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The Relationship Between Wrist Flexion And Leg Muscle Explosive Power Against Volleyball Smash Ability

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Abstract

This study aims to determine the relationship between wrist flexion and leg muscle explosive power on the volleyball smash ability of athletes at the Kusuma Bhirawa Ponorogo club. Smash ability is the most important technique in scoring points in volleyball, and in the Kusuma Bhirawa club there are still some athletes who can be said to be still lacking in smash ability, especially in the accuracy of the smash, in that case it can be influenced by factors that can support the athlete's smash ability. Therefore, the authors conducted this study which aimed to find out whether there is a relationship between wrist flexion and leg muscle explosive power on athletes' smash ability. The sample in this study used 15 athletes taken using the *Purposive Sampling method.* This study uses a type of correlation research, and data collection techniques in this study are carried out using test measurement instruments, including: 1. Vertical jump test, 2. Geniometer test, and 3. Smash Accuracy Test.

Keywords: Wrist Flexion; Limb Muscle Explosive Power; Smash Ability

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A. Introduction

Sport is a means for individuals and groups that can actualize themselves with the aim of awakening their self-confidence and national pride. In general, people understand sports is one of the physical activities carried out by people, a group of people with the aim of creating physical fitness. Various types of sports that a person can do such as walking, jogging, running, basketball, volleyball, badminton, and so on. One of the sports branches that is very popular among the public today is volleyball, because this sport can be done by all groups, both men and women (Keswando and Septi Sistiasih 2022).

Elijah 2020 in (Jariono et al. 2021) argues that volleyball is one of the big ball sports played by two teams on one court separated by a net opposite each other totaling six people. Each squad is also allowed to have reserve players. There are also variations of beach volleyball games where each group has only two players. Volleyball has a variety of basic techniques in the game, the basic techniques in the volleyball game consist of serve, passing, blocking, and smash (Sistiasih and Pratama 2021). In volleyball itself, there are several parent organizations, namely *FIVB (Federation International Volley Ball*), which is the body in charge of volleyball globally/internationally throughout the world, while the parent of volleyball in Asia is *AVC (Asian Volleyball Confederation),* in Indonesia itself the umbrella body is PBVSI (Indonesian Volleyball Association) according to (Nurseto 2021).

Volleyball club is a forum for an organized gathering of athletes with the aim of forming and improving achievements in the field of volleyball. Volleyball is also a sport that has been widespread in Indonesia, one of which is Ponorogo regency. This club often donates its athletes in various competitions or championships representing Ponorogo Regency. In Ponorogo there are also many volleyball clubs including Kusuma Birawa. Kusuma Birawa Club in Ponorogo is a club that can build cooperation and communication so that it is thick with social nuances. Kusuma Bhirawa Club also opens coaching for early age volleyball athletes where all coaches or coaches are nationally licensed. Kusuma Bhirawa Club holds regular training by dividing the Exercise group from beginner or junior to senior. Kusuma club training Bhirawa 3x in 1 week, namely every Monday, Wednesday and Friday every 14.30 – 17.00 WIB for the first session, while the second session is carried out every 20.00 – 22.00 WIB. Each exercise is divided into 2 sessions, namely the junior category – Senior Boys and Junior – Senior Women. In each exercise accompanied by a coach or coach who will guide and direct them so that the training can be maximized.

In this study, researchers saw that volleyball matches not only prioritize technique and tactics, but from a physical point of view also greatly affect the victory of their team. According to Subekti 2017 in (Herdion, Ozone, and Sistiasih 2023) In essence, every physical activity that humans always do also requires excellent physical fitness. However, the demands of physical fitness are different. From the difference it can be influenced from the type of activity, the activity carried out by humans. Volleyball also requires excellent physical condition, in the sense that when playing volleyball apart from technique, good physique is also needed, where wrist flexibility plays an important role in the game of volleyball (Endrawan, Indarta, and Martinus 2022).

According to (Pratama and Sistiasih 2021) In addition to the technical skills that players must have, one of the abilities that cannot be separated in volleyball games is *vertical* jump or high jump up also to support the game to get points through smash and block attacks. In supporting good smash mastery, wrist flexibility is needed to make the smash on target and hard and the explosive power of the leg muscles to support high jumps when smashing. Flexibility is one of the components of physical freshness, is the ability to move the body or its parts as widely as possible without joint tension and muscle injury (Endrawan, Indarta, and Martinus 2022). While explosive power is the ability of a muscle or group of muscles of a person to use maximum force deployed in the shortest or shortest time. Explosive power is a collection of physical activities that arise from within and outside an athlete to make punches and jumps in accordance with the targets set by the athlete in the match to the maximum (Subekti et al. 2021).

A person's ability to perform a good *vertical jump* is greatly influenced by the strength of the leg muscles and the explosive power of the leg muscles. Vertical jump increase factors are needed several components that support in determining the height of the jump, there are several components that can be achieved by a player, including *power, strength, speed, agility, fleksibilitas* and *proposeptive* (Setiyono 2019). One exercise technique that can increase explosive power in leg muscles and jump height is the provision of *plyometric* exercises (jumping on blocks).

This research is a type of correlation research that aims to find out hubungan wrist flexion and limb muscle explosive power against volleyball smash ability. To determine the flexibility of the wrist using goniometer measurements. Meanwhile, to

determine the explosive power ability of the leg muscles used vertical jump *test*. And the last is the *smash ability* test, this test is used *as a precision* test *where researchers divide 1 field into sections, and each section has a predetermined score.*

Based on the results of surveys and observations on the field as well as explanations from club coach Kusuma Bhirawa, researchers are interested in conducting research at the club with the title "The Relationship of Wrist Flex and Leg Muscle Explosive Power to Volleyball Smash Ability in Kusuma Bhirawa Ponorogo Club Athletes". Researchers took the problem because the Kusuma Bhirawa club had never been conducted research related to this and also researchers wanted to know the relationship between wrist flexion and leg muscle explosive power on the ability to smash volleyball which later is also expected to be useful for future researchers.

B. Methods

This study is a type of correlation research that aims to determine the relationship between wrist flexion and leg muscle explosive power on smash ability. Where the independent variable is the relationship between wrist flexion and leg muscle explosive power. The dependent variable is the ability to smash. This research was conducted on Jl. Mangga, Krajan, Keniten, Ponorogo District, Ponorogo District, East Java in the field of the Kusuma Birawa club training ground. On August 29, 2023, the population in this study is athletes at the Kusuma Bhirawa club in Ponorogo Regency which consists of 30 athletes, using the Purposive Sampling technique, which is a sampling technique with special considerations and selected who have the best ability. While the research sample was 15 athletes at the Kusuma Bhirawa club in Ponorogo Regency.

This study used Purposive Sampling technique because this study only took 15 samples from 30 Kusuma Bhirawa club populations in Ponorogo Regency which are the core players recommended by coaches who are active in participating in training. In accordance with the type of research, researchers use methods in obtaining data through interviews conducted before making proposals and during the implementation of research. The interview was conducted with the club's Volleyball coach Kusuma Birawa Ponorogo. Further tests and measurements, In this study, The researcher tested the variable (X1) is the flexibility of the wrist, (X2) the explosive power of the leg muscles and the variable (Y) is the result of the ability to smash.

While for this research data analysis technique is carried out with Correlation

which is used to calculate the correlation of X1 (Wrist Flex) to Y (Smash Results) the test used is to use the Goniometer test tool which aims to measure wrist flexibility. Record the number shown which is the score or area of motion of the wrist in one direction of motion (Muttakin, 2012: 38), then to calculate the correlation of the variable X2 (explosive power of leg muscles to) Y (Smash Results) To collect explosive power data of leg muscles using a vertical jump test board which aims to measure leg muscles in jumping in a vertical direction (Anam et al. 2015). Thus, to prove the relationship between variables, this study uses data normality tests and hypothesis tests.

C. Result and Discussion

Result

In The population used in the study were athletes from the Kusuma Bhirawa club located in Ponorogo Regency. The sample taken was 15 athletes from a total of 30 athlete populations in the club Kusuma Bhirawa located in Ponorogo Regency. In this study using purposive sampling, the sample taken is a sample that has certain criteria. The data that has been collected is then processed using SPSS software with several stages of data analysis, including the following:

The respondents in this study were athletes at the Kusuma Bhirawa club in Ponorogo Regency. Using 15 athletes as a sample of a total of 30 athlete populations in the Kusuma Bhirawa club, Ponorogo Regency. In this study the division is based on the characteristics of respondents. The characteristics in this study are seen from height and weight.

Table 1. Height Characteristics

No	Height	Number Of Respondents	Presented
1	150-155 cm	1	6,7
2	156-160 cm	0	0
3	161-165 cm	1	6,7
4	166-170 cm	2	13,3
5	171-175 cm	5	33,3
6	176-180 cm	4	26,7
7	181-185 cm	1	6,7
8	186-190 cm	1	6,7
Total		**15**	**100%**

Source: Primary data processed, 2023

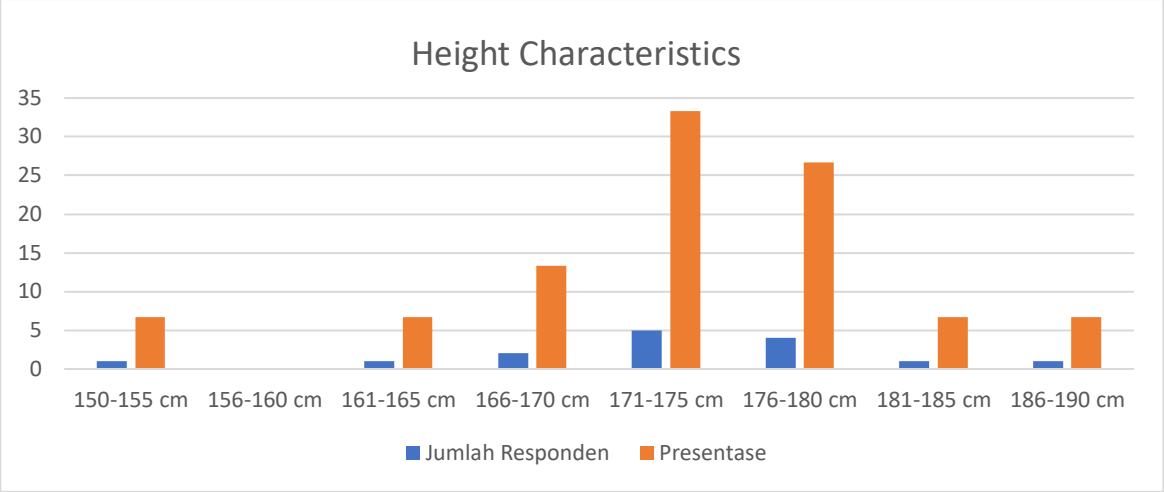

Figure 1. Height Characteristics

Based on the height table above, 6.7% of respondents with a height of 150-155 cm are 1 athlete. 6.7% of respondents with a height of 161-165 cm totaled 1 athlete. 13.3% of respondents with a height of 166-170 cm totaled 2 athletes. 33.3% of respondents with a height of 171-175 cm totaled 5 athletes. 26.7% of respondents with a height of 176-180 cm totaled 4 athletes. 6.7% of respondents with a height of 181-185 cm amounted to 1 athlete. 6.7% of respondents with a height of 186-190 cm amounted to 1 athlete. Based on the table of respondent characteristics based on height above, it can be explained that the number of respondents in this study was 15 athletes.

Table 2. Weight Loss Characteristics

No	Weight	Number Of Respondents	Presented
1	50-55 kg	1	6,7
2	56-60 kg	3	20
3	61-65 kg	3	20
4	66-70 kg	3	20
5	71-75 kg	4	26,7
6	76-80 kg	0	0
7	81-85 kg	0	0
8	86-90 kg	1	6,7
TOTAL		15	100%

Source: Primary data processed, 2023

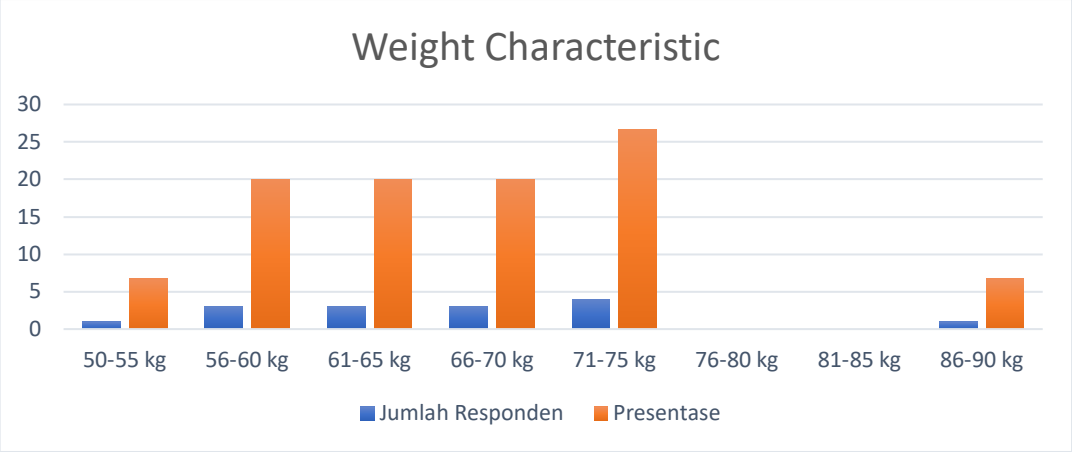

Figure 1. Weight Characteristics

Based on the weight table above, 6.7% of respondents weighing 50-55 kg as many as 1 athlete. 20% of respondents weighing 56-60 kg totaled 3 athletes. 20% of respondents weighing 61-65 kg totaled 3 athletes. 20% of respondents weighing 66-70 kg totaled 3 athletes. 26.7% of respondents weighing 71-75 kg totaled 4 athletes. 6.7% of respondents weighing 86-90 kg amounted to 1 athlete. Based on the table of respondent characteristics based on body weight above, it can be explained that the number of respondents in this study was 15 athletes.

From the results of the analysis that has been done, it can be described in the form of a table as follows:

Table 3. Descriptive Statistics

No	Variable	N	Max	Min	Mean
1.	Wrist Flexibility	15	92	80	83,87
2.	Limb Muscle Explosiveness	15	69	47	58,20
3.	Volleyball Smash Ability	15	15	7	10,53

Source: Primary data processed, 2023

Based on the table data above, each variable in this study can be described, the first is wrist flexion (X1) which has a max value of 92, a min value of 80 and a mean of 83.87. Limb muscle explosive power (X2) with a max value of 69, min value of 47 and mean of 58.20. And finally there is the ability to smash volleyball (Y) with a max value of 15, a min value of 7 and a mean of 10.53.

Normality test is a test conducted with the aim of assessing the distribution of data in a group of data or variables, whether the distribution of data is normally distributed or not. For normality test results from this study can be seen in the following table:

Table 4. Normality Test Results

NO	Variable	N	Std. Deviation	Sig	Description
1.	Wrist Flexibility	15	3,420	0,109	Normal
2.	Limb Muscle Explosiveness	15	7.702	0,070	Normal
3.	Volleyball Smash Ability	15	2,066	0,200	Normal

Source: Primary data processed, 2023

From the results of the normality test above, it can be concluded that the variables in this study are distributed normally, both independent variables and dependent variables. This is indicated by the significance value of each variable greater than 0.05, it can be interpreted that the data tends to follow a normal distribution. Thus the data from these variables can be considered to satisfy the normal distribution required for further analysis.

Hypothesis testing is testing a statement using statistical methods so that the test results can be declared statistically significant. In this study, the hypothesis test used was the t test and F test.

In this hypothesis test using the F test to determine whether the independent variable, namely wrist flexibility and leg muscle explosive power, has a simultaneous influence on the dependent variable, namely the ability to smash volleyball. This F Test Method uses the help of the SPSS application which is explained as follows:

Table 5. F Test Results

	Sum of Square	df	Mean Square	F	Sig.
Regression	2.463	2	1.232	14.258	0.038b
Residual	57.270	12	4.773		
Total	59.733	14			

Source: Primary data processed, 2023

Based on the table above, it can be shown that Fcalculate is 14.258, while Ftable is 3.982 and the significant value obtained is 0.038. This means that Fcalculate > Ftable (14.258 > 3.982) and the significant value is smaller than the α value of 0.05, significant < α (0.038 < 0.05). So (H1), accepted and (H0) rejected, meaning that the variables wrist flex and leg muscle explosive power have a simultaneous positive effect on the volleyball smash ability variable.

This t test is used to measure the level of partial significant influence between variables X1 and X2 on variable Y. To test the hypothesis is done by comparing the calculated value with the ttable value. If tcount is greater than t of the table, this means that there is good reason to accept hypothesis one (H1) and reject hypothesis zero (H0), and vice versa. In addition, it can

also be by using a significance test. If the significance value is less than 0.05 alpha, then this means that there is good reason to accept hypothesis one (H1) and reject hypothesis zero (H0), and vice versa. By entering the formula df = n – k = 15 – 3 = 12. So that the ttable 1.78229 is obtained and the calculated value obtained from the results of SPSS management is presented in the table below:

Table 6. Test Results t

	Unstandarized Coefficients		Standarized Coefficients		
	B	**Std. Error**	**Beta**	**t**	**Sig.**
(Constant)	19.793	14.409		1.374	0.195
Kelentukan Pergelangan Tangan	0.256	0.174	0.248	2.514	0.017
Daya Ledak Otot Tungkai	0.373	0.077	0.368	3.386	0.010

Source: Primary data processed, 2023

Based on the table above, it can be explained the hypothesis test partially or individually as follows:

1. Variable Wrist Flex (X1)

Based on the results of the H1 test line analysis shown in the table above, it states that the value of the standardized beta coefficient of wrist flexion (X1) in this regression is 0.248, meaning that religiosity has an effect of 24.8% on the ability to smash volleyball (Y). The value of standardized coefficients beta (S.S beta), is the value of path or path. While the value of the regression coefficient (β) of the religiosity variable was 0.256 that the wrist flexion variable affected the ability to smash volleyball by 25.6%. While the value (t-test is 2.514 > 1.78229 ttable) and value (significance 0.017 < 0.05). The value of the regression coefficient (β) and the t-test uses a α level of significance of 0.05. Maka H1 diterima H0 ditolak, sehingga dapat disimpulkan bahwa hasil variabel Wrist flexion positively and significantly affects the variable ability of volleyball smashes.

1. Variable Limb Muscle Explosive Power (X2)

Based on the results of the H1 test line analysis shown in the table above, it states that the value of the standardized beta coefficient of leg muscle explosive power (X2) in this regression is 0.364, meaning that the explosive power of the leg muscles has an effect of 36.4% on the ability to smash volleyball (Y). The value of standardized coefficients beta (S.S beta), is the value of path or path. While the value of the regression coefficient (β) of the limb muscle explosive power variable is 0.373 that the limb muscle explosive power variable affects the volleyball smash ability by 37.3%. While the value (t-test is 3.386 >

1.78229 ttable) and value (significance 0.010 < 0.05). The value of the regression coefficient (β) and t-test uses a α significance level of 0.05. So H1 is accepted H0 is rejected, so it can be concluded that the results of the limb muscle explosive power variable positively and significantly affect the volleyball smash ability variable.

Discussion

The effect of wrist flexion on volleyball smash ability

The variable wrist flexion affects the ability to smash volleyball, this is due to the value (t-test of 2.514 > 1.78229 t table) and value (significant 0.017 < 0.05). The value of the regression coefficient (β) and t-test used a significant α level of 0.05. So H1 is accepted H0 is rejected, so it can be concluded that the results of the wrist flexion variable positively and significantly affect the volleyball smash ability variable.

The variable explosive power of leg muscles affects the ability to smash volleyball, this is due to the value (t-test of 3.386 > 1.78229 t table) and value (significant 0.010 < 0.05). The value of the regression coefficient (β) and t-test used a significant α level of 0.05. So H1 is accepted H0 is rejected, so it can be concluded that the results of the limb muscle explosive power variable positively and significantly affect the volleyball smash ability variable.

The effect of wrist flexion and leg muscle explosive power on volleyball smash ability

The variable flexion of the wrist and explosive power of the leg muscles on the ability to smash volleyball, this is due to the F calculate of 14,258, while F table is 3.982 and the significant value obtained is 0.038. This means Fcalculate > Ftable (14.258 > 3.982) and significantly more values kecil From the α value of 0.05, significant < α (0.038 < 0.05). So (H1), accepted and (H0) rejected, meaning that the variables wrist flex and leg muscle explosive power have a simultaneous positive effect on the volleyball smash ability variable.

D. Conclusion

Based on the results of the analysis and discussion described in the previous chapter, the researcher concluded from this study that wrist flexion has a positive and significant effect on the ability to smash volleyball in Kusuma Bhirawa Ponorogo athletes. Then the explosive power of the leg muscles has a positive and significant effect on the ability to smash volleyball in Kusuma Bhirawa Ponorogo athletes. In addition, the variables of wrist flexion and explosive power of leg muscles have a positive effect simultaneously on the variable of volleyball smash ability.

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F. Conflict of Interest

Research conducted by researchers has applied scientific procedures, but still in this study there are still many shortcomings and limitations. The shortcomings of this study include:

1. The theory used is still minimal and needs a lot of references, considering the independent variables studied.
2. The number of samples that belong to is still small even though it already represents the population.
3. The independent variable under study explains only a fraction of the dependent variable.

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