Available online at : http://journal.unj.ac.id/unj/index.php/gjik
Gladi : Jurnal Ilmu Keolahragaan, 17 (01) 2026, 105-113
Permalink/DOI: https://doi.org/10.21009/GJIK.171.10

The Correlation Between Leg Power Endurance and Arm Power Endurance with Breaststroke Swimming Performance

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(Submission Track: Received: 30-01-2026, Final Revision: 28-02-2026, Available Online: 15-03-2026)

Abstract. This study aimed to determine the relationship between leg power endurance and arm power endurance and the performance of the 50-meter breaststroke among athletes of the Tendy Swimming Club. The study employed a quantitative method with a correlational approach. The population and sample consisted of 15 athletes selected using a total sampling technique. The research instruments included the hurdle jump endurance test to measure leg power endurance, the clapping push-up test to measure arm power endurance, and a 50-meter breaststroke swimming test to measure swimming performance. Data analysis was conducted using descriptive statistics, the Shapiro–Wilk normality test, and the Pearson correlation test at a significance level of $\alpha = 0.05$. The results showed a strong and significant negative relationship between arm power endurance and 50-meter breaststroke performance ($r = -0.656$; $p < 0.05$), as well as a very strong and significant negative relationship between leg power endurance and 50-meter breaststroke performance ($r = -0.922$; $p < 0.05$). These findings indicate that higher levels of leg and arm power endurance are associated with faster swimming times. Therefore, it can be concluded that leg and arm power endurance have a significant relationship with 50-meter breaststroke performance, with leg power endurance showing a more dominant contribution and requiring special attention in swimming training programs.

Keywords: leg power endurance, arm power endurance, breaststroke, swimming performance.

INTRODUCTION

Swimming can be classified based on its purpose, such as competitive swimming, educational swimming conducted in schools, recreational swimming performed in rivers, lakes, beaches, or the sea, and swimming for health purposes (Falaahudin et al. 2025). Swimming is an activity that requires complex coordination of movements (Syahrastani et al. 2025). To perform swimming movements effectively, an individual must be able to coordinate the movements of the arms, legs, and breathing in harmony (Apriyano et al. 2025). In swimming, athletic performance can be objectively measured through time records obtained during competitions, making swimming a competitive and measurable sport (Ren et al. 2025; Sgrò et al. 2024). To improve swimmers' performance, mastery of basic skills such as leg coordination, body position, arm pull, and breathing rhythm is essential (Brat et al. 2025).

In certain swimming events, particularly the breaststroke, athletes are required to produce strong propulsive forces repeatedly over a certain duration. Although breaststroke is considered a relatively simple technique, many athletes are still unable to achieve optimal time results during both training and competition (Mardesia et al. 2021; Marineau et al. 2024). In line with these findings, in practice there are still athletes who experience muscle fatigue in the arms and legs more quickly, which subsequently affects the effectiveness of their stroke and kicking movements (Souaifi et al. 2025; Adlou, Wilburn, and Weimar 2025). In practice, many swimmers are still unable to demonstrate optimal performance during competitions.

A phenomenon frequently observed in the field, particularly among athletes of the Tendy Swimming Club, shows that several athletes experience a decline in speed during the middle to final phases of the race, even though they have mastered the basic techniques. This condition indicates limitations in maintaining movement quality and muscular strength throughout the race. To achieve optimal physical condition, swimming athletes need to possess good physical components such as strength, endurance, and flexibility, as these components play an important role in supporting sports performance (Adirahma et al. 2024; Prieto-González et al. 2021). Physical condition is a crucial element that every athlete must possess to achieve optimal performance. Without good physical conditioning, athletes will experience difficulties in mastering techniques and maintaining their performance. Elements of physical fitness such as strength, endurance, power, speed, flexibility, agility, and coordination significantly contribute to sports achievement, including swimming performance. Several physical components such as strength, endurance, and power interact with each other in supporting athletes' performance during sports activities. The combination of these components forms what is known as power endurance, which refers to the ability of an athlete to repeatedly produce force and maintain it over a certain period during physical activity (Ren et al. 2025; Hung et al. 2023)**.**

Power is defined as the ability of muscles to generate force quickly and explosively within a relatively short period of time, representing a combination of strength and speed in performing movements (Podrigalo et al. 2025; Hermosilla et al. 2021). This component plays an important role in various sports because it relates to an athlete's ability to produce strong and rapid movements to support sports performance. Power endurance, on the other hand, is a combination of power and endurance, referring to the ability to maintain power output over a certain period. In swimming, power endurance plays an important role in maintaining technique consistency and movement efficiency, especially in activities that require repetition and stable rhythm. Previous research has shown that leg muscle power endurance significantly contributes to the breaststroke swimming ability over a distance of 200 meters among athletes from a swimming club in Solok City, with a contribution of 74.65% (Apriyano et al. 2025).

Based on the background described above, this study aims to examine the relationship between leg muscle power endurance and arm power endurance and the performance of 50-meter breaststroke swimming. In addition, this study seeks to determine the contribution of leg and arm power endurance to 50-meter breaststroke swimming performance and to provide a scientific basis for designing more effective and targeted training programs for swimming athletes

METHOD

This study employed a quantitative research design with a correlational approach. Correlational research is a part of quantitative methods used to collect numerical data in order to determine the strength and direction of the relationship between variables. Population is defined as the entire group of individuals, objects, or events that become the main focus of a research study. A sample is a subset of the population selected to represent the characteristics of the population and serve as the data source in a study. By using a sample, researchers are able to draw conclusions that represent the overall population (Sugiyono 2018). The population of this study consisted of 15 students from Tendy Swimming Club. The sampling technique used in this research was total sampling, which is a sampling technique in which all members of the population are used as research samples. This technique was applied because the population size was relatively small, allowing all members of the population to be included as respondents. Therefore, the entire population served as the research sample, totaling 15 participants.

The instruments used in this study consisted of the following tests. The Hurdle Jump Endurance Test was used to measure leg muscle power endurance and was performed for 60 seconds. In this test, participants performed repeated jumps over hurdles continuously, and the score was determined based on the number of successful repetitions performed with correct technique. The Clapping Push-Up Test was used to measure arm muscle power endurance and was conducted for 60 seconds. Participants performed explosive push-ups accompanied by a hand clap repeatedly, and the score was determined based on the number of correct repetitions completed. Meanwhile, the 50-meter Breaststroke Swimming Test was used to measure swimming performance. Participants swam a distance of 50 meters using the breaststroke technique, and the completion time was recorded using a digital stopwatch and expressed in seconds.

The data analysis techniques used in this study included descriptive statistics, the normality test, and Pearson correlation analysis. Descriptive statistics were used to determine the mean, standard deviation, minimum value, and maximum value of each research variable. The normality test was conducted to determine whether the data were normally distributed as a prerequisite for the use of parametric statistical tests. Furthermore, the Pearson correlation test was used to determine the relationship between leg power endurance and 50-meter breaststroke swimming performance, as well as the relationship between arm power endurance and 50-meter breaststroke swimming performance. The significance level was set at $\alpha = 0.05$.

RESULT AND DISCUSSION

Result

Description of Research Data

Based on measurements conducted on 15 athletes from Tendy Swimming Club, with data collection carried out three times, data were obtained on leg power endurance, arm power endurance, and 50-meter breaststroke swimming performance. The following presents the statistical description of the data obtained.

Table 1. Descriptive Statistics of the Research Variables

Variable	Mean	SD	Min	Max
Push-Up (repetitions)	9.67	2.58	4	14
Hurdle Jump (repetitions)	8.33	2.06	5	12
50 m Breaststroke Swimming (seconds)	37.82	2.15	33.89	40.80

Normality Test

The normality of the data was assessed using the Shapiro–Wilk test, as the sample size was fewer than 50 participants. The results indicated that all variables were normally distributed ($p > 0.05$), indicating that the assumptions for Pearson correlation analysis were met.

Table 2. Normality Test

	Calping push up	Hurdle jump	Swimming
Sig.	0,263	0,091	0,060

Correlation Test Results

Based on the Pearson correlation analysis, the following results were obtained:

Table 3. Pearson Correlation Test Results

Variables	Person corelation	Sig.	Description
Clapping Push-Up – 50 m Breaststroke Swimming	-0,813	0,200	Significant
Hurdle jump-renang 50m	-0,914	0,200	Significant

Discussion

The results of the study indicate that there is a significant negative relationship between arm power endurance (push-up) and 50-meter breaststroke swimming performance, with a correlation coefficient of $r = -0.656$ ($p < 0.05$). This negative correlation value indicates that the higher the arm power endurance possessed by the athletes, the faster the 50-meter breaststroke swimming time achieved (a shorter time indicates better performance). The strength of this relationship is categorized as strong based on the interpretation of the correlation coefficient.

These findings are consistent with the study conducted by Apriyano et al. (2025) which identified a significant contribution of arm muscle power endurance to breaststroke swimming performance. This capacity enables athletes to maintain consistency in the quality of arm pull and propulsion throughout the 50-meter distance, thereby optimizing swimming speed. Similar findings were also reported by Nicol et al. (2022) , who confirmed a moderate to strong correlation between leg and arm strength and breaststroke swimming performance. The convergence of these findings strengthens the understanding that the biomotor component of the arms plays a crucial role in generating the propulsive force required to maintain optimal performance in breaststroke swimming, although variations in findings are still reported in the related research literature.

Meanwhile, the relationship between leg power endurance (hurdle jump) and 50-meter breaststroke swimming performance shows a very strong negative correlation with a coefficient of $r = -0.922$ ($p < 0.05$). This correlation value is higher than that of arm power endurance, indicating that leg power endurance has a more dominant contribution to 50-meter breaststroke swimming performance. This can be explained by the fact that in breaststroke swimming, the leg kick contributes greater propulsive force compared to the arm pull.

Research conducted by Miguel-Ortega, Calleja-González, and Mielgo-Ayuso (2024) also confirmed a significant relationship between power endurance and swimming speed, allowing athletes to maintain power output to sustain movement efficiency throughout the swimming distance. However, found Karadenizli et al (2026) that the contribution of arm strength and leg explosive power to breaststroke swimming speed was not statistically significant, indicating variability in findings across different studies. Overall, leg and arm power endurance demonstrate a significant relationship with 50-meter breaststroke swimming performance, with leg power endurance contributing more dominantly. Pan (2025) further supported these findings by identifying that leg muscle endurance contributed 94.73% and arm endurance contributed 86.45% to swimming speed, highlighting the importance of developing these physical components within training programs, particularly with greater emphasis on leg power endurance.

CONCLUSION

Leg power endurance and arm power endurance have a significant relationship with 50-meter breaststroke swimming performance, with leg power endurance showing a more dominant contribution to swimming speed. These findings emphasize that improving power endurance, particularly in the leg muscles, plays an important role in maintaining movement effectiveness and optimal athlete performance during competitions. Swimming coaches should pay special attention to the development of leg and arm power endurance when designing training programs for breaststroke swimmers, with a greater training emphasis placed on leg power endurance due to its more dominant contribution to swimming performance. Furthermore, future research is recommended to involve a larger sample size and include additional physical condition variables in order to obtain a more comprehensive understanding of the factors influencing breaststroke swimming performance, as well as to develop more effective training methods for improving leg and arm power endurance in swimming athletes.

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