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Long Limb Prediction, Body Mass Index, Flexibility and Speed to Long Jump Style Squatting

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Abstract

This study aims to determine the relationship and how much the prediction of long jump squat style achievement in terms of limb length, body mass index, body flexibility and running speed. The objective of this research is that trained students of state senior high school in Pekalongan Regency, with a total sample of 60 students. The independent variables in this research is limb lenght, body mass index, body flexibility, and running speed whereas dependent variable was long jump with squat style achievement. This study uses multivariat correlational method. The results showed that the length of the legs, body and togok flexibility has a positive relationship, whereas the body mass index and running speed has a negative relationship with the long jump squat style achievement. Prediction value at limb length was 0.027, body mass index was -0.049, body flexibility was 0.026 and running speed was -0.234. The conclusion of this study is that there is a significant relationship and can be predicted between limb length, body mass index, body flexibility and running speed against long jump squat style achievement.

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INTRODUCTION

Long jump is a form of jumping movement that begins with horizontal movement and is transformed into vertical movement by doing repulsion on one of the strongest legs to get the distance as far as possible (Wiarto, 2013). According to Aip Syarifuddin (1992) the long jump is a form of moving forward foot forward in an effort to carry weight as long as possible in the air (flying in the air) is done quickly by doing repulsive force on one foot to reach a distance as far as possible. The fundamental factor that a jumper must possess is the ability to master the technical skills and ability of the physical condition. Adequate physical condition that will support the appearance of long jump when making a leap. Thus, physical conditions become important for jumpers because of the physical condition as a foundation for learning techniques, tactics, strategies, and mental. As for some components of the physical condition that greatly support the achievement of long jump, the elements are power, strength, flexibility, speed, kelinicahan, balance, coordination and reaction (Sajoto 1998). in the opinion of Suharno HP (1993) that the factors that determine maximal achievement include: (1) indogenous factors: good physical and mental health, body shape and body proportions, physical conditions and abilities, perfect mastery of techniques, mastering the problem of tatik, having the psychological aspect and the good personality and having the maturity of soul; (2) Exogenous factors: Coach (coach), coach assistant, trainer, venue, equipment, finance, organization, environment, government participation, methods and training system.

Long jump is a form of jumping movement that begins with horizontal movement and is converted to vertical movement by performing repulsion on one of the strongest legs to obtain the greatest distance (Wiarto, 2013). Ballesteros in Ade Mardiana, et al (2009) suggests that long jumps are the result of horizontal speeds made during the prefix with the vertical power generated from the strength of the repelling leg.

According to Ade Mardiana, et al (2009) that the basic principle of long jump is to build the fastest prefix and do the strongest repulsion toward the front-up with one leg to reach the optimal height when flying so as to produce the distance leap that far - he said.

Hadi Marwanto (2007) explains that the length of the leg is the vertical distance between the feet to the groin as measured by standing upright. The legs as a member of the lower motion serves as a support for upper limb motion, as well as determinants of movement in walking, running, jumping or kicking. According to Ade Mardiana et al. (2009) that the basic principle of long jump is to build the fastest prefix and do the strongest repulsion upward with one leg to reach the optimum height when flying so as to produce a leap- away. The longer the muscle gets stronger to move. A person who has longer leg lengths with another will likely have a better jump because of the wider jump or wider step toward the front. So the longer the legs will be the further jump or run in the long jump (Syaifudin Ilham, 2016).

The ideal body porposes are very important in achieving high achievement, as each sport demands an ideal body ideal in accordance with the terms of the sport that is followed. In general, athletes especially for long jump athletes should have the ideal high body size or portion (Amirudin, 2016). Hamlin (2013) states that a large body portion of his influence on a person's ability to exercise aktvitas. This is very much for the long jumping athlete, because with a good body poseposi the athlete will be easy to do repulsion and get a longer drift time during floating phase.

The flexibility of the body is thought to play a role in the determination of the long jump achievement whereby an athlete is concerned with the body during the floating phase, because the flexibility of the flexible body makes it easier for an athlete to position his body while flying and also when it falls (Syaifudin Ilham, 2016). In this case it is explained that flexibility is the effectiveness seserang in penyusuaian himself to do all the activities of the body with stretching as far as possible, especially on the muscles, ligaments around the joints. The higher the body flexibility the angle of body movement in the swing is also greater so that the power generated is also greater (M. Sajoto, 1995).

Running speed or prefix speed is one component of basic physical conditions that may affect jumping performance in long jump numbers, students will get good long jump performance. Due to the speed of a jumper run a jumper can increase the power of a forward impulse and when doing repulsion or take off (Jess Jarver, 2005). Running speed is defined simply, the step length of step frequency, is the determinant of running speed. To determine the running speed should be done by increasing one or both of these parameters, keeping in mind the good running technique (Aip Syarifuddin, 1992).

This study aims to determine whether there is a relationship seta prediction on the factors of anthopometri and physical ability to the achieve-

ment of long jump style squatting. Anthropometric factors are leg length and Body Mass Index (BMI), whereas in the ability of physical condition is the body flexibility and running speed.

METHODS

In this research the researcher use correlational research method by using approach approach survey method with test and measurement. Tests and measurements were performed to obtain an idea of the extent and relationship of leg length predictions (X1), Body Mass Index (X2), Body Flexibility (X3) and Running Speed (X4) to the squat style long jump achievement (Y).

Measurement instruments to be used in this study are as follows: Measurement of limb length using midline measuring instrument. Measurement of body mass index by measuring body weight and height by using measuring instruments stratu meter and scales. Measurement of back flexibility using the flexibility test test with sit and reach. Running speed measurements were measured using a 40 meter run track and measured with a stopwatch. Jogkok style long jump performance measurements using a squat style long jump test using a meter gauge.

Implementation of data analysis research, after data obtained from the results of further measurement analysis with regression techniques. But before performing the test of analysis first done a number of test requirements to determine the feasibility of data. The prerequisite test consists of a test of normality and a linearity test. After the prerequisite test, the next analysis is hypothesis test that is correlation coefficient analysis, multiple linear regression, F test and t test.

RESULTS AND DISCUSSION

Based on the data of test result and limb measurement, body mass index, body flexibility, running speed, and squat style long jump performance conducted in May-June 2017 with sample of 60 students trained SMA Negeri in Pekalongan Regency, group of research variables obtained analysis results for limb length variables obtained at least 70, maximum value 90, mean 78.6 with standard deviation 4,4501; for body mass index (BMI) variable, the value of at least 17, maximum value 29,4, mean 21,6 with standard deviation 2,8177; for variable body flexibility obtained a minimum value of 23, max value 47, mean 34.4 with standard deviation 5,5945; for running speed variables obtained a minimum value of 4.2, maximum value 6.6, mean 5.3 with standard deviation 0.6533; whereas for the variable achievement of long jump style squat obtained minimum value 3,2, max value 5,2, mean 4,4 with standard deviation 0,4330.

The results of normality test data performed on each group using SPSS 19.0 application through Kolmogorov-Smirnov test are as follows (**table 1**).

Table 1. Tests of Normality

	Kolmogorov-Smirnova		
	Statistic	Df	Sig.
Leg length	.104	60	.174
Body mass index	.079	60	.200*
Body Flexibility	.092	60	.200*
Running Speed	.111	60	.051
Long Jump Achievement	.100	60	.200*

From the normality test results in **table 1** found that the limb length variables obtained value of significance of 0.174 where the value is greater than 0.05 which means that the data on the limb length variables are normally distributed. In the body mass index (IMT) normality data, the value of 0.200 is obtained which is greater than 0.05, which means that the data on body mass index (IMT) variables are normally distributed. For variable flexibility togok obtained value of significance of 0.200 where the value is greater than 0.05 and has a normal data distribution. While the variable running speed obtained by the value of significance of 0.51 where the value is also greater than 0.05 which means the value of the data distribution is normal. And on the variable

Table 2. Regression Linearity Test

Independence Variable	Dependence Variable	F	Sig. (linearity)	Sig. (Deviation from Linearity)	Linearity
Leg Length (X1)	Long Jump Squat Style Achievement (Y)	0,543	0,119	0,907	Linier
Body Mass Index (X2)		2,230	0,005	0,157	Linier
Body Flexibility (X3)		1,035	0,000	0,447	Linier
Running Speed (X4)			0,000	0,130	Linier

of long jump achievement is got significance value 0,200 where the value is normal distribution.

From the result of **table 2** it can be seen that in the relation of long limb variable (X1) with the achievement of long jump style squat (Y) got the sig value. (linearity) 0.119 and sig. (deviation from linearity) 0.907, this proves that the variable has a significant linear relationship. On the relationship of body mass index variables (X2) with the achievement of long jump style squatting (Y) obtained sig value. (linearity) 0.005 and sig. (deviation from linearity) 0.157, this proves that the variable has a significant linear relationship. In the variable relation of body flexibility (X3) with long jump performance of squat style (Y) got sig value. (linearity) 0.000 and sig. (deviation from linearity) 0.447, this proves that the variable has a significant linear relationship. In the relation of variable running speed (X4) with the achievement of long jump style squatting (Y) got sig value. (linearity) 0.000 and sig. (deviation from linearity) 0.130, this proves that the variable has a significant linear relationship.

Table 3. Correlation Coefficient Analysis

Summary Model				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.715a	.511	.475	.3137

The result of correlation coefficient analysis can be seen in **table 3** obtained value R = 0,715 and value R2 = 0,511. Based on these results it can be stated that there is a significant relationship between the length of the legs, body mass index, body flexibility and running speed simultaneously with the achievement of long jump style squatting on students trained SMA Negeri in Kabupaten Pekalongan with the value of data analysis that is 0.715.

Table 4. Correlation Significance Test Results

ANOVA[b]					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	5.649	4	1.412	14.352	.000a
Residual	5.412	55	.098		
Total	11.062	59			

Hypothesis test for variable limb length t**able 4**, body mass index, body flexibility and running speed simultaneously using F test with 5% significance level obtained that significance value (0,000) <0.05 and Fcount = 14,352> Ftable = 2,540, then from test the hypothesis is accepted which means that there is a significant relationship between the length of the limb, body mass index, the flexibility of the body and the simultaneous running speed of the squat style long jump achievement.

While the hypothesis test for each predictor variable is obtained that **table 5**: limb length variable to the achievement of long jump squat style significance value (0.005) <0.05 and tcount = 2,915> ttable = 2,004, then from the test the hypothesis is accepted which means that there is a significant relationship between the length of the limbs against the long jump performance of the squat style; variable of body mass index to the achievement of long jump squat style value significance (0,002) <0,05 and tcount = -3,223> ttable = 2,004, hence from the test hypothesis accepted which mean that there is significant relation between body mass index to achievement

Table 5. Test Analysis of Multiple Regression coefficient

Coefficients[a]					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.711	.859		4.319	.000
Leg Length	.027	.009	.278	2.915	.005
Body Mass Index	-.049	.015	-.318	-3.223	.002
Body Flexibility	.026	.008	.330	3.274	.002
Running Speed	-.234	.069	-.352	-3.382	.001

of long jump squat style; the variable flexibility of body on the jumper long jump performance of significance value (0.002) <0.05 and tcount = 3.274> ttable = 2,004, then from the test the hypothesis is accepted which means that there is a significant correlation between the flexibility of body to the squat style long jump performance; while the running speed variables to the long jump performance of the squat style of significance value (0.001) <0.05 and tcount = -3.382> ttable = 2,004, then from the test the hypothesis is accepted which means that there is a significant relationship between the run speed against the long jump style achievement squat.

The result of regression coefficient correlation analysis from research can be written that simple linear regression formula is Y = 3,711 + 0,027 X1 - 0,049 X2 + 0,026 X3 - 0,234 X4. The interpretation of the above regression is as follows: Constanta (a), this means that if the limb length variable, body mass index, body flexibility and running speed have zero (0), then the value of the squat style long jump variable is 3.711.

Length coefficient value of 0.027. This implies that the limb length variable has a positive relationship with the long jump performance of the squat style which means that every increase of limb length of one unit then the jumper style long jump performance will rise by 0.027 meters with the assumption that the other independent variables of the regression model are fixed. The coefficient value of body mass index is -0.049. This implies that the body mass index variables have a negative relationship with the jumper style long jump performance which means any decrease in body mass index of one unit then the jumper style long jump performance will rise by 0.049 meters with the assumption that the other independent variables of the regression model is fixed . Together coefficient value of body equal to 0,026. This means that the variable flexibility of body has a positive correlation with the long jump performance of the squat style which means that each increase of flexibility of one unit body then the jumper style long jump performance will increase by 0,026 meters with the assumption that the other independent variable from the regression model is fixed. The value of the run speed coefficient is -0.234. This implies that the variable running speed has a negative relationship with the achievement of long jump style squat which means any decrease in the speed of one unit run then the jumper style long jump performance will rise by 0.234 meters with the assumption that the other independent variables of the regression model is fixed.

Discussion of the results of this study provides further interpretation of the results of data analysis has been done previously. Based on the hypothesis testing has yielded the conclusion of analysis that can be exposed.

In this study it was found that long jump athletes who had different leg lengths that were one long short in achieving a leap would be farther with long limbs. Each increase of limb length of one unit then the achievement of long jump style squatting will rise by 0.027 meters. Leg length is a strength advantage, because with a good long legs and explosive does not rule out the effect on muscle strength. The longer the muscle is stronger to move (Warsito, 2001). Viewed from biomechanics that long limbs have a longer or longer range. Thus, long legs have longer or longer swings, which can help achieve maximum jump spacing. The advantage of long legs is possible to increase the length of steps that can be done (Aip Syarifudin, 1996).

In the body mass index analysis also has a role in predicting the skip long jump style. Means any decrease in body mass index of one unit then the achievement of long jump style squats will rise by 0.049 meters Body weight and height is a part in biometrics that can affect the achievement of sports achievement. Adisasmita (1992) says that: The attractiveness of the earth caught at a point called "weight points". The weight is located at the waist, slightly below the navel.

At the time of a good landing on the long jump the squat style is a continuation of the squat style hovering pattern. Of course, should get the distance as far as possible, namely at the largest horizontal distance between the heel and center of gravity. So at the moment before touching the sand, both legs / limbs straightened / stretched forward and body bent forward (Jarver, 20015). The role of back spacing in the long jump is seen when the body whips forward as it flies. Good formation will provide a boost to mastery of techniques when performing long jump techniques especially when flying in the air. In this study the variable body flexibilit has a positive relationship with the achievement of long jump style squat which means any increase in flexibility togok one unit then the jumper style long jump performance will rise by 0.026 meters.

Running speed variables have a negative relationship with the achievement of long jump style squat, which means any decrease in the speed of one unit run then the achievement of long jump style squats will rise by 0.234 meters. According to Jess Jarver (1982) the leap away depends on running speed, strength and accelera-

tion at take off (moving the horizontal speed to angular or vertical movement). The purpose of running before this jump is to increase maximum horizontal acceleration during take off.

Achievements that are optimal to achieve can be obtained by always paying attention to a fast technique, so that will produce a distance leap that far-away.

The results of this study can be seen that there is a relationship and prediction between the length of the leg, body mass index, flexibility togok and running speed together against the long jump style squatting. And it has a positive relationship on leg length variables and body flexibility, in other words if the value of limb length and body flexibility the greater, the greater the jump results in the long jump style squatting. While the variable body mass index and running speed have a positive relationship, which means if the body mass index and running speed is smaller then the greater the jump results in the long jump style squat Thus in this study if an athlete has a long leg, ideal body in this case has a low body mass index, large body flexibility and has a fast running ability it will get maximum jump results. So it can be concluded that between leg muscle strength, body weight and height influence and support in achievement of skip long jump jump results. And still there are other factors that affect the results of the long jump jump style squat not included in this study.

CONCLUSION

Based on the results of the research and the results of data analysis conducted, this study gives the conclusion that the variable length of the legs, body mass index, body flexibility and running speed have a partial or simultaneous relationship and become a predictor variable of squat style long jump performance on students trained SMA Negeri Regency of Pekalongan. The conclusions of this study are:

1. There is a significant correlation between the length of the limbs to the jumper style long jump performance with a prediction of 0.027
2. There is a significant relationship between the body mass index on the performance of long jump style squatting with a prediction of -0.049.
3. There is a significant correlation between the flexibility of body to the long jump performance of squatting style with prediction of 0,026.
4. There is a significant relationship between the running speed of the jumper style long jump performance with a prediction of -0.234.

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