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### Contribution of Leg Muscle Power and Height to Jump Results

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#### Abstract

*This study aimed to determine the contribution of leg power and height to the straddle high jump. This research is correlational. This study's population was students of Sports Coaching Education at the Faculty of Sports and Health, Gorontalo State University semester 1 T / 2020-2021, which had a population of 43 students. The research sample is the entire population (total sampling). This study used a vertical jump test for leg muscle power and a Stadiometer for height measurement. The result, this study suggests that leg muscle power with height has a contribution to high jump results.*

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## INTRODUCTION

Athletics is a physical activity consisting of dynamic and harmonious basic movements comprised of walking, running, throwing, and jumping (Jarver, 2014; Sidik, 2014). The term athletics used in Indonesia is taken from the English word 'Athletic,' which means a sport that includes walking, running, jumping, and throwing. Because athletics has various forms of activity, athletics can be used as a coaching tool for every sport. Some even call it the "mother" of all sports or (mother of

sport).

Athletics is a means for physical education to improve biomorphic abilities, for example, strength, endurance, speed, flexibility, coordination, and so on. In schools today, athletics is still an activity that is often given to students. Even in some universities, athletics is one of the basic general subjects (Bahagia, 2012). Meanwhile, for Sports Coaching Education, Faculty of Sports and Health, Gorontalo State University athletics is a compulsory subject.

In athletics, especially in the high jump, it is closely related to leg power and height. Logically, for people who have strong leg power, the resulting jump will be higher or farther. Meanwhile, people who have a proportional size will benefit from reaching a height. Therefore, it is necessary to conduct a study to determine leg power contribution and elevation to the crown and the low of the jump.

High jump aims to raise the center of the body mass as high as possible and try optimally not to touch the bar until it falls. The scots style, the roll style technique (western), the straddle force, and the flop technique are various kinds of high jump styles that high jump athletes often use. However, in general, most of today's high jump athletes use straddle and flop techniques in their execution.

The high jump from the supine (flop) style can often be seen and practiced by international and national athletes. The advantage of this flop is that it maximizes the spine's flexibility, which helps it pass the bar. However, this style requires intensive training to master it in contrast to the rotational style (straddle), which can be mastered with minimal practice.

The high jump technique has several stages that are very influential on the results of the jump, these stages are prefix, support, hovering, and the last is landing. The four stages are a unity that cannot be separated in a high jump. Of course, in these stages, the floating stage is the most critical step in achieving success over the bar without

dropping it.

Researchers, when conducting observations on students of Sports Coaching Education at the Faculty of Sports and Health, Gorontalo State University, found that students who had high leg power and also had a slender height had advantages in passing the bar over students who had low leg power and also has a short size.

Researchers are interested in raising the topic of research on the contribution of leg power and height to the high jump straddle. It is essential to do a study because this research will reference coaches in athletes who are superior in physical condition. Through these advantages, the coach only needs to polish his athletes to develop techniques, tactics, and the mentality that will make it easier for the coach.

Previous research that examined the relationship between leg muscle power and high jump results in male elementary school students showed that leg muscles' explosive power had a relationship with the high jump results of the straddle force (Hartati, 2016). Of course, this study has a weakness. Namely, elementary school students do not have the stability in increasing mass muscle growth with bones, which will have a drastic increase.

Another similar study, namely research on the contribution of leg power and height to the straddle-style high jump achievement of male junior high school students of grade VIII, shows a significant contribution of leg power and size straddle-style high jump achievement (Sampurno, 2015). However, this research also has weaknesses in its study. The disadvantage

is that the junior high school age range from 12-14 years is not the age for peak achievement.

The superiority of research that can be conveyed in this study is that this study uses a sample of a population whose age range is 19 years and over, which is the ideal age physiologically in achieving stable achievement.

## METHOD

This research is a correlational study that aims to determine whether or not there is a relationship between the two or several variables (Ramadan & Juniarti, 2020). The subjects in this study were students of Sports Coaching Education at the Faculty of Sports and Health, Gorontalo State University semester 1 T / 2020-2021, which has 43 students. The research sample was taken from the entire population of Sports Coaching Education students at the Faculty of Sports and Health, Gorontalo State University semester 1

T / A 2020-2021 (total sampling) by implementing strict health protocols.

The instrument in this study for leg power used the vertical jump test, whose assessment was obtained from the jump minus the upright achievement, and in its implementation, it was carried out three times, and the best value was taken. Meanwhile, to record the height using a Stadiometer tool that has been previously measured so that the results are valid.

This study's data analysis technique was obtained from this study, followed by analyzing the data and then drawing conclusions using parametric statistics, which include prerequisite tests (normality test, linearity test) and hypothesis testing using SPSS 22.

## FINDINGS AND DISCUSSION

### Findings

In summary, the data description from the results of this study are as follows:

**Table 1. Statistical Description**

Statistics	Limb Power	Height	High Jump (Straddle)
N	43	43	43
Mean	47,1860	165,8488	139,0698
Median	45,0000	166,0000	140,0000
Mode	45,00	166,00	130,00 <sup>a</sup>
Std. Deviation	10,41349	3,01096	10,81532
Minimum	30,00	153,00	110,00
Maximum	74,00	173,00	165,00

The results of calculating leg power data of Sports Coaching Education students at the

Faculty of Sports and Health, Gorontalo State University semester 1 T / 2020-2021 resulted

in 47.18, median = 45.00, mode = 45.00, and standard deviation = 10.41. The smallest value is 30.00, and the most significant matter is 74.00.

The results of calculating the Sports Coaching Education students' height data at the Faculty of Sports and Health, Gorontalo State University semester 1 T / 2020-2021 resulted in a mean of 165.84, median = 166.0, mode = 166.0, and standard deviation = 3.01. The smallest value is 153.0, and the most significant matter is 173.0.

The results of the calculation of the straddle style high jump results of students of Sports Coaching Education at the Faculty of Sports and Health, Gorontalo State University semester 1 of T / 2020-2021 resulted in a mean

of 139.06, median = 140.0, mode = 130.0, and standard deviation = 10.81. The smallest value is 110.0, and the most significant matter is 165.0.

Data analysis to test hypotheses requires several test requirements that must be met so that the results can be accounted for. The following is a normality test that aims to determine whether the data from each variable is normally distributed or not. To determine whether the distribution is generally distributed, if a distribution is  $p > 0.05$ , the distribution is declared normal, and if  $p < 0.05$ , the distribution is said to be abnormal. The summary of the results of the normality test is as follows:

**Table 2. Summary of Normality Test**

Variabel	<i>p</i>	<i>Sig.</i>	Information
Limb Power	0,578		Normal
Height	0,125	0,05	Normal
High Jump	0,599		Normal

The normality test results suggest that the significance value ( $p$ ) is more significant than 0.05, so the data is usually distributed.

Furthermore, the second requirement is a linearity test aiming to determine whether the relationship between the dependent variable and the independent variable is linear.

The linearity test of the association was carried out through the F test. The relationship between the variables X and Y were declared linear if the value of  $F_{table} > F_{count}$  with  $db = m; N-m-1$  at the 5% significance level. The summary results of the linearity test are as follows:

**Table 3. Summary of Linearity Tests**

Functional Relations	F			Information
	$F_{hitung}$	<i>db</i>	$F_{tabel}$	
X <sub>1</sub> .Y	1,008	21;20	2,14	Linier
X <sub>2</sub> .Y	1,660	10;31	2,15	Linier

The linearity test results suggest that the

value of  $F_{count}$  of all independent variables

with the dependent variable is more minor than Fable. So, the relationship of all independent variables with the dependent variable is stated to be linear.

After conducting the analysis prerequisite test, the latter is a hypothesis test.

**Table 4. Correlation Coefficient between X1 and Y**

Correlation	r <sub>hitung</sub>	r <sub>tabel</sub>	Information
X <sub>1</sub> .Y	0,855	0,254	Signifikan

Based on the above analysis results, the correlation coefficient of leg power on the straddle force high jump result is 0.855, which is positive, which means that the greater the value that affects, the greater the value of the product. The test for the correlation coefficient is carried out by consulting the price of  $r_{x1} = 0.855 > r(0.05)(42) = 0.254$ , which means that there is a significant relationship. This means a

This research uses a multiple regression analysis hypothesis test. The first hypothesis is that there is a relationship between leg power and the straddle force high jump. The results are as follows:

substantial connection between leg power and the straddle-style high jump results of students of Sports Coaching Education, Faculty of Sports and Health, Gorontalo State University semester 1 T / 2020-2021.

The second hypothesis is that there is a relationship between height and the straddle force high jump. The results are as follows:

**Table 5. Correlation Coefficient between X2 and Y**

Correlation	r <sub>hitung</sub>	r <sub>tabel</sub>	Information
X <sub>2</sub> .Y	0,721	0,254	Signifikan

Based on the above analysis results, the correlation coefficient of height to the straddle-style high jump result is 0.721, which is positive, which means that the greater the value that affects, the greater the value of the product. The correlation coefficient test of significance was carried out by consulting the price of  $r_{x1} = 0.721 > r(0.05)(42) = 0.254$ , which means that there is a significant relationship. This means a meaningful relationship between height and straddle-style high jump results for students of Sports

Coaching Education, Faculty of Sports and Health, Gorontalo State University semester 1 T / 2020-2021.

The third hypothesis is that there is a relationship between leg power and height on the straddle force high jump. The results are as follows:

**Table 6. Correlation Coefficient between X1 and X2 against Y**

Correlation	r <sub>hitung</sub>	r <sub>tabel</sub>	Information
X <sub>1</sub> .X <sub>2</sub> .Y	0,926	0,254	Signifikan

Based on the above analysis results, the correlation coefficient of leg power and height on the straddle-style high jump result is 0.926, which is positive, which means that the greater the value that affects, the greater the value of the product. The correlation coefficient test of significance was carried out by consulting the price of  $r_{x1} = 0.926 > r(0.05)(42) = 0.254$ , which means that there is a significant relationship. This means a substantial

connection between leg power and height on the straddle-style high jump results of students of Sports Coaching Education, Faculty of Sports and Health, Gorontalo State University semester 1 T / 2020-2021.

The magnitude of the contribution of leg power and height to the high jump result of the straddle force can be determined using  $R = (r \times 100\%)$ . The results are as follows:

**Table 7. Effective Contribution and Relative Contribution**

Variabel	KE	KR
Limb Power (X <sub>1</sub> )	56,47%	65,82%
Height (X <sub>2</sub> )	29,33%	34,1%
Jumlah	85,8%	100%

The contribution value of leg power and height to the straddle-style high jump results of students of Sports Coaching Education, Faculty of Sports and Health, Gorontalo State University semester 1 T / 2020-2021 based on research results is 85.5%, then the rest is 14, other factors influence 2%. The conclusion is that the hypothesis says there is a significant contribution between leg power and height to the straddle-style high jump results of students of Sports Coaching Education, Faculty of Sports and Health, Gorontalo State University semester 1 T / 2020-2021 can be accepted.

The magnitude of the contribution of leg power to the high jump result of the straddle force is 56.47%, which means that the

hypothesis says there is a significant contribution of leg power to the high jump results of the straddle style high jump students of Sports Coaching Education, Faculty of Sports and Health, Gorontalo State University semester 1 T / 2020-2021 is acceptable.

The contribution of height to the straddle-style high jump result is 29.33%, which means that the hypothesis says there is a significant contribution of size to the straddle-style high jump results of students of Sports Coaching Education, Faculty of Sports and Health, Gorontalo State University semester 1 N / 2020-2021 is acceptable.

## Discussion

Based on the results of the analysis of the research data, it can be seen that there is a relationship between leg power and the straddle-style high jump results for students of Sports Coaching Education, Faculty of Sports and Health, Gorontalo State University semester 1 T / 2020-2021. Leg muscle power concerns the maximum strength and speed of muscle contraction in the fastest possible time (Nazzala, 2016). This is in line with research findings that suggest that leg muscle power can affect a person's jump results (Heldayana et al., 2016). Because in practice, leg muscle power combines speed, strength, and agility (Wanena, 2018; Suharjana, 2013).

Various types of exercises can obtain leg muscle power. Several types of exercises that are proven to increase leg muscle power are quarter squat jump, and knee tuck jump (Adhi et al., 2017), zigzag drill training method and lateral cone hops training (Nur & Hidayah, 2017), plyometric training (Karyono, 2016), resistance training (Mardhika, 2016), jump to box training, depth jump and single-leg depth jump (Pembayun et al., 2018) and many more. Therefore, the trainer needs to understand his foster children's characteristics so that the training given has a positive impact on leg muscle power, so that the straddle force high jump results or other forces will increase.

Based on the results of the analysis of the research data, it can be seen that there is a relationship between height and high-jump straddle force among students of Sports Coaching Education, Faculty of Sports and

Health, Gorontalo State University semester 1 T / 2020-2021. Body height or height is the maximum distance from the vertex to the sole, which means that the height is the human body's size measured from the top (head) of the human to the only (Sudibjo et al., 2011). This is in line with research findings that suggest that height will affect jumping results (Yuliana, 2014). Because someone who can take advantage of height will have the gift of extending the reach from one place to another, it is from the floor, hovering vertically and landing without hitting the jump bar.

Human height is influenced by age; the earlier the age of menarche, the shorter the woman's final size will be, and vice versa (Hidayat et al., 2018). Sex, the difference between men and women (sexual dimorphism), originates due to the presence of growth spurt; in this study, it was around 10 years of age for the female sample, and approximately 2 years later for men, which is by the population- other populations that have been studied (Artaria, 2009). Disease, Osteoporosis is a chronic disease characterized by a reduction in bone mass so that it is porous and breaks easily so that this disease will gradually affect the sufferer's height to become shorter (Sugiarto, 2015). Gene abnormalities, this dysplasia occurs due to mutations in the FGFR3 gene encoding fibroblast growth factor receptor 3, which results in an increased inhibitory effect on bone growth (Shirley & Ain, 2013). Eating habits and eating patterns that meet one's nutrition can increase development, which means change between

height and weight (Sari et al., 2016). Physical activity/sports, with regular exercise, will increase bone mass (Rungkat et al., 2020). Ethnicity/race is more influenced by genetic factors of ethnicity than climate, latitude, and geography. Indonesian people's height in the anthropological classification is moderate (mesosome), Indonesian men are supra medium, and Indonesian women are medium (Indriati, 2001).

Based on the results of the analysis of the research data, it can be seen that there is a relationship between leg power and height on the high-jump straddle force of students of Sports Coaching Education, Faculty of Sports and Health, Gorontalo State University semester 1 T / 2020-2021. This study is in line with previous studies, which stated that leg muscle power contributed 9.24% and height 22.75% to the jump (Rohmat, 2010). This relationship, when analyzed, is a mutually supportive relationship to the achievement of the leap results. The better the two dependent variables, the better the results of the independent variable will be.

Based on the data analysis results, it can be seen that there is a contribution of leg power and height to the high jump straddle style of students of Sports Coaching Education, Sports and Health Faculty, Gorontalo State University semester 1 T / 2020-2021. It is in line with research that states that leg muscle power contributes 62.56%, and height also contributes 8.41% to the jump. This shows a reinforcement of the

findings in this study which also contributed to the long jump results.

## CONCLUSION

This research has several conclusions obtained, including a relationship between leg power and the straddle-style high jump, there is a relationship between height and straddle-style high jump, there is a relationship between leg power and body height on the straddle-style high jump, there is a contribution leg power and size to the straddle-style jump high.

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