

Effects of Leg Muscle Power Exercise and Leg Length on Power Leg Muscle and 50-meter Breaststroke Swimming Speed

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Abstract

The purpose of this study was to analyze the effect of the leg muscle power training method and leg length on the increase in leg muscle power and the 50-meter breaststroke swimming speed. This research is a quasi-experimental study with a 2x2 factorial design of 20 research samples with a sampling technique using purposive sampling technique. Data analysis techniques using Multivariate Analysis of Variance (MANOVA). The results of this study are there are differences in the effect of front barrier hop training methods and jump to box on the increase in leg muscle power, there is a difference in the effect of the front barrier hop training method and jump to box on the 50-meter breaststroke swimming speed, there is a difference in influence between athletes having long limbs and short limbs on increasing leg muscle power, there is a difference in the effect between an athlete having long limbs and short limbs on the 50-meter breaststroke swimming speed, there is an interaction between leg muscle power training and leg length to increase leg muscle power, there was no interaction between leg muscle power training and leg length to the 50-meter breaststroke swimming speed.

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INTRODUCTION

Swimming is a sport that has been known since prehistoric times, and swimming sports activities are also much in demand by humans. Swimming is much in demand and carried out both men and women from the ages of children to adults, even to old age. Swimming is one of the sports branches of achievement that is widely contested both at the regional, national and international level.

Breaststroke swimming is one of the forms of water sports performed in body positions such as crawling and then combined with hand and foot movements, as well as coordinated breathing techniques. Swimming is supported by many factors, including the movement of the legs, and arm movements that are always coordinated. Counsilman (Untoro, 2016) said that the primary source of encouragement in breaststroke swimming is produced by foot push. According to Syafruddin (2011) states that influence sports performance are internal and external factors. So to support optimal achievement, especially achievement in breaststroke swimming, an athlete must be supported by various factors, especially internal factors related to physical conditions. Mutohir, and Maksun (2007) there are ten components of physical conditions that must be met by athletes, including cardiorespiratory endurance, muscle endurance, muscle strength, flexibility in body composition, speed, agility, balance, speed of reaction, and coordination.

Besides the physical component that affects the ability of swimming breaststroke is leg power. According to Lutan (2002) muscle power is the ability of a person to direct the maximum possible power to overcome a prisoner. Setiawan (2004) explains that the thrust can be increased by exercising muscle strength, and muscle power, while leg muscle power functions to push during chest breast leg movements. Based opinion above, what is meant by muscle power is the ability of a muscle or group of muscles in a maximum contraction to fight the burden in a particular activity.

In addition to the mastery of basic techniques that are good and right, limbs are one of the aspects that influence the speed of breaststroke swimming. Therefore, to increase leg muscle power, there must be an appropriate exercise method. Power is a combination of strength, and speed or mobilization of maximum muscle force with maximum speed. Based on observations made by researchers, it can be seen from 30 swimming athletes of the Lumban Tirta Club Palembang four athletes have a time record of under 35 seconds with the best time record of 32.07 seconds or only 13.3% of the total. Whereas the national qualification time limit for the 50-meter breaststroke in 28.60 seconds. Based on the data that has been presented shows that the swimming speed of the breaststroke at the Lumban Tirta Club Palembang is still relatively low.

Several things cause the lack or not the maximum speed of 50-meter breaststroke swimming, one of which is the lack of physical exercise. Based on observations during training, the training given by the trainer consists of physical training methods, physical exercises applied by the trainer only do stretching or stretching exercises and physical exercises performed in special places such as gym clubs. The purpose of physical exercise is very influential in increasing leg muscle power, and which can then affect the speed of swimming breaststroke.

Leg muscle power in breaststroke swimming is also an essential factor because breaststroke swimming requires explosive movements useful for swimming speed. Therefore there must be an exercise method used to increase the leg muscle power. One of the current exercises that are quite popular to increase explosive power is plyometrics. Plyometrics is one of the favorite exercises done by coaches at this time, especially in sports that require leg muscle explosive power.

Exercises that can be used as alternatives to increase leg muscle explosiveness consist of many kinds, one of which uses plyometric exercises. Plyometric training is a type of exercise that aims to increase leg muscle power. Exercise

is an alternative researcher in overcoming swimming speed problems using front barrier hop exercises and jump to box. Front barrier hop exercises, this exercise is done in a flat place, how to do this exercise by taking a position facing the barrier, both legs are opened parallel, and both arms are slightly opened, then do the jump over the barrier. When jumping, keep both legs together, after that, continue jumping over the next barrier (Bagus, 2017). While the type of jump to box exercise is a form of training jumping up to the front by landing on a box measuring 15-100cm high. The purpose of training using plyometrics media is to overload, and to train the leg muscle power (Bagus, 2017). The purpose of front barrier hop training and jump to box in the hope that it can become an alternative trainer to increase the swimming speed of the 50-meter breaststroke swimming.

Also, body posture can affect the achievement of one's accomplishments in the field of sports, including the speed of breaststroke swimming. Height, arm length, arm strength, and leg length are the basis of body shape and the primary means of supporting the achievement of sports achievements. Tangkudung, and Puspitorini (2012) states that the biological aspects of a person can affect performance in sports; these aspects include body shape, long limbs, long arms, large size, width, and weight.

Based on the theories the achievement of 50-meter breaststroke swimming is achieved more leverage, correct training techniques and right training methods, an athlete's posture can also be taken into consideration when giving treatment in an exercise program. Thus to find out this, researchers not only use the exercise method but the proportion of athlete's limb length is also a concern in this study.

METHODS

This type of research is quantitative research with quasi-experimental methods that aim to compare two different treatments to research subjects with factorial design techniques. According to Sudjana (2005) factorial experiment is an experiment in which almost or all levels of a factor are combined or crossed with all the levels of each of the other factors that exist in an experiment.

The design of this study was to use a two-factor design with a 2x2 design. The treatment is arranged in such a way that each individual can be a subject together in two different factors, each of which consists of several levels (Dantes, 2012). The data in this study are arranged in a research design framework with the design can be described in table 1.

Table 1. Research Design

Leg length (B)	Method of exercise	
	Front barrier hop (A ₁)	Jump to box (A ₂)
Long legs (B ₁)	A ₁ B ₁	A ₂ B ₁
Short legs (B ₂)	A ₁ B ₂	A ₂ B ₂

Budiwanto (2014) population is the whole subject or source of data that is the center of attention of researchers in the form of people, objects, events with the same characteristics. The population is the whole subject of the study (Arikunto, 2010). Population in this study amounted to 30 people.

Arikunto (2020) says that the sample is "part or representative of the population under study." The samples used in this study were 20 people obtained by purposive sampling technique. According to Sugiyono (2015)

purposive sampling technique is a sampling technique based on specific goals and considerations.

The independent variable in this study is the plyometrics exercise method (front barrier hop, and jump to box exercises), while the dependent variable in this study is leg muscle power and the result of a 50-meter breaststroke swimming speed. The instrument used in this study was the measurement of leg length using a microtoise tool, a standing board jump test to

measure leg muscle power and then a 50-meter breaststroke swimming speed test was performed.

The analysis prerequisite test data collection technique with the normality test is intended to find out that the sample comes from normally distributed populations. Testing data normality with SPSS is carried out by applying the Kolmogorov-Smirnov technique (Candiasa, 2010) which is assisted by an SPSS 24 with a significant level $\alpha = 0.05$. Furthermore, the homogeneity test is intended to show that two or more sample groups come from populations that have the same variance.

The data analysis technique used to test the hypothesis of this study is by using the analysis of the General Linear Model (GLM) Multivariate of Analysis variance (Manova). Criteria used in concluding, if the probability of error $p < 0.05$. Then H_0 is rejected, H_1 is accepted with an error probability $p < 0.05$.

RESULTS AND DISCUSSION

This study aims to determine the results of increased leg muscle power and 50-meter breaststroke swimming speed at the Lumban Tirta Palembang swimming club. This study was

conducted to analyze the effect of leg muscle power training, and leg length on increasing leg muscle power, and 50-meter breaststroke swimming speed at the Lumban Tirta Palembang swimming club. Before conducting the data analysis technique using Manova, in this study, several prerequisite tests must be carried out, namely the data normality test and the variance homogeneity test.

Based on the data normality test conducted using SPSS 24 for windows, a significance value of $0.200 > 0.05$ was obtained so that the study sample came from normally distributed populations. While the homogeneity test obtained a significant value on the leg muscle power variable with a value of $0.070 > 0.05$, and on the swimming variable got a significance value of $0.134 > 0.05$, so based on the results described, it can be concluded that the sample tested can be said to be homogeneous or come from the same sample.

After the normality test and homogeneity test, the next step is to test the hypothesis. The research hypothesis test was carried out using SPSS 24 for windows with the Manova test. Hypothesis test results can be seen in table 2 tests of between-subjects effects.

Table 2. Tests of Between-Subjects Effects in Leg Muscle Power Exercises, and Leg Length for Leg Muscle Power, and Breaststroke Swimming Speed

Source	Dependent variable	df	Mean square	F	Sig.
Exercise method	Swimming	1	403.543	7.105	.011
	Power	1	507.443	10.705	.002
Leg length	Swimming	1	1265.288	22.276	.000
	Power	1	451.250	8.498	.010
Exercise method * Leg length	Swimming	1	85.996	1.514	.227
	Power	1	528.007	5.889	.018

The first hypothesis test in table 2 shows that the significance value of the influence of front barrier hop exercises, and jump to box on the increase in leg muscle power, obtained a significance value ($0.002 < 0.05$), so it can be concluded that there is an effect of leg muscle power training on increasing power leg muscles. The second hypothesis test in table 2 shows that the significance value of the influence of front barrier hop exercises, and jump to box to 50-meter breaststroke swimming speed, obtained a significance value ($0.011 < 0.05$), so it can be

concluded that there is an effect of leg muscle power training on 50-meter breaststroke swimming speed.

The third hypothesis test in table 2 shows that the significant value of athletes having long and short limbs to increase leg muscle power obtained significance values ($0.010 < 0.05$), so it can be concluded that long and short limbs to increase leg muscle power. The fourth hypothesis test in table 2 shows that the significance value of long and short limbs to the 50-meter breaststroke swimming speed obtained significance values

($0,000 < 0,05$), so it can be concluded that the long and short limbs to the 50-meter breaststroke swimming speed.

The fifth hypothesis test in table 2 shows that the interaction between leg muscle power training and leg length to increase leg muscle power obtained significance value ($0,018 < 0,05$), so it can be concluded that the interaction between leg muscle power training, and leg length to increase leg muscle power. The sixth hypothesis test in table 2 shows that the significance value of the interaction between leg muscle power training, and leg length to the 50-meter breaststroke swimming speed obtained significance value ($0,227 > 0,05$), so it can be concluded that there is no interaction between leg muscle power training and the length of the limbs against the 50-meter breaststroke swimming speed.

Plyometric types of front barrier hop and jump to box are exercises that aim to improve one's physical condition. These results are following the research of Jaya, and Rohmat (2019) jump to box training affected increasing leg muscle power with a significance value of 0.150. Nasuka, and Alpies (2016) there are differences in the effect of the results of the Multiple boxes to box jump and Lateral hops exercises on the vertical jump results in IVOKAS club athletes. Multiple boxes to box jump and lateral hops exercises are equally influential on the results of vertical jumps in IVOKAS club athletes. Also, in the sports teacher training journal (Basuki, 2016) states that there is an interaction between plyometric exercises and the explosive power of leg muscles to squat-style long jump abilities. Students who have high leg muscle explosive power are more apt to be trained with multiple boxes to box jumps with single-leg landing exercises. Students who have low leg muscle explosive power are more apt to be trained in the form of single-leg bounding exercises.

If the principle of front barrier hop and jump to box training is done with the correct training principle. So it can cause limb muscle to undergo physiological adaptation and affect the increase in leg muscle power as has been stated in

the above research results. If physical conditions such as increased leg muscle power increase. Then indirectly, the method used will be associated with an increase in breaststroke swimming speed.

CONCLUSION

Based on the results of the analysis and discussion above, the conclusions of this study are as follows. There is a difference in effect between the front barrier hop and jump to box training methods on increasing leg muscle power in the Lumban Tirta Palembang swimming club athletes. There is a difference in the effect between the front barrier hop and jump to box training methods on increasing the speed of the 50-meter breaststroke swimming at the Lumban Tirta Palembang club swimmer. There is a difference in the effect of having long limbs, and short limbs on increasing leg muscle power in Lumban Tirta Palembang club athletes. There is a difference in the effect of having long limbs and short limbs on the 50-meter breaststroke swimming speed of the Lumban Tirta Palembang swimming club. There is an interaction between leg muscle power training and leg length to increase leg muscle power in Lumban Tirta Palembang club athletes. There was no interaction between leg muscle power training and leg length to the 50-meter breaststroke swimming speed of the Lumban Tirta Palembang club.

REFERENCES

- Arikunto, S. (2010). *Prosedur penelitian suatu pendekatan praktik*. Jakarta: PT. Rineka Cipta.
- Bagus, I. W. (2017). *Teori dan praktik latihan kondisi fisik*. Depok: PT Raja Grafindo Persada.
- Basuki, S. (2016). Pengaruh latihan pliometrik multiple box to box jumps with single leg landing dan single leg bounding terhadap kemampuan lompat jauh gaya jongkok ditinjau dari daya ledak otot tungkai. *Thesis*. Kediri: Universitas Nusantara PGRI Kediri. Retrieved from http://simki.unpkediri.ac.id/mahasiswa/file_artikel/2016/14.0.06.01.0004.pdf

- Budiwanto, S. (2014). *Metodologi penelitian penerapannya dalam keolahragaan*. Malang: Departemen Pendidikan Nasional
- Candiasa, I. M. (2010). *Statistik univariant dan bivariant disertai aplikasi spss*. Singaraja: Up Undiska.
- Dantes, N. (2012). *Metode penelitian*. Yogyakarta: Andi.
- Jaya, M. K., & Rohmat, D. (2019). Perbandingan latihan plyometric jump to box dan knee tuck jump terhadap peningkatan muscle power pada atlet dayung rowing. *Jurnal Kepeleatihan Olahraga*, 11(1). Retrieved from <http://ejournal.upi.edu/index.php/JKO/article/view/16828>
- Lutan, R. (2002). *Menata pembinaan olahraga*.
- Mutohir, T. C., & Maksum, A. (2007). *Sport development index: alternatif baru mengukur kemajuan pembangunan bidang keolahragaan (konsep, metodologi dan aplikasi)*. Jakarta: PT Indeks.
- Nasuka, & Alpies, T. B. W. N. S. (2016). Pengaruh latihan plyometric multiple box to box jump dan lateral hops terhadap hasil vertical jump pada atlet klub ivokas. *Prosiding Seminar Nasional FKIP UTP Surakarta*, 36(1). Retrieved from <http://ejournal.utp.ac.id/index.php/PROPKO/article/view/598>
- Setiawan, T. T. (2004). *Keterampilan renang*. Semarang: Semarang: Fakultas Ilmu Keolahragaan, Universitas Negeri Semarang.
- Sudjana. (2005). *Desain dan analisis eksperimen*. Bandung: Tarsito.
- Sugiyono. (2015). *Statistika untuk penelitian*. Bandung: Alfabeta Bandung.
- Syafruddin. (2012). *Ilmu kepelatihan olahraga*. Padang: UNP Press.
- Tangkudung, J., & Puspitorini, W. (2012). *Kepelatihan olahraga, pembinaan prestasi olahraga*. Jakarta: Cerdas Jaya.
- Untoro, B. D. (2016). Kontribusi dorongan tangan dan kaki terhadap kecepatan renang gaya dada pada mahasiswa putra kelas f angkatan 2014 jurusan penjaskesrek unpkediri tahun 2015. *Undergraduate Thesis*. Kediri: Universitas Nusantara PGRI Kediri. Retrieved from http://simki.unpkediri.ac.id/mahasiswa/file_artikel/2015/11.1.01.09.0520.pdf