Journal of Educational Sciences
Journal homepage: https://jes.ejournal.unri.ac.id/index.php/JES

P-ISSN 2581-1657
E-ISSN 2581-2203

Biomechanics Study on Volleyball Lower Serve Technique: The Influence of Body Angle and Foot Position, Sports Education Students of UMKT

Bayu Walhidayat*, Andri Tria Raharja
Sport Education Study Program, Faculty of Teacher Training and Education, Muhammadiyah University of East Kalimantan 75124 Indonesia

ARTICLE INFO

Article history:

Received: 12 April 2025
Revised: 21 April 2025
Accepted: 27 April 2025
Published online: 05 May 2025

Keywords:

Volleyball
Bottom Serve
Biomechanics

* *Corresponding author:*

E-mail: bayuwlhdyt21@gmail.com

Article Doi:

https://doi.org/10.31258/jes.9.3.p.1163-1169

This is an open access article under the CC BY-SA license.

A B S T R A C T

The purpose of this research is to study and analyze the biomechanics that affect the lower serve technique. This research focuses on the body angle and position of the player's feet when serving down, and the purpose of this research is to gain a better understanding of the parts that affect the performance of the lower serve technique with a better level of precision.The type of research used by researchers is a quantitative method, using a descriptive quantitative approach. The instrument used is a handphone camera, can use a laptop equipped with the Kinovea 2023 version 1 application. 2 to record video. This application will serve to measure the angle of the body and legs when serving down in a volleyball game. object 1 produces a body angle of 112.8 °, as for the distance between the front and back legs 102.66 cm and a foot angle of 57.4 ° at the time of the ball's contact with the hand. object 2 data results produce a body angle of 93.1°, for the distance between the front and back feet produces a smaller distance compared to object 1 with a distance of 90.34 cm. the success of the lower serve that achieves effectiveness and also precision, is that objects with larger body angles and foot distances tend to successfully pass the ball across the net, while objects with smaller angles and foot distances experience failure.

1. Introduction

Volleyball has been known since medieval times and was invented by William G. Morgan in 1893. Morgan was a physical education teacher at the YMCA in Holyoke and was the person who gave birth to this now very popular sport. Volleyball is a sport that requires bouncing skills. Two teams compete to knock the ball into the opponent's court. Volleyball game is a sport in the form of volleying the ball in the air back and forth over the net / net aims to drop the ball in the opponent's field to seek victory (Muhajir, 2016). The ultimate goal is to win, basic techniques are skills that need to be mastered. (Sudarmada, Wijaya,

2015) technique is the ability to utilize principles or theories in improving skills in an efficient manner.

Volleyball is a sport that requires special skills to be played well. One of the most important aspects of this game is the mastery of basic techniques, which is the foundation for every player. The lower serve is one of the basic techniques that is very important for volleyball players, regardless of their skill level. According to Mu'arifuddin (2018), the basic techniques of volleyball consist of various movements. The basic techniques of volleyball games are serving, passing, smash, and block.

In the game of volleyball at least there are no 6 basic techniques that must be mastered by everyone who will play volleyball (Sentot, 2017). These techniques include serving, lower passing, upper passing, smash, block, and sliding. Mastering all of these techniques will help players play better on the court. One of the fundamental techniques that must be mastered by volleyball players is the basic technique of serving. Khaidir & Aziz (2020), serve is one of the techniques in the game of volleyball which is an initial attack tactic to obtain scores for a team to win.

This technique involves a simple movement where the player hits the ball with the hand from below, thus providing better control of the direction and speed of the ball. The lower serve is very effective in certain games, especially when precision and consistency are more important than power. Although it looks easy, proper execution of the lower serve requires good coordination and timing (Zhang & Xiaolong, 2019).

Biomechanics is a science that study the shape and variety of human movements sports and the basis of the principle of mechanics and analyzes thase sports movements to understand (Sugiyanto, 2017). The study recommended an improvement in volleyball sessions with more in-depth scientific implementation or prerequisite analysis of biomechanical development. (Meriyanto et al., 2016) Biomechanics is the science that deals with external and internal forces that act on the human body and the effects produced by these forces. According to (Uddin et al., 2020) As a coach or teacher, it is necessary to evaluate and analyze all techniques and movements performed by students biomechanically to improve the achievement of students in learning physical education health and sports.

(Bambang et al., 2014) in his book entitled biomechanics basic level sports says that, biomechanics is the study of the structure and function of biological systems with a mechanical method or approach, which is related to statics, dynamics, kinematics and kinetics. Covering linear motion (straight) and angular (circular), as well as other general movements (combined motion), which can occur. These movements are studied through laws and mechanical patterns according to the specific characteristics of the human biological system, including anatomical and physiological knowledge (Kharmanda & El Hami, 2017; León, Calero, & Chávez, 2016). In summary, researchers seek to find and analyze information about aspects of the game of volleyball on the lower service technique.

The benefit of studying this is that students know the game of volleyball and the motion of the lower serve. According to (Yıldırım et al., 2020) players must be able to control their body movements with precision, ensuring that contact with the ball occurs at the optimal point. This research also examines effective lower serve techniques and strategies so that they can be developed and applied to improve performance for the students themselves.

The purpose of this research is to study and analyze the biomechanics that affect the lower serve technique used by volleyball players. This research focuses on the body angle and foot position of players when performing the lower serve, and the goal of this research is to gain a better understanding of the parts that affect the performance of the lower serve technique with a better level of precision. In summary, the researcher sought to find and analyze information about the biomechanical aspects of the lower serve in the game of volleyball.

2. Methodology

This research applies quantitative methods with a quantitative descriptive approach. Descriptive is a research method that deals with questions about the existence of independent variables, either only on one variable or more. (Sugiyono, 2015). Because this study analyzes using video biomechanics of student motion when serving down to determine body angle, foot distance, and foot angle when performing volleyball lower serve movements. As according to (Waruwu, 2023) the data collected in this type of survey is data that is a combination of measurements, counts and brief narrative explanations, which are then analyzed using descriptive statistics.

This method is used by researchers in biomechanics research, which is to examine between biological systems (such as the human body) and the principles of mechanics or motion science when serving down volleyball. This research aims to find out what factors affect the movement of the human body. Therefore, researchers used descriptive analysis methods in this study.

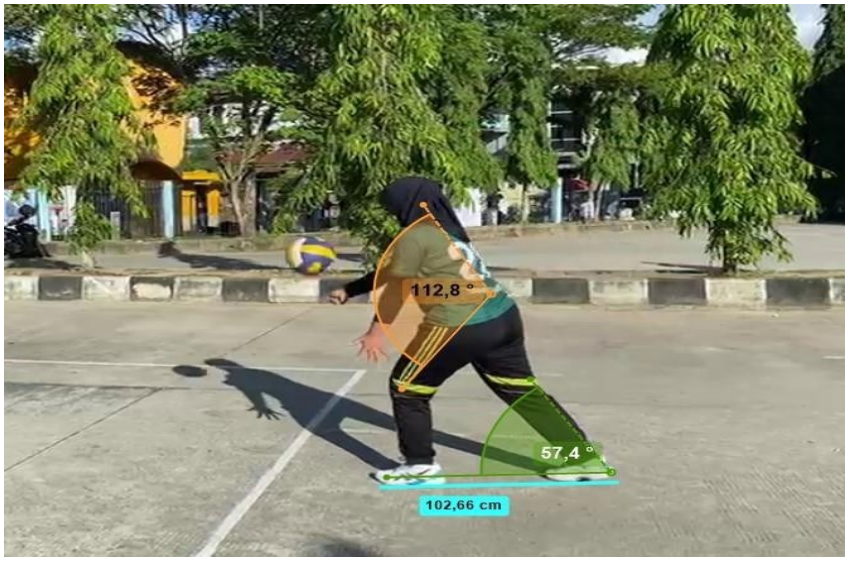
At the time of data collection, the researcher took videos using a cellphone camera, from the camera anggle to the left of object 1 and object 2 when serving down. Each object serves down 2 times to serve down. After taking the video, the researcher measured the body angle, foot distance, and object foot angle using a laptop that already has the kinovea 2023 1.2 software application.

Research involves measurement, so it is important to have a good measuring instrument. A research instrument is a tool used to measure natural or social phenomena that are observed (Djollong, 2014) This measuring tool is called a research instrument. The instrument used is a handphone camera, you can use a laptop equipped with the Kinovea 2023 version 1 application. 2 to record video. This application will serve to measure the angle of the body and legs when serving down in a volleyball game.

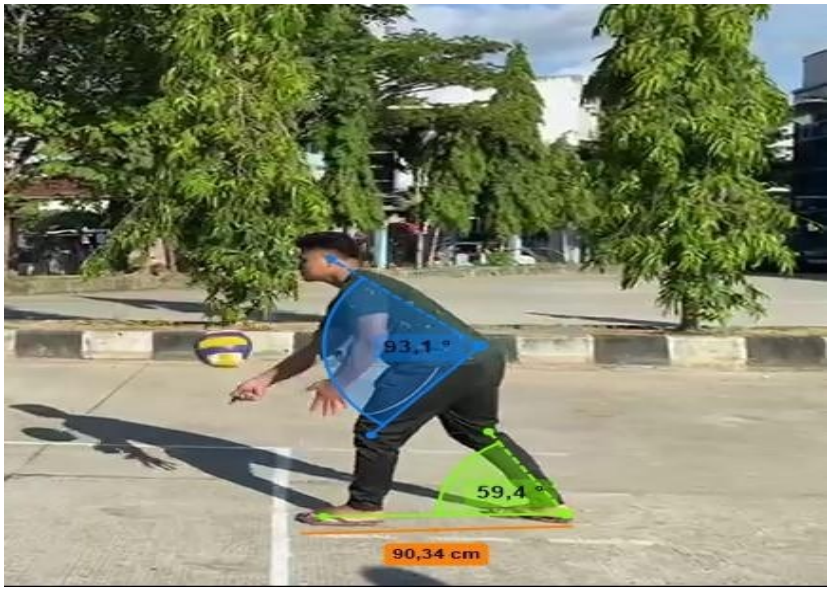
3. Result and Discussion

Results

The results of this study discuss in detail the analysis of the Kinovea 2023 1.2 software application. The analysis explains the planned movement process involved in the lower serve technique in volleyball games based on the influence of body angle and foot position of Sports Education students at Muhammadiyah University of East Kalimantan. The following measurements when serving down and object measurements are taken using the Kinovea 2023 1.2 software application. The documentation and measurements are presented as follows:



Picture 1. Object 1 Performing an edit of the lower service using Kinovea 2023 1.2 software



Picture 2. Object 2 Performing an edited lower service using Kinovea 2023 1.2 software

Discussion

Table 1. Results of lower service data from 2 objects

	Object 1	Object 2
Body Angle	112,8°	93,1°
Foot Distance	102,66 cm	90,34 cm
Foot Angle	57,4°	59,4°

Volleying and bouncing the ball into the air must use any part of the body, as long as it is with a perfect bounce (Rizal & Kasriman, 2020). In a volleyball game to start the game, a serve is needed to start the game. The lower serve also at the time of its implementation requires skills for setting or processing the ball, especially those dominant in the fingers of the hand (Khadir & Ishak, 2020).

The data in the table is data on the body angle and the angle of the object's feet when serving down in a volleyball game. With a series of movements performed by object 1 resulting in a body angle of 112.8 °, as for the distance between the front and back legs 102.66 cm and a foot angle of 57.4 ° at the time of the ball's imposition on the hand. Whereas in the data results object 2 produces a body angle of 93.1 °, for the distance between the front and rear feet produces a smaller distance compared to object 1, namely with a distance of 90.34 cm. At the angle of the foot object 2 produces data that is greater than object 1 with a foot angle of 59.4 °.

From the two data above object 1 produces a body angle and the distance between the front foot and the back foot is greater than object 2, where at the time of the implementation of the lower serve object 1 can provide results, by being able to pass the ball across the net. While object 2 whose results are smaller than object 1, when serving under the ball cannot cross the net perfectly, because object 2 body angle and the distance between the front foot and hind foot are smaller than object 1.

The explanation above is to explain the effect of body angle, foot distance and foot angle on the results of the serve and effectiveness when serving down, so that the ball can enter the opponent's area perfectly. How also according to Hanif (2015) is a good serve is a serve with ball contact more in front of the body position.

4. Conclusion

Using biomechanical methods to influence body angle and foot position on the effectiveness of the lower serve technique in volleyball games. The study used a descriptive quantitative approach, which involved using the Kinovea app to analyze the video. The results show that body angle and foot distance affect the success rate of the serve. An object with a larger body angle and foot distance tends to successfully pass the ball across the net, while an object with a smaller angle and foot distance experiences failure. This was demonstrated by data from

two objects. This study shows that biomechanical analysis can help improve players' skill and precision in the basic technique of the lower serve.

References

Bambang., Ks, Hakim., A., A, Kusuma., H., N., M. (2014). *Biomekanika Olahraga.* Kemenpora.

Djollong, A. F. (2014). Tehnik Pelaksanaan Penelitian Kuantitatif. Istiqra' *: Jurnal Pendidikan dan Pemikiran Islam*, 2(1), 86–100

Hanif, (2015). *Sepak Takraw untuk Pelajar.* Jakarta : PT. Raja Grafindo Persada.

Khaidir, F., & Aziz, I (2020). Hubungan Kekuatan Otot Lengan dan Koordinasi MataTangan dengan Ketepatan Servis Atas Atlet Club Sultanika Putri Minas, Universitas Negeri Padang. *Jurnal Patriot,* 2(1), 2714-6596.

Kharmanda, G., & El Hami, A. (2017). *Biomechanics: Optimization, Uncertainties and Reliability.* USA: John Wiley & Sons.

León, S., Calero, S., & Chávez, E. (2016). *Morfología funcional y biomecánica deportiva (2E ed.). Quito, Ecuador:* Editorial de la Universidad de las Fuerzas Armadas ESPE.

Meriyanto, D., Nurrochmah, S., & Heynoek, F. P. (2016). Hubungan Antara Kekuatan Otot Tungkai Dengan Kemampuan Lompat Jauh. *Jurnal Pendidikan Jasmani*, 26

Mu'arifuddin, M. A. (2018). Pengembangan Model Latihan Passing Bawah Klub Bolavoli. *Jurnal Sportif,* 4(2), 2477-3379.

Muhajir. (2016). *Penjasorkes 1: SMP Kelas VII* (A. Setyanto & B. Wicaksono, Eds.; 1st ed.). Yudhistira.

Rizal, B. T., & Kasriman, K. (2020). Pengaruh Gaya Mengajar dan Koordinasi Mata Tangan Terhadap Keterampilan Smash Bola Voli. *Jurnal MAENPO: Jurnal Pendidikan Jasmani Kesehatan Dan Rekreasi.*

Sentot, M. U. B. (2017). Survey Teknik Dasar Bola Voli pada Siswa Ekstrakurikuler di SMP PGRI 2 Kota Kediri. *Simki-Techsain.*

Sudarmada, I. N., & Wijaya, I. M. K. (2015). *Biomekanika olahraga* (Cet. 1). Graha Ilmu.

Sugiyanto, S. (2017). Peningkatan Hasil Belajar Lompat Jangkit Peserta Didik SMKN 2 Purworejo, Melalui Analisis Biomekanika dengan Software Kinovea. *Jurnal Pendidikan Surya Edukasi*, 3(1), 1–10.

Sugiyono. (2015). *Metode Penelitian Kuantitatif, Kualitatif, dan R&G.* Bandung : Alfabeta.

Tao, Z., & Liang, X. (2019). Analysis of factors affecting serving effectiveness in volleyball matches. In 4th international social sciences and education conference (ISSEC). Wuhan*: Wuhan University of Technology Press* (pp. 187-190).

Uddin, Z. S., Setijono, H., & Wiriawan, O. (2020). Evaluasi Pembelajaran dan Latihan Siswa Smanor Sidoarjo pada Prestasi Nasional (Studi pada Atlet Putra Bola Voli Pantai Smanor Sidoarjo). *Jurnal Ilmiah Mandala Pendidikan*, 6(2), 488–498.

Waruwu, M. (2023). Pendekatan Penelitian Pendidikan: Metode Penelitian Kualitatif, Metode Penelitian Kuantitatif dan Metode Penelitian Kombinasi (Mixed Method). *Jurnal Pendidikan Tambusai*, 7(1), 2896–2910.

Yıldırım, G., Gencer., B., & Öğe. (2020). Analysis of the Relationship Between Service Power and Anthropometric Traits with Tennis Service Success in Female Volleyball Players. *Turkish Journal of Sport and Exercise.* 22(2), 183-188.

How to cite this article:

Walhidayat, B., & Raharja, A, T. (2025). Biomechanics Study on Volleyball Lower Serve Technique: The Influence of Body Angle and Foot Position, Sports Education Students of UMKT. *Journal of Educational Sciences*, *9(3)*, 1163-1169.