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THE RELATIONSHIP BETWEEN LEG EXPLOSIVE POWER AND ARM STRENGTH ON BREASTSTROKE SWIMMING PERFORMANCE OF YUDA 22 SWIMMING CLUB ATHLETES

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Abstrak: This study aims to determine the relationship between leg muscle explosive power and arm muscle strength with breaststroke swimming performance among athletes of the YUDA 22 Swimming Club. The research used a quantitative approach with a correlational design to analyze the association between the variables. The population consisted of 20 athletes, and 10 athletes were selected as research subjects through simple random sampling.
Data were collected using several standardized tests. Leg muscle explosive power was measured using the standing board jump test, while arm muscle strength was assessed through the push-up test. Breaststroke swimming performance was evaluated by recording the time achieved in a 50-meter breaststroke swim. The data obtained were analyzed statistically to determine the relationship between physical strength components and swimming performance. The results showed that leg muscle explosive power and arm muscle strength, either partially or simultaneously, did not have a statistically significant relationship with the breaststroke swimming performance of Yuda 22 Swimming Club athletes. Although these two variables contributed about one-third of the performance variation, this finding indicates that breaststroke swimming ability is more influenced by other factors such as technique, coordination, and psychological aspects.
Kata Kunci : Rigid muscle explosive power, arm muscle strength, swimming ability, breaststroke

INTRODUCTION

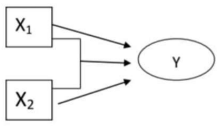
Sports are systematic physical activities aimed at encouraging, fostering, and developing physical, spiritual, and social potential (Utamayasa, 2020:3). Swimming, according to Ariestika (2022), is an activity performed in water using various forms and styles that

have long been known to provide many benefits for humans. Hermosilla et al. (2021) explain that swimming is a complex skill requiring extensive knowledge and basic techniques to be mastered quickly. According to Kapus et al. (2018), swimming consists of four competitive styles: crawl (freestyle), breaststroke, backstroke, and dolphin (butterfly).

Physical condition in sports refers to all physical abilities that determine performance (Sobriyanyo et al., 2020), which are manifested through personal capabilities such as willpower and motivation (Hasanuddin, 2019). This sport has four styles, namely freestyle (crawl), breaststroke, backstroke, and butterfly. From these four styles, the variable examined in this study is breaststroke swimming ability. An essential component of physical conditioning programs is strength, because strength functions both as a driving force and as an injury-prevention factor (Syarifuddin et al., 2019). In addition, strength is also a key factor in achieving optimal performance (Kusmita et al., 2022). Strength is a component of physical condition related to an individual's ability to use their muscles to bear loads during activity.

Explosive power (power) is the ability of the human body to adapt to physical loads (Dewi, 2021) without causing significant fatigue (Sahabuddin et al., 2022) and to maintain a reserve capacity for subsequent activities (Yeni et al., 2019). Speed is a person's ability to perform continuous movements (Pratama et al., 2022) in the same form in the shortest possible time or to execute rapid movements within a brief period after receiving a stimulus (Syam & Bismar, 2020). Based on observations conducted by the researcher on January 24, 2024, it was seen that the athletes possessed fairly good leg explosive power. This was evidenced by the strong push during the start and when pushing off the pool wall after turning. In addition, the athletes' arm muscle strength also appeared stable; during the pulling motion, the arms worked consistently and effectively in helping lift the body to the surface.

Keterangan :



Bebas(Sumber : Neolaka : 2014)

Keterangan :

X1 : Kekuatan Otot Tungkai

X2 : Kekuatan Otot Lengan

Y : Hasil Renang Gaya

: Hubungan kedua variable

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measuring observed natural and social phenomena. The success of a study is largely determined by the instruments used, as the data obtained are used to answer the research questions and test them. The instruments in this study consisted of:

According to (Santosa 2015), the instruments used in this study were:
1) Writing instruments. The purpose was to record the results of the standing board jump test.
2) Whistle. The purpose was to use a whistle to signal the participants before performing the standing board jump test.
3) Leg muscle power measuring instrument (meter) to obtain leg power data in the standing board jump test. The purpose was to measure leg muscle components.
4) Tools/Facilities: a measuring tape or similar, and a judge's flag.

METHOD

Research Design

This study employed a correlational research design to determine the relationship between leg muscle explosive power, arm muscle strength, and breaststroke swimming ability in athletes of the Yuda 22 Swimming Club. A correlational design was selected because it allows the researcher to examine the degree to which variables are associated without manipulating them (Creswell, 2014).

Population and Sample

The population of this study consisted of all athletes trained at Yuda 22 Swimming Club. The sample included **athletes who regularly trained in the 2024–2025 season**, selected using a **purposive sampling technique** based on the criteria that they:

1. actively participated in training sessions,
2. mastered basic swimming techniques, and
3. were able to perform breaststroke movements.

The final sample included **X athletes** (insert number), comprising both male and female swimmers.

Data Collection Techniques

Data were collected using the following instruments:

1. **Leg Muscle Explosive Power Test**
    a. Measured through the **vertical jump test or standing broad jump** (choose one and specify).
    b. Results were recorded in centimeters to represent explosive power.

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2. **Arm Muscle Strength Test**
    a. Measured using the **push-up test or handgrip dynamometer** (choose the instrument used).
    b. Scores were recorded based on repetitions or strength values in kilograms.
3. **Breaststroke Swimming Ability Test**
    a. Assessed by measuring **swimming speed and performance** in a 25–50 meter breaststroke trial.
    b. The time taken to complete the distance was recorded in seconds.
4. **Documentation**

    Used to obtain supporting records related to athlete profiles and training routines.

Data Analysis Techniques

Data were analyzed using **descriptive and inferential statistics**, including:

1. **Descriptive statistics** (mean, minimum, maximum, and standard deviation) to describe each variable.
2. **Normality and linearity tests** to determine whether the data met the assumptions for correlation analysis.
3. **Pearson Product–Moment correlation** to measure the strength and direction of the relationship between:
    a. leg muscle explosive power and breaststroke ability,
    b. arm muscle strength and breaststroke ability, and
    c. both independent variables combined with swimming performance.
    d. The level of significance was set at **α = 0.05**.

RESULTS AND DISCUSSION

Results

Tabel 4.4 Ringkasan Hasil Pengujian Hipotesis

Hipotesis	Korelasi	t/F hitung	t/F tabel	Keputusan	R^2
H_1 (X_1-Y)	-0.595	-2.091	2.306	H_o diterima	0.354
H_2 (X_2-Y)	-0.515	-1.697	2.306	H_o diterima	0.265
H_3 (X_1,X_2-Y)	0.599	1.960	4.74	H_o diterima	0.359

The research was conducted at the Noren Tirta Buana Swimming Pool, A. Widodo Tugumulyo, Musi Rawas Regency. In this study, the researcher collected data on leg muscle explosive power, arm muscle strength, and breaststroke swimming performance

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from a population of 20 athletes. The results showed considerable variation among the athletes in all measured variables. Differences were observed in the athletes' leg explosive power, arm strength, and breaststroke performance, reflecting the diverse physical conditions, training adaptations, and technical skills possessed by each athlete.

The sample consisted of **7 male athletes and 3 female athletes**, ranging in age from **11 to 14 years**. This distribution illustrates a relatively young athlete population that is still in the developmental phase of both physical conditioning and swimming technique.

1. Hypothesis Testing

a. Relationship Between Leg Muscle Explosive Power and Breaststroke Swimming Ability

The analysis revealed a correlation coefficient of $\mathbf{r_1y = -0.595}$, with a calculated **t-value of –2.091** and a **t-table value of 2.306** at a significance level of $\alpha = 0.05$ (df = 8). Since **|t-count| < t-table**, the null hypothesis (H_0) is accepted. This indicates that although the correlation is practically strong and negative, it is **not statistically significant**.

The coefficient of determination $\mathbf{r^2 = 0.354}$ suggests that **35.4%** of the variation in breaststroke swimming performance can be explained by leg muscle explosive power, while the remaining 64.6% is influenced by other factors such as technique, endurance, coordination, and overall physical condition.

b. Combined Relationship of Leg Explosive Power and Arm Strength with Breaststroke Ability

The simultaneous relationship between both independent variables produced a multiple correlation coefficient of **Ry.12 = 0.599**, with **F-count = 1.960** and **F-table = 4.74** ($\alpha = 0.05$, $df_1 = 2$, $df_2 = 7$). Since **F-count < F-table**, the null hypothesis is accepted, indicating that the combined influence of leg explosive power and arm muscle strength is **not statistically significant**.

The coefficient of determination $\mathbf{R^2 = 0.359}$ shows that together, both variables explain **35.9%** of the variance in breaststroke swimming ability. The remaining percentage is likely influenced by factors such as technique efficiency, breathing control, body position, flexibility, training frequency, and psychological readiness.

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DISCUSSION

The findings of this study indicate that leg muscle explosive power and arm muscle strength, both individually and collectively, do not have a statistically significant relationship with breaststroke swimming performance. Although the correlation between leg explosive power and breaststroke ability showed a moderately strong negative coefficient ($r = –0.595$), the result was not statistically significant. This suggests that leg explosive power alone does not adequately predict breaststroke performance among young athletes. Similar tendencies were observed by Dewi (2021), who emphasized that explosive power contributes to performance only when combined with technique and coordination.

The coefficient of determination showed that leg explosive power accounted for 35.4% of the variance in breaststroke performance. This aligns with the explanation by Syarifuddin et al. (2019), who stated that power contributes to propulsive force during movement; however, breaststroke relies heavily on technique efficiency, timing, and body position. Thus, high explosive strength may not translate directly into faster breaststroke execution if technical mastery is lacking.

Arm muscle strength also did not demonstrate a significant effect when tested together with leg explosive power. Although strength is considered an essential element in swimming performance (Kusmita et al., 2022), this study suggests that arm strength alone is insufficient in determining breaststroke outcomes. Hermosilla et al. (2021) noted that swimming is a complex skill requiring coordination of multiple physical components, including breathing control and stroke technique. This complexity may explain why the relationship between the tested physical attributes and swimming performance was statistically weak.

The combined influence of leg explosive power and arm strength explained only 35.9% of performance variation. This further supports the view that physical attributes, while important, are not the sole determinants of breaststroke performance. Technical proficiency—particularly in timing the kick-and-pull sequence—is essential for effective propulsion, as supported by Kapus et al. (2018), who emphasized that each swimming style requires specific biomechanical efficiency. Additionally, psychological readiness, motivation, and training frequency may also contribute to performance outcomes (Hasanuddin, 2019).

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Overall, these findings imply that training programs for young swimmers should emphasize not only physical conditioning but also the development of technical skills, movement coordination, and tactical understanding of the stroke. Future research may involve larger samples, inclusion of biomechanical measurements, or longitudinal designs to better understand performance predictors in breaststroke swimming.

CONCLUSION

Based on the results of this study, it can be concluded that the leg muscle explosive power and arm muscle strength of the athletes from Yuda 22 Swimming Club show varied physical characteristics and performance abilities. Although the statistical analysis revealed a negative correlation between leg explosive power and breaststroke swimming performance, this relationship was not significant. Similarly, when leg explosive power and arm muscle strength were analyzed together, the combined influence on breaststroke performance also did not reach statistical significance.

Despite the lack of significant relationships, the determination coefficients indicate that both variables still contribute meaningfully to performance variation, accounting for approximately one-third of the differences observed among athletes. These findings suggest that breaststroke performance is influenced by a broader combination of physical, technical, and possibly psychological factors, which were not fully captured in this study.

Therefore, coaches and trainers should consider adopting a more holistic training approach that integrates not only strength and explosive power training but also technique refinement, coordination, flexibility, and endurance development. Future research is recommended to include larger sample sizes, additional biomechanical variables, and more specific performance indicators to better understand the complex factors that affect breaststroke swimming ability.

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