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Research Article

Contribution of Hand Muscle Strength and Waist Muscle Strength to Hand Slams of Greco Roman Style Wrestling Athletes in Bengkulu Province in 2024

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Abstract:
This study aims to determine the contribution of hand muscle strength and waist muscle strength to the ability of scientific hand slams. The formulation of the problem in this study is how much is the contribution of hand muscle strength and waist muscle strength together to the ability of hand slams in wrestling? This research was conducted at the Bengkulu Province PPLP wrestling gym. The research method used is quantitative research, the research sample amounted to 12 Bengkulu Province wrestling athletes who were taken with total sampling technique. The contribution of hand muscle strength to the ability of hand slams is 77.44% and the contribution of waist muscle strength to the ability of hand slams is 81%. The data results of $r_{count} = 0.88 > r_{table} = 0.576$ then Ho is rejected and Ha is accepted, meaning that there is a relationship between the contribution of hand muscle strength and waist muscle strength together to the ability of hand slams in wrestling. The contribution of hand muscle strength and waist muscle strength to the ability of hand slams is $K = r^2 \times 100\% = (0.88)^2 \times 100\% = 77.44\%$. So it can be concluded that the positive contribution between hand muscle strength and waist muscle strength to the ability of hand slams is 77.44%.
Keywords: Hand Muscle, Slamming Hand , Waist Muscle

1. INTRODUCTION

In its development, sports have become a necessity for the community to improve and maintain the condition of the body to stay healthy and vibrant in carrying out daily activities and can be relied upon to make the nation proud through achievement. In order to achieve good and maximum achievements, it is necessary to carry out sports coaching which is carried out by holding a sports association. Then a tiered and sustainable competition is held to serve as a measure of the success or failure of sports coaching carried out (Fengyingna et al., 2024). Sports coaching and development has become a shared responsibility starting from the center to the regions through the existing parent organization in order to achieve maximum achievement, including the achievements of Wrestling sports in Bengkulu Province.

Wrestling is a martial art that has its own characteristics, namely facing each other by using all limbs to bring down the opponent by pulling, pushing, slamming, tripping and locking with the aim of the position of the two shoulders of the opponent sticking to the mat, so that there is a touce (absolute victory). Touche to declare that a wrestler is declared defeated by a fall technique. The sport of wrestling is known for two competing styles, namely the Greek Roman style and free style (Bajkowski & Cynarski, 2024).

Based on Wrestling style, the styles competed in every wrestling championship are freestyle and gryco roman. Freestyle wrestling is a wrestling game in which wrestlers are allowed to attack both legs of the opponent, namely tackling, pulling the legs according to the specified rules and can use both legs and the whole body, while gryco roman style wrestling is a wrestling game that prohibits wrestlers from attacking the lower part of the body such as under the pelvis, thighs and legs, the similarities are the techniques of interceptions, slams, rolls and locks (Shadgan et al., 2024).

Since before World War II, Indonesia has known international wrestling, this wrestling was brought by the Dutch army. In 1941-1945 when Indonesia was occupied by the Japanese army, Japanese martial arts such as Judo, Sumo and kempo also entered Indonesia, so wrestling gradually disappeared. On February 7, 1960, an Indonesian amateur wrestling organization was established under the name of the

Indonesian Wrestling Association (PGSI). Wrestling is the oldest martial sport in the world and has become a health and performance sport and has been competed since the ancient Olympics until now. The first wrestling National Championship in 1961 was competed in Bandung and following PON to V in the same year Wrestling has also been competed.

Strength is one component of physical condition that requires separate attention and priority. In addition, strength is very important to improve overall physical condition and plays an important role in sports activities. Muscle strength is a component of physical condition that can improve the overall physique (Jiménez-Morcillo et al., 2024). One factor that is very supportive in improving sports performance is the strength factor. An overview of the notion of strength in general as an effort to make it easier to interpret what is meant by arm muscle strength is "the ability of muscles to generate stress against a voltage" (Junior et al., 2024).

The strength of the waist muscles serves to support the opponent's body when it will be lifted and will be slammed (Irawan et al., 2024). Hand muscle strength serves to pull and push the opponent to de-stabilize the defense. Then together the strength of the hand muscles and the strength of the leg muscles pull and lift the opponent. The grip of the fingers serves to keep the opponent in control by hooking both hands when controlling the opponent. A less powerful hand grip will result in the wrestler losing the opponent (due to resistance) during the attack (Milošević et al., 2024).

Based on the facts through interviews with PPLP Bengkulu wrestling coaches said that; "The tendency to fail a hand slam is due to the weakness of the hand muscles to react quickly and strongly, and also the lack of support from the waist and leg muscles to produce a slam. To be able to do a slam that needs to be done is to train the hand muscles, waist muscles and also leg muscles so that they can perform slam techniques supported by physical exercise that leads to these muscles ".

Based on the explanation above, the researcher is interested in conducting research on muscle strength, especially hand muscle strength and waist muscle strength so that the coach provides a more specific form of training for the success of the hand slam technique supported by the athlete's own physical condition.

2. MATERIAL AND METHOD

The type of research used in this study is quantitative research. The research design uses a correlational design (correlation). The methods used are determining the object of research, data collection methods, data processing methods and data analysis. This research was conducted at the Bengkulu City PPLP wrestling gym on Jalan Bumi Ayu Sukarami and was carried out in a period of approximately 1 month, which began on January 9, 2024 to February 8, 2024. The research population was Bengkulu Province wrestling athletes.

The variables used in this study are independent variables and dependent variables. The independent variables in this study are hand muscle strength and waist muscle strength, while the dependent variable is the ability to slam hands in wrestling. Data collection techniques in the form of tests that researchers observe directly in the implementation of tests and measurements in the field. The tests carried out were push ups, back and leg dynamometer movements, and hand slamming abilities.

The research instruments needed are:

1. Measurement of Hand Muscle Strength

To measure the strength of the hand muscles, the test items are used to lift the body with straight limb techniques (push ups) and lift the body with bent limb/knee techniques (knee push ups) (Barbosa et al., 2024). The reliability of the modified push ups was reported to be 0.86 and the validity coefficient was 0.91.

2. Measurement of Waist Muscle Strength

The instrument used to measure waist muscle strength is a back and leg dynamometer (Wang et al., 2024). The test was carried out with two attempts and the highest value was taken. With reliability for modified waist muscle strength, it is reported that the coefficient of reliability is 0.97 and the coefficient of validity is 0.97.

3. Measurement of Hand Slam Ability

The hand slam ability test is a movement or catch made in a standing position that causes the opponent to lose contact with the mat and describe a large circular line in the air and then immediately dropped to the mat in a danger position or back facing the mat (Tong & Wang, 2024).

4. RESULT AND DISCUSSION

4.1 Result

1. Description Data

a. Hand Muscle Strength Results

To achieve the research objectives entitled the contribution of hand muscle strength and waist muscle strength to the hand slam of Bengkulu Province roman greco-style wrestling athletes, the researchers conducted data collection. The data obtained is the result of the hand muscle strength test (push up).

Table 1. Frequency Distribution of Hand Muscle Strength Results

No	Category	Male	Female	Percentage
1	Very good	3	0	25%
2	Good	3	0	25%
3	Medium	4	2	50%
4	Less	0	0	0%
5	Very less	0	0	0%
	Total	10	2	100%

Based on table 1 of the frequency distribution above of 12 Bengkulu Province wrestling athletes studied, 3 athletes have hand muscle strength with a value range of > 70 with a very good category, 3 athletes have hand muscle strength results in the good value range 54-69, 6 athletes have hand muscle strength with a value range of 35-53 with a moderate category, If presented in the form of a bar diagram is as follows:

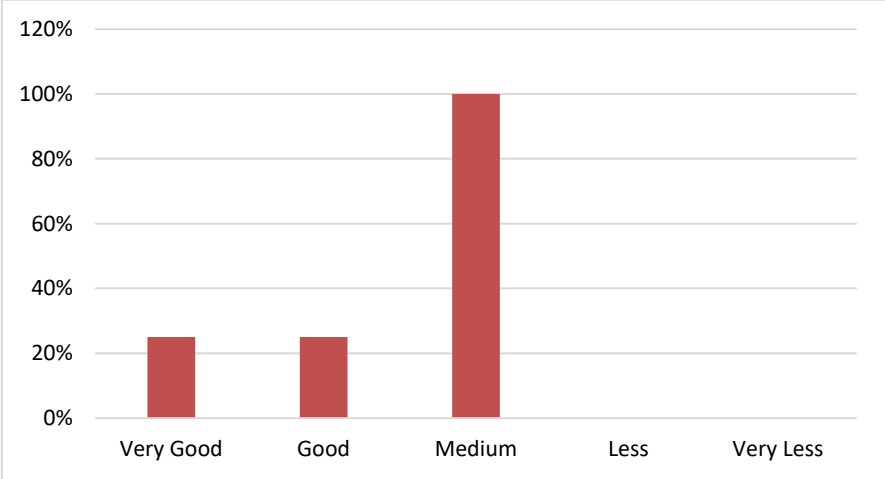

Figure 1. Frequency Distribution of Hand Muscle Strength

Based on Figure 1, it can be seen that the hand muscle strength test is in the "excellent" category by 25%, in the "good" category by 25%, in the "moderate" category by 50%.

Table 2. Hand Muscle Strength Results

Source of Variation	Experiment Group
Sample	12
Mean value	55.50
Standard deviation	14.19
Highest value	72
Lowest value	36

Based on table 2 after doing the test with a sample of 12 athletes, the following results were obtained: Average value = 55.50, standard deviation = 13.19, highest value 72, and lowest value 36.

b. Waist Muscle Strength Results

To achieve the research objectives entitled the contribution of hand muscle strength and waist muscle strength to the hand slams of Bengkulu Province roman greco-style wrestling athletes, the researchers conducted data collection. The data obtained is the result of the waist muscle strength test (back and leg dynamometer).

Table 3. Frequency Distribution of Waist Muscle Strength Results

No	Category	Male	Female	Percentage
1	Very good	0	0	0%
2	Good	4	0	33.33%
3	Medium	4	0	33.33%
4	Less	2	2	33.33%
5	Very less	0	0	0%
	Total	10	2	100%

Based on table 3 frequency distribution above of 12 Bengkulu Province wrestling athletes studied 4 athletes have waist muscle strength results in the good value range 187.5-259, 4 athletes have waist muscle strength with a value range of 127.5-187 in the moderate category, 4 athletes have waist muscle strength with a value range of 84.5-127 in the deficient category. When presented in the form of a bar chart is as follows:

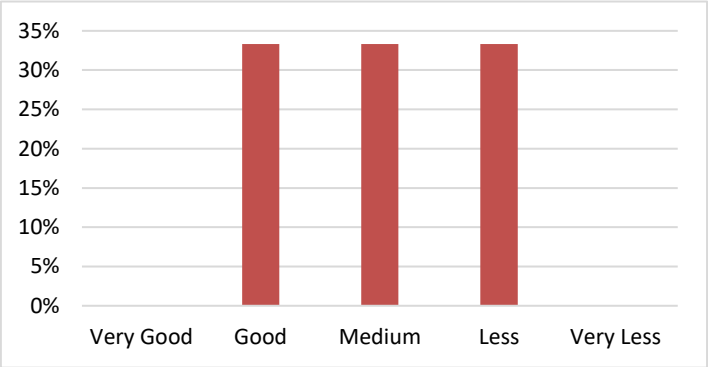

Figure 2. Frequency Distribution of Waist Muscle Strength

Based on Figure 2, it can be seen that the waist muscle strength test is in the "good" category of 33.34%, in the "moderate" category of 33.33%, in the "less" category of 33.33%.

Table 4. Waist Muscle Strength Results

Source of Variation	Experiment Group
Sample	12
Mean value	149.42
Standard deviation	34.89
Highest value	190
Lowest value	95

Based on table 4 after doing the test with a sample of 12 athletes, the following results were obtained: obtained average value = 149.42, standard deviation = 34.89, highest value 190, and lowest value 95.

c. Results of Hand Slams

To achieve the research objectives entitled the contribution of hand muscle strength and waist muscle strength to the hand slams of Bengkulu Province roman greco-style wrestling athletes, the researchers conducted data collection. The data obtained is the result of the hand slam test.

Table 5. Frequency Distribution of Hand Slam Results

No	Category	Male	Female	Percentage
1	Very good	10	2	100%
2	Good	0	0	0%
3	Medium	0	0	0%
4	Less	0	0	0%
5	Very less	0	0	0%
	Total	10	2	100%

Based on table 5 frequency distribution above of 12 Bengkulu Province wrestling athletes studied, 10 male athletes got the results of hand slams with a value range> 12 with a very good category, 2 female athletes got the results of hand slams having very good value results,> 9. If presented in the form of a bar diagram is as follows:

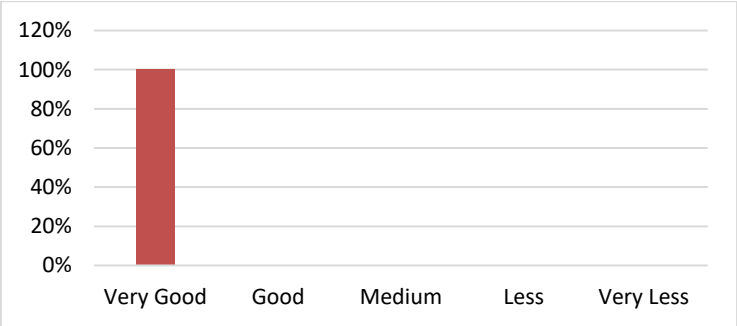

Figure 3. Frequency distribution of hand slams

Based on Figure 3, it can be seen that the hand slam test is in the "excellent" category of 100%.

2. Analysis Prerequisite Test

a. Normality Calculation

Normality calculations aim to determine whether samples from normally distributed populations. Calculation of the normality test using the Liliefors formula. The results obtained are:

Table 6. Normality Test

N	Hand Muscle Test		Waist Muscle Test		Hand Slam Test		Description
	L_o	L_{table}	L_o	L_{table}	L_o	L_{table}	
30	0.181	0.242	0.147	0.242	0.153	0.242	Normal Distribution

From table 6 above, it is known $L_o < L_{table}$. This means that the data taken from one experimental group under study has a Normal distribution.

b. Homogeneity Test

Table 7. Homogeneity Test

No	Variable	Standard Deviation (S)	Variance (S^2)
1	Hand Muscle Strength (X1)	14.49	0.818
2	Waist Muscle Strength (X2)	34.89	0.72
3	Hand Slam Ability (Y)	2.37	1.67

From table 7 above, it can be seen that the calculation result of the variance (X1) is 0.818 while the variance (X2) is 0.72 and the variance (Y) is 1.67.

Calculation Formula:

$$F_{count} = \frac{Largest\ variance}{Smallest\ variance}$$

$$= \frac{1.67}{0.72} = 2.31$$

From the calculations that have been carried out, the value of f_{count} = 2.31 while f_{table} at a significant level α = 0.05 is 2.82. $f_{count} < f_{table}$, namely 2.31 < 2.82 this means that there is no difference from each variable or the variance is homogeneous. Based on the results of the prerequisite test analysis above, it can determine the correlation results and the contribution of hand muscle strength and waist muscle strength to hand slams.

c. Correlation test

- Correlation of Hand Muscle Strength to Hand Slam

Based on data analysis obtained r_{count} = 0.88. So that the correlation of hand muscle strength to hand slams is r_{count} = 0.88 showing the interpretation of the correlation coefficient (very strong).

- Correlation of Waist Muscle Strength to Hand Slams

Based on data analysis obtained r_{count} = 0.90. So that the correlation of waist muscle strength to hand slams is the value of r_{count} = 0.90 hows the interpretation of the correlation coefficient (very strong).

- Correlation of Hand Muscle Strength and Waist Muscle Strength to Hand Slams

Based on data analysis obtained r_{count} = 0.88. So the correlation of hand muscle strength and waist muscle strength to hand slams r_{count} = 0.88 hows the interpretation of the correlation coefficient (very strong).

d. Contribution Test

- Contribution of Hand Muscle Strength to Hand Slam

To determine the quality of regression significance between variables, the "t" test was conducted. From the calculation, the value of t_{count} = 5.91 with n = 12 while t_{tabel} at a significant level α = 0.05 obtained 1.796. It can be concluded t_{count} = 5.91 > t_{table} = 1.796 that the correlation between waist muscle strength and hand slam ability is significant. The contribution of hand muscle strength to the ability of hand slams is K = r² x 100% = (0.88)² x 100% = 77.44%. So, it can be concluded that the contribution of hand muscle strength to the ability of hand slams is 77.44%.

- Contribution of Waist Muscle Strength to Hand Slam

To determine the quality of regression significance between variables, the "t" test was conducted. From the calculation, the value of t_{count} = 6.61 with n = 12 while t_{tabel} at a significant level α = 0.05 is obtained 1.796. It can be concluded t_{count} = 6.61 > t_{table} = 1.796 that the correlation between hand muscle strength and hand slam ability is significant. The contribution of waist muscle strength to the ability of hand slams is K = r² x 100% = (0.90)² x 100% = 81%. So, it can be concluded that the contribution of waist muscle strength to the ability of hand slams is 81%.

- Contribution of Hand Muscle Strength and Waist Muscle Strength to Hand Slams

To determine the quality of regression significance between variables, the "t" test was conducted. From the calculation, the value of t_{count} = 5.91 with n = 12 while t_{table} at a significant levelα = 0.05 diperoleh 1.796. It can be concluded t_{count} = 5.91 > t_{table}= 1.796 b that the correlation between hand muscle strength and hand slam ability is significant.

Based on the calculation of the data it turns out that r_{count} = 0.88 > r_{table} = 0.576 then Ho is rejected and Ha is accepted, meaning that there is a significant relationship between X1 and X2 together with Y. The contribution of hand muscle strength and waist muscle strength to the ability of hand slams is K = r² x 100% = (0.88)² x 100% = 77.44%. So, it can be concluded that the contribution of hand muscle strength and waist muscle strength to the ability of hand slams is 77.44%.

4.2 Discussion

1. Contribution of Hand Muscle Strength to Hand Slams

Based on the results of the analysis presented and from the results of testing the first hypothesis, it is accepted that there is a significant relationship between hand muscle strength and hand slamming ability in wrestling.

The stronger the hand muscles, the better the slamming ability. In performing good slamming techniques, adequate physical condition elements are needed. With good conditions athletes can mobilize all the technical abilities that athletes have well. One of the physical components needed is strength. Without the support of arm muscle strength it is impossible for a wrestler player to get very good hand slam results (Awad et al., 2024).

2. Contribution of Waist Muscle Strength to Hand Slams

Based on the results of the analysis and the results of testing the second hypothesis, it is true that there is a significant relationship between waist muscle strength and the ability to slam hands in wrestling. The stronger the waist muscles, the better the ability to slam his hands. The strength of the waist muscles serves to support the opponent's body when it will be lifted and will be slammed. The grip of the fingers serves to keep the opponent in control by hooking both hands when controlling the opponent. A less powerful hand grip will result in the wrestler losing the opponent (due to resistance) during the attack (Figueroa et al., 2024).

3. Contribution of Hand Muscle Strength and Waist Muscle Strength to Hand Slams

The third hypothesis proposed is accepted, namely that there is a significant relationship between hand muscle strength and waist muscle strength on hand slamming ability and it can be concluded that the stronger the hand muscles and the stronger the waist muscles, the better the hand slamming ability achieved. The hand slam technique is that the wrestlers face each other in a standing position, the wrestler rotates in front of the opponent when the

wrestler controls the opponent, the wrestler's knees are bent and the right shoulder is under the opponent and prepares to take force to drop the opponent and onto the mat (Lougiakis et al., 2024).

The hand slam technique or grand amplitude slam is a movement or catch made in a standing position that causes the opponent to lose contact with the mat and describe a large circular line in the air and then immediately dropped to the mat in a danger position or back facing the mat (Zhang et al., 2024). The failure of a wrestler to perform a hand slam technique is caused by several factors, including: poor technique, concentration, tactics and physical condition (Shahabikaseb et al., 2020).

5. CONCLUSION

From the results of research, data processing and analysis, it can be concluded that based on the results of research conducted at the Bengkulu Province PPLP Wrestling Gym, it can be concluded that the contribution of hand muscle strength to hand slams is 77.44%, the contribution of waist muscle strength to hand slams is 81% and the contribution of hand muscle strength and waist muscle strength to the ability to slam hands in wrestling is 77.44%.

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