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

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Abstract

The research aims to determine the correlation between arm muscle strength and abdominal muscle strength with badminton smash ability. This research was carried out at SMP Negeri 49 South Konawe utilizing the descriptive method with a correlational design. The sampling technique uses a total sampling of 30 junior high students who actively participated in extracurricular activities. The instrument for measuring arm muscle power employs 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 utilize descriptive analysis, regression analysis with normality, linearity tests, and hypothesis testing using the SPSS version 26 application. The correlation results show a significant relationship between variables X1, X2, and Y with a correlation coefficient 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, the greater the arm 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 requires a complex combination of physical strength, speed, coordination, and technical precision (Gómez et al., 2020; Saman, 2023; Agustan & Rahman, 2023). The ability to smash is the crucial hitting technique in badminton and is the main focus for players and coaches to improve and optimize (Primayanti & Isyani, 2021). Smash is an aggressive blow with maximum strength and speed to surpass the opponent's defense and score (Hung et al., 2020). In pursuing effectiveness and consistency in the smash technique, it is crucial to consider the physical factors influencing

a player's ability to execute the shot, such as arm muscle strength and abdominal muscle strength.

The arm muscles are essential in producing strength and speed in smashes. In contrast, the abdominal muscles provide body stability and transfer energy from the lower body to the upper body when punching (Zharifah, 2024). Arm and abdominal muscle strength influencing smash ability can support badminton players in improving technical performance. This muscle strength can provide a significant competitive advantage in performance. Coaches should design more targeted and effective training programs to improve physical factor ability. These factors will ensure that the time and effort invested in training produce 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 among students is that they need to realize the importance of arm and abdominal muscle strength 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 interest in improving their physical abilities (Awatani et al., 2018). Students should learn to train their arm and abdominal muscles effectively to increase their strength and endurance. Lack of proper training can hinder their ability to improve technical skills 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. Schools and coaches need to increase students' awareness of the importance of physical strength in supporting their sports performance. This problem can be solved 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 strength can help improve their technical abilities in the match. This research aims to determine the

correlation between arm muscle strength and abdominal muscle strength with badminton smash ability.

METHOD

The descriptive method with a correlational design was utilized in this research. This research examines three variables: arm muscle strength, abdominal muscle strength, and badminton smash ability. The research was conducted at SMP Negeri 49 South Konawe. The sampling technique uses total sampling with 30 SMP Negeri 49 South Konawe students who actively participated in extracurricular activities. 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; Kusumawati, 2015).

The data collection technique for 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. The ball is thrown hard forward as far as possible. The distance recorded is the ball falling to its initial position at the throw time. Sit-ups are carried out by lying on the back, with hands behind the head, while the legs are folded so the 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 include 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 1:

Table 1. Description Score X1, X2 with Y

Data Variabel	Score Maximum	Score Minimum	Mean	Standard Deviation
X1	4.20	2.67	3.48	0.47
X2	47	25	34.93	5.71

| Y | 67 | 36 | 53.67 | 8.22 |

The conclusion based on statistical description stated that score data for the arm muscle power variable with the highest score of 4.20, the lowest score of 2.67, a mean of 3.48, and a standard deviation of 0.47. For the abdominal muscle strength variable score, the highest value was 47, and 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, and 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:
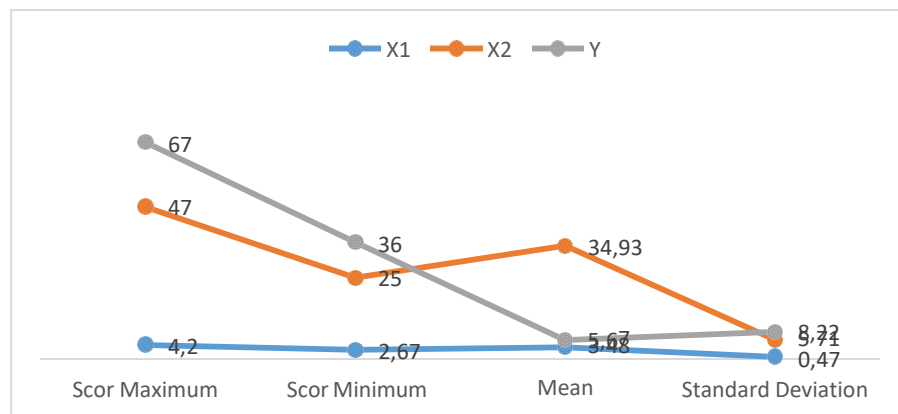

Figure 1. Histograms of X1, X2, and Y

Statistical analysis with a normality test aims to determine the normality distribution of variables using the Kolmogorov-Smirnov test on each variable using a probability > 0.05. Data normality data distribution is rejected if the variable has a probability <0.05.

Table 2. The Data Normality Prerequisite Analysis Test

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 shows the value is >0.05. It can be concluded that the results data are normal with a value of X1 of 0.604, X2 of 0.903, and variable Y of 0.783.

To test the prerequisites for data linearity, utilize 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. The Data Linearaity Prerequisite Analysis

Variable Data	F	Significance
X1Y	0.865	0.629
X2Y	1.065	0.454

Based on the data linearity prerequisite analysis test results, it can be concluded that the results are linear with an X1Y value of 0.629 and an X2Y variable of 0.454 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. Correlation Test Between Arm Muscle Power and Abdominal Muscle Strength 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, with a correlation coefficient 0.788. Meanwhile, the contribution coefficient of determination is 0.621, or in other words, 62.1%, which can contribute to variables X1, durability.

DISCUSSION

The research results show a significant correlation between arm muscle strength, abdominal muscle strength, and smash ability in badminton. This result reveals important findings and has broad implications in sports. It 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 improve technical performance during competition.

Arm muscles are crucial in producing the strength and speed needed to smash effectively (Arisman et al., 2018; Anisah & Guntoro, 2022). Arm muscle strength allows athletes to move the racket quickly and simultaneously produce a strong hitting force. With optimal arm muscle strength, athletes can gain advantages in increasing stroke speed and producing stronger smashes (Surahman et al., 2019). Meanwhile, abdominal

muscle strength is crucial in maintaining body stability and facilitating energy transfer from the body's lower part to the upper part when 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 conducted by Koloway et al. (2021) utilizes similar measurement methods to assess arm and abdominal muscle strength, such as strength and power tests. Measuring smash ability is usually accomplished through field tests or observation. Statistical analysis generally used in Koloway's research includes correlation analysis to determine the relationship between variables and 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 others only use students who participate 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

The research results show a significant relationship between arm muscle strength, abdominal muscle strength, and smash ability in badminton. The greater arm 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. In contrast, abdominal muscle strength helps maintain body stability and transfer energy during the stroke.

REFERENCE

Agustan, B., & Rahman, R. (2023). Development of Learning Applications e Mole B in Badminton Games. *Physical Activity Journal (PAJU)*, *5*(1), 13–26. https://doi.org/10.20884/1.paju.2023.5.1.9664

Al Fathi, Z. S., Hartoto, S., & Prakoso, B. B. (2022). Hubungan antara Tingkat Konsentrasi Siswa dengan Hasil Kemampuan Smash Ekstrakurikuler Bulu Tangkis. *Sriwijaya*

Journal of Sport, *1*(2), 93–104. https://doi.org/10.55379/sjs.v1i2.359

Anisah, A., & Guntoro, T. S. (2022). Hubungan Antara Power Otot Tungkai dan Kekuatan Otot Lengan Terhadap Ketepatan Smash pada Siswa Ekstrakulikuler Bulutangkis SMP Negeri 2 Merauke. *Jurnal Pendidikan Jasmani Indonesia*, *18*(2), 194–202. https://doi.org/10.21831/jpji.v18i2.53849

Arisman, A., Saripin, S., & Vai, A. (2018). Hubungan kelentukan pergelangan tangan dan power otot lengan-bahu dengan hasil akurasi smash bulutangkis putra pada PB. Angkasa Pekanbaru. *Journal Of Sport Education (JOPE)*, *1*(1), 9–16. https://doi.org/10.31258/jope.1.1.9-16

Awatani, T., Morikita, I., Urata, T., Shinohara, J., & Tatsumi, Y. (2018). Correlation between isometric shoulder strength and racket velocity during badminton forehand smash movements: study of valid clinical assessment methods. *Journal of Physical Therapy Science*, *30*(6), 850–854. https://doi.org/10.1589/jpts.30.850

Gómez, M., Rivas, F., Leicht, A. S., & Buldú, J. M. (2020). Using network science to unveil badminton performance patterns. *Chaos, Solitons & Fractals*, *135*, 109834. https://doi.org/10.1016/j.chaos.2020.109834

Hung, C.-L., Hung, M.-H., Chang, C.-Y., Wang, H.-H., Ho, C.-S., & Lin, K.-C. (2020). Influences of lateral jump smash actions in different situations on the lower extremity load of badminton players. *Journal of Sports Science & Medicine*, *19*(2), 264. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7196745/

Irham, A. I., & Puronomo, M. (2022). Analisis Kondisi Fisik Atlet Putra Bulutangkis PB Wiman Lamongan Usia 15-17 Tahun. *Jurnal Prestasi Olahraga*, *5*(5), 5–12. https://ejournal.unesa.ac.id/index.php/jurnal-prestasi-olahraga/article/view/46944

Khotijah, S., Sudiana, I. K., & Sudarmada, I. N. (2023). Pengaruh Pelatihan Core Stability Terhadap Keseimbangan dan Kekuatan Otot Perut Atlet Putra Ekstrakurikuler Pencak Silat. *Jurnal Ilmu Keolahragaan Undiksha*, *11*(3), 320–327. https://doi.org/10.23887/jiku.v11i3.65939

Koloway, C. B. G., Runtuwene, J., & Langi, F. L. F. G. (2021). Kekuatan Otot Perut, Daya Ledak Otot Lengan, Tinggi Lompatan dan Hasil Pukulan Smash Penuh pada Atlet Bulutangkis. *Sam Ratulangi Journal of Public Health*, *2*(1), 22–31. https://doi.org/10.35801/srjoph.v2i1.33887

Kusuma, I. A. (2020). Hubungan Antara Koordinasi Mata-Tangan, Persepsi Kinestetik dan Kekuatan Otot Perut dengan Kemampuan Short Service dalam Permainan Bulutangkis pada Pemain Putra Usia 14-15 Tahun Pb Natura Prambanan Klaten Tahun 2019. *Jurnal Ilmiah Spirit*, *20*(2), 11–23. https://doi.org/10.36728/jis.v20i2.1099

Kusumawati, M. (2015). *Penelitian Pendidikan Penjasorkes*. CV. Alvabeta.

Primayanti, I., & Isyani, I. (2021). Pengaruh latihan drill dan latihan pola pukulan terhadap kemampuan smash bulutangkis pada PB Liansa Junior Masbagik Lombok Timur Tahun 2019. *Gelora: Jurnal Pendidikan Olahraga Dan Kesehatan IKIP Mataram*, *6*(1), 25–31. https://doi.org/10.33394/gjpok.v6i1.1742

Rinaldi, M. (2020). *Buku Jago Bulu Tangkis*. Ilmu Cemerlang Group.

Saiful. (2021). *Tes dan Pengukuran dalam Olahraga*. UD Al Hasanah.

Saman, A. (2023). Hubungan Koordinasi Mata Tangan dengan Kemampuan Servis Panjang Permainan Bulutangkis pada Mahasiswa Jurusan Ilmu Keolahragaan Angkatan 2020 FKIP Universitas Halu Oleo. *JOKER (Jurnal Ilmu Keolahragaan)*, *4*(1), 25–30. https://joker.uho.ac.id/index.php/journal/article/view/15

Surahman, F., Yeni, H. O., & Sanusi, R. (2019). Hubungan Daya Ledak Otot Lengan dan Kelentukan Pinggang dengan Kemampuan Smash Bulutangkis pada Ekstrakurikuler Siswa Sma N 2 Karimun. *Jurnal Minda*, *1*(1), 42–53. https://www.ejurnal.universitaskarimun.ac.id/index.php/mindafkip/article/view/18

Widiastuti. (2015). *Tes dan Pengukuran Olahraga*. PT. RajaGrafindo Persada.

Wismanadi, H., Roepajadi, J., Pudjijuniarto, P., Rusdiawan, A., Dini, C. Y., & Sholikhah, A. M. (2024). Glutamine accelerates post-exercise recovery of arms power, leg power, and smash velocity at 48 hours for non-elite badminton athletes. *Retos: Nuevas Tendencias En Educación Física, Deporte y Recreación*, *53*, 481–488. https://dialnet.unirioja.es/servlet/articulo?codigo=9304692

Zharifah, F. (2024). Hubungan Kekuatan Otot Lengan dan Koordinasi Mata Tangan Dengan Kemampuan Smash Bulutangkis Siswa MAN 4 Pasaman Barat. *Jurnal JPDO*, *7*(4). https://doi.org/10.24036/JPDO.7.4.2024.94