Correlation of arm

by Marsuna Rusli

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Correlation of Arm Muscle Power and Abdominal Muscle Strength with Badminton Smash Ability

Marsuna[1], Muhammad Rusli[2], Jud[3], Muhtar Asshagab[4]

[1,2,3,4]Department of Physical Education, Health and Recreation, Faculty of Teacher Training and Education, Halu Oleo University, Indonesia
email: marsuna@uho.ac.id[1], muhrusli@uho.ac.id[2], jud_pjok@uho.ac.id[3],
muhtarasshagab@uho.ac.id[4]

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Abstract

The research aims to determine the correlation between arm muscle strength and abdominal muscle strength with badminton smash ability. The descriptive method with a correlational design was used in this research. This research was carried out at SMP Negeri 49 South Konawe for 1 week. The population in the study were all 30 students of SMP who actively participated in extracurricular activities. The sampling technique uses total sampling, namely the population as a whole so that the sample in this study was 30 people. The instrument for measuring arm muscle power uses the overhead medicine ball throw test to measure abdominal muscle strength using the sit up test, while to measure smash ability uses the badminton smash ability test. Data analysis techniques use descriptive analysis, regression analysis with normality, linearity tests, and hypothesis testing using the SPSS version 26 application. Based on the correlation results above, there is a significant relationship between variables X1, X2, and Y, where the correlation coefficient is 0.788. Meanwhile, the contribution coefficient of determination is 0.621, or in other words, 62.1% can contribute to variables X1, durability. From the research results, it can be concluded that the greater the arm muscle strength and abdominal muscle strength a person has, the better their ability to smash in badminton.

Keywords: *arm muscle power, abdominal muscle strength, badminton smash*

INTRODUCTION

Badminton is a sport that requires a complex combination of physical strength, speed, coordination, and technical precision (Gómez et al., 2020; Saman, 2023; Agustan & Rahman, 2023). In this context, the ability to smash, one of the crucial hitting techniques in badminton, is the main focus for players and coaches to improve and optimize (Primayanti & Isyani, 2021). Smash is an aggressive blow performed with maximum strength and speed, aiming to get past the opponent's defense and score (Hung et al., 2020). In pursuing effectiveness and consistency in smash technique, it is important to consider the physical

Alamat Koresponden :
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factors that influence a player's ability to execute the shot. Among these factors are arm muscle strength and abdominal muscle strength.

The arm muscles have a very important role in producing strength and speed in smashes, while the abdominal muscles are responsible for providing body stability and transferring energy from the lower body to the upper body when making punching movements (Zharifah, 2024). Arm and abdominal muscle strength influencing smash ability can help badminton players improve technical performance in the game. This can provide a significant competitive advantage on the field. As for the physical factors that are important for smash ability, coaches can design more targeted and effective training programs. This will ensure that the time and effort invested in training produces optimal results (Koloway et al., 2021). Strong and balanced muscles can help reduce the risk of injury, especially in sports that require fast and aggressive movements such as badminton (Rinaldi, 2020; Wismanadi et al., 2024). By focusing on developing arm and abdominal muscle power, players can reduce the risk of injury caused by muscle imbalances or body instability.

The problem that occurs among students is that they do not realize how important arm and abdominal muscle strength are in supporting their smash ability in badminton (Khotijah et al., 2023). This lack of knowledge can lead to a lack of motivation to engage in strength training or a lack of interest in improving their physical abilities (Awatani et al., 2018). Students don't know how to effectively train their arm and abdominal muscles to increase their strength and endurance. Lack of understanding of proper training can hinder their ability to improve technical skills such as smashes. Students do not realize that it is important to have a balance between arm and abdominal muscle power to support technical abilities such as smashes. This imbalance can disrupt the stability and coordination of their movements when executing a punch.

Some students are not interested or motivated to be involved in badminton, so they are less concerned about the correlation between muscle strength and technical ability in this sport. To overcome this problem, it is important for schools and coaches to increase students' awareness of the importance of physical strength in supporting their sports performance. This can be done through education about the benefits of strength training, providing access to adequate exercise facilities, and creating exercise programs that suit students' needs. In addition, providing motivation and support for students to get involved in badminton and emphasizing the importance of balance between arm and abdominal muscle

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strength can help improve their technical abilities in the game. So the aim of this research is to determine the correlation between arm muscle strength and abdominal muscle strength with badminton smash ability.

METHOD

Descriptive method with correlational design used in this research (Kusumawati, 2015). There are three variables, namely arm muscle strength, abdominal muscle strength, and badminton smash ability. This research was carried out at SMP Negeri 49 South Konawe for 1 week. The population in the study were all 30 students of SMP Negeri 49 South Konawe who actively participated in extracurricular activities. The sampling technique uses total sampling, namely the population as a whole, so that the sample in this study was 30 people. The instrument for measuring arm muscle power uses the overhead medicine ball throw test (Widiastuti, 2015), to measure abdominal muscle strength uses the sit up test (Saiful, 2021), while to measure smash ability uses the badminton smash ability test (Al Fathi et al., 2022).

The technique for collecting data on the implementation of arm muscle power is using a 2 kg medicine ball, by standing behind the line, both feet shoulder-width apart with hands above the head holding the ball, then the ball is thrown hard forward as far as possible. The distance recorded is the ball falling to its initial position at the time of throw. Sit ups are carried out by lying on your back, with your hands linked together behind your head, while your legs are folded so that your knees can form a 90 degree angle. The implementation is assisted by a friend who holds both ankles tightly and presses when the sample wakes up, carried out repeatedly for 60 seconds. Meanwhile, the badminton smash's ability to produce a strong whip can produce 20 smashes. Data analysis techniques use descriptive analysis, regression analysis with normality, linearity and hypothesis testing using the SPSS version 26 application.

RESULT

A description of the data analysis of arm muscle power (X1) and abdominal muscle strength (X2) with badminton smash ability (Y) can be seen in the following table:

Table 1. Description score X1, X2 with Y

Data Variabel	Scor Maximum	Scor Minimum	Mean	Standard Deviation
X1	4.20	2.67	3.48	0.47

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X2	47	25	34.93	5.71
Y	67	36	53.67	8.22

Statistical description score data for the arm muscle power variable with the highest score of 4.20, the lowest score of 2.67, with a mean of 3.48 and a standard deviation of 0.47. For the abdominal muscle strength variable score, the highest value was 47, the lowest was 25, with a mean of 34.93 and a standard deviation of 5.71. Meanwhile for the badminton smash ability variable, the highest value was 67, the lowest was 36, with a mean value of 53.67, and a standard deviation of 8.22. The results of the research data description can be depicted in the following histogram:

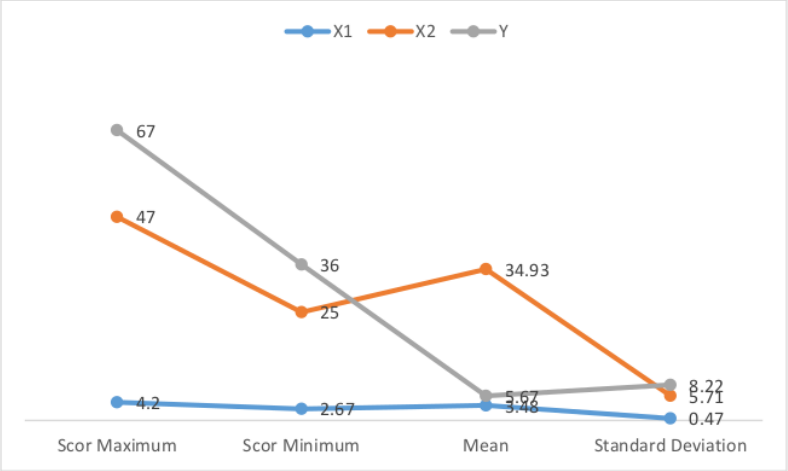

Figure 1. Histograms of X1, X2, and Y

Statistical analysis with a normality test which aims to determine whether a variable has a normal distribution or not with the Kolmogorov Smirnov test on each variable using a probability > 0.05 then the data is normal, but if the probability < 0.05 it is not normally distributed.

Table 2. Test the prerequisite analysis for normality of data X1, X2, with Y

Variable Data	Kolmogorov Smirnov	Significance
X1	0.764	0.604
X2	0.568	0.903
Y	0.656	0.783

Based on the data normality prerequisite analysis test, it can be concluded that the results are normal with a value of X1 of 0.604, X2 of 0.903, and variable Y of 0.783 which

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is greater than 0.05. To test the prerequisites for data linearity, use the significance deviation of linearity. If significance is > 0.05, then the data is linear, and vice versa, and the test results can be seen in the following table:

Table 3. Test the prerequisite analysis for the linearity of X1Y and X2Y data

Variable Data	F	Significance
X1Y	0.865	0.629
X2Y	1.065	0.454

Based on the results of the data linearity prerequisite analysis test, it can be concluded that the results are linear with an X1Y value of 0.629 and an X2Y variable of 0.454 which is greater than 0.05. The results of the correlation test of arm muscle power and abdominal muscle strength with badminton smash ability can be seen in the following table:

Table 4. Test the correlation between arm muscle power and abdominal muscle strength badminton smash ability

Variable Data	Correlation (r)	r^2
X1,2Y	0.788	0.621

Based on the correlation results above, there is a significant relationship between variables X1, X2, and Y, where the correlation coefficient is 0.788. Meanwhile, the contribution coefficient of determination is 0.621 or in other words 62.1% can contribute to variables X1, durability.

DISCUSSION

The research results showing a significant relationship between arm muscle strength and abdominal muscle strength and smash ability in badminton are important findings and have broad implications in the world of sports. This reinforces the understanding that physical aspects, such as muscle strength, play an important role in optimal performance. These findings indicate that developing arm and abdominal muscle power can be the main focus in training programs for badminton players who want to improve their smash ability. Directed and planned power training can help improve technical performance during competition.

Arm muscles have a crucial role in producing the strength and speed needed to smash effectively (Arisman et al., 2018; Anisah & Guntoro, 2022). Arm muscle strength allows players to move the racket quickly and produce a strong hitting force at the same time. Apart from that, with optimal arm muscle strength, players can gain advantages in

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increasing stroke speed and producing stronger smashes (Surahman et al., 2019). Meanwhile, abdominal muscle strength plays an important role in maintaining body stability and facilitating the transfer of energy from the lower part of the body to the upper part when performing punching movements, including smashes. Strong abdominal muscles help maintain a stable body posture and reduce the risk of injury due to unstable movements (Irham & Puronomo, 2022; Kusuma, 2020).

Supporting research was conducted by Koloway et al., (2021), that this research generally uses similar measurement methods to assess arm muscle strength and abdominal muscle strength, such as strength tests and power tests. Measuring smash ability is usually done through field tests or observation. Statistical analysis generally used in this research includes correlation analysis to determine the relationship between these variables, as well as regression analysis to understand the relative contribution of each factor to smash ability. This research uses samples that vary, both in terms of size and individual characteristics. Some studies use samples from professional athletes, while other studies only use students who take part in extracurricular activities.

Based on the results of research, the greater the arm muscle strength and abdominal muscle strength a person has, the better their ability to smash in badminton. These results provide important direction for trainers to design training programs focused on developing arm and abdominal muscle strength.

CONCLUSION

Based on the research results, it can be concluded that there is a significant relationship between arm muscle strength and abdominal muscle strength and smash ability in badminton. The greater the arm muscle strength and abdominal muscle strength a person has, the better their ability to smash in badminton. This conclusion shows that physical aspects, such as muscle strength, play an important role in technical athletic performance in badminton. Arm muscle strength allows a player to generate the speed and power needed to execute a smash, while abdominal muscle strength helps maintain body stability and transfer energy during the stroke.

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