

## The relationship between leg length and crescent kick speed in Pencak Silat sport

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### Abstract

Pencak Silat is an Indonesian martial art that contains four elements, including elements of sports, artistic elements, martial and spiritual elements. The elements of martial arts are to defend themselves against an opponent by using martial arts punches and kicks. Crescent kick is a kick done by trajectory curved like a scythe/sickle. The focus is on the back foot. These kicks can be executed in the position of the feet in the front or at the back can also vary with the leaps. Based on the findings in the variable X represents the average score of 100.68. While the score of the variance of 19.71 and a standard deviation of 4.44. While the results of studies on variable Y represents the average score of 19.65, while the variance of 11.11 and a standard deviation of 3.33. To test the homogeneity of data between the research variables X and Y have a population variance is homogeneous and has a population that is normally distributed. F calculate price obtained for linearity test of 0.73 and F count to the significance of 2.21. Based on the testing criteria for the linearity test set out above that  $F_{table}$  obtained from the  $F < F(1-\alpha)(k-2, n-k)$ . If used real level of significance  $\alpha = 0.01$  then  $F(1-0.01)(16-2, 40-16) = 3.18$ . Turns price  $F_{count}$  is smaller than  $F_{table}$  ( $0.73 < 3.18$ ). Therefore we can conclude the regression equation. Furthermore, to test the significance predetermined test criteria that may obtainable  $F_{table}$  of  $F_{count} > F_{table}(1-\alpha)(1, n-2)$  = if used level of significance  $\alpha = 0.01$  then  $F(1-0.01)(1, 40-2) = 4.41$ . The price of  $F_{count}$  is larger than  $F_{table}$  ( $2.21 > 4.41$ ). It can be concluded that the linear regression equation is significance (mean). While the simple linear regression test showed similarities variable X and variable Y contains meaning that any chance (decrease or increase) by one unit in the variable X, it will be followed by chance (decrease or increase) the average 0.18 units of variable Y. Testing the correlation between variables X and Y indicated that there is the degree of relationship between variables X and Y or it means that the variable X can explain the variations which occur in the variable Y. It can be concluded that there is a relationship with

the speed of leg length in a crescent kick sports of Pencak Silat, but the relationship is still quite weak.

**KEYWORDS:** leg length, speed, crescent kick, Pencak Silat.

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### Introduction

The development of achievements in sports can be achieved through a planned, organized and measurable exercise involving various scientific and technological disciplines. Every sport requires physical exercise to achieve maximum performance as it is the foundation of every sport.

Some factors can spur the development of achievements in sports, such as quality improvement in training and sports coaching. Attempts to improve achievement in sport should be carried out by exercises conducted through a scientific approach with related sciences. With the support of various related disciplines, the training theory will be well developed so that the sports achievements can be improved well. Pencak

Silat achievement cannot be speculatively achieved. Achievement must go through intensive training with a proper exercise program. The exercise should certainly be specialized in developing the components required in Pencak Silat sport.

To achieve achievement in the sport of Pencak Silat, it takes a lot of consideration and calculation as well as careful analysis of the determining factors. The supporting factors of achievement can be used as the basis in preparing the program. One of the supporting factors in the achievement of Pencak Silat is the practice method. For the exercise process that is used to improve the physical quality is not time-consuming, it is necessary to develop the method of exercise. Through the development of training methods, it is expected that physical quality can increase in line with the increasing technique and psychic quality of the Pencak Silat athletes at the end of the designed macro cycle.

A fighter will get the point if the attack is fast, strong and remain on target without any obstacles, so it takes a good punch and kick. In Pencak Silat, this is known as the deadly blow technique. Deadly kick is caused by the attack done strongly, quickly and precisely on the target which is the point of weakness of the opponent.

One of the attacks to be discussed here is a leg attack commonly called a kick. A strong, quick and targeted kick requires a special practice focused on the leg muscles, leg muscle endurance, leg length and application of the training forms. Much research has been done to measure the effect of leg muscles and endurance of leg muscle for the improvement of Pencak Silat kick. However, the relationship between the length of the leg and the speed of the kick has not been deeply studied.

According to some experts the longer the leg, the longer the range of attacks. Based on the above statement, the researcher is interested in making a study that aims to see the relationship between the length of the leg with the speed of kick in the sport of Pencak Silat martial arts without involving the strength and endurance of leg muscles.

### Studies on Pencak Silat

Pencak Silat is one of the indigenous cultures of Indonesia, where it is believed that the Malay society created and used this martial art since prehistoric times. Because at that time period people had to face the harsh nature to survive [8].

Pencak Silat is one of the martial arts originating from Indonesia. The center of Pencak Silat organization in Indonesia is called IPSI (Pencak Silat Indonesia Association). Basic techniques that must be mastered

to be able to do Pencak Silat are basic attitude, basic motion, basic attack technique, the basic technique of defense [6]. Martial arts are one of the arts that arise as a way of a person's self-defense. Martial arts are said to be art because there are beautiful and interesting movements in it. Martial arts have long existed and developed in the community for generations. Almost all countries have different martial arts. In Indonesia, martial arts in the form of Pencak Silat is well known by the people [18].

Pencak Silat is estimated to have spread in the archipelago in the 7th century AD. Currently, Pencak Silat has been recognized as Malay culture, namely the coastal population of Sumatra Island and Malacca Peninsula, as well as other ethnic groups who use Malay as lingua franca. In various areas such as in the islands of Java, Bali, Kalimantan, and Sulawesi have also developed traditional Pencak Silat [21].

Pencak Silat is an Indonesian martial art. In Pencak Silat, there are four elements including, an element of sport, an element of art, an element of martial arts, and the element of spirituality. In martial arts elements to defend themselves from opponent attacks, Pencak Silat uses punches and kicks. The ancestral scores of Pencak Silat are listed in the form of pledge called *prasetya* of Indonesian Silat athlete. This pledge is usually read before the fighters do the exercises [9].

### Kicks on Pencak Silat

In martial arts, the technique of kicking is as important as the blowing technique. The kick has a greater power than the force of the punch blow. According to MUNAS IPSI XII in obtaining the point (score), the kick has a higher score of 2 or 1 + 2, whereas the blow gets only 1 or 1 + 1. The dominant attack technique in Pencak Silat match is a kick technique. The kicking technique is a movement process using the leg.

Nugroho [11] divides the kick type into four, namely: (a) front kick or a kick using the back, palms, tip of the sole, and heel of the foot; (b) side kick (T) or kick using the side of the foot, and heels; (c) the back kick is a kick that uses the sole and the heel of the foot, and (d) a crescent kick, which is a kick that uses the back end of the foot of the back bow using the heel of the foot [13]. The kick in Pencak Silat fights has many variations. However, in general, to get maximum results, almost all kicking techniques use the knee leg axle method followed by rotation of the waist and hip impulse to add explosive kicks.

Kick has several advantages such as a kick to get a high enough score of two points. The range of this kick is

longer and has greater power than any other attack, such as punch that only earns a score of one [11, 13].

Kick has a particular position in Pencak Silat. This is supported by the opinion of Fahrizal [3] that the coaching characteristic of the Tapak Suci teaching focuses more on the attack of the legs (kicks) [3]. However, the full force kick must be supported by a steady pace to minimize catch. The definition of the catch itself is expressed by the Refiater [16]. Speed is the ability of a person to perform the same movement in a short time, whereas according to Fahrizal the speed is the ability of athletes to make changes in motion and maintain balance in relatively short time [3].

There are many kick techniques in Pencak Silat, including straight kicks, T kicks, back kicks and crescent kicks. Each kick has different targets and different targeting tools. As with the sickle, the trajectory is circled from the outside inward while the target is the back of the opponent with the targeting tool is the back of the foot. Meanwhile, according to Wilujeng the crescent kick is a kick in which the trajectory is a semi-inward circle, targeting all parts of the body with the back of the foot or fingers of the foot [20]. Sanoesi et al. (2010) suggest that the crescent kick is a kick done with a curved sideways track using the back of the foot [17]. So it can be concluded that the crescent kick is a kind of kick with a half circular trajectory directed at the target using the back of the foot. The speed of a crescent kick is the ability of a person to do a kick using the back of the foot in a short time.

The crescent-kick is a raised foot movement that swings the leg forward. A crescent-kick is the ability to master basic, which is one of the foundations for achieving optimal learning outcomes. According to Abdul Majid "technique is the process of teaching and learning activities that are not independent, but related to the material and time components" [4]. Techniques cannot be used if the material is not delivered and the technique cannot be applied if it is not the right time to use.

Power is required for explosive movements such as throwing, jumping, kicking and hitting. The movement requires high strength and is done in a short period to achieve the desired result. Power is one of the essential components of physical fitness. Power is muscle ability in overcoming the load or resistance in a complete movement in a short time with high speed [15].

In some dynamic body movements, kicking, throwing, moving part or the entire body load, require explosive power [5]. According to Rinaldy, explosive muscle power is closely related and even highly dependent on muscle volume. Leg muscle strength can be increased

by increasing the work of leg muscles trained over a period of time or reducing the amount of time desired to produce the style needed [10].

Based on some of the opinions of these experts, it can be concluded that the muscle leg explosive power is a leg muscle ability to perform activities quickly and firmly to generate power.

Body type or shape is one part that can affect the achievement of sports achievement. The physical shape of talented athletes can support the sports achievement [14]. However, the physical form should be supported by the use of techniques, tactics and good mental. Similarly, in the football game, body shape plays an important role to achieve high achievement. It also body types are divided into three categories, namely: 1) endomorphic somatotypes, 2) mesomorphic somatotype, and 3) ectomorph somatotype [14].

The length of the leg involves the bones and leg-forming muscles of both the lower leg and the upper leg. The leg-forming bones include the leg bones, the tibia and fibula bones, and the femur bone. The leg-forming muscles involved in the kicking of the ball are the muscles of the lower leg. The muscles of the lower leg consist of several muscle groups, namely: 1) groin muscles, 2) upper leg muscles, 3) lower leg muscles, and 4) leg muscles.

The top leg muscle has a solid wrapping membrane called the *fascia lata*. The muscles of the upper leg are divided into three groups: 1) abductor muscles, including a) the internal abductor and inner muscle, b) the middle abductor Brevis muscle, and c) the outer abductor longus muscle. These three muscles become one and are called the abductor femoral muscles, with the function of organizing the abduction movement of the femoral bone; 2) extensor muscle, including a) the muscle of the rectus femoris, b) the external lateral vastus muscle, c) the internal vastus medial muscle, d) the vastus intermedial muscle; 3) the flexor muscles of the femur, including a) the biceps femoris which serves to bend the leg and straighten the leg, b) muscular semi membranes function to bend the leg, c) muscular semi tendinosis function to bend the vein down and rotate into, d) musculus Sartorius function for *eksorotasi* femur, which helps flexion and bending out [19].

The leg length is a lower leg member consisting of the legs and pelvis. Broadly speaking, the human body consists of three parts: the upper leg, the thigh from the groin to the knee. The term anatomy is the femur. This thigh is the longest bone in the body, which is a pipe bone. The lower leg, from knee to ankle (limited to *patea*), or a leg. The lower leg is composed of the

tibia (shinbone) which is the main skeleton of the lower leg, the pipe bone, and the fibula (the calf bone), located on the lateral side of the lower leg. The soles of the feet, consisting of tarsal bones and *falanks*. Tarsal bone (foot bone) serves to sustain weight while standing. While the *falanks* are toe joints that have the same shape as the fingers but shorter.

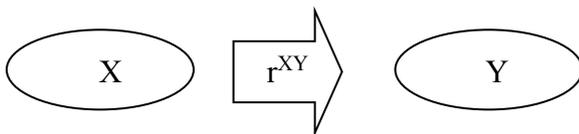
The efforts to achieve optimal results in exercising require several kinds of implementation of success supporting elements, such as speed. Speed is a combination of three elements, namely time, reaction, the frequency of movement per unit of time and speed to travel a distance.

Speed is the ability to perform similar movements in a row at the shortest possible time. Speed exercises should be given pre-season or after athletes have adequate strength, flexibility, and endurance [1].

Speed is also said to be the ability of a muscle reaction characterized by a change between contraction and relaxation to the maximum frequency. The speed is the ability of a person to do motion or series of the movement as quickly as possible in response to excitatory [2]. For a Pencak Silat athlete, speed is the ability of the athlete to perform the movement in the shortest time.

**Method**

The method used in this research is correlation research method. Correlation research is a study conducted strictly to determine the relationship between variables. The design of this study is as follows:



Where:

X – length of leg

Y – the speed of a crescent kick

r<sup>XY</sup> – correlation between one leg with crescent-kick

The technique of collecting data in this research is as follows:

1. Data collection procedure. The data collected include data of long leg and crescent-speed data on martial arts sport.
2. Instrument research. Instrument used in this research are:
  - a) Leg length is measured using meters.
  - b) The speed of the crescent kick using the measurement instrument of the speed of

Pencak Silat kick namely: to determine the ability of Pencak Silat athletes' kick speed (for straight, side, and crescent kick technique). The equipment used is sand sack (50 kg/target) (sandbox), meter, and stopwatch. The equipment is sand sack/target height gauge, timekeeper, and sand sack guard.

**Implementation**

The athlete prepares to stand behind the sand sack with one foot of pivot behind the line as far as 50 cm (female) 60 cm (male). On the 'yes' command, the athlete kicks in with the right foot and returns to the starting position by touching the floor behind the line, then continuing the right kick as fast as possible and for as long as 10 seconds. The same procedure also applies to the left leg. Implementation is done three times, and the highest number of kicks is recorded with the height of sand sack/target of 75 cm (female) and 100 cm (male) [7].

Data processing techniques employed correlation test. Before testing the hypothesis, the prerequisite test of data analysis was first utilized the normality test and homogeneity test, with the following procedures:

1. Prerequisite test analysis before testing the research hypothesis. Homogeneity test of variance is by using Bartlett test and normality test by using Kolmogorov–Smirnov test.
2. Hypothesis testing. To test the research hypothesis that there is a relationship between the length of the leg with the speed of crescent kick in Pencak Silat sport using the formula r test as the following:

$$r = \frac{n \sum XY - (\sum X)(\sum Y)}{\sqrt{\{n \sum X^2 - (\sum X)^2\} \{n \sum Y^2 - (\sum Y)^2\}}}$$

Information:

n – number of samples

ΣX – number of variables X

ΣY – number of variables Y

XY – the multiplication of variables X and Y

**Results and Discussion**

The data obtained on variable X shows the total amount of data is 4,027, and then 406,187 after squaring. The average score of 100.68 and variance score of 19.71 and the standard deviation is 4.44. Calculation of variance and standard deviation using the following formula:

$$Sd_1 = \sqrt{\frac{(X_1 - \bar{X}_1)^2}{n-1}}$$

Description:

X – data variable X

$\bar{X}$  – average variable X

n – total number of samples

This X variable data is calculated in the frequency distribution table as follows (Table 1):

**Table 1.** List of frequency distribution of variable X

No.	Interval class	Frequency
1	88-91	1
2	92-95	2
3	96-99	11
4	100-103	13
5	104-107	11
6	108-111	2
total		40

The data obtained on the variable Y shows the total data amounted to 786, and this number increased up to 15,878 after squaring. The average score analysis was 19.65, and the variance score was 11.11, and the standard deviation was 3.33. Calculation of variance and standard deviation employed the following formula:

$$Sd_1 = \sqrt{\frac{(X_1 - \bar{X}_1)^2}{n-1}}$$

Description:

X – variable data Y

$\bar{X}$  – average variable Y

n – total number of samples

This variable Y data or the crescent kick speed data was then calculated in the frequency distribution table below (Table 2):

**Table 2.** List of frequency distribution of variable Y

No.	Interval class	Frequency
1	14-16	8
2	17-19	13
3	20-22	11
4	23-25	6
5	26-28	1
6	29-31	1
total		40

**Findings and Discussion**

The relationship between the length of the leg and the speed of the crescent kick begins by explaining the purpose of measuring the length of the leg and the speed at which the sickle cuffs on the martial arts sport properly and correctly. Furthermore, the researcher called each sample based on the name in accordance with the attendance list to examine the length of the sample leg by using the meter and recorded the results. After leg length measurements were completed, the measurement of the sickle-cycling test was performed for 10 seconds, and the researchers noted the number of crescent kicks.

The results of research on the variable X shows the average score is 100.68. The variance score is 19.71 and the standard deviation is 4.44. The results of research on the variable Y shows the average score of 19.65 while the variance is 11.11 and the standard deviation is 3.33. Homogeneity data between the results of research variables X and Y variables showed homogeneous population variance is normally distributed.

While in simple linear regression test indicates the equation of variable X and variable Y, which means if any change (decrease or increase) of one unit in variable X, it will be followed by change (decrease or increase) average of 0.18 units of variable Y.

The price of F arithmetic is obtained for the linearity test that is equal to 0.73 and F arithmetic for the significance of 2.21. Based on the test criteria for the linearity test specified above, the F list is obtained from  $F < F(1-\alpha)(k-2, n-k)$ . If a real level of  $\alpha = 0.01$  is used, then  $F(1-0.01)(16-2, 40-16) = 3.18$ . It shows that the value of F arithmetic is smaller than F list ( $0.73 < 3.18$ ). So it can be concluded this regression equation is linear.

Furthermore, for the significance test, the criterion has been determined that the F list can be obtained from

$F_{\text{arithmic}} > F_{\text{list}} (1-\alpha) (1, n-2) =$  by using the real level  $\alpha = 0.01$ , which makes  $F (1-0, 01) (1, 40-2) = 4.41$ . It shows that the value of  $F_{\text{arithmic}}$  is greater than  $F_{\text{list}} (2.21 > 4.41)$ . So it can be concluded that the linear regression equation is significant.

The correlation test between variables  $X$  and variable  $Y$  indicates that the degree of relationship between variables  $X$  and  $Y$  which means that the variable  $X$  can explain the variations that occur in variable  $Y$ . Thus it can be concluded that there is a relationship between the length of the leg with the speed of crescent kick in the sports of Pencak Silat. However, this relationship is still relatively weak. This can be proven by the table below (Table 3):

**Table 3.** Result of relationship criteria

$r$	Relationship criteria
0	no correlation
0-0.5	weak correlation
0.5-0.8	medium correlation
0.8-1	strong correlation
1	perfect correlation

By looking at the relationship criteria between the above tables and based on the correlation calculation of  $r = 0.23$ , the relation criterion between leg length and kick speed is categorized in the criterion of weak correlation.

### Conclusions

Based on the results of analysis and discussion it can be concluded that there is a direct relationship between the lengths of the leg with the result of crescent-kick speed in the sport of Pencak Silat. The leg length has a weak relationship to the result of the crescent kick. Therefore, more data on leg muscle strength and leg muscle strength and the need for special action forms are required. The length of the leg should be equipped with force and endurance of the leg muscles to achieve a robust and fast crescent kick.

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