and negative relationship of arm muscle power to the ability to swim 50M crawls in female athletes aged group 12 to 15 years Tirta Prima Swimming Klub Kota Medan in 2017. According to Dedy Sumiyarsono (2002) states that power is the product of power and speed. The effect of arm power on swimming according to Sani (2016) if the swimmer has arm length and arm power, it will expand the stroke area and will accelerate the pace in the future. Based on the results of the discussion above, the researcher can temporarily conclude that the power arm is based on the ability to swim crawl because in doing crawl swimming athletes use the power arm in launching the body forward so that the ability to swim crawl can be better or faster.

There is a contribution of leg power to crawl swimming ability

This can be explained that if the athlete has good leg power then the athlete can do a good leg swing and produce a good slide in the crawl swimming style. Thus the power of the legs contributes to the ability to crawl swimming. Research conducted by Subhan, Sukardi Putra, and Abdurrahman (2016) entitled "The Relationship between Leg Muscle Power and Crawl Swimming Speed in Students of the FKIP UNSYIAH Assessment Study Program". Thesis of Penjaskesrek FKIP Unsyiah class of 2011. The sample used was 20 students. Data collection used leg muscle power measurements and crawl swimming speed tests. The correlation results of leg muscle power (X) and swimming speed (Y) were 0.57. The results of testing the hypothesis can be described as the results obtained a t-count of 3.55 and a t-table at a significant level of 95% is 1.73 (t-count = 3.55>t-table = 1.73). The proposed hypothesis is accepted for its correctness. This means that there is a relationship between leg muscle power and crawl swimming speed in the FKIP Unsyiah students class of 2011. In pedalling, if the power of the leg muscles is not strong enough, it cannot provide power assistance so the speed produced will not be fast and the results are not good. Swimmers who have good leg power will support good speed as well and can spur speed in swimming. Harsono (1988) stated "power is the result of strength and speed" so the presence of strength and speed possessed in the leg muscles makes it easier for swimmers to obtain crawl swimming speed. Based on the results of the discussion above, the researcher concluded that the power of the legs is based on the ability to swim crawl because in doing crawl swimming athletes use leg power in launching the body forward so that the ability to swim crawl can be better or faster.

There is a contribution of arm power and leg power to crawl swimming ability

An athlete needs both physical elements, namely arm power and leg power. The power of the legs and arms provides an urge to go faster when swimming as well as the power of the legs which also gives a push to the body to slide faster. So these two physical competitors contribute to the ability to crawl swimming. Research conducted by Yustinus Laia (2017) "The Relationship of Arm Muscle Power and Leg Muscle Power to 50m Crawl Swimming Speed in Female Athletes in the Age Group of 12 Years to 15 Years Tirta Prima Swimming" Thesis Medan State University. The sample used was 15 people. The instruments used in this study were a medicine ball throw for arm muscle power, a standing broad jump for leg muscle power and a 50M crawl swimming test instrument. The results of the first statistical analysis showed a correlation coefficient of -0.5386. The coefficient of determination explains that arm muscle power has an influence of 29% on the ability to swim in the 50M crawls while 71% is influenced by other variables. Based on the results of a significant test, namely the one-way t-test, it is known that the calculation of the > t-Table where (-2.30 > 1.77) so it is concluded that there is a significant and negative relationship of arm muscle power to the ability to swim 50M crawls in female athletes aged group 12 to 15 years Tirta Prima Swimming Klub Kota Medan in 2017. The results of the second statistical analysis showed a correlation coefficient of -0.4906. The coefficient of determination explains that leg muscle power has an influence of 24.07% on the ability to swim in the 50M crawls while 75.93% is influenced by other variables.

Based on the results of a significant test, namely the one-way t-test, it is known that the calculation of > t-Tabel (-2.03 > 1.77) so it can be concluded that there is a significant and negative relationship of leg muscle power to the ability to swim 50M crawls in female athletes in the age group of 12 to 15 years Tirta Prima Swimming Klub Kota Medan in 2017. The results of the third statistical analysis showed a correlation coefficient of 0.6564. The coefficient of determination explains that simultaneously arm muscle power and leg muscle power have a significant relationship of 43.09% to the ability to swim in the 50M crawls while 56.91% is influenced by other variables. Based on the significant results, namely the F test, it is known that Fhitung = 4.54 Ftabel > 3.88 at a significant level of 0.05 so it can be concluded that simultaneously there is a significant correlation or relationship between arm muscle power and leg muscle power to the ability to swim 50M crawls in female athletes in the age group of 12 to 15 years Tirta Prima Swimming Klub Kota Medan in 2017. Thus researchers can conclude that arm power and leg power contribute or have an important role in crawl swimming.

CONCLUSION

Based on the results of data analysis and hypothesis testing based on the problem posed, the following conclusions can be drawn: 1) There is a contribution of arm power to the ability to swim crawl in Garuda Laut Makassar Athletes; 2) There is a contribution of leg power to the ability to crawl swimming in Garuda Laut Makassar Athletes; 3) There is a contribution between arm power and leg power together to the ability to crawl swimming in Garuda Laut Makassar Athletes.

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