



Impact of Running Speed and Limb Muscle Strength on Squat Style Long Jump for Secondary School

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Abstract: This study aims to determine the impact of running speed and limb muscle strength on the squat-style long jump results of State Senior High School students. The participants of this study were 40 people. The data collection technique for measuring speed was the 40-meter sprint test, for measuring limb muscle strength, namely the standing broad jump test, and for measuring the long jump style squat, namely the long jump style squat test. Data analysis techniques to find out the relationship between (X1, Y) and (X2, Y) used the Product Moment Correlation Formula. The Linearity Test was intended to test whether the data obtained is linear or not. If the data is linear, then it can be continued with the regression technique. The finding concludes that the three variables have a significant value that is less than 0.05 (significant value <0.05). The multiple correlations (R) between the independent variable and the dependent variable have a significant relationship because of $F\text{-count} (18,5) \leq F\text{-table} (37)$. This means that there is a contribution to the relationship between running speed and limb muscle strength with the results of the squat-style long jump. So, schools can take advantage of the results of this research as one of the considerations for providing facilities for long jump activities and providing teaching materials for sports teachers.

Keywords: limb muscle, long jump, running speed, squat style, secondary school

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INTRODUCTION

The long jump has movements that have high complexity, because it contains elements of complex movements starting from the initial stages, rejecting, hovering, and landing. This movement certainly has a very high level of difficulty. So, there is a take-off angle that must be understood by jumpers in making long jumps based on the problem of maximizing flight distance. The takeoff model proposed here includes three parameters: horizontal velocity of the center of mass, takeoff velocity, and takeoff angle (Matić et al., 2012; Tsuboi, 2010). From the results of the practical exams at Senior High School 10 Palembang, it was concluded that the students' long jump scores were not by the learning completeness scores set in sports subjects as expected. Of the 40 students who took the practice exam, it was shown that many students were unable to achieve maximum jump results, which resulted in not achieving the minimum standard criteria for completeness.

From the observations there were still students who were not able to do good running speed and repulsion, 15 students with a percentage of 37.5% were able to do good running speed and repulsion and 25 students with a percentage of 62.5% were not good enough. This problem is caused by the influence of factors such as a lack of understanding of the basic techniques of the long jump movement, not understanding the importance of elements in the long jump movement such as prefix, support/repulsion during takeoff and landing, and lack of speed and explosive power. The researcher found that many students, especially male students, did not maximize their running speed at the start and the students' explosive power was weak at the time of repulsion. This is inversely proportional to female students who are most able to produce maximum jumps.

So, the findings of the problem illustrate that many factors influence the results of the long jump of students. For example, maximal strength measured on the front squat and deadlift appears to be a good predictor of jump performance (Styles et al., 2016; Warneke et al., 2022). Previous studies also found the conclusion that speed, leg explosive power, and balance on long jump ability (Henjilito et al., 2021; Susila, 2022). It can even be said that increasing the touch-down speed of the jumper's supporting leg will increase the distance of the jump (Seyfarth et al., 1999). Thus, educators who teach long jump must be able to distinguish the various developmental levels of children who do long jump and these measurements can be made using inertia (Sgrò et al., 2017). In addition to understanding the concept of knowledge in long jump learning, teachers can also consider other influencing factors such as learning approaches or models, because the success factor of this learning can also be influenced by the presence of the teacher as a facilitator. Many learning models can be used to teach long jump in schools, such as both traditional and modern games that involve technology (Adhie, 2020; Burhanuddin et al., 2022; Defliyanto et al., 2020; Sari, 2019; Sumantri, 2015;

Tiza et al., 2018; Wibowo & Hartati, 2021).

From the findings of the problem and the analysis of several previous studies, it was concluded that many factors influence the success of learning the squat style long jump both from the content and procedure aspects of doing the long jump, student internal factors, and the presence of a teacher. Therefore it is important to know about the basic technical understanding of the long jump and the elements of running speed and explosiveness as well as the understanding of the elements of the squat-style long jump. Although this research has been carried out a lot, this research is not only oriented to the factors of running speed and limb muscle strength on the learning outcomes of the squat style long jump. So, the direction of the research focused on student internal factors, and the test results were taken into consideration in describing the factors that influenced the success of the long jump squat style for class X students. Thus, this research became material for consideration for sports teachers in providing long jump learning.

So, this research aims to determine the impact of running speed and limb muscle strength on the squat-style long jump results of State Senior High School students at Palembang. It is hoped that the results of the research can be used to develop ways of teaching the long jump with various styles and taking into account the different levels of running speed and limb muscle strength of the students. In addition, the results of this study can be used as material for consideration for schools to improve the professionalism of the teaching competence of sports teachers so that schools can provide or organize training related to designing teaching materials. Moreover, the development of science and technology develops very quickly and provides updates on the implementation of education to the needs of the industry or the global era. Thus, teachers must be able to understand how to develop the teaching and learning of sports and health education in schools that can meet students' or global needs.

METHODS

Research Design

This research was a quantitative type of correlational research using the exposed facto method (Creswell & Creswell, 2018; Edmonds & Kennedy, 2020; Johnson & Christensen, 2014). So, this study used a survey which is used as a way of collecting data through tests and measurements. This research was carried out using inferential descriptive research procedures to examine the effect of the independent variables on the dependent variable (Creswell, 2012; Sugiyono, 2016). The independent variable is running speed and limb muscle strength, while the dependent variable is the long jump squat learning result. The research design is as follows.

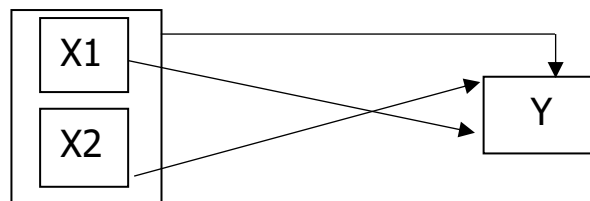


Figure 1. Framework of Study

Place and Time

The research was conducted at Palembang 10 Senior High School in class XI. The research was conducted in the odd semester of the 2022-2023 school year for 5 months from July to November 2022.

Population and Sample

The population in the study was 40 students of class XI at SMA 10 Palembang. In a research process, if the subjects are less than 100 all the better, so the research is a population study (Arikunto, 2010). The sampling technique used random sampling, so in this study, the authors took a sample of 40 students.

Data Measurement Technique

Data was collected using tests, namely 1) the test conducted to measure running speed was a 40-meter sprint. Time is measured from when the flag is raised until the runner crosses the finish line. The recorded result is the time achieved by the runner to cover a distance of 40 meters, in seconds. 2) The test to measure limb muscle power is the standing broad jump test. Testees with feet parallel to shoulder width apart stand behind the starting line. Testi bends the knees and swings the arms forward as far as possible. Chance jumps 3 times. The farthest distance of three jumps in centimeters is the score. If the testicles on landing fall backward, then the score is recorded between the starting line and the body part (closest) that touches the floor. 3) Long jump test. Students jump 3 times using the prefix, to get the result of the jump as far as possible. Furthermore, from the three jumps, the longest jump will be taken. In the implementation, it is carried out individually alternately, and after finishing in the last sequence, the test is carried out from the beginning again. This is so that students can rest and their condition can recover. The following is the test norm;

Table 1. Test norm

| Category | Running speed time | Distance to measure limb muscle power | Distance to measure long jump | Grade score |
|------------|--------------------|---------------------------------------|-------------------------------|-------------|
| Very well | <6.3 second | >250 cm | 450-500 cm | A |
| Good | 6.4-6.9 second | 241-250 cm | 350-449 cm | B |
| Enough | 7.0-7.7 second | 231-240 cm | 250-349 cm | C |
| Not enough | 7.8-8.8 second | 211-220 cm | 150-249 cm | D |
| Once less | >8.9 second | <191 cm | 100-149 cm | E |

Data Analysis

The relationship (X1, Y) and (X2, Y) is a simple linear relationship or correlations, which can be analyzed using the Product Moment Correlation Formula. The Linearity Test is intended to test whether the data obtained is linear or not. If the data is linear, then it can be followed by a regression technique. Testing the hypothesis of limb muscle speed and power with long jump results using multiple regression analysis. The result of normality data is presented in the following table;

Table 2. Normality Data

| Variable | Normality score | Conclusion |
|--|-----------------|------------|
| Running Speed (X ₁) | -0,31 | Normal |
| Limb Muscle Strength (X ₂) | 0,63 | Normal |
| Squat Style Long Jump (Y) | 0,77 | Normal |

RESULT AND DISCUSSION

The results of the test data analysis are presented in the following table;

Table 3. Results of Multiple Regression Analysis

| Variable | F-account | F-table | Conclusion |
|--------------------|-----------|---------|------------|
| Y – X ₁ | 0,045 | 3,26 | linear |
| Y – X ₂ | 0,09 | 2,65 | linear |

If $F_{\text{count}} \leq F_{\text{table}}$, then reject H_0 means that the data has a linear pattern. If $F_{\text{count}} \geq F_{\text{table}}$, then reject H_0 , meaning that the data is not linear. It turns out that $F_{\text{count}} (0.045) \leq F_{\text{table}} (3.26)$, then it can be concluded that the speed resulting from the long jump squat style is linear. While the result of linearity test x_2 with y (limb muscle power with squat style long jump results) is $F_{\text{count}} = 0,09$ and $F_{\text{table}} = 2,65$. If $F_{\text{count}} \leq F_{\text{table}}$, then reject H_0 means that the data has a linear pattern. If arithmetic $\geq F_{\text{table}}$, then reject H_0 means that the data is not linear. It turns out that $F_{\text{count}} (0.09) \leq F_{\text{table}} (2.65)$, so it can be concluded that limb muscle power with long jump squats has a linear pattern. The results of the correlation analysis of the speed variable with the results of the squat style long jump are presented in the inter-correlation matrix as shown in the following:

Table 4. Results of Multiple Regression Analysis

| Variable | X ₁ | X ₂ | Y | r-table (n=40) | |
|----------------|----------------|----------------|------|----------------|--------|
| | | | | 5% | 1% |
| X ₁ | 1 | 0,41 | 0,27 | 0,3044 | 0,2573 |
| X ₂ | 0,14 | 1 | 0,29 | | |
| Y | 0,27 | 0,29 | 1 | | |

The table concludes that there is a significant relationship (at a significance level of 5% with $n = 40$) between speed and limb muscle strength. Based on the calculation results, it can be concluded that H_0 is rejected, which means that there is a significant relationship between speed and leg muscle power with the long jump squat style at a significant level of 5% ($F_{\text{count}} \leq F_{\text{table}}$).

Table 5. Results of Multiple Regression Analysis

| Variable | F-account | F-table | Conclusion |
|--------------------------------------|-----------|---------|-------------|
| X ₁ X ₂ with Y | 18,5 | 37 | Significant |

Table 5 shows an F count of 18.5 and an F table of 37, so there is a significant relationship between speed and limb muscle strength in the results of the squat-style long jump. So it can be concluded that together speed and limb muscle strength can be used as a predictor of the long jump squat style. The data findings show that the ability to run speed has influenced the results of the students' squat-style long jump repulsion. However, the data obtained was $r = 0.14$ or 14%, meaning that the influence that emerged in this study was weak. Other

studies show that athletes run at various speeds and increase as the jump distance and take-off speed increase, the foot angle at touchdown almost does not change, and the take-off angle and take-off duration continue to decrease (Bridgett & Linthorne, 2007; Macdermid et al., 2021). From in-depth observation of when the long jump class was held, it can be understood that this weak influence cannot be avoided and ignored. The teachers still have to pay attention to the speed level of the students. This means that there is a running speed effectiveness index (SEI) that teachers must understand because SEI can be considered as a metric of jumping skills that is normally distributed (Azuma & Matsui, 2019). So, another finding that can be understood from the results of this study is that different physical characteristics of students will of course give different levels of running speed (Azuma et al., 2021). Moreover, each student has a different and unique running technique according to their respective physical strengths, which is a part that must be understood in depth by the teacher so that the assessment of the results of the long jump given is quite fair (Bridgett et al., 2016).

However, the test results of the effect of limb muscle strength on long jump results showed moderate significance because the r value obtained was $r = 0.27$ or 27%. After all, limb muscle strength is used when taking off from the takeoff board. Thus, these findings become material for consideration for sports teachers to provide muscle training that is included in other physical activities (Meriyanto et al., 2016; Putra et al., 2020). Another study has developed the training model which is named the "KRIBO" training model (creative and innovative with the ball) to train the limb power of long jump athletes and junior high school level sprinters and is considered to be quite effective in increasing muscle strength (Ismadraga & Lumintuarso, 2015). However, teachers must also pay attention to the condition of limb length, limb explosive power, and the shape of the soles of the feet so that they can provide proper training for limb muscle strength in long jump learning (Hasbunallah, 2018; Hermawan & Tarsono, 2017). The relationship of movement is one of the characteristics of coordination that is very important and needs to be understood by sports players because the relationship of movement is one of the foundations for being able to master the forms of sports motor skills.

All independent variables of running speed and limb muscle strength together are very significant to determine the long jump squat result. Improving the squat style long jump requires running speed and limb muscle strength. Running speed gives a very high distribution with a correlation of 0.14, while limb muscle strength contributes a correlation of 0.27. Taken together the two independent variables contributed a correlation of 0.29. Based on the data it can be concluded that running speed and limb muscle strength with the long jump squat style are closely related. The results of this study indicate that simultaneously running speed and leg muscle strength are significantly related (Anwar et al., 2020; Aziz & Yudi, 2019; Haryanto et al., 2021).

This can be seen from the results of the squat style long jump as evidenced by the results of the analysis obtained by the value of $F\text{-count } 18.5 \geq F\text{-table } 37$. Double Correlation (R) between the independent variables and the dependent variable has a strong correlation, this can be Judged from the results of the calculation of the size and correlation of the determinants of 1.39, it means that there is a contribution to the relationship between running speed and limb muscle strength with the results of the long jump squat style of students at State Senior High School at Palembang City. The contribution is very strong, the value of r is positive, thus if students have a good level of running speed and limb muscle strength they will contribute to the results of the squat-style long jump. Learning at school in the subject of Physical Education, Sports, and Health for long jump activities, some things must be considered including running speed and limb muscle strength. Students who have good running speed and limb muscle strength generally have good long jump results.

CONCLUSION

The results of the data analysis concluded that there were three findings related to the correlation between variables, including 1) the value of the sample correlation coefficient was 0.14 which indicates a weak correlation level, meaning that the correlation level between variable X_1 and variable Y is weak. 2) The value of the sample correlation coefficient is 0.27 which indicates a moderate level of correlation, meaning that variables X_2 and Y are still moderate. 3) The sample correlation coefficient is 0.29 with a strong correlation level, meaning that there is a strong relationship between variable X_1 and variable X_2 to variable Y . So, there is a relationship between running speed and limb muscle strength with the results of long jump activities in class XI students at one of the public schools in Palembang, South Sumatera and there is a relationship between these three variables with different levels of correlation. The results of this study also have implications for the understanding of sports teachers in schools to pay attention to the factors that influence the success of the squat-style long jump activity. Thus, this study recommends sports teachers, especially at Senior High Schools in Palembang regarding training in running speed and limb muscle strength that must be programmed so that the results of students' squat style long jump activities are better. In addition, teachers can also make running speed training and limb muscle strength training as supporting materials for long jump activities. Schools can take advantage of the results of this research as one of the considerations for providing long jump activity facilities and providing

teaching materials for sports teachers. Meanwhile, future researchers can examine further the relationship between running speed and limb muscle strength with long jump results which are understood through gender differences.

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