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Determinants of Side Kick Ability Athlete of Tarung Derajat

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ABSTRACT
The aim of this study was to examine the impact of leg muscle strength and leg muscle explosive power on Tarung Derajat side kick ability through reaction speed. This study enhances the existing literature regarding the effect of leg muscle strength and leg muscle power on the side-kick ability of Tarung Derajat and includes reaction speed (simple and total), which is often trained to determine the level of performance in martial arts. In this study, subjects were randomly assigned n = 60 people to the test to see the ability of each of the proposed variables. Next, to examine the model structure effect of this study, we made use of IBM SPSS software. The results showed that leg muscle strength, leg muscle explosive power, and reaction speed had a significant impact on the ability of the Tarung Derajat side kick both directly, indirectly and totally. These results illustrate the important role of the direct influence of the yield power of the leg muscles which have a major influence on the side kick abilities of Tarung Derajat athletes. The implications for practitioners and researchers are discussed in detail.

Keywords: *Kick ability, Tarung derajat*

1. INTRODUCTION

Tarung Derajat is one of the sports achievements that are gaining popularity among the public and the world. Grade fighting martial sports are not only practiced by certain age groups, but have been comprehensive for all ages, from children, adolescents, adults to the elderly at this age. Tarung Degrees has entered all Regencies / Cities of all Provinces in Indonesia, and has been included in all Southeast Asian countries, namely the Sea Games since 2011 in Jakarta. This Tarung Derajat Martial Arts Sport has held the 2nd Southeast Asian Championship in Malaysia and the September 2016 XX PON in the West Java Championship in Southeast Asia, and the IFTD World Championship (Alnedral et al., 2018).

In achieving achievement, a degree fighting athlete must master all the elements that are in the degree fighting itself, such as punches, kicks, blocks, and various other basic techniques. Kick is an attack that has a higher value than a punch attack. In addition, the kick is one of the attacks that can knock your opponent down quickly. Kick technique consists of inner circle kick, side kick, back circle kick, back kick, front kick, and back hook kick.

One of the kicks that is often taken in a match is a side kick. The side kick is one of the most dominant techniques in generating points in a match. A side kick is a kick that is performed with the body on its side while the kicking leg is in the form of a knife leg with the target direction of the body or head, the position of the hand still protects the jaw and face. In addition, the side kick is a technique in which the athlete tends to declare the highest number of broken boards. Thus, it will certainly affect the final score in each competition (Wąsik, 2011).

This accurate side kick is balanced by the coaching of several components of the athlete's physical condition such as leg muscle strength, leg muscle explosive power, and reaction speed. Muscle strength is defined as the muscle's ability to generate strength (Robles P.G. et al., 2011). Functional limitations and low levels of physical activity such as side kicks are associated with low muscle strength (Bernabeu-Mora et al., 2017). Muscle strength, which is defined as the ability to generate energy (Joule) in a short time, can be expressed by the product of force and velocity (Reid & Fielding, 2012). Muscle strength is also referred to as the maximum force (in N) or torsion (in Nm) developed during maximal voluntary contraction under certain conditions (Bohannon, 2007; Jaric, 2002; Rantanen, 2003). In addition, muscle strength has been shown to be more strongly associated with capacity and functional mobility, such as speed and balance (Accettura et al., 2015; Cadore et al., 2014).

The side kick requires the ability to generate and maintain the output of force and explosive force used for concentric muscle action in cyclical stretching of the lower limb. This, can affect technical and tactical action in combat (Bridge et al., 2014). Muscle strength is important to produce the speed of the leg swing in taking side kicks. Several authors have reported the relationship between leg muscle strength generated during kicks (Apriantono et al., 2006). So, it can be interpreted that leg muscle strength is an important component for success in sports. Therefore, when doing side kicks muscle strength can increase leg performance (Shetty, 1985).

In addition to the muscle explosive capacity, the limb extremity produces a rapid rotation of the leg (Brophy et al., 2007). This muscle capacity is not only related to the capacity for contraction power but also with motor coordination (MacHado et al., 2010). upper and lower limbs (Chaabène et al., 2012).

The side kick is a high level performance. In addition to the explosive power of the lower leg muscles, the reaction rate also plays an important role in giving the impls production. Reaction speed is the product of speed and strength over a short time interval. That is, reaction speed is the time that has elapsed between the stimulus and the corresponding response in brief (COUNKUN et al., 2014). The ability of the side kick in Tarung Derajat martial arts sports requires further review of the effect of leg muscle strength and limb muscle explosive power as well as reaction speed in producing high performance. Therefore, this article aims to see the direct, indirect, and total influence between leg muscle strength and leg muscle explosive power on side kick ability through reaction speed: specifically Tarung Derajat sports.

2. METHODOLOGY

2.1 Sample and data collection

The population of this study were all 110 athletes of Padang City who were still active, consisting of 60 men and 50 women. As a method of data collection in this study, using purposive sampling technique, which is based on the consideration of the objectives set by the researcher, so that the data to be taken is only 60 athletes from 110 existing athletes.

3. RESEARCH INSTRUMENT

To verify the proposed hypothesis, it is necessary to take measurements related to leg muscle strength, leg muscle explosive power, reaction speed and side kick ability (Bui et al., 2019; Fiske et al., 2007). So, to get information about the effect of the variables proposed specifically for the Tarung Drajat sport, the data collected in this study are primary data taken from test respondents. For more details, the instruments used in data collection can be seen below:

1) The strength of the leg muscles possessed by each Tarung Derajat athlete in 2019, using the Leg Dynamometer.
2) The explosive power of the leg muscles owned by each Tarung Derajat athlete in 2019, by using a Standing Broad Jump.
3) The reaction speed of each Tarung Derajat athlete in 2019, using the reaction speed of the legs.
4) The side kick ability of each Tarung Derajat athlete in 2019, by taking a 1 minute side kick.

3.1 Data analysis

First, descriptive statistics were examined to describe the general ability of leg muscle strength, leg muscle power, reaction speed, and side kick ability. Second, to assess the conceptual relationship between the proposed variables, namely using IBM SPSS software. Significance was determined at the $p < 0.05$ level.

4. RESULT

4.1 Respondent ability profile

The ability of leg muscle strength, leg muscle explosive power, reaction speed and side kick ability, which were surveyed by about 60 degree fighting athletes produced data as in table 1.

Table 1. Descriptive Statistics

Variable	*N*	*Min*	*Max*	*X ± SD*	*Variance*
Leg muscle strength	60	31	70	50.00 ± 10.000	100.004
The power of leg muscles	60	33	74	50.00 ± 10.000	100.000
Reaction speed	60	30	66	50.00 ± 9.998	99.968
Side kick	60	33	73	50.00 ± 10.001	100.012
Valid N (listwise)	60			10.000	

P<0,05*

3.2 Struktur model

Structure 1 Output and Interpretation of Results X1 and X2

First, the relationship between the proposed variable leg muscle strength and leg muscle explosive power. The results show that:

Table 2. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.310[a]	.096	.081	9.588	.096	6.182	1	58	.016
a. Predictors: (Constant), X1									

Table 1 shows that dertemination (R2) of 0.096 means that 09.6% of the variable leg muscle explosive power can be explained by the variable leg muscle strength. So that error (ε) = 1- R2 1 - 0.096 = 0.904 = 0.90.

Table 3. ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	568.321	1	568.321	6.182	.016[b]
	Residual	5331.693	58	91.926		
	Total	5900.014	59			

a. Dependent Variable: X2
b. Predictors: (Constant), X1

Table 2. Above shows the obtained Fo = 6.182 db 1 = 1; db2 = 58, p-value = 0.016 <0.05 or H0 is rejected. Thus, the variable leg muscle strength affects the variable leg muscle explosive power. next:

Table 4. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	34.482	6.363		5.419	.000
	Kekuatan otot tungkai	.310	.125	.310	2.486	.016

a. Dependent Variable: X2

Table el 3. shows that the path coefficient is obtained in the Beta column (Standardized Coefficients), namely the path coefficient X1 to X2 (p21) = 0.310. Furthermore, the coefficients obtained by the price of t0 = 2.486 and p-velue = 0.016 / 2 = 0.008 <0.05 or H0 is rejected. Thus, the variable leg muscle strength has a positive direct effect on the explosive power of the leg muscles.

Structure 2 Output and Interpretation of Results X1, X2, and X3.

Second, the relationship between the variables of leg muscle strength, the proposed leg muscle explosive power and reaction speed. The results show that:

Table 5. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.702[a]	.493	.475	7.243
a. Predictors: (Constant), X2, X1				

It appears that the coefficient of determination for model 1 (R2) is 0.493. So that error (ε) = 1- R2 1 - 0.493 = 0.507 = 0.51.

Table 6. ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2907.904	2	1453.952	27.715	.000[b]
	Residual	2990.227	57	52.460		
	Total	5898.131	59			

a. Dependent Variable: X3
b. Predictors: (Constant), X2, X1

Based on the results of the analysis in Table 5, it is found that, model 1, Fo = 27.715, p-value = 0.000 <0.05 or H0 is rejected. Thus, simultaneously model 1 on the variable leg muscle strength, and leg muscle explosive power has an effect on the variable reaction speed. Next:

Table 7. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.930	5.899		1.175	.245
	Kekuatan otot tungkai	.361	.099	.361	3.638	.001
	Daya ledak otot tungkai	.501	.099	.501	5.046	.000

a. Dependent Variable: X3

Based on table 6, model 1 is obtained, where the path coefficient will be shown by the Unstandardized Coefficients (Beta) column. Where from the coefficient in model 1, it is obtained:

1) p31 = 0.361; t0 = 0.001 / 2 = 0.001 <0.05, or H0 is rejected, which means there is an effect of leg muscle strength on reaction speed.
2) p32 = 0,501; t0 = 0.000 / 2 = 0.000 <0.05 or

H0 is rejected, which means that the explosive power of the leg muscles has a positive direct effect on reaction speed.

From the analysis that, path coefficient (p31 and p32) has a positive direct effect between leg muscle strength and leg muscle explosive power on reaction speed.

Structure 3 Output and Interpretation of Results X1, X2, and X3, with Y

Third, the relationship between the variables of leg muscle strength, yield muscle power and reaction speed proposed in the side kick. The results show that:

Table 8. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.749[a]	.562	.538	6.797

a. Predictors: (Constant), X3, X1, X2

It appears that the coefficient of determination (R2) of 0.562 means that 56.2% of the variable veriability of the side kick ability of degree fighting can be explained by the variable leg muscle strength, leg muscle explosive power, and reaction speed. So that error (ε) = 1 - R2 1 - 0.562 = 0.438 = 0.44.

Table 9. ANOVA[a]

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3313.741	3	1104.580	23.911	.000[b]
	Residual	2586.943	56	46.195		
	Total	5900.684	59			

a. Dependent Variable: Y, b. Predictors: (Constant), X3, X1, X2

Based on the results of the analysis in Table 8, it is found that Fo = 23.911; db1 = 3 db2 = 56, p-value = 0.000 <0.05 or H0 is rejected. Thus the variables of leg muscle strength, leg muscle explosive power, and reaction speed simultaneously affect the side kick ability of degree fighting. The positive direct influence can be learned from the following input.

Table 10. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.645	5.602		.651	.518
	Kekuatan otot tungkai	.289	.103	.289	2.796	.007
	Daya ledak otot tungkai	.345	.112	.345	3.085	.003
	Kecepatan reaksi	.293	.124	.293	2.356	.022

a. Dependent Variable: Y

By using the backward method, the path coefficient is obtained which is shown by the Unstandardized Coefficients (Beta) column. From the Coefficients table, it is obtained;

1) py1 = 0.289; t0 = 0.007 / 2 = 0.004 <0.05, H0 is rejected, which means leg muscle strength, has a positive direct effect on the side kick ability of degree fighting.
2) py2 = 0.345; t0 = 0.003 / 2 = 0.002 <0.05, H0 is rejected, which means that the leg muscle explosive power has a positive direct effect on the side kick ability of degree fighting.
3) py3 = 0.293; t0 = 0.022 / 2 = 0.011 <0.05, H0 is rejected, which means that the reaction speed has a positive direct effect on the side kick ability of degree fighting.
4) py31 the indirect effect of X1 on Y through X3 is = 0.361 * 0.293 = 0.106.
5) py32 the indirect effect of X2 on Y through X3 is = 0.501 * 0.293 = 0.147.

5. DISCUSSION

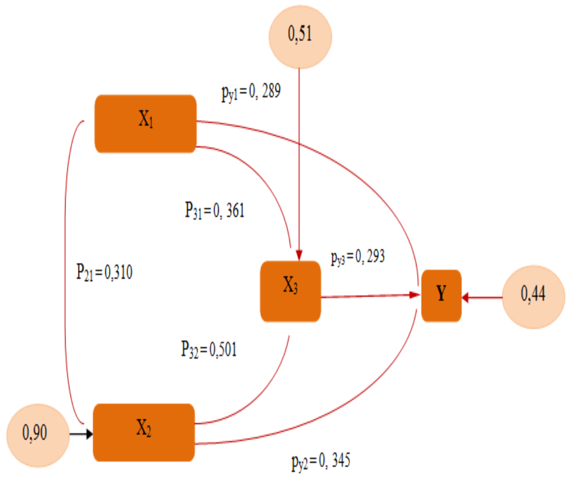
Our results show a high direct effect of the variable explosive power of the leg muscles on the side kick. The three proposed variables have a direct and indirect effect simultaneously (simultaneously) on the Tarung Derajat side kick. This finding is similar to that previously made by other researchers that, the power of leg muscles has a significant effect on the work done on the joints, because the transfer of power during leg extension is shown from the hip joint to the knee during the kick (Jacobs, Bobbert, & Van Ingen Schenau, 2012). In addition, this study revealed valuable results, namely the influence of py1, py2, py3, p31, p32, and p21, see table 11.

Tabel 11. Analysis of the Measurement Model

Pengaruh lansung antara variabel	Koefesien Jalur (p_{ij})	Kesalahan Baku (sb_i)	t_{hitung}	p-value	Simpulan
X_1 terhadap y (p_{y1})	0,289	0,103	2,796	0,007	Sig**
X_2 terhadap y (p_{y2})	0,345	0,112	3,085	0,003	Sig**
X_3 terhadap y (p_{y3})	0,293	0,124	2,356	0,022	Sig*
X_1 terhadap X_3 (p_{31})	0,361	0,099	3,638	0,001	Sig**
X_2 terhadap X_3 (p_{32})	0,501	0,099	5,046	0,000	Sig**
X_1 terhadap X_2 (p_{21})	0,310	0,125	2,486	0,016	Sig*

P < 0,05, P < 0,01**

Based on the results of hypothesis testing using the SPSS application, the causal models of X1, X2, and X3, with Y, are visualized as follows.



Gambar 1. Model Struktural Kausal Empiris X_1, X_2, dan X_3, dengan Y
Model fit: p_{21} L = 0,310, p_{y1} L = 0,289, p_{y2} L = 0,345, p_{y3} L = 0,293, p_{31} L = 0,361, dan p_{32} L =501

Based on the above empirical causal structure all path coefficients are significant. So that the structure of the proposed model does not need to be improved. This is because all variables have an effect either directly or indirectly. Furthermore, the direct effect is the variable explosive power of the leg muscles compared to the variable of leg muscle strength and reaction speed. This can be seen from the multiplication result of p32 = 0.501 and py2 = 0.345. While the direct effect is suggested to use the variable limb muscle explosive power p2y = 0.345. So with the variable explosive power of the tilapia muscles, it has a great effect directly or indirectly on the side kick ability of degree fighting.

Lower limb muscle strength can result in improved athlete performance (Yoo et al., 2018). Speed and strength and reaction speed are now considered the best predictors of performance in martial arts athletes (Beattie et al., 2014). In performing side kicks, strength and speed were investigated in athletes of 3 different playing ability levels. This causes the overall strength, power, and speed to be correlated (Baker, 2001). Thus, feeding requires a high level of explosive strength in order to dynamically improve athletic performance (Sporiš et al., 2010).

In addition, the strength that contains high speed contraction is a more optimal way to improve athlete performance, especially in side kicks. Because high leg muscle contraction affects the side kicks of Tarung Derajat athletes (Gourgoulis et al., 2014; Hazell et al., 2007). Therefore, it is necessary to implement an effective strength training program and the speed of specific muscle contraction, to improve the performance of athletes in side kicks (Manolopoulos et al., 2006). Coordination-based exercises that aim to increase the response time called reaction speed can also increase the effectiveness of the technique and possibly earn points in competitive situations (Ball, 2013).

Through the speed of the reaction, the leg muscle strength and the explosive power of the leg muscles indirectly affect the side kick. The findings showed that leg muscle strength and leg muscle explosive power affected the athlete's reaction speed (shorter execution time) when starting from a standing position of 0 ° and 45 ° from a position of 90 ° ($P < 0.05$). It will indirectly have an impact on the kicks taken by athletes. Therefore, it is recommended that athletes do not adopt the 90 ° position as it will not allow them to achieve their best performance in kicks (Estevan et al., 2013).

According to, (Armando & Alnedral, 2019) there is a significant relationship between the explosive power of the leg muscles and the accuracy of the kick at goal, 2) There is a significant relationship between the coordination of the eyes and the accuracy of the kick on the goal 3) There is a significant relationship between the explosive power of the leg muscles and coordination of the eyes together with the accuracy of the kick on goal.

A key factor for performing a specific skill such as kicking, another time explains that, strength can be considered as explosive force (that is, the product of strength and speed) or an athlete exerts strength rapidly. Speed and time include muscle speed and reaction time (reaction speed). These are fundamental aspects that affect the performance of athletes (Pędzich et al., 2006; Yu et al., 2012).

6. CONCLUSION

The strength of the leg muscles and the explosive power of the leg muscles through the reaction speed have an impact on the ability of the Tarung Derajat side kick. This finding is unique because the side kick is influenced by all the indicators proposed. This study revealed that leg muscle strength (cruris and antecruris) and leg muscle explosive power (cruris and antecruris) had a direct and indirect effect as well as total on the side kick ability through reaction speed. Furthermore, the explosive power of the tilapia muscles has a major effect, directly or indirectly, on the ability of the Tarung Derajat side kick. This is because the leg muscle explosive power is the best predictor of performance in martial arts athletes when performing kicks.

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