

## Correlation between the leg muscle strength, arm muscle power, hand-eye coordination, arm length, and body balance towards the accuracy of volleyball overhead passing of players from PBV pervas Sleman

Muhammad Khanif Hidayatullo<sup>1</sup>, Syamsuryadin<sup>1\*</sup>, Afni Silvia Putri<sup>1</sup>, Alissa Rachel Chrystalin<sup>1</sup>, Andrean Danu Wardana<sup>1</sup>, Yoga Sampurna<sup>1</sup>, Putri Ratu Rima<sup>1</sup>, Mohammad Rizqi Febrian<sup>1</sup>, Teresa Agustin Ababil<sup>1</sup>, Bayu Akbar Prasetyo<sup>1</sup>, Muhammad Rifqi Asyraf<sup>1</sup>

<sup>1</sup>Pendidikan Kepelatihan, Fakultas Ilmu Keolahragaan, Universitas Negeri Yogyakarta, Jl. Colombo No. 1, Karangmalang, Depok, Sleman, Daerah Istimewa Yogyakarta, Indonesia.

\*Corresponding Author. Email: [syamsuryadin@uny.ac.id](mailto:syamsuryadin@uny.ac.id)

### Abstract

This research seeks to (1) ascertain the correlation between leg strength and the accuracy of volleyball overhead passes of players at Pervas Volleyball Club, (2) investigate the correlation between arm muscle strength and the accuracy of volleyball overhead passes of players at Pervas club, (3) investigate the correlation between hand-eye coordination and the accuracy of volleyball overhead passes of players at Pervas Club, (4) investigate the correlation between arm length and the accuracy of volleyball overhead passes of players at Pervas Club, (5) examine the correlation between body balance and the accuracy of volleyball overhead passes of players at Pervas club, and (6) examine the correlation among leg muscle strength, arm muscle strength, hand-eye coordination, arm length, and body balance concerning the accuracy of volleyball overhead passes of players at Pervas club.

This research was a descriptive quantitative study employing a correlational methodology. The research population consisted of volleyball athletes of Pervas Club. The sample method employed purposive sampling. The criteria included: (1) male and female volleyball players from PBV Pervas Sleman Club, (2) aged 17 years old, and (3) were prepared to serve as a research sample. The leg muscle strength was assessed by using the wall sit test, arm muscle strength was evaluated by using the push-up test, hand-eye coordination was measured with the tennis ball throw-catch test, arm length was determined via the arm span test, and balance was tested by using the stork stand test. This research employed descriptive analysis, hypothesis testing, and determination testing as data analytic methodologies.

The research findings indicate a correlation between leg muscle strength and passing accuracy, with a computed  $r$  value of 0.804.  $R$  table: 0.282, significance value: 0.000, which is less than 0.05. (2) A correlation exists between arm muscle strength and passing accuracy, with a computed  $r$  value of 0.948.  $R$  table: 0.282, significance value: 0.000, which is less than 0.05. (3) A correlation exists between hand-eye coordination and passing accuracy, with a calculated  $r$  value of 0.931.  $R$  table: 0.282, significance value: 0.000, less than 0.05. A correlation exists between arm length and passing accuracy, with an estimated  $r$  value of 0.932.  $R$  table: 0.282, significance value: 0.000, which is less than 0.05. (5) A correlation exists between body balance and passing accuracy, with a calculated  $r$  value of 0.986.  $R$  table: 0.282, significance value: 0.000, which is less than 0.05. (6) A correlation exists among leg muscle strength, arm muscle strength, hand-eye coordination, arm length, and body balance, with the accuracy of volleyball overhead passing at PBV Pervas Sleman Club, shown by a calculated  $F$  value of 1566.  $F$  value of 2.55 and significance level of 0.000, which is less than 0.05.

**Keywords:** Leg Muscle Strength, arm muscle strength, hand-eye coordination, arm length, body balance, overhead passing

### INTRODUCTION

Volleyball is one of the most popular sports among the general public. Tawakal (2020: 3) explains that volleyball is one of the most popular sports in Indonesia and has developed significantly since its

inception. Volleyball is played by all segments of society, from children to the elderly, men and women, and people in both rural and urban areas. Currently, volleyball is not only played as a recreational sport or a hobby. Instead, it is now considered a sport that can lead to proud achievements. To achieve success, a structured and coordinated training process is required.

The training process in sports to achieve high achievements today is not only seen from one aspect, but is a complex, methodological, sophisticated process that requires time. Training is a series of training processes that are systematically arranged, carried out repeatedly, and the amount of load trained in each training session increases (Mahfud, 2020). This is in agreement with Palar, et al. (2015), who state that training is a physical activity that is carried out repeatedly over a relatively long period of time, with the load in each training session being increased gradually and continuously in accordance with the athlete's abilities.

One of the most important basic techniques in volleyball is the overhead pass. The overhead pass serves as the initial technique in building an attack, especially to pass the ball to the spiker so that they can attack effectively. The accuracy of the overhand pass greatly determines the quality of the team's attack pattern and the chances of scoring points (Beutelstahl, 2016). An inaccurate overhand pass can disrupt the rhythm of the game and reduce the effectiveness of the attack, so mastery of this technique is a must for every volleyball player.

The accuracy of the overhand pass is not only influenced by technical mastery, but also by various factors such as physical condition and movement coordination. Several physical components that are thought to be closely related to the accuracy of overhead passing include leg muscle strength, arm muscle strength, eye-hand coordination, arm length, and body balance. Leg muscle strength plays a role in supporting the initial stance and maintaining body stability when receiving the ball, while arm muscle strength functions in controlling the direction and speed of the ball when passing (Suharjana, 2013).

Strength is the ability of muscles or a group of muscles to overcome a load or resistance when performing training activities. Strength is absolutely necessary for every athlete in all sports, especially in volleyball (Atradin, 2017). The strength that will be studied in this research is leg muscle strength and arm muscle strength. Leg muscle strength is the ability of the legs to withstand or lift a load, whether it is the body's own weight or an external load. Leg muscle strength is part of physical fitness that discusses a person's precision in using their legs or feet (Mikel, 2023).

Coordination is one of the components of physical condition biomotor that should not be overlooked. Biomotor components of physical condition are very useful as a support for the skill level possessed by an individual (Arifianto, 2020). In this case, the coordination referred to is hand-eye coordination, which is a component where the body is able to coordinate several movements into one complex movement in volleyball. Hand-eye coordination is the ability to combine vision and hand movements simultaneously to direct something accurately towards a target (Khaidir & Aziz, 2020).

Another important biomotor component, besides strength and coordination, is balance. Balance is one of the physical elements required in volleyball (Budiwibowo, 2015). Balance is the body's ability to maintain the neuromuscular system in an efficient posture or position when the body is moving (Salsabilla, 2023). Balance has several functions, such as stabilising multiple or simultaneous movements, facilitating the mastery of advanced techniques in volleyball, and orienting oneself towards opponents and the environment.

In addition, body balance plays an important role in maintaining a stable body position when receiving the ball, especially in dynamic game situations. Good balance allows players to perform overhead passes with better control even when moving or under pressure from opponents. Without adequate body balance, players will find it difficult to maintain the ideal position when performing overhead passes.

Arm length is one of the body parts included in anthropometric measurements, specifically one of the upper body movement parts (Jahrir, 2019). Arm length is one of the physical factors in anthropometry that needs to be considered in sports activities, especially volleyball, because if an athlete has long arms, it will enable them to achieve maximum performance (Susi & Primayanti, 2016). Based on the tests described above, starting from the biomotor and anthropometric components, a coach is expected to be able to develop a structured testing programme. Structured testing can help improve mastery of basic techniques in optimising the application of each movement and create a harmonious combination to achieve superior performance on the court.

Based on initial observations at the PBV Pervas Sleman Club, there are still players who lack consistency in their overhead passing accuracy. This condition is thought to be caused not only by technical limitations but also by differences in physical ability, coordination, and the physical characteristics of each player. However, the relationship between these factors and overhead passing accuracy is not yet known with certainty and is not supported by measurable empirical data. Therefore, this research is important to scientifically examine the relationship between leg muscle strength, arm muscle strength, eye-hand coordination, arm length, and body balance with the accuracy of overhead passing in volleyball at the PBV Pervas Sleman Club. The results of this study are expected to contribute to the development of sports coaching science, particularly in the formulation of more effective training programmes based on the physical needs and characteristics of volleyball athletes.

## **METHOD**

This study is a quantitative descriptive study using a correlational method. The study population consists of volleyball athletes at the Pervas Club. Purposive sampling was used to select the sample. The criteria were (1) male and female volleyball athletes at the PBV Pervas Sleman Club. (2) Aged 17 years. (3) Willing to be included in the study sample. The instruments used were the wall sit test for leg muscle strength, the push-up test for arm muscle strength, the tennis ball throw-catch test for hand-eye coordination, the arm reach test for arm length, and the stork stand test for balance. The data analysis techniques used in this study were descriptive analysis, hypothesis testing, and determination testing.

## **RESULTS AND DISCUSSION**

The results of the study show that (1) There is a relationship between leg muscle strength and passing accuracy with a calculated  $r$  value of 0.804 > table  $r$  value of 0.282, sig. value of 0.000 < 0.05. (2) There is a relationship between arm muscle strength and passing accuracy with a calculated  $r$  value of 0.948 > table  $r$  value of 0.282, sig. value of 0.000 < 0.05. (3) There is a relationship between hand-eye coordination and passing accuracy with a calculated  $r$  value of 0.931 > table  $r$  value of 0.282, sig. value of 0.000 < 0.05. (4) There is a relationship between arm length and passing accuracy with a calculated  $r$  value of 0.932 > table  $r$  value of 0.282, sig. value of 0.000 < 0.05. (5) There is a relationship between body balance and passing accuracy with a calculated  $r$  value of 0.986 > table  $r$  value of 0.282, sig. value of 0.000 < 0.05. (6) There is a relationship between leg muscle strength, arm muscle strength, eye-hand coordination, arm length, and body balance with passing accuracy in volleyball at the PBV Pervas Sleman club, with a calculated  $F$  value of 1566 > table  $F$  value of 2.55 and a sig. value of 0.000 < 0.05.

### **The Relationship Between Leg Muscle Strength and Passing Accuracy**

The results of the analysis show that leg muscle strength has a positive and significant relationship with the accuracy of overhead passing. Leg muscle strength plays an important role in supporting body position, maintaining initial stability, and helping to adjust position when receiving the ball. In overhead passing, a light push from the legs is needed to control the direction and height of the ball with precision. Lower extremity strength plays an important role in stability and force transfer in volleyball technical skills.

### **Relationship between Arm Muscle Strength and Overhead Passing Accuracy**

Arm muscle strength also shows a significant relationship with overhead passing accuracy. Arm muscles function as the main controllers of the direction and speed of the ball when it comes into contact with the hands. Athletes with good arm muscle strength are able to control the ball more precisely, resulting in accurate and consistent passing. These findings are in line with research by Forthomme et al. (2018), which states that arm and shoulder muscle strength contributes significantly to the quality of passing and setting techniques in volleyball.

### **The Relationship between Hand-Eye Coordination and Overhead Passing Accuracy**

Hand-eye coordination has a strong relationship with overhead passing accuracy. This coordination allows athletes to adjust the timing, direction, and position of their hands to the arrival of the ball. Overhead passing requires good synchronisation between visual perception and hand movement response so that the ball can be directed to the target. These results support the opinion of Schmidt and Lee (2019), who emphasise that eye-hand coordination is an important motor component in sports skills involving moving objects, including volleyball.

### **The Relationship Between Arm Length and Overhead Passing Accuracy**

The arm length variable shows a significant relationship with overhead passing accuracy. Athletes with relatively longer arms have a biomechanical advantage in the form of a wider reach and a more flexible ball contact angle. This makes it easier for athletes to adjust their hand position to the ball, especially in fast-paced game situations. According to Norton and Olds (2018), anthropometric factors such as arm length can affect the effectiveness of techniques in game sports, including volleyball.

### **The Relationship Between Body Balance and Overhead Passing Accuracy**

Body balance has also been shown to have a significant relationship with overhead passing accuracy. Good balance allows athletes to maintain a stable body position when receiving and passing the ball, both when stationary and in motion. When balance is disrupted, ball control tends to decrease, resulting in less accurate passing. This is in line with the findings of Hrysomallis (2011), who stated that balance is an important factor in the performance of sports skills that require postural control and movement precision.

Simultaneous Relationship (Multivariate) Simultaneously, leg muscle strength, arm muscle strength, eye-hand coordination, arm length, and body balance have a significant relationship with the accuracy of overhead passing. This indicates that overhead passing ability is the result of the interaction of various physical, coordinative, and anthropometric components. These findings support the concept of modern sports training that emphasises a holistic approach to athlete development, focusing not only on technique but also on physical readiness and movement control (Bompa & Buzzichelli, 2019).

The practical implication of these research results is the need for PBV Pervas Sleman Club coaches to develop an integrated training programme, with a balanced allocation of training between mastering overhead passing techniques and developing supporting physical conditions such as strength, coordination, and balance. Thus, improvements in overhead passing accuracy can be achieved more optimally and sustainably.

## **CONCLUSION**

Based on the results of data analysis, research testing, and discussion related to the relationship between leg muscle strength, arm muscle strength, hand-eye coordination, arm length, and body balance with the accuracy of passing a volleyball at the PBV Pervas Sleman club, it can be concluded that:

1. There is a significant relationship between leg muscle strength and the accuracy of overhead passes by volleyball athletes at the PBV Pervas Sleman club, with a calculated value of  $0.804 >$  table value of  $0.282$ , with a significance value of  $0.000 < 0.05$ .
2. There is a significant relationship between arm muscle strength and passing accuracy among volleyball athletes at the PBV Pervas Sleman club, with a calculated value of  $0.948 >$  table value of  $0.282$ , and a significance value of  $0.000 < 0.05$ .
3. There is a significant relationship between hand-eye coordination and passing accuracy among volleyball athletes of the PBV Pervas Sleman club, with a calculated value of  $0.931 >$  table value of  $0.282$ , with a significance value of  $0.000 < 0.05$ .
4. There is a significant relationship between arm length and passing accuracy among volleyball players at the PBV Pervas Sleman club, with a calculated value of  $0.932 >$  table value of  $0.282$ , with a significance value of  $0.000 < 0.05$ .
5. There is a significant relationship between body balance and the accuracy of overhead passes by volleyball players at the PBV Pervas Sleman club, with a calculated value of  $0.986 >$  table value of  $0.282$ , with a significance value of  $0.000 < 0.05$ .
6. There is a significant relationship between leg muscle strength, arm muscle strength, hand-eye coordination, arm length, and body balance with the passing accuracy of volleyball athletes at the PBV Pervas Sleman Club, with a calculated F value of  $1566 >$  F table  $2.55$  and a sig value of  $0.000 < 0.05$ .

## **REFERENCES**

Ahmadi, N. (2007). *Panduan olahraga bola voli*. Surakarta: Era Pustaka Utama.

- Muhammad Khanif Hidayatulloh, Syamsuryadin, Afni Silvia Putri, Alissa Rachel Chrystalin, Andrean Danu Wardana, Yoga Sampurna, Putri Ratu Rima, Mohammad Rizqi Febrian, Teresa Agustin Ababil, Bayu Akbar Prasetyo, Muhammad Rifqi Asyraf
- Budiwibowo, F., & Setiowati, A. (2015). Unsur indeks massa tubuh dan kekuatan otot tungkai dalam keseimbangan. *Journal of Sport Science and Fitness*, 4(2).
- Bompa, T. O., & Buzzichelli, C. (2019). *Periodization: Theory and methodology of training*. Champaign, IL: Human Kinetics.
- Beutelstahl, D. (2016). *Belajar bermain bola voli*. Bandung: Pionir Jaya
- Forthomme, B., Croisier, J. L., Ciccarone, G., Crielaard, J. M., & Gleizes-Cervera, S. (2018). Factors correlated with volleyball spike velocity. *The American Journal of Sports Medicine*, 36(8), 1513–1519.
- Hrysomallis, C. (2011). Balance ability and athletic performance. *Sports Medicine*, 41(3), 221–232.
- Jahrir, A. S. (2019). Kontribusi Kekuatan Otot Lengan, Koordinasi Mata Tangan Dan Panjang Lengan Terhadap Kemampuan Passing Bawah Bolavoli Siswa. *Exercise*, 1(1), 313231.
- Irawadi, H. (2011). *Kondisi fisik dan pengukurannya*. Padang: UNP Press.
- Khaidir, F., & Aziz, I. (2020). Hubungan kekuatan otot lengan dan koordinasi mata-tangan dengan ketepatan servis atas atlet Club Sultanika Putri Minas. *Jurnal Patriot*, 2(1), 2714-6596.
- Mahfud, I., Yuliandra, R., & Gumantan, A. (2020). Model latihan dribling sepakbola untuk pemula usia SMA. *Sport Science And Education Journal*, 1(2).
- Mikel, P., & Ismaya, B. (2023). Pengaruh Flexibilitas Tubuh Siswa Terhadap Gerakan Kayang Senam Lantai dalam Menunjang Pembelajaran Penjas. *JPKO Jurnal Pendidikan dan Kepeleatihan Olahraga*, 1(02), 82-90.
- Norton, K., & Olds, T. (2018). *Anthropometrica: A textbook of body measurement for sports and health courses*. Sydney: UNSW Press.
- Palar, C. M., Wongkar, D., & Ticoalu, S. H. (2015). Manfaat latihan olahraga aerobik terhadap kebugaran fisik manusia. *eBiomedik*, 3(1).
- Salsabilla, D., Yuliadarwati, N. M., & Lubis, Z. I. (2023). Hubungan antara Aktivitas Fisik dengan Keseimbangan pada Lansia di Komunitas Malang. *Jurnal Ilmiah Ilmu Keperawatan*, 14(1), 273-281.
- Suharjana. (2013). *Kebugaran jasmani*. Yogyakarta: UNY Press.
- Susi, Y., & Primayanti, I. (2016). Hubungan Antara Kekuatan Otot Lengan Dan Panjang Lengan Terhadap Prestasi Lempar Cakram Pada Siswa Kelas X Sman 3 Praya Tahun Pelajaran 2015/2016. *Jurnal Ilmiah Mandala Education*, 2(1), 28–32. [Http://Ejournal.Mandalanursa.Org](http://Ejournal.Mandalanursa.Org)
- Schmidt, R. A., & Lee, T. D. (2019). *Motor learning and performance: From principles to application*. Champaign, IL: Human Kinetics.
- Sheppard, J. M., Gabbett, T., & Stanganelli, L. C. (2009). An analysis of playing positions in elite men's volleyball. *Journal of Strength and Conditioning Research*, 23(6), 1858–1866.
- Tawakal, I. (2020). *Jago Bola Voli Untuk Pemula*. Semarang: Cemerlang Media Publishing.
- Widiastuti. (2017). *Tes dan pengukuran olahraga*. Jakarta: Rajawali Pers.