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The Relationship Between Arm Flexibility and Muscle Strength and The Results of Gyaku Tsuki Karate Punching Ability

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Abstract

The aim of this research was to determine the relationship between arm flexibility and arm muscle strength on the results of Gyaku Tsuki karate blows at the Sukawinatan Palembang dojo. The method used in this research is correlation using quantitative methods. The population of this study were all karate athletes at the Sukawinatan Palembang dojo with a total sample of 30 people. The data analysis technique used is correlation and regression techniques with a significance level of 70.5% or 0.05. The results of the study showed that there was a significant relationship between Gyaku Tsuki's arm muscle strength in the martial art of karate, while arm flexibility and Gyaku Tsuki's punch results had no partial relationship. Simultaneously, the research results show that there is a certain relationship between arm flexibility and arm muscle strength and the results of Gyaku tsuki karate blows at the Palembang Sukawinatan dojo. The conclusion of this research is that there is a relationship between arm flexibility and arm muscle strength and the results of Gyaku tsuki Karate blows at the Sukawinatan Palembang dojo.

How to Cite

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INTRODUCTION

Education is a foundation that builds the framework of an individual's life, shaping a person's existence, defining their character, morality, ideology, principles, life skills, and everything necessary to navigate life beyond just career enhancement. Education serves as a process to optimize human resources, enabling individuals to achieve social and personal development that fosters a strong connection between the individual, society, and the surrounding cultural environment (Azzahra et al., 2023).

Physical education, in essence, is an inseparable part of the overall education system, with a focus on physical activities. It is an integral component of the broader educational system, aimed at developing aspects of health, physical fitness, critical thinking, emotional stability, social skills, reasoning, and moral actions through physical activities and sports. Physical education is essential at all educational levels, from elementary to high school, as it is inherently linked to the general objectives of education and maintains a balance between physical and spiritual development.

Physical education is a part of general education and can be defined as an educational process designed to achieve educational goals through physical movement. It is widely recognized that physical education, as a fundamental part of education, plays a significant role in enhancing the quality of Indonesian human resources. It also has a profound impact on shaping students' character, especially through the learning process.

Discussing character education means addressing a system of instilling character values, which includes components of knowledge, awareness or intention, and actions to realize these values toward God Almighty, oneself, others, the environment, and the nation. National character can be developed by fostering individual character. However, since individuals live within specific social and cultural environments, individual character development can only occur within these social and cultural settings. This means that character and cultural development can be achieved through an educational process that does not detach students from the social environment, community culture, and national culture (Sukatin et al., 2023).

Strengthening character education is highly relevant today in addressing the moral crisis affecting our country. Recognized or not, there is a real and concerning crisis in society, impacting our most valuable asset: children. Adolescent behavior often includes a tendency toward cheating, bullying at school, and fights. The resulting consequences are serious and can no longer be seen as simple issues, as these actions are leaning toward criminal behavior.

In martial arts, there are several types of combat sports, including Karate. Karate is a martial art that is popular across age groups, from children to adults. This is evident as many karate practitioners, or "karateka," participate in training at various dojos. Karate has also become widespread in schools, not only as a form of self-defense but also as a sport with competitive potential. According to (Sartika et al., 2023) "karate is an empty-handed martial arts sport so that in technical training the hands tend to be used more than the feet, in using the hands to hit and parry with the principle of one attack making the opponent no longer able to doing so provides resistance". Karate is a special method for defending oneself through the use of body parts that are trained well and naturally, which is based on and aimed at following Eastern philosophical values (Heliza & Fetiloka, 2023).

Karate is a form of martial art recognized worldwide and was introduced as an Olympic sport at the Tokyo 2021 Olympics. Originating in Okinawa, Japan, karate is a martial art that uses empty-handed techniques and has developed into a competitive sport at local, national, and international levels. In karate, two types of movements are commonly competed in: kata and kumite. According to Same et al., (2022), kata literally means "form" or "pattern." It is more than simple physical or aerobic exercise; it incorporates principles of fighting. Each kata has a unique rhythm of movement and breathing. Kumite, which literally means "meeting of hands," is generally practiced by advanced students, although some dojos now teach it to beginners. Before practicing free sparring (Jiyu Kumite), students learn structured sparring (gohon kumite or yakusoku kumite). In competitive sparring, known as Shiai Kumite, Shotokan-style kumite in Japan is only performed by practitioners who have reached a high level (black belt) and can control their punches to avoid injuring their opponents.

To excel as an athlete, a karateka must master basic techniques such as punches and kicks, both for attack and defense. The Gyaku Tsuki punch, for example, is a straight punch aimed at the opponent's midsection, performed opposite to the stance direction (Ruskin & Liputo, 2021). The purpose of this punch is self-defense, and it represents one of the fundamental techniques in

karate, particularly the straight punch or gyaku tsuki.

South Sumatra (Sumsel) is a province located in the southern part of Sumatra Island. Sumsel has a rich sports history and has hosted various significant sporting events. Some major sports events held in Sumatra Selatan include the XVII National Sports Week (PON) in 2004, the World Sepak Takraw Championship in 2018, and the XVI National Student Sports Week (POPNAS) in 2023.

Initial field observations and interviews with coaches reveal that some athletes in the Sukawinatan dojo have mastered basic karate techniques. However, most of the athletes struggle with mastering one of the fundamental techniques, the gyaku tsuki punch. The relationship between arm flexibility and gyaku tsuki punching ability is not yet understood, nor is the connection between arm muscle strength and the gyaku tsuki punch in the Sukawinatan dojo, Palembang. This preliminary observation lacks valid data. Therefore, to find answers to these issues, a study titled "The Relationship Between Arm Flexibility and Arm Muscle Strength with the Performance of Gyaku Tsuki Punching Ability in Karate at the Sukawinatan Dojo, Palembang" is needed.

The purpose of this study is to determine the relationship between arm flexibility and arm muscle strength with the performance of the Gyaku Tsuki* punch at Dojo Sukawinatan Palembang. The researcher aims to find out whether there is a connection between: Arm flexibility (how flexible the arm is). Arm muscle strength (how strong the arm muscles are). And the performance of the Gyaku Tsuki punch (a specific punching technique in karate). The study is conducted at Dojo Sukawinatan Palembang (a karate training center).

The novelty of this research lies in several aspects: Specific technique focus: The study focuses solely on Gyaku Tsuki it's quite rare for research to isolate one particular karate technique. Combination of physical factors: It examines the combination of two physical attributes (flexibility and strength) rather than analyzing just one factor independently. Local context: The research provides localized data from athletes at Dojo Sukawinatan Palembang, which may not have been widely explored before.

METHODS

The research method is a scientific approach to obtaining data with specific purposes and uses Sugiyono, (2019). This study is a correlational research, utilizing data collection techniques. This correlation technique is used to find relationships and test hypotheses concerning the association between two variables when both variables are in interval or ratio form, with data sourced from the same set for both variables. Data collection is conducted by administering tests and measurements through a survey method, where the researcher observes the implementation of tests and measurements directly in the field. Data analysis employs correlation testing, which is used to determine the relationship between each independent variable and the related variable. The purpose of this study is to determine whether there is a relationship between arm length and arm muscle strength with the speed of the gyaku tsuki punch in karate at the Sukawinatan Dojo, Palembang.

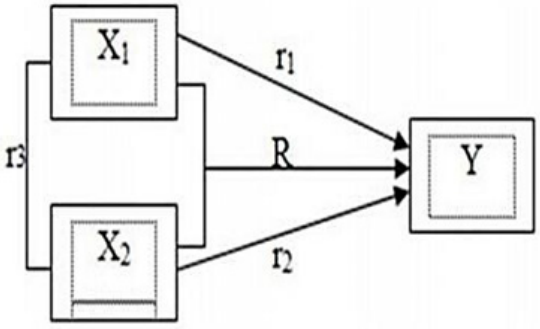

Figure 1. Research Design
Source: Sugiyono, (2016)

Information:
X1: Arm Flexibility
X2: Arm Muscle Strength
Y: Gyaku Tsuki Punch Performance Result
R: Multiple Correlation

Based on a total population of 30 male athletes at the Sukawinatan Dojo in Palembang, the sample taken for this study consists of male and female athletes participating in training activities at the Sukawinatan Dojo in Palembang. Specifically, the sample includes 30 male athletes aged 13-17 years from the Sukawinatan Dojo in Palembang.

According to Komariah et al., (2018), a research instrument is a tool used to collect data or measure the object of a research variable, and a valid, consistent, and reliable instrument is essential for obtaining accurate data that reflects the true condition of the study.

This study uses the following instruments:

Static Flexibility Test - Shoulder and Wrist

This test measures the static flexibility of the shoulders and wrists, assessing how far an in-

dividual can stretch or bend their shoulder and wrist joints in a fixed position without active or dynamic movement. It provides insight into the flexibility of the shoulder and wrist joints and muscles (Brown, 2019).

Equipment Needed:
A stick, 18 inches in length
A 1-meter ruler
A tester
Procedure:

1. Lift the stick as high as possible while keeping your nose on the floor.
2. Measure the vertical distance from the floor to the highest point of the stick in inches.
3. Repeat the test three times and record the best measurement.
4. Measure the arm length from the acromion extremity to the tip of the longest finger.
5. Subtract the arm length from the best of the three flexibility measurements.

Table 1. Norms for the Flexibility Test

Category	Man	Woman
Very Good	> 12.50	>11.75
Good	12.50-11.50	11.75-1075
Average	11.49-8.25	10.74-7.50
Below Average	8.24-6.00	7.49-5.50
Bad	<6.00	<5.50

Source : (Hasdiana, 2018)

Arm Muscle Strength Test (Push-Up)

The measurement of arm muscle strength can be conducted through a push-up test. This test can be performed using the straight-leg technique (push-up) or the bent-leg/knee technique (knee push-up). According to Fikri et al., (2022) Arm muscle strength refers to explosive movements performed to maximize the muscles in the arms. One effective exercise for building arm strength is push-ups, which can enhance arm muscle capability. Push-ups are among the exercises that can be utilized to improve arm muscle strength. Males perform the test with the straight-leg technique, while females use the bent-leg/knee technique (Wiriawan, 2017). The procedure for the arm muscle strength measurement test is as follows:

1. The athlete starts in a prone position with the head, back, and legs aligned straight.
2. Both palms rest on the floor beside the chest, with fingers pointing forward.
3. The soles of both feet are close together, with the toes touching the floor.
4. In the prone position, only the chest touches the floor, while the head, abdomen, and lower legs remain elevated.
5. From the prone position, lift the body by straightening both arms, then lower it again by bending both arms until the chest touches the floor.
6. During each lift and lowering of the body, the head, back, and legs must remain straight.
7. Each time the body is lifted counts as one repetition.
8. The push-up is performed as many times as possible within 1 minute.
9. A push-up is considered correct when the body is lifted with both arms fully extended, and the head, back, and legs remain straight.

(1) Assesment:
Record results for at most 1 minute

Table 2. Norms Push Up Test

Category	Man
Very Good	> 12.50
Good	12.50-11.50
Average	11.49-8.25
Below Average	8.24-6.00
Bad	<6.00

Source: (Wiriawan, 2017)

(2). Gyaku Tsuki Punching Ability Test

a. Objective: To measure the accuracy and skill level of the testee in performing the gyaku tsuki punch.

b. Equipment/Facilities/Implementation:

1. Karate uniform (Dogi).
2. Belt.
3. Training space (Dojo).
4. Writing tools and evaluation sheets.
5. Execution procedure.

Test Procedure:

The gyaku tsuki punching ability test involves performing a sequence of gyaku tsuki punching movements. The assessment criteria for the test are as follows **Table 3**.

Table 3. Gyaku Tsuki's Punching Ability Norms

Demension	Indicator
1. Stance Form	1. Body weight is on the front leg.
	2. The back leg is straight.
	3. The front and back legs are not aligned in a straight line.
2. Punch Form	4. Left hand is positioned near the head or waist.
	5. The right hand punches toward the abdomen/solar plexus.
	6. The arm is straight, with the right hand near the head.

Source: (Hasdiana, 2018)

Implementation: The test participants must perform the gyaku tsuki punch movements as instructed.

Assessment: The performance will be evaluated based on the following criteria:

1. Score 1: Considered poor if the movement meets only 1, 2, or 3 indicators.
2. Score 2: Considered sufficient if the movement meets 4 indicators.
3. Score 3: Considered good if the movement meets 5 indicators.
4. Score 4: Considered excellent if the movement meets all 6 indicators.

In this study, the researcher will analyze the data using linear regression analysis, as the study tests three relationships or correlations:

1. The significant relationship between arm flexibility and the performance of the gyaku tsuki punch in karate (X1, Y).
2. The significant relationship between arm muscle strength and the performance of the gyaku tsuki punch in karate (X2, Y).
3. The significant relationship between arm flexibility and arm muscle strength with the performance of the gyaku tsuki punch in karate (X1, X2, Y).

Table 4. Guidelines for Interpreting Correlation Coefficients

Category	Performance
0,00 – 0,199	Very Weak
0,20 – 0,399	Weak
0,40 – 0,599	Currently
0,60 – 0,799	Strong
0,80 – 1,000	Very Strong

Source: (Sugiyono, 2017).

RESULTS AND DISCUSSION

Description of Arm Flexibility Test Results

This study was conducted on the field by having participants lift a stick as high as possible while keeping their nose on the ground. Athletes were lined up on the field before starting the test. The researcher provided instructions or procedures to ensure that the athletes understood what to do. Then, the athletes were called one by one according to the order determined by the researcher. Before performing the test, the participants were allowed to practice first. The purpose of this research was to measure the arm flexibility of athletes from the Dojo Sukawinatan Palembang and to examine the relationship between arm flexibility and the gyaku tsuki punching ability in Karate.

Based on the arm flexibility test results from 30 samples, the average score obtained was 15.5 cm, with a range of 11, a minimum value of 12, a maximum value of 23, a mean of 17.5, and a standard deviation of 3.219. The statistical description can be seen in the **Table 5.**

Table 5. Descriptive Statistics of Arm Flexibility Test

Descriptive Statistic	
N	30
Avarage	15.5
Range	11
Minimum	12
Maximum	23
Sum	525
Mean	17.5
Std. Deviation	3.219
Variance	10.362

Description of Push-Up Test Results

This study was conducted outdoors at the Sukawinatan dojo by counting the number of push-up repetitions performed in one minute, following the research instrument guidelines. The push-up test aimed to evaluate the arm strength of athletes from the Sukawinatan dojo in Palembang and analyze the relationship between push-up test results and the athletes' gyaku tsuki punching ability.

The research results were described using descriptive statistical analysis as follows: the average score was 76.33, with a range of 79, a minimum value of 31, a maximum value of 110, a mean of 76.3, and a standard deviation of 19.799. The detailed results of the study are presented in the **Table 6.**

Table 6. Description of Push-Up Test Results

Descriptive Statistic	
N	30
Avarage	76.333
Range	79
Minimum	31
Maximum	110
Sum	2290
Mean	76.33
Std. Deviation	19.779
Variance	391.195

Description of Gyaku Tsuki Punching Ability Test in Karate

The gyaku tsuki punching ability test was conducted on the field of the Sukawinatan dojo in Palembang. Before performing the test, athletes were lined up and given instructions according to the test instrument. Athletes then performed the test in the order determined by the researcher. They were allowed to practice the gyaku tsuki punch and stances beforehand.

During the test, athletes executed the gyaku tsuki punch based on the test instrument. Each athlete was given three attempts to perform the punch and stance, with the best score or point being recorded. The purpose of this test was to assess and measure the gyaku tsuki punching ability of the athletes at the Sukawinatan dojo in Palembang. The results were analyzed using descriptive statistics as follows: the average score was 10.733, with a range of 3, a minimum value of 9, a maximum value of 12, a mean of 10.733, and a standard deviation of 1.112. The detailed results are presented in the **Table 7.**

Table 7. Description of Gyaku Tsuki Punching Ability Test Results

Descriptive Statistic	
N	30
Avarage	10.2333
Range	4
Minimum	8
Maximum	12
Sum	306
Mean	10.200
Std. Deviation	1.3955
Variance	1.959

Prerequisite Test Analysis

Data analysis in conducting multiple regression tests requires several prerequisites to be met to ensure the results are valid and reliable.

Normality Test

The normality test was performed using the Shapiro-Wilk test since the sample size consisted of 30 respondents. This test evaluates whether the data originates from a normally distributed population. The hypothesis is accepted or rejected by comparing the Asymp. Sig value with the significance level (α).

The criteria for accepting the hypothesis are as, If Asymp. Sig > 0.05, the data is considered normally distributed. If Asymp. Sig < 0.05, the data is considered not normally distributed.

The Asymp. Sig values exceed 0.05, indicating that all data are normally distributed. Based on this, the variables in this study meet the requirements for parametric testing.

Linearity Test

The linearity test is used to determine whether there is a linear relationship between the ind,ependent and dependent variables. Data are considered linear if the significance value exceeds 0.05. It can be concluded that both significance values are greater than 0.05, indicating a linear relationship between the variables.

Multicollinearity Test

The multicollinearity test aims to identify whether there is any correlation among independent variables in the multiple regression model. A good regression model should not exhibit multicollinearity between the independent variables. Multicollinearity is detected when:

Tolerance value is less than 0.1.

Variance Inflation Factor (VIF) value exceeds 10.

The results of the multicollinearity test for this study are presented in the tolerance value of 0.990 exceeds 0.1, and the variance inflation factor (VIF) of 1.010 is less than 10. These results indicate that the independent variables in this study do not have multicollinearity issues and are free from correlation among independent variables.

Hypothesis Testing

Data analysis was performed to address the hypotheses proposed regarding the relationship between arm flexibility, arm strength, and the gyaku tsuki punching ability. The hypotheses are as follows:

H1: There is a relationship between arm flexibility and gyaku tsuki punching ability.

H2: There is a relationship between arm strength and gyaku tsuki punching ability.

H3: There is a combined relationship between arm flexibility and arm strength with gyaku tsuki punching ability.

The significance level and contributions (relative and effective) were determined based on the R value obtained from the analysis.

First Hypothesis Test

The first hypothesis suggests no significant relationship between arm flexibility and gyaku tsuki punching ability among the athletes at Dojo Sukawinatan Palembang.

The result indicates a significance value of 0.718, which is higher than 0.05. This means there is no significant relationship between arm flexibility and gyaku tsuki punching ability. Additionally, the correlation coefficient contribution is 0.0, which falls within the range of 0.00–0.199,

indicating a "Very Weak" relationship.

Thus, H1 is rejected, and it can be concluded that there is no significant relationship between arm flexibility and gyaku tsuki punching ability at Dojo Sukawinatan Palembang.

Second Hypothesis Test

The second hypothesis suggests a significant relationship between arm strength and gyaku tsuki punching ability among the athletes. The result shows a significance value of 0.000, which is lower than 0.05, indicating a significant relationship between arm strength and gyaku tsuki punching ability. The correlation coefficient contribution is 0.691, which falls within the range of 0.60–0.799, indicating a "Strong" relationship.

Therefore, H2 is accepted, confirming that there is a significant relationship between arm strength and gyaku tsuki punching ability at Dojo Sukawinatan Palembang.

Multiple Regression Hypothesis Test

The third hypothesis suggests a simultaneous relationship between arm flexibility and arm strength with gyaku tsuki punching ability among the athletes at Dojo Sukawinatan Palembang. This hypothesis was tested using multiple regression analysis.

The obtained significance value (Fc) is 0.000, which shows a positive correlation. These results confirm that there is a combined and significant relationship between arm flexibility, arm strength, and gyaku tsuki punching ability at Dojo Sukawinatan Palembang. H3 is accepted.

The significance of the multiple regression coefficients was tested using the F value. From the multiple regression analysis, the calculated F-value (Fhitung) was 13.338, which was compared to the F-table value (Ftabel) at a significance level of 5% with degrees of freedom (df) 2 versus 27. The Ftabel value was 2.501. Since Fhitung (13.338) is greater than Ftabel (2.501), it indicates that the multiple regression is significant.

Thus, it can be concluded that there is a significant relationship between arm flexibility and arm strength with the gyaku tsuki punching ability among the athletes at Dojo Sukawinatan Palembang.

Coefficient of Determination

The determination coefficient (R^2) obtained from the multiple regression analysis was 0.705, which translates to 70.5%. This means that 70.5% of the variation in gyaku tsuki punching ability at Dojo Sukawinatan Palembang is influenced by arm flexibility and arm strength, while the remaining 29.5% is influenced by other factors or variables not examined in this study.

This study, titled The Relationship Between Arm Flexibility and Arm Strength with the Gyaku Tsuki Punching Ability in Karate at Dojo Sukawinatan Palembang, aimed to determine the level of relationships between the variables presented. The results are discussed as follows:

1. The Relationship Between Arm Flexibility and Gyaku Tsuki Punch Performance

According to the research, there is no significant relationship between arm flexibility and Gyaku Tsuki punch performance, as indicated by a significance value of 0.718 ($p > 0.05$). This suggests that arm flexibility alone does not directly contribute to punch performance in this context. The correlation coefficient ($r = 0.217$) is within the range of 0.00–0.199, categorizing the relationship as "very weak."

Flexibility, while beneficial in some athletic contexts, appears to have a limited role in enhancing the explosive movements required for Gyaku Tsuki punches. According to Sepdanius et al., (2019), Although flexibility enhances range of motion, its influence on power and speed is not as significant as that of strength or explosive power. This aligns with the findings that flexibility alone may not suffice in developing optimal punching performance.

The Relationship Between Muscle Strength and Gyaku Tsuki Punch Performance*

The study reveals a strong and significant relationship between muscle strength and Gyaku Tsuki punch performance, as indicated by a significance value of 0.000 ($p < 0.05$). The correlation coefficient ($r = 0.691$) falls within the range of 0.60–0.799, denoting a "strong" relationship.

Muscle strength is a critical factor in karate techniques, as it determines the ability to exert maximum force through muscle contraction. According to Aras et al., (2017), well-developed arm muscles enable individuals to effectively counter resistance and maintain performance under physical strain, such as during prolonged or repeated punching movements. Lamusu & Lamusu, (2023) emphasized that trained arm muscles not only increase strength but also enhance endurance, which is essential for delivering fast and powerful punches like Gyaku Tsuki. Strength training that focuses on the contraction of specific arm muscle groups is crucial in developing this capability.

Simultaneous Relationship Between Arm Flexibility and Muscle Strength with Gyaku Tsuki Punch Performance

The combined influence of arm flexibility and muscle strength on Gyaku Tsuki punch

performance was analyzed using multiple regression. The calculated F-value of 13.338 exceeds the F-table value of 2.501 at a 5% significance level, confirming that the relationship is significant. The determination coefficient ($R^2 = 0.705$) indicates that 70.5% of the variability in Gyaku Tsuki punch performance can be explained by arm flexibility and muscle strength, while the remaining 29.5% is attributed to other unexamined factors.

Purwanto, (2022) supports these findings, emphasizing that arm power a combination of strength and dynamic flexibility plays a significant role in punch performance. Karate athletes with superior arm strength exhibit faster and more forceful punches. Furthermore, Widhiantoro et al., (2024) highlighted that strong muscle strength paired with flexibility improves both the power and speed of punches, making them more effective during combat. This demonstrates the importance of integrating strength and flexibility training for optimal results in karate techniques.

These findings underscore the importance of muscle strength as a primary factor influencing Gyaku Tsuki punch performance, while flexibility may serve as a supplementary component. This insight reinforces the need for targeted strength and conditioning programs in martial arts training to enhance performance outcomes.

CONCLUSION

Based on the research conducted, the following conclusions can be drawn:

This research revealed that, when assessed individually, the variable of arm flexibility does not have a statistically significant effect on the performance of the Gyaku Tsuki punch. In contrast, the variable of arm muscle strength demonstrates a significant influence on the punch outcome. Nevertheless, when both variables — arm flexibility and arm muscle strength — are analyzed simultaneously, they collectively exhibit a significant impact on the performance of the Gyaku Tsuki punch. This conclusion is supported by the results of the multiple regression analysis, where the coefficient of determination (R^2) was found to be 0.705. This indicates that 70.5% of the variations or fluctuations in the Gyaku Tsuki punch performance at Dojo Sukawinatan Palembang can be explained by the combined effects of arm flexibility and arm muscle strength. Meanwhile, the remaining 29.5% of the performance variations are attributable to other factors or variables not examined within the scope of this study.

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