JURNAL MASTER PENJAS & OLAHRAGA
Volume 7 | Issue 1 | April 2026 | pp. 954-962
p-ISSN: 2725-5660 | e-ISSN: 2722-1202
https://jmpo.stkippasundan.ac.id/index.php/jmpo

The Effect of Vertical Kick Training on 15 Meter Underwater Speed in Swimming Athletes

[1]Anis Asaddun*, [2]Bhayu Billiandri
[1,2] Universitas Negeri Semarang, Indonesia

Abstrac: This study aimed to determine the effectiveness of vertical kick training on 15-meter underwater speed in swimming athletes of Tegal Regency. This research used an experimental method with a one group pretest posttest design. The sample consisted of swimming athletes from Tegal Regency who participated in a vertical kick training program for 12 training sessions. Data analysis was carried out using the Shapiro–Wilk normality test, followed by the paired sample t-test to determine the effect of the training program. The statistical analysis was conducted using IBM SPSS Statistics version 32.0. Based on the data analysis, the average pre-test time was 10.4600 seconds, while the average post-test time was 9.9020 seconds. The findings indicated a decrease in time of 0.55800 seconds after the treatment was given. The results showed an improvement in the athletes 15-meter underwater speed after participating in the training program.

Keyword: Athletes, Swimming, Training, Vertical Kick

Address Correspondence: Universitas Negeri Semarang
*Email: asassadun@student.unnes.ac.id

ISSN 2721-5660 (Cetak)
ISSN 2722-1202 (Online)

How to cite this article (APA):
Asaddun, A., & Billiandri, B. (2026). The Effect of Vertical Kick Training on 15 Meter Underwater Speed in Swimming Athletes. *Jurnal Master Penjas & Olahraga*, *7*(1), 954–962. https://doi.org/10.37742/jmpo.v7i1.204

Article History:

Submitted : April, 2026	Revised : Mei, 2026	Accepted : Mei, 2026	Publish : Mei, 2026

INTRODUCTION

Sports can be practiced by people of all backgrounds as a form of daily physical activity. According to Law No. 11 of 2022 on Sports, sports are defined as all activities that involve the mind, body, and spirit in an integrated and systematic manner to encourage, nurture, and develop physical, spiritual, social, and cultural potential (Law of the Republic of Indonesia No. 11 of 2022, Article 1, Chapter 1, 2005). Sports activities are no longer limited to athletes but should be incorporated as a daily habit in the lives of the general public (Pribadi et al., 2024). Through physical activities such as sports, the human body can be trained to be in better condition, both in terms of physical strength and mental endurance (Reren et al., 2024). One sport that can be practiced by the general public is swimming.

Swimming is a sport practiced in water and can be enjoyed by people of all ages, from children to teenagers and adults. Swimming is also a healthy form of exercise because it involves nearly all the muscles in the body, allowing them to develop optimally. Movements in swimming can be optimized through good coordination between the swimmer's body parts namely the arms, legs, and head. This coordination results in maximum movement and can lead to strong performance during swimming competitions.

Indonesian Law No. 3 of 2005 defines competitive sports as sports that nurture and develop athletes in a planned, tiered, and sustainable manner through competition to achieve excellence, supported by sports science and technology (Indonesian Law No. 3 of 2005, Article 1, Chapter 1, 2005). The principles that swimmers must apply are mastery of swimming technique and speed, particularly when competing to achieve excellence (Muhajirin, 2022). In competitive swimming, the focus is on measuring each participant's speed based on their stroke and age group.

In the sport of swimming, there are four different stroke styles: first, the freestyle; second, the backstroke; third, the breaststroke; and finally, the butterfly (Hastuti, 2009). In accordance with a decision by the Executive Board of the Indonesian Swimming Association (PRSI), the sport of swimming is divided into several age groups (AG) for competitions or events: AG V comprises those under 10 years of age, followed by AG IV for ages 10 to 11, then AG III for ages 12 to 13, AG II covers ages 14 to 15, AG I covers ages 16 to 18, and finally, the Senior AG covers ages 19 and older (Decision of the Executive Board of the Indonesian Swimming Association No. 1 on the Organization of Aquatic Sports Championships, 2022). These regulations established by PRSI are also based on regulations enacted by FINA, the world swimming organization.

Federation Internationale the Nation Amateur, more commonly known as FINA, is a global governing body for amateur swimming. The organization was founded in London in 1908, and following its establishment, swimming experienced rapid growth. Then in 2022, specifically on December 12, 2022, through an Extraordinary Congress held in Melbourne, Australia, the organization changed its name from FINA to World Aquatics (World Aquatics, 2026). This organization has established rules regarding the maximum underwater distance permitted for athletes.

According to World Aquatics regulations during competitions, an athlete is permitted to remain fully underwater after the start and the turn, but for a maximum distance of 15 meters. Before passing this limit, the swimmer's head must have broken the water's surface. If an athlete exceeds the established underwater distance limit, then according to these World Aquatics regulations, the athlete in question will be disqualified from the competition (World Aquatics, 2026).

Frequently, swimmers lose races when their 15-meter underwater start is not executed quickly and with maximum efficiency, as well as during the underwater turn. Underwater movements are used to minimize drag and maximize propulsive force. These movements are a key factor in minimizing deceleration from the initial speed following a dive start or wall exit. Swimmers with higher skill levels will exhibit longer and faster underwater movements during a race than swimmers who are less proficient in underwater movements. The underwater distance covered by swimmers typically ranges from 8 meters to 14 meters, depending on how they execute their underwater movements. One way to improve a swimmer's 15-meter underwater speed is by performing a vertical kick training program.

Vertical kicking is a swimming training method performed with the body in an upright position in the water. Vertical kicking training aims to improve a swimmer's underwater movement ability as an effort to minimize speed loss until reaching the water's surface. It is also used to strengthen arm and leg muscles, improve movement coordination, and help swimmers generate more effective kicks while swimming (Maghlischo, 2003). The training program implemented during an athlete's training process, specifically, in the case of swimmers depends on the coach at the facility where the athlete trains.

Coaches play a crucial role in an athlete's performance by designing training programs that encompass planning, implementation, monitoring, and evaluation of the athlete's performance. The learning process aims to teach a variety of basic movements, fundamental game and sport techniques, game and sport tactics, as well as noble values, including the virtue of sportsmanship (Biliandri et al., 2018). A coach with knowledge of training periodization is a key factor in designing long-term training programs. A training program is a vital activity for coaches, serving as a guide for planning training phases over a specific period to achieve maximum performance (Ginting, 2013).

Previous studies have examined the effects of various swimming training methods on improving athletic performance, as demonstrated by I Putu Bayu Ardhya Satrio in his study entitled 'The Effect of Double-Leg Incline and Stair-Bound Plyometric Training on Leg Power and 15-Metre Underwater Speed in Diving'. The results of this study indicate that training using the double-leg incline and stair-bound plyometric methods is effective in improving leg strength and underwater speed over a distance of 15 metres (Satrio, 2017). However, there remains a lack of research specifically examining the effectiveness of vertical kicking exercises on swimming speed during the underwater phase, particularly over a 15-metre distance following a start or turn in small clubs located in districts; consequently, this aspect has yet to be studied in depth.

Translated with DeepL.com (free version) Based on observations conducted on athletes in Tegal Regency, the researchers noted issues with the athletes' 15-meter underwater speed, preventing them from achieving optimal performance times (best times). In fact, underwater swimming in competitive swimming is one of the most important components of competitive performance (Veiga et al., 2022). Tegal Regency is one of the regencies with a fairly rapid development in the sport of swimming. This is evidenced by the presence of several active swimming clubs that regularly train athletes and consistently implement training programs and athlete development initiatives at the regional level.

Furthermore, research on the effectiveness of vertical kicking training for regional club-level swimmers in Tegal Regency, particularly for athletes from the Kalijanur Swimming Club, remains very limited. Differences in athlete characteristics, training intensity, and development programs may lead to results differing from previous studies conducted on different subjects and in different contexts.

Based on the above description and explanation, the researcher conducted a study titled "The Effectiveness of Vertical Kicking Training on the 15-Meter Underwater Speed of Swimmers in Tegal Regency," as an effort to provide empirical evidence and serve as a basis for coaches in designing more effective training programs, particularly during the underwater phase.

METHOD

Research Design

The research design used in this study is the One-Group Pretest–Posttest Design. In this design, the research sample is first administered a pretest before receiving the treatment; then, after receiving the treatment, the sample is administered a posttest to assess the effects of the treatment.

Participants

The population is the domain of generalization consisting of objects or subjects possessing specific qualities and characteristics as defined by the researcher for study, from which conclusions are subsequently drawn (Sugiyono, 2020). The sampling technique used in this study was purposive sampling, a non-probability sampling technique in which subjects are selected based on specific characteristics relevant to the research objectives. The sampling

criteria for this study were as follows: (1) active swimmers from Tegal Regency, (2) those who participate in a regular training programme, (3) those capable of performing a 15-metre underwater swim, and (4) those willing to participate in the entire research process.

Based on these criteria, a sample of 30 swimmers from Tegal Regency was obtained. According to Campbell et al., purposive sampling is used to select respondents most likely to provide information that is appropriate and useful for the research (Campbell et al., 2020). The independent variable in this study is the vertical kick training method, whilst the dependent variable is the 15-metre underwater speed.

Instruments

The instruments used in this study can be described through a two-stage data collection process: at the beginning and end of the study, or before and after the intervention was administered. The baseline measurement in this study was a 15-meter underwater speed test conducted prior to the vertical kick training. The type of instrument used is a test in which each athlete performs the vertical kick movement 10 times, with each repetition consisting of a 10-second explosive effort followed by a 20-second rest.

This exercise requires dedication and commitment to improve by building the endurance needed to perform it consistently. Meanwhile, the post-intervention measurement used in this study is the 15-meter underwater speed test after performing the vertical kick exercise. The test was conducted at the beginning and end of the research experiment to determine the initial test results and the extent of improvement, as well as the differences in the effectiveness of the vertical kick exercise on 15-meter underwater speed.

Research Procedures

The initial stage of data collection began with administering a pretest to the sample group, followed by the intervention a vertical kick training program and concluded with a post test. The documentation method involved collecting the results of the pretest and posttest of the vertical kick exercise for the 15-meter underwater speed in the form of written records regarding the achievement of the 15-meter underwater speed time, as well as documentation in the form of photographs of activities during the study.

During the training sessions, the 30 participants in the experimental group were given the vertical kick training method to the maximum extent. The researcher collected data for this study over 12 sessions. There were three sessions per week, held on Tuesdays, Thursdays, and Fridays at the Kalipancur Swimming Pool in Tegal Regency.

Table 1. Vertical Kicking Training Program

Session	Training Intensity
1.	10x vertical kick no fins 10" work explode + 20" rest
2.	12x vertical kick no fins 10" work explode + 20" rest
3.	12x vertical kick no fins 10" work explode + 20" rest
4.	12x vertical kick no fins 10" work explode + 20" rest
5.	12x vertical kick no fins 10" work explode + 20" rest
6.	12x vertical kick no fins 10" work explode + 20" rest
7.	12x vertical kick no fins 10" work explode + 20" rest
8.	12x vertical kick no fins 10" work explode + 20" rest
9.	12x vertical kick no fins 10" work explode + 20" rest
10.	14x vertical kick no fins 10" work explode + 20" rest
11.	16x vertical kick no fins 10" work explode + 20" rest
12.	20x vertical kick no fins 10" work explode + 20" rest

Data Analysis

The data processing and analysis technique used in this study is descriptive statistics. The data or information obtained by the researcher from the pretest and posttest after administering the vertical kick training model is raw data. This data will be processed by the researcher using descriptive statistics. After determining the mean values of the pretest and posttest results, the next step is to test the normality of the test results using the Shapiro-Wilk normality test formula.

The normality test for the data in this study uses the Shapiro-Wilk method. Data analysis was conducted using SPSS 32.0 for Windows software. Subsequently, hypothesis testing was performed using the results of the data analysis via the Paired t-test method.

RESULT

The objective of this study was to determine whether the vertical kick has an effect on the 15-meter underwater speed of the swimmer athletes selected as the sample. There were 30 swimmers studied in this research, with a training frequency of 12 sessions and three training sessions per week. Data collection was conducted twice: a pre-test, or before the vertical kick training, and a post-test, or after the vertical kick training. Data analysis in this study was conducted using SPSS version 32.0 for Windows, and the results of the data analysis performed on the sample are as follows:

Table 2. Pre Test and Post Test Data

Data	Sample	Minimum	Maximum	Mean	Std
Pre Test	30	10.03	10.98	10.4600	0.27839
Post Test	30	9.04	10.60	9.9020	0.39165

Based on this data, we can determine that the sample size consisted of 30 children, who are members of the Kalijanur Swimming Club located in Tegal Regency. According to the data above, the maximum time recorded during the pre-test was 10.98 seconds, and the minimum time was 10.03 seconds. After 12 weeks of training using the vertical kick technique, a post-test was conducted to determine the general effect of vertical kick training on the children's swimming speed. The post-test results are as follows: the maximum time recorded was 10.6 seconds, and the minimum time was 9.04 seconds.

Table 3. Normality Test Using Shapiro-Wilk Method

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre Test	.119	30	.200*	.952	30	.194
Post Test	.121	30	.200*	.965	30	.407

**. This is a lower bound of the true significance.*
a. Lilliefors Significance Correction

After obtaining the results of the pre-test and post-test, the next step is to conduct a normality test using the Shapiro-Wilk method. This normality test is performed to determine whether the pre-test and post-test scores follow a normal distribution; normal data distribution is a prerequisite for conducting a parametric test using the Paired Sample t-Test. After calculating the results using SPSS, it was found that the significance level (sig) for both the pre-test and post-test was >0.05. Therefore, it can be concluded that the data being tested follows a normal distribution. Based on the results of this normality test, the next step is to perform the Paired-Sample t-Test.

Table 4. Result of The Paired Samples Test

Pair	Variabel	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre Test	10.4600	30	0.27839	0.05083
	Post Test	9.9020	30	0.39165	0.07151

Based on the table above, it is evident that the average pretest result was 10.4600 seconds, while the average result after the post test was 9.9020 seconds. This indicates a reduction in completion time of 0.55800 seconds following the implementation of the vertical kicking training intervention. This reduction in completion time indicates that the athletes' 15-meter underwater ability improved after the training intervention. Additionally, a correlation analysis was

conducted between the pretest and post test results, with the results of the correlation analysis presented in the table below.

Table 5. Result of Paired Samples Correlations

Pair		N	Correlation	One-Sided p	Two-Sided p
Pair 1	Pre Test & Post Test	30	0.751	<0.001	<0.001

Based on the table, it is evident that the correlation coefficient between the pretest and posttest is 0.751, with a significance level of <0.001. This value indicates a positive and significant relationship between the pretest and posttest results. Thus, there is a relationship between changes in the athletes' abilities before and after the intervention involving vertical kick training. After conducting descriptive and correlation analyses, the next step is to test the hypothesis using a Paired Sample t-Test. This test is used to determine whether or not vertical kick training affects the 15-meter underwater speed of swimmers.

Table 6. Results of The Paired Samples t-Test

Pair	Paired Differences Mean	Std. Deviation	Std. Error Mean	95% Convidence Interval of The Difference		t	df	One-Sided p	Two-Sided p
				Lower	Upper				
Pre Test & Post Test	0.55800	0.259	0.473	0.461	0.654	11.79	29	<.001	<.001

Table 6 presents the results of the paired samples t-test, which was used to determine whether there was a significant difference between the pre-test and post-test scores within the same group before and after the intervention was administered. According to the results of the Paired Samples t-Test, the t-value is 11.794 with a degrees of freedom (df) of 29 and a significance level (Sig., 2-tailed) of <0.001. Since the significance level is less than 0.05, the null hypothesis (Ho) is rejected and the alternative hypothesis (Ha) is accepted. Thus, it can be concluded that there is a significant effect of vertical kick training on the 15-meter underwater speed of the tested swimmers.

DISCUSSION

Before and after administering the vertical kick training intervention, the researcher conducted pre- and post-tests to measure the time taken by the athletes. Vertical kick training is designed to enhance leg muscle strength; with strong leg muscles, athletes can maximize their movement during the 15-meter underwater swim. Swimming the 15-meter underwater segment quickly is one strategy to reduce the time taken by athletes during competitions. The time taken by swimmers during a race is a key determinant of victory. Therefore, vertical kick training is a crucial exercise for improving a swimmer's speed. This is in alignment with the aim of competitive sports, particularly swimming, which is to achieve the highest possible level of performance through a well-planned, systematic, and sustainable program (Sobarna et al., 2021).

Based on the hypothesis testing conducted, it was found that vertical kick training has a significant effect on the 15-meter underwater speed of swimmers. The average pre-test and post-test times derived from the data analysis were 10.4600 seconds for the pre-test and 9.9020 seconds for the post-test, with a time reduction of 0.55800 seconds. Based on these average times, the researcher can determine the extent of improvement in the sample resulting from the vertical kick training model implemented as the treatment.

This reduction in time indicates that vertical kicking exercises can improve the efficiency of leg movements while underwater, enabling athletes to move faster in the water. Furthermore, the resulting p-value was <0.001, which is less than 0.05. Therefore, we can write $p < 0.05$, and thus H0 is rejected and H1 is accepted. Consequently, it can be concluded that the vertical kick training administered has an effect on increasing the 15-meter underwater speed of swimmers.

These findings are also consistent with a study conducted by Sheli Putri Deswanti and Supriyono from Universitas Negeri Semarang in 2024, titled The Effect of Vertical Kick Training on the 15-Meter Underwater Swimming Speed of Swimmers at the Central Java Student Sports Education and Training Center (PPLOP). The study showed that vertical kick training significantly improved the 15-meter underwater swimming speed of the swimmers. The results showed an average time of 7.5266 seconds on the pre-test, which decreased to 6.9353 seconds on the post-test. Furthermore, statistical analysis revealed a p-value of 0.000 < 0.05, confirming that vertical kick training effectively improves swimmers' underwater swimming performance (Deswanti & Supriyono, 2024)

Both of these studies have similarities in their use of vertical kicking training methods and the variables studied, which are underwater swimming speed over a 15-meter distance. Both studies employed a single-group pretest-posttest experimental design and demonstrated improvements in athlete performances following the training program. The differences lie in the study participants and the average time required, overalls both studies indicate that vertical kick training is effective in improving athletes' underwater swimming ability.

Another relevant study was conducted by Muthia Rachmawati from Universitas Pendidikan Indonesia in 2019, titled "The Relationship Between Underwater Distance and 50-Meter Backstroke Speed." This study found a significant relationship between underwater distance and 50-meter backstroke speed. The results indicate that the better a swimmer's underwater ability, the better their speed performance during swimming (Rachmawati, 2019).

This study can serve as a point of comparison in my paper since both address underwater ability in swimming. The difference is in the focus of the research, while my research examines the effect of vertical kick training on 15-meter underwater speed, Rachmawati's study examines the relationship between underwater distance and backstroke speed. Nevertheless, both studies demonstrate that the quality of the underwater phase contributes to improved swimming performance.

According to several existing studies, it can be concluded that vertical kick training can help improve underwater performance in swimmers. This training enhances leg kick power, resulting in improved underwater speed. Therefore, the findings from the study on athletes in Tegal Regency support previous research indicating that vertical kick training is effective for improving 15-meter underwater speed in swimmers. However, this study also has its limitations, namely that it was conducted only in a regency where the level of knowledge and facilities is not yet on a par with training centres in major cities, such as the PPLOP (Student Sports Training and Education Centre) in Semarang.

CONCLUSION

This study concludes that vertical kick training constitutes an effective training method for enhancing swimmers' 15-meter underwater performance. Rather than merely improving time outcomes, the training appears to optimize the efficiency of underwater propulsion, particularly through increased lower limb strength and better movement coordination during the underwater phase. These findings reinforce the critical role of underwater technique as a determinant of competitive swimming performance, especially in the start and turn phases where speed maintenance is essential. The improvement observed indicates that structured and progressive vertical kick training can serve as a targeted intervention to minimize deceleration and enhance overall race performance.

From a practical perspective, it is recommended that coaches systematically incorporate vertical kick exercises into regular training programs, particularly in phases emphasizing speed and technical refinement. Future research is also encouraged to involve a larger and more diverse sample, as well as to compare vertical kick training with other specific underwater training methods in order to obtain more comprehensive insights into performance optimization in swimming.

ACKNOWLEDGEMENT

The author would like to express gratitude to those who have provided both material and moral support, enabling the completion of this research. The author also extends gratitude to the coaches and athletes of the Kalijanur Club in Tegal Regency for their participation in this study. Furthermore, I would like to thank Semarang State University for providing facilities, guidance, and a learning environment throughout my studies and this research.

REFERENCES

Biliandri, B., Supriyono, S., Pujianto, A., & Priyono, B. (2018). Pengembangan Konservatif Games in Aquatic Untuk Meningkatkan Kebugaran Jasmani Dan Sportivitas Siswa Sekolah Dasar. *JP.JOK* (Jurnal Pendidikan Jasmani, Olahraga Dan Kesehatan), 2(1), 70–79. https://doi.org/10.33503/jpjok.v2i1.232

Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D., & Walker, K. (2020). Purposive sampling: Complex or simple? Research case examples. *Journal of Research in Nursing*, 25(8), 652–661.

Deswanti, Sheli. P., & Supriyono. (2024). Pengaruh latihan *Vertical Kicking* Terhadap Kecepatan Underwater 15 meter Atlet Renang di Pusat Pendidikan Latihan Olahraga Pelajar (PPLOP) Jawa Tengah. *Skripsi,* Program Studi Pendidikan Jasmani Kesehatan dan Rekreasi, Fakultas Ilmu Keolahragaan Universitas Negeri Semarang

Ginting, A. (2013). Program Pelatihan Berbeban Metode Sirkuit Pada Cabang Olahraga Renang Gaya Bebas. *Pengabdian Kepada Masyarakat*, 19 Nomor 7(September), 1–11

Hastuti, Pudji. (2009). *Buku Panduan Cabang Olahraga Renang*. Jakarta: Special Olympics Indonesia

IBM Corp. (2024). *IBM SPSS Statistics for Windows* (Version 32.0 Computer Software). IBM Corp

Maghlischo, Ernest W. (2003). *Swimming Fastest*. Human Kinetics

Rachmawati, Muthia. (2019). Hubungan Panjang Jarak Underwater dengan Hasil Kecepatan Renang 50 meter Gaya Punggung. *Skripsi*, Program Studi Pendidikan Kepelatihan Olahraga, Fakultas Pendidikan Olahraga dan Kesehatan Universitas Pendidikan Indonesia

Muhajirin. (2022). *Buku Panduan Guru Pendidikan Jasmani, Olahraga, dan Kesehatan untuk SD/MI Kelas VI*. Jakarta: Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi

Pribadi, I., Maidarman, M., Afrizal, A., & Okilanda, A. (2024). Revitalisasi Kinerja Fisik: Membuka Potensi Tersembunyi dalam Peningkatan Kondisi Fisik Pemain Sepakbola. *Gladiator*, 4(4), 840-852

Reren, D. M., Maidarman, M., Ridwan, M., & Haryanto, J. (2024). Kontribusi Kelenturan dan Kelincahan terhadap Tendangan Sabit pada Atlet Perguruan Silat Tangan Mas. *Gladiator*, 395–403.

Satrio, I Putu Bagus Ardya. (2017). Pengaruh Latihan Plyometric Double Leg Incline and Stair Bound Terhadap Peningkatan Power Tungkai dan Hasil Kecepatan Underwater 15 Meter Cabor Selam. *Skripsi*, Program Studi Pendidikan Kepelatihan Olahraga, Fakultas Pendidikan Olahraga dan Kesehatan Universitas Pendidikan Indonesia

Sobarna, A., Hamidi, A., & Rizal, R. M. (2021). *Sosiologi olahraga: Teori, konsep dan aplikasi praktis*. Desanta Publisher.

Sugiyono. (2020). *Metode Penelitian Kuantitatif, Kualitatif, dan R&d*. Alfabeta

Surat Keputusan Pengurus Besar Persatuan Renang Seluruh Indonesia Nomor 1 Tahun 2022 tentang Penyelenggaraan Kejuaraan Cabang Olahraga Akuatik

Undang-Undang Republik Indonesia Nomor 3 Tahun 2005 tentang Sistem Keolahragaan Nasional. https://peraturan.bpk.go.id/Home/Details/40237/uu-no-3-tahun-2005

Undang-Undang Republik Indonesia Nomor 11 Tahun 2022 tentang Keolahragaan. https://peraturan.bpk.go.id/Home/Details/212182/uu-no-11-tahun-2022

Veiga, S., Lorenzo, J., Trinidad, A., Pla, R., Fallas-Campos, A., & de la Rubia, A. (2022). Kinematic Analysis of the Underwater Undulatory Swimming Cycle: A Systematic and Synthetic Review. *International Journal of Environmental Research and Public Health*, 19(19). https://doi.org/10.3390/ijerph191912196

World Aquatic. (2023). *FINA Swimming Rules 2023-2025*. January, 1–21. https://www.fina.org/swimming/rules
World Aquatics. 2026. *Competition Regulations and Rules*. World Aquatics Official Rules