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Correlation of Leg Muscle Explosive Power with Sickle Kick Performance in Pencak Silat Athletes

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ABSTRACT

Background: Pencak silat is a martial art that requires a combination of technique, strength, speed, and agility. One of the main attack techniques in pencak silat is the crescent kick, which requires explosive leg muscle ability so that the kick can be done quickly, powerfully, and precisely. **Methods:** This study uses a quantitative research method with a correlational design. The population in this study was 30 students. Sampling in this study used a total sampling technique. The sample in this study amounted to 30 students. The instrument to measure the explosive power of the leg muscles was the standing broad jump test, the instrument to measure the ability of the crescent kick was the ability test of the crescent kick for 10 seconds. The data analysis technique uses descriptive statistics, analysis prerequisite tests with normality tests, linearity, and using hypothesis tests with correlation tests with the help of SPSS version 23. **Results:** based on the results of the data analysis, the calculated r value is 0.776 and the significance level value is 0.000 <0.05 with a coefficient of determination of 0.603 or 60.3%, which means there is a significant relationship between the explosive power of the leg muscles and the ability of the sickle kick. **Conclusion:** This study shows that there is a significant relationship between the explosive power of the leg muscles and the performance of the sickle kick in pencak silat athletes. The higher the explosive power of the leg muscles owned by the athlete, the better the strength, speed, and accuracy of the resulting sickle kick. Thus, the explosive power of the leg muscles is an important physical factor that directly influences the performance of the sickle kick technique in pencak silat. **Implications and Recommendations**: the results of this study imply that the explosive power of the leg muscles plays an important role in improving the performance of the sickle kick in pencak silat athletes.

Keywords: Explosive power of leg muscles; Crescent kick; Pencak silat

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INTRODUCTION

Pencak silat is an Indonesian cultural heritage that not only contains artistic and traditional values, but is also a rapidly developing competitive sport at both the national and international levels (Khotijah et al., 2023). In the context of competitive sports, pencak silat demands an optimal combination of physical abilities, techniques, tactics, and psychological aspects. Each of these elements contributes significantly to achieving a silat athlete's maximum performance in the competition arena (Ubis et al., 2024). One important component that greatly influences the effectiveness of attack techniques is explosive leg muscle power, especially when executing crescent kicks, the attack technique most often used to score points in matches (Ihsan et al., 2018).

In modern pencak silat competitions, the sickle kick is the primary weapon for most athletes due to its wide reach, high speed, and high potential for scoring if accurately hit.

The success of a sickle kick is influenced by the athlete's ability to generate explosive force from the leg muscles (Rosmawati & Darni, 2019). Explosive power is a combination of strength and speed that allows muscles to contract maximally in a short period of time. Therefore, the higher the explosive power of a silat athlete's leg muscles, the greater their sickle kick's ability in terms of speed, power, and effectiveness against an opponent (Fardi et al., 2022). In the context of developing sports performance, identifying the dominant physical factors affecting specific technical skills is crucial. Many coaches and sports researchers emphasize that an athlete's success in performing basic techniques, such as the sickle kick, is not solely the result of technical training but also the physical conditioning that supports the movement. Therefore, research that examines the relationship between explosive power of leg muscles and sickle kick performance is relevant and strategic to support improving the quality of pencak silat training at various levels of training (Akmal et al., 2019).

Physiologically, muscle explosive power is the ability of muscles to exert maximum force in a short time (Rahmana & Suwirman, 2020). Leg muscle explosive power has a major contribution to motor skills involving jumping, pushing, or kicking. In the sickle kick movement, the silat athlete relies on the contraction of the quadriceps, hamstring, gluteus, gastrocnemius, and tibialis anterior muscles to produce fast and powerful acceleration of the leg movement from a standing position to a position to hit the target. According to Hakim's biomechanics theory of movement Hakim, (2023), an effective kick depends on three main aspects, namely: (1) the power of the impulse generated by the leg muscles, (2) coordination between the lower and upper legs, and (3) control of body balance when executing the movement. The explosive movement in the sickle kick involves the support, swing, and recovery phases. In the swing phase, the momentum generated from the pelvis to the toes determines the speed and power of the kick. This process is greatly influenced by the explosive power of the leg muscles, which plays a role in producing high rotational acceleration. In addition to biomechanical theory, physical conditioning theory according to Sinaga et al., (2024) explains that explosive power is a fundamental component of physical conditioning that must be developed specifically for each sport. In pencak silat, explosive power training should be aimed at increasing muscle contraction capacity in a short period of time, for example through plyometric exercises, jump squats, or knee tuck jumps. These exercises have been shown to improve the leg muscles' ability to generate the explosive force required for the crescent kick.

Beberapa penelitian terdahulu telah mengkaji hubungan antara daya ledak otot tungkai dengan keterampilan teknik dalam berbagai cabang olahraga. Dalam konteks pencak silat, Menurut Ihsan et al., (2018), menemukan bahwa daya ledak otot tungkai berpengaruh signifikan terhadap kemampuan tendangan sabit pada atlet remaja. Penelitian ini juga menjelaskan bahwa faktor koordinasi dan keseimbangan turut memperkuat hubungan tersebut.

Several previous studies have examined the relationship between leg muscle explosiveness and technical skills in various sports. In the context of pencak silat, Ihsan et al., (2018), found that leg muscle explosiveness significantly influences sickle kick ability in adolescent athletes. This study also explained that coordination and balance factors contribute to this relationship. This study is based on a correlational approach that links the physiological capabilities of leg muscle explosive power with specific technical performance indicators (crescent kick performance) in competitive situations. Unlike previous studies that have focused more on general physical training aspects, this study

focuses on quantitative explosive power measurements (through the vertical jump test or standing broad jump) and crescent kick technique assessment based on performance criteria (speed, strength, and accuracy) that reflect actual abilities on the field. In addition, this study provides a new contribution by linking the results of physical condition measurements to technical performance that is assessed objectively and measurably, not simply the perception of coaches or observers. This provides a scientific basis for pencak silat coaches in developing data-based training programs. The purpose of this study is to determine the relationship between leg muscle explosive power and crescent kick performance in pencak silat athletes.

METHOD

This research is a correlational study. The population is the entire research subject. The population in this study is all 30 students of Hidayatullah Middle School who participate in the pencak silat extracurricular activity. The sample in this study is the 30th student who participates in the pencak silat extracurricular activity. According to Setiawan, (2021), the instrument used in this study is a test. The test is a performative test in the form of a movement skill test. To obtain data on leg muscle explosive power, the researcher will use a standing broad jump test. The tools or equipment used are a room/field, a sandbox, a meter, a whistle, and stationery. Meanwhile, to obtain data on crescent kick ability, the researcher will use a crescent kick ability test as many times as possible for 10 seconds. The students stand behind a sandsack/target with one foot behind the line as far as 60 cm (boys). When the command "yes", the students kick with the right foot and return to the starting position by touching the floor behind the line (Saiful, 2021) The test was conducted three times, with the best time recorded. The equipment used included a sandbag/target (handbox), a tape measure, and a stopwatch.

The testee stretches before the test begins. The researcher calls each participant to the standing broad jump test. The participant first stands on the starting board with their knees bent to a 45-degree angle. Lower their body by bending their arms so that their chest almost touches the floor. As the body descends, their entire body, including their buttocks and hips, descends. Straighten their arms back, then pushes forward with their legs as hard as possible and lands on both feet without falling backward. Three attempts are made, and the best score is taken. The best jump distance is measured from the inside edge of the starting board to the point where their feet/body are closest to the starting board. Three attempts are made, and the best score is taken. The researcher calls each participant one by one. Students prepare and stand behind the sandsack/target with one supporting foot 60 cm behind the line (male). At the command "yes," the athlete kicks with their right foot and returns to the starting position, touching the floor behind the line. Then, continue with the right kick as quickly and as many times as possible for 10 seconds, and do the same with the left leg. This can be done three times, with the best time recorded at a sandsack/target height of 100 cm (men). The result recorded is the best result of the three crescent kick attempts.

The data analysis technique used descriptive statistical tests to find the average, standard deviation, maximum value, and minimum value. The prerequisite analysis tests included normality and linearity tests, and then correlation tests using SPSS version 23.

RESULTS AND DISCUSSION

Findings

Based on the results of the leg muscle explosive power and sickle kick ability tests on students at Hidayatullah Middle School in Kendari, the data obtained included the minimum, maximum, average, and standard deviation scores obtained by students in each test. For more details, please see Table 1 below:

Table 1. Descriptive Statistics of Leg Muscle Explosive Power (X) with Crescent Kick Ability (Y)

Variable	Mean	Standart Deviation	Maksimum Value	Minimum Value
X	155,87	7,84	170	142
Y	25,20	3,40	31	19

Based on the results of the descriptive analysis in table 1, it can be seen that the results of the research on the explosive power of the leg muscles (X) obtained an average value (mean) of 155.87, the value of the standard deviation of 7.84, the maximum value of 170, the minimum value of 142. Meanwhile, the results of the research on the ability of the sickle kick (Y) obtained an average value (mean) of 25.20, the standard deviation value of 3.40, the maximum value of 31, the minimum value of 19.

Table 2. Distribution of Interval Classes, Categories, Frequencies and Percentages of Leg Muscle Explosive Power Data

Class Interval	Frequency	Percentage
142-146	3	10%
147-151	7	23%
152-156	6	20%
157-161	7	23%
162-166	4	14%
167-171	3	10%
Total	**30**	**100%**

Based on the table above, it can be seen that the sample group that has an interval class, category, frequency and presentation of leg muscle explosive power, namely in the interval class 142-146 has a frequency of 3 with a percentage of 10%. In the interval class 147-151 has a frequency of 7 with a percentage of 23%. In the interval class 152-156 has a frequency of 6 with a percentage of 20%. In the interval class 157-161 has a frequency of 7 with a percentage of 23%. In the interval class 162-166 has a frequency of 4 with a percentage of 14%. In the interval class 167-171 has a frequency of 3 with a percentage of 10%. For more clarity graphically, the frequency distribution of the data distribution of leg muscle explosive power can be seen in the following graph:

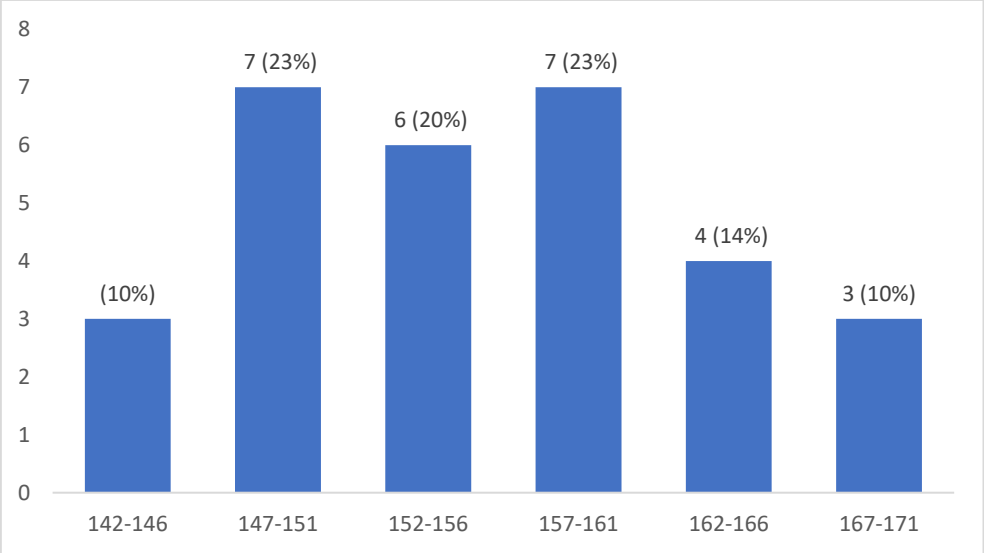

Figure 1. Histogram of Frequency Distribution of Leg Muscle Explosive Data (X)

Based on table 2, descriptive data and histogram of the frequency distribution of leg muscle explosive power data, it can be said that in the interval classes 147-151 and 157-161 have the most frequency and the highest percentage, with as many as 7 frequencies, and a percentage of 23%. While in the interval classes 142-146 and 167-171 have the lowest frequency and percentage, with a value of 3 frequencies and a percentage of 10%. To see the distribution of interval classes, frequencies and percentages of sickle kick ability data can be seen in the following table and graph:

Table 3. Distribution of Interval Class, Category, Frequency, and Percentage of Crescent Kick Ability Data

Class Interval	Frequency	Percentage
19-20	3	10%
21-22	3	10%
23-24	5	17%
25-26	8	27%
27-28	3	10%
29-30	7	23%
31-32	1	3%
Total	30	100%

Based on the table above, it can be seen that the sample group that has interval classes, frequencies, categories, and presentations of crescent kick abilities, namely in the 19-20 interval class has a frequency of 3 with a percentage of 10%. In the 21-22 interval class has a frequency of 3 with a percentage of 10%. In the 23-24 interval class has a frequency of 5 with a percentage of 17%. In the 25-26 interval class has a frequency of 8 with a percentage of 27%. In the 27-28 interval class has a frequency of 3 with a percentage of 10%. In the 29-30 interval class has a frequency of 7 with a percentage of 23%. In the 31-32 interval class has a frequency of 1 with a percentage of 3%. For more clarity graphically, the frequency distribution of the crescent kick ability data can be seen in the following graph:

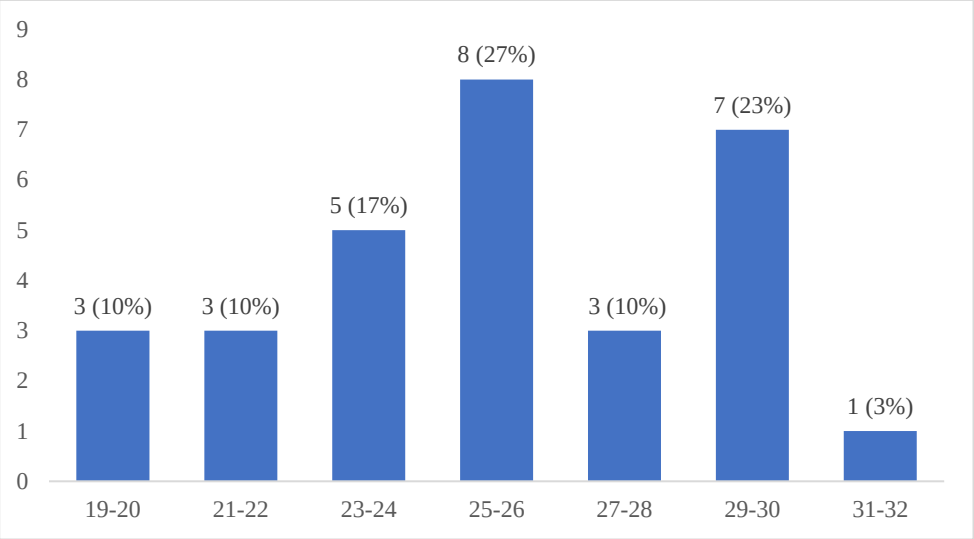

Figure 2. Histogram of Frequency Distribution of Crescent Kick Ability Data (Y)

Based on the descriptive data table 3 and the histogram of the frequency distribution of the sickle kick ability data, it can be said that the 25-26 interval class has the highest frequency and the highest percentage, with 8 frequencies and a percentage of 27%. Meanwhile, the 32-32 interval class has the lowest frequency and percentage, with a value of 1 frequency and a percentage of 3%.

Table 4. Results of Normality Test Calculation

Variable	*Sig*	*Asymp.* Sig	Conclusion
Explosive power of leg muscles	0,200	0.05	Normal
Crescent kick ability	0,177	0,05	Normal

Based on the table above, it is known that the explosive power data for leg muscles is obtained Asymp. Sig (2-tailed) 0.200 > 0.05, which means that the data is normally distributed. The sickle kick ability data is Asymp. Sig (2-tailed) 0.177 > 0.05, which means that the data is normally distributed. Therefore, the hypothesis that states that the sample is based on a normally distributed population is accepted.

Table 5. Linearity Test Calculation Results

Variable	Significant	Conclusion
Explosive power of leg muscles and sickle kick ability	0,407	Linear

Based on the table above, it is obtained that the results of the linearity test found a relationship between X and Y obtained Sig. (deviation from linearity) 0.407 > 0.05, so it can be interpreted that the relationship between the variable of explosive power of leg muscles and the ability of sickle kicks in Hidayatullah Middle School Students Kendari is linear.

Table 6. Results of the Correlation Test of Leg Muscle Explosive Power (X) with Crescent Kick Ability (Y)

Type of correlation	r count	*Sig* 0,05	R *square* (coefficient of determination)	Description
X - Y	0,776	0,000	0,603	Significant

Based on the table above, it can be seen that the correlation coefficient between the explosive power of the leg muscles and the ability of the sickle kick (rxy) is 0.776, then the rxy value obtained is compared with the correlation table value at a significant level of 0.000 <0.05, which means that there is a significant relationship between the explosive power of the leg muscles and the ability of the sickle kick. determination (r2) of 0.603 in other words, 60.3% of the ability of the sickle kick is determined by the explosive power of the leg muscles. Then, to find out the relationship between the two variables, it is also done by finding the correlation coefficient with the product moment technique, namely finding the r-count. Based on the r-count obtained, namely 0.776, it can be seen that the relationship between the variables of the explosive power of the leg muscles (X) and the ability of the sickle kick (Y) is included in the strong category.

Physiologically, explosive leg muscle power is closely related to the ability of type II muscle fibers to contract rapidly and generate large forces in a short period of time. Athletes who have a predominance of type II muscle fibers tend to have better explosive abilities (Oktarina et al., 2021). The energy system used in explosive movements such as the sickle kick primarily involves the anaerobic alactate (ATP-PCr) system, which provides energy in less than 10 seconds (Novri & Kamarudin, 2023). From a biomechanical perspective, the sickle kick movement consists of several phases: the preparation phase, where the athlete forms a horse stance and prepares the center of mass to maintain balance. The swing phase, where the leg muscles produce a strong concentric contraction to swing the leg toward the target. The contact phase, where momentum is transferred from the leg to the target; the greater the muscle's explosive power, the greater the force received by the target. The recovery phase, where the muscles work eccentrically to stabilize the movement so as not to disturb the body's balance. All of these phases are highly dependent on the leg muscles' ability to generate large forces in a short period of time. High explosive power also allows athletes to maintain postural stability and control the direction of their kicks. This explains why athletes with high leg power tend to be more effective and efficient at executing crescent kicks than those with low explosive abilities (Ramadhan & Irawan, 2025).

This study is novel because it not only assesses the relationship between leg muscle explosive power and kicking power, but also relates it to overall sickle kick performance, which includes elements of speed, strength, accuracy, and movement effectiveness. Furthermore, this study uses a quantitative correlational approach in a population of competitive-level pencak silat athletes, providing a more specific empirical picture of the actual conditions of athlete development in the field. The contribution of this study is both theoretical and practical. Theoretically, the study strengthens the understanding that developing leg muscle explosive power is the main foundation for achieving optimal kicking technique. Practically, the results of the study can be used as a reference by coaches in designing training programs that are more focused on increasing leg muscle explosive power, such as plyometric training (jump squats, bounding, box jumps), dynamic weight training (power lifting), and rapid reaction training (reactive training).

The results of this study provide several important implications for the world of pencak silat coaching. First, coaches need to recognize that increasing explosive leg muscle power not only increases kicking power but also improves technical efficiency and reduces the risk of injury due to unstable movements. Second, coaches should implement specific training models, namely exercises that mimic the explosive movement pattern of the sickle kick, so that neuromuscular adaptation occurs directly in the movement being trained.

Third, coaches should use objective measurement tools to monitor explosive power development, such as the vertical jump test, standing broad jump, or force plate, to evaluate the effectiveness of the training program. Furthermore, the results of this study can serve as a basis for developing a sports science-based pencak silat training curriculum that integrates physical training, technique, and competition strategy. With this scientific approach, athlete development can be carried out more effectively and sustainably, thereby increasing the chances of achieving success at the national and international levels.

This research makes an important contribution to the development of sports science, particularly in the fields of biomechanics, sports training, and the physiology of pencak silat. The results clarify that leg muscle explosive power is a key physiological variable determining kicking performance in martial arts. This study also provides insight into how measuring leg muscle explosive ability can be used as an important indicator in the selection and development of talented pencak silat athletes. Furthermore, these findings can encourage further research on the relationship between other physical variables such as balance, flexibility, or coordination with the crescent kick technique, thus fostering a more comprehensive understanding of the determinants of pencak silat performance.

CONCLUSION

Based on the research results and data analysis, it can be concluded that there is a significant relationship between leg muscle explosiveness and sickle kick performance in pencak silat athletes. This indicates that the higher an athlete's leg muscle explosiveness, the better the ability and effectiveness of the resulting sickle kick, both in terms of strength, speed, and accuracy of the kick direction. This finding strengthens the theory of sports physiology and movement biomechanics which states that kicking technique performance is highly dependent on the ability of muscles to generate large forces in a short time. Leg muscle explosiveness plays a crucial role in creating explosive movements, maintaining balance, and increasing movement efficiency during the execution of the sickle kick. Practically, the results of this study emphasize the importance of training to increase leg muscle explosiveness in pencak silat athlete development programs. Exercises such as plyometrics, squat jumps, bounding, and box jumps need to be implemented systematically to improve explosive ability and sickle kick technique performance.

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CONFLICT OF INTEREST

There were no conflicts that occurred in this study.

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