



## **The Correlation Between Leg Muscle Strength, Balance, and Reaction Speed to the Ability of the Crescent Kick**

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### **Abstract**

This study aims to determine the correlation between leg muscle strength, balance, and reaction speed to the ability of the sickle kick in pencak silat athletes Elementary School 1 Bangilan. The study used a correlational method with a quantitative approach. The population and sample in this study were all 20 students of the pencak silat extracurricular Elementary School 1 Bangilan with a saturated sampling technique. The research instruments included a leg muscle strength test using a vertical jump, a balance test using a standing stork test, a reaction speed test using a 10-meter run, and a 10-second sickle kick ability test. Data analysis was carried out using the Pearson Product Moment correlation test and multiple linear regression with the help of the SPSS 23 program. The results showed that partially balance had a significant relationship to the ability of the sickle kick ( $r = 0.54$ ;  $p < 0.05$ ), while leg muscle strength and reaction speed had a weak and insignificant relationship. Together, leg muscle strength, balance, and reaction speed had a significant relationship to the ability of the sickle kick with a multiple correlation coefficient ( $R$ ) of 0.621 and a coefficient of determination ( $R^2$ ) of 0.386. This indicates that these three variables contribute 38.6% to the sickle kick's ability. It can be concluded that balance is the most dominant physical factor in supporting the sickle kick ability of pencak silat athletes.



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## INTRODUCTION

Sport is an important means of self-development, encompassing physical aspects, motor skills, knowledge, as well as psychological and intellectual development (Sari et al., 2024). Through regular and planned sports activities, a person can improve their physical fitness while fostering positive values such as discipline, sportsmanship, and teamwork. Furthermore, sport also plays a role in developing a healthy lifestyle that supports a balance between physical and mental development (Ibeng, 2021). Essentially, sport is a systematic body movement activity aimed at maintaining and improving physical condition, while simultaneously developing an individual's potential and talents in the sporting field (Anggraeni et al., 2026). In physical education, sport also plays a crucial role in shaping individuals with high quality and strong character (Setiawan & Wibowo, 2023).

One of the sports that has developed well in Indonesia is pencak silat (Andriawan & Irsyada, 2022). Pencak silat is a national cultural heritage that is continuously preserved and passed down from generation to generation, thus becoming part of the national identity (Ismar, 2024). As a martial art, pencak silat not only emphasizes the technical aspects of defense and attack, but also contains philosophical, moral, and spiritual values that play a role in shaping the character of athletes (Dai et al., 2022). In pencak silat, core values such as piety, resilience, responsiveness, and swiftness are recognized, reflecting the religious attitude, assertiveness, intelligence, and agility of a silat athlete. These values make pencak silat not only function as a competitive sport, but also as a medium for

character development for the younger generation (Wahyu Setia et al., 2021).

In pencak silat matches, attack technique is a key factor in gaining points. One frequently used technique is the kick. Kicks have a high point value and are often used as a strategy to attack opponents (Hidayat & Haryanto, 2021). Several types of kicks known in pencak silat include the straight kick, the T-kick, the back kick, and the crescent kick (Mujahid and Subekti 2021). Among these various types, the crescent kick is the most frequently used technique because it has a circular trajectory that is effective for hitting the opponent's side. When executed with good power, speed, and balance, this kick can be an effective technique for scoring points in matches (Satria et al., 2021).

Success in executing a crescent kick depends not only on mastery of technique but also on the athlete's physical condition (Astutik & Setiawan, 2022). Several components of physical condition that play a crucial role include leg muscle strength, body balance, and reaction speed (Miftachurrohman et al., 2023). Leg muscle strength is needed to generate power during the kick, balance maintains body stability during the movement, and reaction speed helps the athlete respond quickly and accurately to the opponent's movements (Ningsih et al., 2023). The combination of these three components allows the athlete to execute the kick more effectively, thus increasing the chance of gaining points in the match.

Several previous studies have examined the relationship between physical condition components and technical ability in pencak silat. Research conducted by Widorotama, Akbari, and Roberto (2025) demonstrated a relationship between leg muscle strength and sickle kick ability. However, this study focused on only one physical condition

variable, namely leg muscle strength. Meanwhile, research by Darminto (2018) examined the relationship between leg muscle strength and balance, but did not directly link it to sickle kick ability. This indicates that previous research still has limitations because it has not examined the relationship between several physical condition components simultaneously and sickle kick ability.

Based on preliminary observations conducted by researchers on pencak silat athletes at Elementary School 1 Bangilan, it was found that of the 20 athletes observed, 15 still performed crescent kicks that were easily predicted and often caught by opponents, resulting in fewer points in matches. This condition indicates that the athletes' crescent kicking abilities are still relatively low. This low ability is suspected to be related to the athletes' physical condition, which has not yet developed optimally, particularly in aspects of leg muscle strength, balance, and reaction speed.

Based on these issues, research is needed to examine the relationship between several components of physical condition and crescent kick ability. This research is crucial to provide scientific information on the physical condition factors that influence crescent kick ability, thus providing a basis for developing more effective training programs for pencak silat athletes.

Therefore, the purpose of this study was to determine the relationship between leg muscle strength, balance, and reaction speed with the sickle kick ability of pencak silat athletes at Elementary School 1 Bangilan. The hypothesis proposed in this study is that there is a significant relationship between leg muscle strength, balance, and reaction speed with the sickle kick ability of pencak silat athletes.

## METHODS

This study employed a correlational research design through a quantitative approach. Quantitative methods focus on the study of a specific population or sample by collecting numerical data, which is then processed through statistical analysis to test hypotheses, map correlation between variables, and formulate scientific conclusions. (P. D. Sugiyono, 2019). In the context of this research, there are four main variables that are the focus of observation, namely leg muscle strength, balance level, and reaction speed as independent variables, and sickle kick ability as the dependent variable.

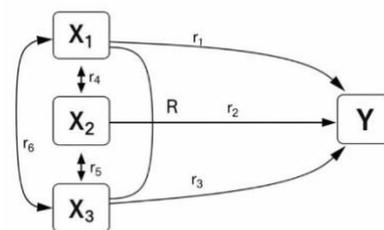


Figure 1. Research Design

Caption:

- X1 : Leg Muscles
- X2 : Balance
- X3 : Reaction Speed
- Y : Crescent Kick
- r : Product moment correlation coefficient
- R : Multiple correlation coefficient

In the image above, X1 describes the variable of leg muscle strength, X2 describes balance, X3 describes the variable of reaction speed, and Y describes the ability to kick a sickle. To achieve the research objectives, the research instruments were structured and systematically arranged so that the data

obtained were relevant to the research objectives and could be analyzed scientifically. The instrument used in this study was a test to measure leg muscle strength with a vertical jump. (Pasaribu, 2020), balance test with standing stork (*III 2023*), reaction speed test with 10 meter run (Kridasuwarno, 2018), and the crescent kick test by doing a crescent kick for 10 seconds (Marlianto et al., 2018).

A population is defined as a generalization scope consisting of subjects or objects with specific criteria selected by researchers to be studied in order to draw specific conclusions. This study involved all students participating in the pencak silat extracurricular activity at Elementary School 1 Bangilan, with a total of 20 participants as the population. Given the limited number, the sampling technique applied was saturated or census sampling, in which all members of the population were directly involved. (P. D. Sugiyono, 2019). The determination of this sample was based on two main criteria: inclusion for students who were actively practicing, and exclusion for those who were forced to be removed from the observation list (dropped out) due to experiencing injuries during the data collection stage.

After all the information was collected, the data was processed digitally using SPSS software version 23. The statistical analysis used was the Pearson correlation test, which aims to map the relationship between the variables, namely leg muscle strength (X1), balance (X2), and reaction speed (X3) to the sickle kick ability variable (Y).

### **Participants**

A population is characterized as a collection of items or individuals exhibiting certain characteristics and traits as described by the researcher for analysis, from which conclusions are drawn (Sugiyono 2021). The total

number of students was 20, consisting of 4 female students and 16 male students. In this study, the population was considered homogeneous because the students were in the same educational environment, had the same age background (between 10-12 years old), and received approximately the same elementary school education. This homogeneity was intended to reduce external influences that might affect the research results.

### **Sampling Procedures**

A sample is defined as a subset of a population selected by researchers to represent the entire population in a study (Ibrahim et al., 2018). This study used a saturated sample, in which all members of the population were directly involved (Sugiyono 2019). The sample was determined based on two main criteria: inclusion of students who were actively practicing and exclusion of those who dropped out due to injuries during the data collection phase.

### **Materials and Apparatus**

Leg muscle strength assessment is carried out using a vertical jump test by preparing a 20 x 100 cm dark-colored board, mounted on a flat wall or pole. The distance between the floor and the board is 150 cm, chalk powder, a board eraser, and writing tools. All equipment is prepared and calibrated before data collection to ensure consistency and accuracy of measurements. Standing stork test: Remove footwear/shoes, then place both hands on the hips, One leg is bent and placed on the inner knee of the

supporting leg. At the whistle signal, the foot that is attached to the floor is positioned on tiptoe as much as possible with eyes closed for a maximum time limit of 1 minute. Reaction speed test: Prepare a 20 - 30 Meter Long field, a rolling tape measure, 6 cones, 2 stopwatches, a whistle, and a test format. Crescent kick test: Prepare a sandsack, tape measure, and stopwatch.

### Procedures

This information is likely to merge the actual procedures with the materials and apparatus because it is hard to say what the participants were doing without indicating what they were doing it with. There are some fairly standard elements in the procedure. They include, (a) variables that are manipulated and measured, including independent and dependent variables, (b) any conditions or groups that you intend to compare, (c) how participants are assigned to, or placed in, groups, (d) the role of the researcher in the session, (e) the directions that participants received, (f) the activities in which the participants engaged. Finally, include a statement with the procedure that participants provided informed consent. When you write your own procedure section, you can determine whether to include how you obtained informed consent. Strictly speaking, it is not part of the data collection process, so you can logically argue that it does not belong in this subsection.

### Design or Data Analysis

The data obtained from the test results were analyzed using regression testing using SPSS version 23 to determine the correlation between variables and to draw conclusions regarding the research hypothesis. Before conducting the regression test, the research data must have met two prerequisite tests: normality and linearity (Toedin et al., 2025). Once the data has been declared normal and linear, a regression test is conducted. After the regression test on each variable is conducted, the results are used to make a decision regarding the previously proposed research hypothesis, which is related to whether the hypothesis is accepted or rejected as a conclusion of this study.

### RESULT

Data acquired from the research with appropriate statistical analysis described in the methods section should be included in this section. In this part, the same data/ information given in a table must not be repeated in a figure, or vice versa. Tables and Figures should be self explanatory and it is not acceptable to repeat extensively the numerals from tables into text and give lengthy and unnecessary explanations of the Tables and Figures.

Based on the data obtained in the field, the following are the research results which include tests of leg muscle strength, balance, reaction speed, and sickle kick, as listed in Table 1 below.

Table 1. Research Result Data

Statistics	X1	X2	X3	Y
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Average (Mean)	43.15	50.80	2.64	20.15
The highest score	48	60	3.14	24
Lowest Value	38	41	2.27	16
Standard Deviation	2.74	5.75	0.27	1.66

**Table 2. Single (Partial) Correlation Analysis**

No.	Research Variables	Correlation Coefficient (r)	Significance (p)	Correlation Level
1	Leg Muscle Strength (X1) against Crescent Kick (Y)	0.21	0.374	Weak
2	Balance (X2) against Crescent Kick (Y)	0.54	0.014	Currently
3	Reaction Speed (X3) to Crescent Kick (Y)	0.26	0.269	Weak

The statistical analysis using the Pearson Product Moment correlation test revealed interesting findings regarding the relationship between physical attributes and the quality of the sickle kick. First, the correlation coefficient between leg muscle strength (X1) and sickle kick ability was 0.21 with a significance level of  $p = 0.374$ . This figure indicates a positive relationship, but it is in the weak category and is not statistically significant. This suggests that for this group of research subjects, strong leg muscles alone do not automatically guarantee a competent kick if other technical factors are ignored. On the other hand, the balance variable (X2) actually showed the most prominent correlation compared to the other variables. This relationship is evidenced by a correlation coefficient value of 0.54 with a significance level of  $p = 0.014$  ( $p < 0.05$ ). This finding confirms that body

stability is a very crucial factor; the better a silat practitioner's balance, the greater the chance of producing an effective sickle kick.

The data demonstrates a significant positive correlation with a moderate degree of correlation. From a biomechanical perspective, body stability during the takeoff is key to delivering a crescent kick with precision and control. This means that an athlete's ability to maintain balance is directly proportional to the quality of the resulting attack; the more stable their body position, the more optimal their movement execution. Meanwhile, for the reaction speed variable (X3), the analysis results show a correlation coefficient of 0.26 with a significance level of  $p = 0.269$ . Although the relationship shown is weak and not statistically significant, the negative correlation direction has functional significance in the context of sports, namely that the shorter the athlete's reaction time, the greater the tendency for their crescent kick ability to improve. Overall, of the three physical components analyzed partially, only the balance factor was shown to provide a real and significant contribution to the success of the crescent kick technique in this study's subjects.

**Table 3. Model Summary Results**

Model	R Square (R2)
1	0.386

Based on statistical data processing, a multiple correlation coefficient (R2) of 0.621 was found. This figure reflects that simultaneously, the relationship between the three independent variables (X1, X2, and X3) with the dependent variable (Y) is in the strong category. This indicates that the combination of leg muscle strength,

balance, and reaction speed has a very close relationship in influencing variations in the sickle kick ability of athletes. Furthermore, the analysis of the coefficient of determination (R<sup>2</sup>) value which reached 0.386 shows that the combination of these three physical factors provides a real contribution of 38.6% to the success of the sickle kick. Meanwhile, a larger portion, namely 61.4%, is influenced by other variables not measured in this study, such as mastery of basic techniques, the athlete's psychological condition, and other tactical aspects. In other words, although the three variables studied play an important role, the perfect kick result is still influenced by other supporting factors in a complex manner.

**Table 4. Significance Test (ANOVA)**

Significance (Sig.)	Significance Level	Information
0.045b	0.05	Significant

Based on the results of the significance test, a Sig. value of 0.045 was obtained, which means it is smaller than the threshold of 0.05. This finding confirms that the research hypothesis is accepted, so that statistically there is a real and meaningful relationship. Thus, it can be concluded that leg muscle strength, balance, and reaction speed together have a significant influence on the quality of the sickle kick. The results of this study confirm that these three physical elements are important pillars in supporting the successful execution of the sickle kick. Therefore, pencak silat coaches and trainers are strongly advised to make strengthening these three aspects a priority in developing training programs to optimize athlete performance in the arena.

**Table 5. Regression Equation (Coefficients)**

Unstandardized Coefficients	B
(Constant)	12.65

Leg Muscles (X1)	0.024
Balance (X2)	0.152
Reaction Speed (X3)	-1,854

Based on the results of multiple linear regression analysis, the mathematical model produced is:  $Y = 12.65 + 0.024X_1 + 0.152X_2 - 1.854X_3$ . The constant value of 12.65 indicates the baseline value of the sickle kick ability if the variables of muscle strength, balance, and reaction speed are eliminated. Specifically, the X<sub>1</sub> coefficient of 0.024 indicates that any strengthening of the leg muscles will have a stable positive impact on kick results. Meanwhile, the balance variable (X<sub>2</sub>) with a coefficient of 0.152 proved to be the most dominant driving factor in improving the quality of the sickle kick compared to other variables. Interestingly, the reaction speed variable (X<sub>3</sub>) actually has a negative coefficient of -1.854. This suggests that within this sample, an increase in reaction speed scores is actually followed by a decrease in kick results. This unique phenomenon is most likely influenced by the dynamics of data in the field or the specific measurement method used during the study.

### Tables & Figures

Tables and figures should be embedded in the text. Tables should be created in open form with a word processor and cited consecutively in the text. To ensure the highest print quality, your figures must be submitted in TIF format with minimum 300 dpi or higher resolutions. Captions/legends will be placed below figures and adjusted to 8-10 font size.

### DISCUSSION

The results of this study indicate that each component of physical condition does not contribute equally to the crescent kick ability of pencak silat athletes. Based on a partial correlation analysis, leg muscle strength has a positive but weak and insignificant relationship with crescent kick ability. This finding suggests that although leg muscle strength plays a role in generating power during kicking, this strength does not necessarily result in an optimal kick if it is not accompanied by good motor coordination, mastery of proper technique, and stable body control. In martial arts, technical performance is the result of the integration of physical abilities and motor skills that are continuously trained. Several studies in sports science also explain that muscle strength is indeed the basis for producing explosive movement power, but the effectiveness of technique is greatly influenced by coordination and mastery of sport-specific skills (Nurman et al., 2023). Therefore, strength training is still necessary, but it should be combined with kicking technique training to achieve optimal improvements in athlete performance.

Unlike leg muscle strength, balance showed a significant relationship with sickle kick ability. The correlation coefficient value, which was in the moderate category, indicates that the better an athlete's ability to maintain body stability, the better the quality of their kick. This finding aligns with various studies that state that balance is a crucial component in executing kicking techniques in martial arts. Biomechanically, balance plays a role in maintaining body position when the supporting leg supports the body weight while the other leg performs the kicking swing. Athletes with good balance are able to maintain body stability, allowing for more precise, powerful, and controlled kicking movements. Studies in sports

science also explain that balance is closely related to postural control and neuromuscular coordination, which support the effectiveness of technical movements in martial arts (Syarifoeddin, 2019). Therefore, the results of this study emphasize the importance of balance training such as core stability training, proprioceptive training, and coordination training to improve the effectiveness of sickle kicks in pencak silat athletes.

Meanwhile, the reaction speed variable showed a weak and insignificant relationship with crescent kick ability. However, the positive direction of the relationship suggests a tendency for athletes with faster reactions to potentially produce better kicking performance. This result indicates that reaction speed likely plays a greater role in dynamic match situations, such as responding to an opponent's attack or determining the right timing to execute an attack, compared to its direct influence on kicking technique quality. Previous research also explains that reaction speed is more related to an athlete's ability to process visual or motion stimuli and make quick decisions during a match (Widorotama et al., 2025). Therefore, the influence of reaction speed on kicking technique quality may be indirect, but still important in the context of overall match performance.

Simultaneously, the results of the multiple correlation analysis indicate that leg muscle strength, balance, and reaction speed together have a strong relationship with the ability to kick the sickle. The coefficient of determination value of 38.6% indicates that these three variables make a significant contribution to the athlete's sickle kick ability, while the rest is influenced by other factors not analyzed in this study. These factors can include mastery of basic techniques, flexibility, motor coordination, training experience, and the athlete's psychological condition when performing the kick. In the concept

of modern sports training, technical performance is seen as the result of the interaction of various components of physical condition and motor skills that support each other (Suchomel et al., 2018; Bompa & Buzzichelli, 2019). Therefore, the development of technical abilities in martial arts requires an integrated training approach between physical aspects and technical skills.

The practical implications of this study suggest that pencak silat trainers need to design training programs that focus not only on increasing leg muscle strength but also on developing balance and reaction speed. Balance training can be performed through core stability exercises, static and dynamic balance exercises, and body coordination exercises. Meanwhile, reaction speed training can be developed through visual stimulus training, rapid response training, or match simulations. This training approach, which integrates various components of physical fitness, is expected to improve the effectiveness and quality of crescent kicks in pencak silat athletes.

However, this study still has several limitations. One limitation is the relatively limited sample size, which means the results cannot be widely generalized. Furthermore, this study only focused on three components of physical condition, while many other factors potentially influence sickle kicking ability, such as flexibility, coordination, mastery of basic techniques, and the athlete's competitive experience. Therefore, future research is recommended to involve a larger sample size and include variables such as physical condition and other technical aspects to provide a more comprehensive picture of the factors influencing sickle kicking ability in pencak silat.

## CONCLUSION

Based on a series of data analyses, this study concluded that the combination of leg muscle strength, balance, and reaction speed significantly correlated with the quality of sickle kicks in pencak silat athletes at Elementary School 1 Bangilan, contributing 38.6%. Of these three aspects, balance was shown to be the most dominant factor influencing kick effectiveness. Given these findings, teachers and coaches are advised to prioritize integrated physical training to significantly boost student performance and learning outcomes. Furthermore, efforts are needed to expand extracurricular pencak silat programs to include more participants, so that students' physical fitness can be optimally maintained through well-programmed sports activities.

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