

Endurance of leg muscle strength and endurance of arm muscle strength to the ability of swimming speed 200 meters breaststroke

Resistencia de la fuerza muscular de las piernas y resistencia de la fuerza muscular de los brazos en la capacidad de velocidad de nado 200 metros braza

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Abstract. The lack of breaststroke swimming ability among athletes has led to a decline in breaststroke swimming performance in the Solok city swimming association. This problem is thought to be related to the low endurance of leg and arm muscles to the swimming speed of 200 meters breaststroke. This correlational study aims to reveal the contribution of leg muscle endurance, arm muscles, and the joint contribution of both to swimming speed 200 meters breaststroke in athletes coaching achievements in the Solok city swimming association. This study involved 25 swimming athletes in Solok city, with total sampling technique. Data on leg muscle strength endurance was measured through the squat jump test, arm muscle strength endurance through the push up test, and swimming speed through the 200 meter breaststroke swimming test. Data were analyzed using simple and multiple correlations with a significant level of $\alpha = 0.05$, and the contribution was calculated by the formula $r^2 \times 100\%$. The results of data analysis showed that leg muscle strength endurance contributed 74.65%, while arm muscle strength endurance contributed 70.06%. The combination of both contributed 74.99% to the ability of 200 meters breaststroke swimming speed of athletes coaching achievements in swimming associations in Solok city.

Keywords: Endurance, Leg Muscle Strength, Arm Muscle Strength, Speed, Breaststroke.

Resumen. La falta de habilidad para nadar a braza entre los atletas ha provocado un descenso en el rendimiento de natación a braza en la asociación de natación de la ciudad de Solok. Se cree que este problema está relacionado con la escasa resistencia de los músculos de las piernas y los brazos a la velocidad de nado de 200 metros braza. Este estudio correlacional pretende revelar la contribución de la resistencia de los músculos de las piernas, los brazos y la contribución conjunta de ambos a la velocidad de nado de 200 metros braza en atletas que entrenan en la asociación de natación de la ciudad de Solok. En este estudio participaron 25 atletas de de la ciudad de Solok, con técnica de muestreo total. Se midió la resistencia de la fuerza muscular de las piernas mediante la prueba de salto en cuclillas, la resistencia de la fuerza muscular de los brazos mediante la prueba de flexiones y la velocidad de natación mediante la prueba de 200 metros braza. Los datos se analizaron mediante correlaciones simples y múltiples con un nivel de significación de $\alpha = 0,05$, y la contribución se calculó mediante la fórmula $r^2 \times 100\%$. Los resultados del análisis de los datos mostraron que la resistencia de la fuerza muscular de las piernas contribuyó en un 74,65%, mientras que la resistencia de la fuerza muscular de los brazos contribuyó en un 70,06. La combinación de ambas contribuyó en un 74,99% a la capacidad de velocidad en 200 metros braza de los atletas que entrenan en las asociaciones de natación de la ciudad de Solok.

Palabras clave: Resistencia, Fuerza muscular de las piernas, Fuerza muscular de los brazos, Velocidad, Braza.

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Introduction

One sport that is currently very popular in the community, both in Indonesia and around the world is swimming. This is evidenced by the number of swimming pools in every country built by both the government and the private sector and almost all star hotels in the world have swimming pools. (Couzin & Li, 2023) Through researcher observations, it turns out that swimming is a sport that is very popular with most levels of society, from children to parents, men and women. Likewise, from urban communities to rural communities, government agencies and private parties and even in educational institutions actively develop swimming sports.

Nowadays, swimming is not only a recreational sport or for health purposes, but since decades ago it has been competed both at national and international levels, which means swimming is part of achievement sports. Through achievement sports, it is hoped that athletes will be created who

will make the region, nation and state proud through various competitions. In accordance with the achievement goals described in the Republic of Indonesia Law No. 11 of 2022 that "Sports achievement is a sport that fosters and develops sportsmen in a planned, tiered, and sustainable manner through competition to achieve achievements with the support of sports science and technology (Amali, 2022)".

Swimming is a very complex sport, because in addition to technical and mental abilities the elements of physical condition must be owned properly. (Caldwell et al., 2020) states that the basic physical condition components are "endurance, strength, explosive power, speed, flexibility, agility, balance and coordination". Each of these components must be at the top level according to the demands of each sport. In swimming, almost every component of physical condition becomes dominant in a swimming competition, such as: endurance, strength, speed, explosive power, agility and flexibility.

In swimming sports, especially in achievement coach-

ing, each element of physical condition must also be adjusted to the main swimming styles of the athletes, such as: butterfly style swimming, backstroke swimming, breaststroke swimming, and freestyle swimming (Spagnolie & Underhill, 2023). In addition, these physical condition factors must also be adjusted to the athletes' main style swimming numbers, such as: numbers 50 meters, 100 meters, 200 meters, 400 meters, 800 meters and 1200 meters. Broadly speaking, the dominant elements are the elements of speed, strength and endurance. If one of the elements has not been owned or mastered, then the best achievement will not be achieved. Especially for breaststroke swimming which is a swimming style that has the lowest record time (Fernandaes, Maidarman, Denay, & Donie, 2021).

In breaststroke swimming, optimal physical conditioning is essential to achieve the best performance. These physical conditioning factors include strength, endurance, flexibility, and good coordination of the leg and hand muscles. When a swimmer has excellent physical condition, every movement of the legs and hands can be performed maximally, resulting in more efficient propulsion in the water (Nicol, Pearson, Saxby, Minahan, & Tor, 2022). Strong and well-coordinated leg movements will help swimmers maintain an ideal body position and reduce water resistance, while strong and rhythmic hand movements will increase speed and stability. Thus, swimmers who have good physical condition will be able to achieve faster times in each breaststroke swimming lap, while reducing the risk of injury due to improper technique (Arifin, Kristiyandaru, Samodra, Santika, & Suryadi, 2023).

In the leg and arm movements of breaststroke swimming, the physical conditions required include speed and power at 50 meters, and speed and power endurance at 100 meters and 200 meters. The training performed for this swimming style should focus on developing leg and arm muscle strength, as these two muscle groups play an important role in generating propulsion and maintaining movement efficiency (Mirvić, Imamović–Turković, Vranešić–Hadžimehmedović, Nurković, & Šebić, 2022).

A good training program will include a variety of exercises that not only increase strength, but also improve the endurance of these muscles, so that athletes are able to maintain optimal performance throughout longer swimming distances. Well-structured training will help athletes achieve the strength, speed and endurance necessary to excel in breaststroke swimming (Pareja-Blanco et al., 2020).

In addition, what needs to be considered is the condition of the facilities and infrastructure for training. Good swimming pool conditions and complete training equipment and equipment are very important in supporting athletes' abilities. Adequate facilities will make it easier for an athlete to train his swimming skills better. Moreover, if this facility is supported by a training program designed by a competent, directed, sustainable coach, and tailored to the needs of each athlete. With the combination of good facilities and the right training program, swimming athletes can develop their abilities optimally and achieve higher achievements.

Support from good training facilities also helps in minimizing the risk of injury, allowing for more intensive and effective training. Therefore, investment in facilities and infrastructure as well as the quality of training programs are essential for the development of outstanding swimming athletes (Lau, Hou, Lai, Edwards, & Chileshe, 2021).

For an athlete, sport is not just a physical activity, but a place to compete and achieve the highest achievements. This achievement is the highest result achieved through a long process full of dedication, with clear goals and targets. Achieving these goals requires serious effort through well-directed and coordinated planning and implementation (Stojanović et al., 2020). This involves various aspects, ranging from the provision of adequate facilities and infrastructure, consistent training, to support from coaches and medical teams. In addition, mental and motivational factors also play an important role in an athlete's journey to peak performance. This whole process illustrates the high commitment and hard work required to achieve success in the world of sports (Barbosa et al., 2023).

In an effort to develop achievements in swimming, various swimming clubs were established in Solok city such as: Atha Swimming Club, SWP Swimming Club and BA Shark Aquatics. Where all of these clubs are located in the Solok Water Park Swimming Pool as a training ground. Through training in the club, athletes are expected to excel in carrying the name of the club, school, region and country. Therefore, there are so many swimming competition events / events such as: O2SN competition between elementary schools at the city, regional and national levels. POPDA competition between junior and senior high schools at city, regional and national levels. POMNAS competition between students at city, regional and national levels. KRAPSI competition between swimming clubs throughout Indonesia to major events such as PON, Sea Games, Asean Games and Olympics..

However, at this time the achievements achieved by swimming clubs in the city of Solok began to decline, only a few clubs were able to survive to bring their athletes at the national level. Especially the decline is clearly visible in breaststroke swimming both 50 meters, 100 meters and 200 meters. The decline in achievement is due to several factors. These factors include ignoring elements that can determine the ability of athletes, such as physical condition and technique, especially in strength and endurance to produce the ability to move legs and hand movements.

Technique is one of the crucial elements that affect the success of an athlete in a competition. Good mastery of technique not only improves the athlete's performance, but also maximizes the chances of achieving the desired achievement. In the context of breaststroke swimming, special attention should be paid to leg and hand movement techniques. Correct footwork ensures effective and efficient propulsion in the water, while proper hand movements help improve speed and stability (Neagu, Leonte, Popescu, & Răchită, 2020). The harmony between foot and hand movements is key to reducing drag and

increasing forward thrust. Thus, a correct and consistent mastery of technique is essential for athletes to win breaststroke swimming events, ensuring they are at the top of the competition and achieve optimal results.

However, based on the observations of researchers in the field, these athletes are still unable to maximize their breaststroke swimming performance. Although many of them have good swimming techniques, their strength and endurance are not yet balanced. Conversely, some athletes have good strength and endurance but their swimming techniques are less than perfect (McCabe, Mossdrop, Hodierne, & Tor, 2022). This imbalance causes the achievements achieved in swimming competitions to be minimal. Therefore, a more holistic approach in training is needed, which not only focuses on improving technique but also on developing balanced strength and endurance, so that athletes can reach their maximum potential and achieve higher achievements in competition (Abrian, Sulistiawati, & Dinangsit, 2021).

The lack of maximum breaststroke swimming speed ability is thought to be caused by several factors, including: lack of endurance of leg muscle strength, lack of endurance of arm muscle strength, poor physical condition ability, poor breaststroke swimming technique, inadequate training facilities and infrastructure, poor interest, talent and motivation of athletes, and poor training program provided by the coach, resulting in the ability of breaststroke swimming speed is still not optimal (Y. Wang & Huang, 2024).

From some of the factors described above, there are several factors that are thought to also affect the ability of breaststroke swimming speed which is still low. That factor is the endurance of leg muscle strength and the endurance of arm muscle strength. This can be seen with the lack of breaststroke swimming ability performed by athletes due to the low level of these two factors, namely endurance of leg muscle strength and endurance of arm muscle strength (Vasic, Djurovic, Madic, & Okicic, 2021).

Starting from the problems described above, the researcher is interested in knowing more about the breaststroke swimming speed ability of athletes coaching achievements in swimming associations in Solok city, and also seeing the relationship of the two factors, namely endurance of leg muscle strength and endurance of arm muscle strength. Then in this study researchers will look at the ability of breaststroke swimming speed at a distance of 200 meters, because the 200 meter number is the number with the longest distance in the breaststroke swimming race and will also be more visible in the form of endurance of leg muscle strength and endurance of arm muscle strength. Breaststroke swimming for 200 meters is also one of the official numbers contested at major events such as the National Sports Week (PON), SEA GAMES, ASIAN GAMES, OLIMPIADE. Therefore the author raised the research title: "The relationship between endurance of leg muscle strength and endurance of arm muscle strength to the ability to swim 200 meters breaststroke speed at

swimming clubs in Solok city."

Material & methods

This research is descriptive research with correlation analysis (product moment correlation). According to (Ramdhan, 2021) that: "Correlation research is research to determine whether there is a relationship between two variables, whether or not the relationship between the two variables is expressed in the form of a correlation coefficient."

Based on the research problem, this research belongs to the type of descriptive research with correlational techniques, because it is in accordance with what is stated by namely: In correlational research, research selects individuals who have variations in the things being investigated, according to the members of the group selected as subjects measured regarding the two types of variables being investigated, then calculated to determine the correlation coefficient. This correlation study aims to determine whether or not there is a relationship between the two variables and how close and meaningful the relationship is.

The population is the whole research subject (Arikunto, 2010). The population in this study were athletes coaching achievements in swimming associations in Solok city, both male and female, totaling 25 people.

Guided by the description contained in the population above, then according to (Ramdhan, 2021) "sampling is determined by total sampling, this is considering the small population and will be sampled". This the sample was taken from male athletes and female athletes coaching achievements in swimming associations in Solok city totaling 25 people.

The instrument used to obtain data in this study was a test. The tests were specifically designed to measure several important aspects of physical fitness. First, the "squat jump" test was used as an instrument to measure endurance and leg muscle strength. This test was considered relevant because it involves the major muscles of the lower body, which are indispensable in intense physical activity. Furthermore, the "push up" test was used to evaluate the endurance and strength of the arm muscles. By using this test, researchers were able to measure the extent of the arm muscles' ability to endure repetitive activities.

In addition, swimming speed ability was also measured through the 200-meter breaststroke swimming test. This test aims to assess the swimmer's speed and efficiency in executing the breaststroke, which is one of the contested swimming styles. The test procedure is carried out in accordance with the rules that apply in swimming competitions, so that the results obtained can reflect the swimming abilities of participants more accurately and standardized. With these test instruments, this study can provide a comprehensive picture of the physical condition of the participants involved.

The data analysis techniques used in this study include

normality test, correlation test, multiple correlation value, contribution, and significance test.

Results

The results and discussion in this study will be presented sequentially, including: 1) Research result data, 2) Analysis prerequisite test, and 3) Hypothesis Test. The following are the results of research that has been tested.

Table 1.
Research result data

Variable	N	Range	Min	Max	Sum	Mean	SD	Variance
Endurance Of Leg Muscle Strength	25	84.00	16.00	100.00	1322.00	528.80	2.449.20	599.860
Endurance Of Arm Muscle Strength	25	45.00	05.00	50.00	594.00	237.60	1.150.46	132.357
Ability Of Swimming Speed (200 Meters Breaststroke)	25	0,139	02.35	05.16	78.83	31.532	0.76208	0,403
Valid N (listwise)					25			

This study involves the analysis of data regarding leg muscle explosiveness, arm muscle strength, and 200-meter breaststroke swimming performance from 25 samples. Descriptive statistics provide an overview of the distribution and variation of each variable measured.

The leg muscle strength endurance data showed a range of values of 84.00, with a minimum value of 16.00 and a maximum value of 100.00. The total number of all samples was 1322.00, giving a mean of 52.88. The standard deviation of this data is 24.49204, indicating significant variation between samples. The variance of this data was 599.860, which supports the existence of a large variation in leg muscle strength.

For arm muscle strength, the range of values found was 45.00, with a minimum value of 5.00 and a maximum value of 50.00. The total number of all samples was 594.00, giving a mean of 23.76. The standard deviation of this data was 11.50464, showing less variation compared to the leg muscle strength resistance data. The variance of this data is 132.357, which also shows variation but not as great as in the leg muscle strength data.

The 200-meter breaststroke swimming performance had a range of time values of 2.81 minutes, with a minimum value of 2.35 minutes and a maximum value of 5.16 minutes. The total number of all samples was 78.83, giving an average travel time of 3.1532 minutes. The standard deviation of this data is 0.76208, indicating relatively little variation between samples in terms of swimming performance. The variance of this data is 0.581, supporting the observation that variation in swimming performance is minimal.

From this descriptive statistical analysis, it can be concluded that there are significant variations in leg muscle explosive power and arm muscle strength among the samples studied. Meanwhile, the variation in 200-meter breaststroke swimming performance was relatively smaller. This data can be used as a basis for further analysis of the relationship between muscle strength and swimming performance, as well as to design more effective training programs that target the improvement of leg muscle explosive power and arm muscle strength to enhance swimming performance.

Table 2.
Analysis prerequisite test

Statistic	Endurance of Leg Muscle Strength	Endurance of Arm Muscle Strength	Swimming Speed (200m Breaststroke)
N	25	25	25
Mean	52.88	1,01111111	03.15
Std. Deviation	24.49.00	11.50	0,05277778
Test Statistic	0,10763889	0.094	0,11319444
Asymp. Sig. (2-tailed)	0,08680556	0,13888889	0.084

The results of the normality test using the One-Sample Kolmogorov-Smirnov Test show that the data obtained from leg muscle explosiveness, arm muscle strength, and 200 meter breaststroke swimming performance tend to follow a normal distribution. For leg muscle endurance data, the Asymp. Sig. value of 0.138 indicates that these data are not significantly different from the normal distribution at the 0.05 level of significance. Likewise, the arm muscle strength data with an Asymp. Sig. value of 0.200 (with Lilliefors significance correction) indicates that these data also follow a normal distribution. The 200 meter breaststroke swimming performance had an Asymp. Sig. value of 0.084, which although close to the limit of

significance, still indicates that these data are not significantly different from the normal distribution.

The conclusion of this normality test is that all three research variables meet the assumption of normality, which is important for further statistical analysis such as correlation or regression tests. Thus, normal data allows the use of more robust and valid parametric statistical methods in evaluating the relationship between leg muscle explosiveness, arm muscle strength, and 200-meter breaststroke swimming performance. These results provide a strong basis to continue with more in-depth analysis to understand the factors that influence athletes' swimming performance.

Table 3.

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Hypothesis Test

Variable	Endurance of Leg Muscle Strength	Endurance of Arm Muscle Strength	Swimming Speed (200m Breaststroke)
Endurance of Leg Muscle Strength	Pearson Correlation	1	0.945**
	Sig. (2-tailed)		0.000
	N	25	
Endurance of Arm Muscle Strength	Pearson Correlation	0.945**	1
	Sig. (2-tailed)	0.000	
	N	25	
Ability of Swimming Speed (200m Breaststroke)	Pearson Correlation	-0.865**	-0.837**
	Sig. (2-tailed)	0.000	0.000
	N	25	

Pearson correlation analysis revealed significant relationships between leg muscle explosiveness, arm muscle strength, and 200-meter breaststroke swimming performance. The results showed some strong and meaningful correlations between these variables.

The Pearson correlation between leg muscle explosiveness and arm muscle strength is 0.945 with a significance value (Sig. 2-tailed) of 0.000. This shows a very strong and positive relationship between these two variables, meaning that an increase in leg muscle explosive power tends to be followed by an increase in arm muscle strength.

The Pearson correlation between leg muscle explosive power and 200-meter breaststroke swimming performance was -0.865 with a significance value of 0.000. This negative correlation indicates that an increase in leg muscle explosive power is related to a decrease in travel time (improved performance) in 200-meter breaststroke swimming. The stronger the leg muscle explosive power, the faster the time required to complete the swim.

The Pearson correlation between arm muscle strength and 200-meter breaststroke swimming performance was -0.837 with a significance value of 0.000. This also shows a strong negative relationship, where an increase in arm muscle strength is related to a decrease in travel time (improved performance) in 200-meter breaststroke swimming. The stronger the arm muscles, the better the swimming performance.

The results of this correlation analysis confirm that both leg muscle explosiveness and arm muscle strength have a strong relationship with 200-meter breaststroke swimming performance. Increased strength in both muscle groups was significantly associated with improved swimming performance, characterized by faster times. These findings are highly relevant for designing training programs that target the strengthening of these muscles to improve swimming performance.

Discussion

Based on the results of these calculations, it can be seen that the endurance element of leg muscle strength greatly contributes to the swimming speed of 200 meters breaststroke by 74.65%, so that 25.35% is the contribution of other factors that affect the swimming speed of 200 meters breaststroke.

In order for a swimming athlete to have better leg muscle strength endurance and contribute more to the 200

meter breaststroke swimming speed, it can be done with leg muscle strength endurance exercises such as: Squat Jump, Squat Trust and various other exercise variations to increase the endurance of leg muscle strength, because if the better the endurance of a swimming athlete's leg muscle strength, the easier it will be for him to do 200 meters breaststroke swimming, so that his body in doing 200 meters breaststroke swimming can look more ready than a swimming athlete who does not have good leg muscle strength endurance.

According to (Cham, Boeing, Wilson, Griffin, & Jorritsma, 2021)"Endurance is the ability to work with a certain intensity in a long enough stretch of time, without excessive fatigue. Then according to (D. X. M. Wang, Yao, Zirek, Reijnierse, & Maier, 2020)Strength is a very important component of overall physical condition, because it is the driving force for every physical activity.

Based on the opinions of the two experts, it can be concluded that endurance is the maximum ability of muscles to perform activities that can be done many times in a long time. This is an integrated result between endurance and strength.

The leg movements that are performed can move due to muscle contraction. The basic unit of the muscular system is the muscle fiber. Several muscle fibers form a motor unit, each unit has a special ability to contract properly, so that a movement will be carried out.

Otot Limb muscles are part of the limbs that function as lower limbs. Generally the muscle is a separate wake that runs across one or more joints, and when contracted causes movement in the joint. Each muscle nerve is covered by a fine connective tissue called Endomesium. Bundles of muscle fibers form bundles, each of which is covered with connective tissue called Perimesium.

The leg muscles consist of lower leg muscles and upper leg muscles. In the upper limb muscles consist of three groups, namely: Flexores, Exteriores, and Adductores. Which consists of Triceps Femoris and Biceps Femoris. The muscle is located at the border of the groin to the knee joint (on the front and back of the leg).

In swimming sports, especially for swimming 200 meters breaststroke, the endurance of arm muscle strength is very necessary because the purpose of the implementation is that athletes can do 200 meters breaststroke swimming speed, freely can be interpreted that endurance is the athlete's ability to do maximum strength while swimming which can continue to be done repeatedly for a long time.

Based on the explanation above, endurance strength is also found in the leg muscles which are divided into upper limbs and lower limbs. In swimming sports when swimming 200 meters breaststroke. In swimming sports, especially for swimming 200 meters breaststroke, the endurance of leg muscle strength is also very necessary because the purpose of the implementation is that athletes can do 200 meters breaststroke swimming speed, it can be freely interpreted that the endurance of leg muscle strength is the athlete's ability to do maximum strength while swimming which can continue to be done repeatedly. All sports that require a relatively long time on average require leg muscle strength, especially swimming, especially in breaststroke swimming competitions with a distance of 200 meters, leg muscle strength greatly affects the ability to breaststroke swimming speed. With good leg muscle strength, it will produce good breaststroke swimming speed ability. So the endurance of arm muscle strength in this study is the ability to swim 200 meters breaststroke.

The results of research for men prove that there is a significant contribution between the endurance of arm muscle strength to the ability to swim 200 meters breaststroke with a percentage level of = 70.06%. meaning that the variable endurance of arm muscle strength can contribute to the ability to swim 200 meters breaststroke for male athletes coaching achievements in swimming associations in Solok city.

The endurance of arm muscle strength resulting from training is a group of muscles to move with high motor function to make it easier to learn techniques that are very dependent on each individual. The forms of exercise that can be done to increase the endurance of arm muscle strength are with arm muscle strength endurance exercises such as : Push Up, Pull Up and various other exercise variations to increase the endurance of arm muscle strength, because if the better the endurance of the arm muscle strength of a swimming athlete, the easier it will be for him to swim 200 meters breaststroke, so that his body in swimming 200 meters breaststroke can look more ready than a swimming athlete who does not have good arm muscle strength endurance.

Our arms can move due to muscle contraction. The basic unit of the muscular system is the muscle fiber. Several muscle fibers form a motor unit, each unit has a special ability to contract properly, so that a movement will be carried out.

Arm muscles are part of the limbs that function as upper limbs. Muscles consist of cylindrical fibers that have the same properties as cells from other tissues. All of this is tied into a bundle of fibers by a type of connective tissue that contains contactile elements. When the muscle is stimulated, there will be a short latency period, namely when the stimulus is received and then the muscle contracts, which means it becomes short and thick and eventually relaxes and lengthens again.

In swimming sports, especially for swimming 200 meters breaststroke, the endurance of arm muscle strength is

very necessary because the purpose of the implementation is that athletes can do 200 meters breaststroke swimming speed, freely can be interpreted that the endurance of arm muscle strength is the athlete's ability to do maximum strength while swimming which can continue to be done repeatedly.

Factors that affect the work of arm muscles include the nervous system, temperature, blood acidity, blood electrolyte state, metabolic waste chemicals and disturbances in the power system. All sports that require a relatively long time on average require arm muscle strength, especially swimming, especially in breaststroke swimming competitions with a distance of 200 meters, arm muscle strength greatly affects the ability to breaststroke swimming speed. With good arm muscle strength will produce good breaststroke swimming speed ability. So the endurance of arm muscle strength in this study is the ability to swim 200 meters breaststroke.

The study proves that there is a contribution of endurance of leg muscle strength and endurance of arm muscle strength together with the ability to swim 200 meters breaststroke with a percentage level = 74.99%. meaning that endurance of leg muscle strength and endurance of arm muscle strength together contribute to the ability to swim 200 meters breaststroke achievement coaching in swimming associations in Solok city.

Based on this discussion, it is clear that the elements of endurance of leg muscle strength and endurance of arm muscle strength contribute to swimming athletes, so that these swimming athletes are able to perform better 200 meter breaststroke swimming speed abilities. So it can be concluded that the better the ability of endurance of leg muscle strength and endurance of arm muscle strength of a swimming athlete, the easier it will be for him to produce a good 200 meter breaststroke swimming speed ability, and vice versa if the ability of endurance of leg muscle strength and endurance of arm muscle strength is not good, then to get the ability to swim 200 meters breaststroke swimming speed will be difficult to reach.

In connection with this, of course in order to achieve a very good 200 meter breaststroke swimming speed ability again, in addition to training the ability of leg muscle strength endurance and arm muscle strength endurance, a swimming athlete must also pay attention to and train other factors that can influence and contribute up to 100% to the ability of 200 meter breaststroke swimming speed, such as: coordination of movements performing breaststroke swimming is also very decisive for speed ability. In addition, physical condition, technique, tactics and mental abilities also affect sports achievements, including swimming achievements. In connection with that psychological factors, such as mentality, confidence, fighting spirit, motivation are also very influential on the appearance of an athlete in the race. Then, in addition to these factors, facilities and infrastructure, training programs can also contribute to the ability of a swimming athlete's 200 meter breaststroke swimming speed (Santos, 2020).

Based on the explanation above, it can be concluded that to achieve a better level of 200 meter breaststroke swim speed ability, swimming athletes should also pay attention to these factors. Speed is one of the biomotor abilities (elements of physical condition) which is very important in sports. According to (Jeffreys, 2024) "Speed is defined as a person's ability to move from one point to another in the shortest possible time". Moving places can be in the form of moving parts of the body. Speed is related to time, frequency, motion, and distance. Thus it is clear that speed is an element of physical condition that is very dominant in sports activities.

In the sport of swimming speed is the main thing that will be formed and achieved, because speed in swimming can always change in other words the record or the fastest time record can continue to always change so that the competition to pursue it will be very tight and heavy.

In an effort to train swimming speed, especially breaststroke swimming, there are several factors that must be considered, namely physical condition, technique, infrastructure, motivation, and the training program to be carried out. Of the several factors mentioned, the most influential factor is the athlete's physical condition factors such as endurance, strength, explosive power, agility, flexibility, speed endurance and strength endurance.

With a heavier breaststroke swimming load to achieve maximum speed, the physical condition factor will have a big influence. Especially when doing breaststroke swimming movements, both when doing pull and push hand movements and when doing kick foot movements that require great energy, the resulting glide will be further away.

Therefore, speed is a very important element and must be owned and developed by swimming athletes, especially for those who compete in breaststroke swimming numbers. Speed not only determines how fast the swimmer completes the distance, but also reflects how efficient the swimmer is in utilizing his body strength. In this case, 200-meter breaststroke swimming speed has its own challenges because it requires a combination of proper technique, muscle strength, and good stamina. With a relatively long distance compared to other numbers, a stable speed is the key to success in maintaining performance until the end of the race.

The 200 meters in breaststroke swimming is the longest distance for the style, which makes it one of the most physically and mentally demanding races. Athletes must be able to manage their power well, maximizing speed from the start without losing efficiency in the middle or end of the race. This is in contrast to shorter distances, such as 50 meters or 100 meters, where a burst of speed can be a major factor. At 200 meters, in addition to speed, endurance also plays an important role, so comprehensive training is needed to meet this challenge.

The importance of speed in 200-meter breaststroke swimming also lies in how athletes can make the most of every movement. In breaststroke, leg and arm movements must be well coordinated to create optimal propulsion. Good speed not only means being able to swim faster, but

also being able to minimize water resistance with efficient technique. Athletes who have high speed tend to be able to maintain the correct technique throughout the race, so they can maintain momentum without excessive fatigue.

Thus, the development of speed for 200-meter breaststroke swimming athletes should be a major focus in the training program. Exercises designed to improve speed should include muscular strength training, endurance training, and technique training to improve movement efficiency. Interval training, for example, can be one effective method of improving both speed and endurance. Given the importance of speed in swimming competitions, especially in the 200-meter breaststroke, athletes must continue to hone this ability in order to compete competitively and achieve maximum results.

Conclusion

Based on the results of the study, it can be concluded that leg muscle strength endurance makes a significant contribution to the ability to swim 200 meters breaststroke at swimming clubs in Solok city, with a contribution rate of 74.65%. The magnitude of this contribution shows how important the role of leg movements in breaststroke swimming. Strong leg movements produce a longer glide, which in turn increases the swimmer's efficiency and speed in completing the 200 meter distance. Thus, leg muscle strength is a key factor in determining breaststroke swimming performance.

On the other hand, the endurance of arm muscle strength also made a large contribution, which was 70.06%, to the ability of 200 meters breaststroke swimming speed. Although this percentage is slightly lower than the contribution of leg muscles, it still shows the important role of arm muscles in supporting swimming movements. However, the dominance of leg movements in generating greater glide power explains why the contribution of arm muscles is smaller. In breaststroke swimming, a strong and coordinated leg kick is more dominant in propelling the body forward compared to the pull of the arms.

Overall, the combination of leg and arm muscle strength endurance contributed 74.99% to the ability of 200 meters breaststroke swimming speed. This confirms that both factors have a complementary role and are very important in improving swimming performance. If these two muscles work optimally, it will create an optimal glide, both from leg movements and arm movements, which are very necessary in breaststroke swimming. The results also showed that in female swimmers, the same pattern was found, although the percentage was slightly larger, which may be due to the smaller sample size.

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