



Does Height Influence Volleyball Overhead Serve Accuracy? A Study of Students

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Abstract

The accuracy of the overhead serve is one of the basic skills that determines the success of volleyball. The success of this technique is influenced by various factors, one of which is anthropometric characteristics, especially height. This study aims to analyze the effect of height on the accuracy of the overhead serve in volleyball games in grade XI students of SMA Muhammadiyah Sape in the 2014/2015 academic year. This study uses a quantitative approach with a comparative design (causal-comparative). The study population consisted of 22 students, all of whom were sampled using a total sampling technique. The sample was then grouped into two groups, namely tall students (≥ 153 cm) and short students (< 153 cm), each consisting of 11 students. Height data were obtained through measurements using a stadiometer, while the accuracy of the overhead serve was measured using an overhead serve skill test for five trials. Data analysis was performed using descriptive statistics and the t-test at a significance level of 5%. The results showed that the tall student group obtained an average score of 22.18 for the accuracy of the overhead serve, while the short student group obtained an average of 16.18. The results of the hypothesis test show that the calculated t_{table} value of 4.082 is greater than the t_{table} table of 1.72 ($\alpha = 0.05$), so the alternative hypothesis is accepted. Thus, it can be concluded that height influences the accuracy of the upper serve in volleyball. This finding indicates that height is one of the anthropometric factors that supports the upper serve skill, although the success of the technique is also influenced by other factors, such as mastery of the technique, training, muscle strength, and motor coordination.

Keywords: Anthropometry, Volleyball, High School Students, Height, Accuracy of Overhead Serve

Introduction

Volleyball is a core subject in Physical Education, Sports, and Health (PJOK) courses, which aims to develop students' motor skills, fitness, tactical thinking, and sportsmanship. Mastery of basic volleyball techniques is crucial because it determines the effectiveness of the game, both in the context of learning and developing achievement. One of the basic techniques that students must master is the overhead serve, as it not only serves as the starting point of the game but also serves as the first attack that can provide an advantage for a team (Pawlik et al., 2024).

Successful overhead serves are influenced by various factors, both technical and physical. Good technical mastery requires adequate physical fitness to enable players to deliver powerful, accurate, and consistent shots. One physical factor thought to contribute to successful overhead serves is anthropometric characteristics. Anthropometry, the measurement of body dimensions, is often used as an indicator in talent identification, training program development, and athlete performance evaluation in various sports, including volleyball (Rosalina et al., 2024).

Height is an anthropometric component closely related to volleyball performance. Taller players generally have advantages in terms of longer arm reach, more optimal shooting angles, and the ability to produce more effective ball trajectories than shorter players. These characteristics make height a crucial consideration in the development of volleyball athletes from school age (Pocek et al., 2021).

Previous research has shown that several anthropometric components, such as height, arm length, and leg length, have a positive relationship with basic volleyball skills, including serving ability. However, this relationship is not always dominant, as playing skills are also influenced by training, motor coordination, playing experience, and other physical conditions (Suryadi et al., 2022).



In the context of physical education (PJOK) instruction in schools, differences in student ability in executing overhead serves are still frequently encountered. Some students are able to execute serves accurately toward the target, while others still struggle to control the direction and power of the shot. This situation indicates that in addition to mastering technique, students' physical characteristics also have the potential to influence the success of overhead serves. However, research on the effect of height on overhead serve accuracy in high school students, particularly in Bima Regency, is still relatively limited, so empirical studies are needed to provide more comprehensive information.

Muhammadiyah Sape High School is one of the schools that regularly implements volleyball lessons in its Physical Education (PJOK) subject. Based on initial observations, students' overhead serve abilities show significant variation. This phenomenon prompts the need for research into the contribution of height to overhead serve accuracy, which can serve as a basis for PJOK teachers and coaches in developing more effective learning and coaching strategies.

Based on the description, this study aims to analyze the effect of height on the accuracy of overhead serves in volleyball in grade XI students of SMA Muhammadiyah Sape. The results of this study are expected to provide scientific contributions regarding the role of anthropometric characteristics in basic volleyball technical skills and serve as a reference in the development of physical education and health education in schools.

Materials and Methods

This study used a quantitative approach with a comparative research design aimed at analyzing the effect of height on the accuracy of the overhead serve in volleyball. The study was conducted at Muhammadiyah Sape High School on 11th-grade students in the 2014/2015 academic year. The study design compared the overhead serve ability between a group of students with above-average height and a group of students with below-average height.

The study population was all 22 eleventh-grade students of Muhammadiyah Sape Senior High School. Considering the relatively small population, the study used a total sampling technique, so that all members of the population were used as samples. Furthermore, the sample was grouped based on the average height value. Students with a height of ≥ 153 cm were included in the tall group, while students with a height of < 153 cm were included in the short group. Each group consisted of 11 students.

The independent variable in this study was height, while the dependent variable was the accuracy of the overhead serve in volleyball. Height was measured using a stadiometer in centimeters (cm). The measurements were taken with the respondent standing upright, with both heels together, and looking straight ahead. The results were recorded to the nearest 0.1 cm according to anthropometric measurement procedures.

The accuracy of the overhead serve was measured using an overhead serve skills test. Each student was given five attempts to serve to a pre-scored target area. The score was the cumulative score of the five attempts. Serves that hit the net or went out of bounds were deemed ineligible. The equipment used in the study included a volleyball court, volleyballs, net, whistle, stadiometer, and a test record sheet.

The data were analyzed using descriptive statistics to obtain the average value, total score, and data distribution for each group. Furthermore, hypothesis testing was conducted using the t^* test on two independent groups with a significance level of 5% ($\alpha = 0.05$). The test was conducted to determine whether there was a difference in the accuracy of the upper serve between the group of tall students and the group of short students. The null hypothesis (H_0) states that there is no effect of height on the accuracy of the upper serve, while the alternative hypothesis (H_1) states that there is an effect of height



on the accuracy of the upper serve in volleyball. The test decision is determined by comparing the calculated t^* value with the t^* table at the specified significance level.

Results

The study involved 22 eleventh-grade students of Muhammadiyah Sape Senior High School, selected through a total sampling technique. Based on anthropometric measurements, the students' heights ranged from 143 cm to 163 cm, with an average of 153 cm. The students were then categorized into two groups: tall (≥ 153 cm) and short (< 153 cm), each consisting of 11 students.

Table 1. Characteristics of Respondents' Height

Characteristics	Mark
Number of respondents	22 students
Minimum height	143 cm
Maximum height	163 cm
Total height	3,369 cm
Average height	153 cm
Tall group	11 students
Low-bodied group	11 students

Based on Table 1, it is known that the average height of respondents is 153 cm. This value is used as the basis for grouping respondents into tall and short groups .

Top Service Accuracy Test Results

All respondents took a top serve accuracy test on five attempts. The score was the sum of the five successful serves.

Table 2. Top Service Accuracy Test Results

Group	n	Total Score	Average	Highest Score	Lowest Score
Tall	11	244	22.18	29	18
Short Body	11	178	16.18	20	11

Table 2 shows that the tall student group obtained a total score of 244 with an average of 22.18. In contrast, the short student group obtained a total score of 178 with an average of 16.18. The difference in the average of the two groups of 6.00 points indicates that students who are taller than average tend to obtain better results on the upper serve test than students who are taller than average.

Hypothesis Test Results

Hypothesis testing was carried out using a *t-test* at a significance level of 5% to determine the effect of height on the accuracy of overhead serves.

Table 3. Hypothesis Test Results



Statistics	Mark
Average height group (M_1)	22.18
Average of low body weight group (M_2)	16.18
Average difference	6.00
t count	4,082
t table ($\alpha = 0.05$)	1.72
Decision	H_0 rejected
Conclusion	H_1 accepted

The analysis results show that the calculated *t value* of 4.082 is greater than the *t* table value of 1.72 ($4.082 > 1.72$). Thus, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted. These results indicate that there is an effect of height on the accuracy of the upper serve in volleyball games for grade XI students of SMA Muhammadiyah Sape.

Descriptively, students with taller heights showed better upper serve performance than students with shorter heights. This difference was evident from the higher average upper serve score in the taller group (22.18) compared to the shorter group (16.18). The statistical test results also supported this finding with a calculated *t-value* of 4.082, which was greater than *the t-* table of 1.72. Thus, height was proven to influence the accuracy of upper serve in volleyball for students at Muhammadiyah Sape High School.

Discussion



The results of the study indicate that height influences the accuracy of the upper serve in volleyball for 11th grade students of SMA Muhammadiyah Sape. This finding is evidenced by the higher average value of the taller student group (22.18) compared to the shorter student group (16.18). In addition, the results of the statistical test show that the calculated t^* value of 4.082 is greater than the t^* table of 1.72, so the alternative hypothesis is accepted. Thus, height contributes to students' success in performing upper serves in volleyball.

These findings indicate that anthropometric characteristics, particularly height, are a contributing factor to the successful execution of basic volleyball techniques. Taller students have biomechanical advantages in the form of a longer arm reach and a higher ball contact angle. This allows players to generate more effective ball trajectories and makes it easier to direct the ball toward the target area when executing an overhead serve. In other words, the better a player's anthropometric characteristics, the greater the chance of optimal technical performance.

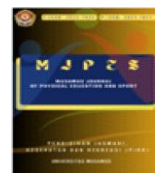
The results of this study align with those of Pocek et al. (2021), who reported that anthropometric characteristics have a significant relationship with technical performance in adolescent volleyball athletes. This study showed that height and arm length are important factors that differentiate technical abilities between players, especially in skills requiring vertical reach and motor coordination. Similarly, Rosalina et al. (2024) stated that anthropometric measurements contribute to volleyball player performance because they influence movement efficiency and the ability to reach the ball in various game situations.

Biomechanically, taller players have the advantage of producing a steeper shot angle, allowing the ball to more easily cross the net and into the opponent's court. Furthermore, a higher contact point means players don't need to compensate for the movement of the ball as much as those with shorter bodies. This increases the chance of a successful overhead serve, particularly in terms of accuracy. These findings support the research of Pawlik et al. (2024), which states that the effectiveness of a serve in volleyball is influenced by a combination of physical characteristics and technical mastery.

However, the results of this study also indicate that height is not the sole factor determining the accuracy of the overhead serve. Some students with relatively short statures were still able to achieve good serve scores, while some taller students did not always achieve the highest scores. This indicates that success in executing an overhead serve is also influenced by other factors, such as the quality of practice, hand-eye coordination, arm muscle strength, body balance, playing experience, concentration, and mastery of basic techniques. Thus, height functions as a supporting factor, not the primary determinant of successful serving skills.

The results of this study have practical implications for physical education teachers and volleyball coaches in schools. Information on students' anthropometric characteristics can be used as a basis for identifying their athletic potential and developing training programs that are more suited to their individual characteristics. Taller students can be guided to optimize their range of motion through structured technical training, while shorter students still have the opportunity to achieve good performance by improving their technique, motor coordination, muscle strength, and training frequency.

Despite providing meaningful findings, this study has several limitations. The number of respondents was relatively small, involving only one school with a total of 22 students, so the results cannot be widely generalized. Furthermore, the study only examined one anthropometric variable, namely height, without considering other physical variables such as arm length, leg length, muscle strength, explosive power, and motor coordination, which also have the potential to influence overhead serve ability.



Therefore, further research is recommended involving a larger sample size and combining several anthropometric variables and physical conditions to obtain a more comprehensive model to explain the factors influencing overhead serve skills in volleyball.

Conclusions

Based on the research results, it can be concluded that height influences the accuracy of the upper serve in volleyball games for grade XI students of SMA Muhammadiyah Sape. Students who have above average height show better upper serve ability than students who have below average height. This is shown by the average upper serve accuracy score of the tall group of 22.18, while the short group is 16.18. The results of the hypothesis testing also show that the calculated t^* value (4.082) is greater than the t^* table (1.72) at a significance level of 5%, so the alternative hypothesis is accepted.

The findings of this study indicate that height is one of the anthropometric factors contributing to the success of the overhead serve in volleyball. The superior reach of taller students provides a biomechanical advantage in achieving the direction and accuracy of the serve. However, height is not the sole factor determining the success of the overhead serve. Mastery of technique, training intensity, motor coordination, muscle strength, and playing experience still play a crucial role in improving serving skills. The results of this study provide practical implications for physical education teachers and volleyball coaches to consider the anthropometric characteristics of students in the learning process and sports coaching. Furthermore, further research is recommended to involve a larger sample size and examine other physical condition variables, such as arm length, muscle strength, explosive power, and motor coordination, so as to obtain a more comprehensive understanding of the factors that influence the accuracy of the upper serve in volleyball.

References

- Suryadi, A., et al. (2022). *The Correlation of Body Anthropometry and Volleyball Movement Skills*. Nusantara Sports Page: Journal of Sports Science.
- Berriel, G., Cardoso, A.S., Cavagni, M.E., Kruel, L.F., & Peyré-Tartaruga, L.A. (2025). *Profile of Brazilian Under-19 Volleyball Team Athletes: Anthropometry, Jump Performance, Stiffness and Pre-Stretch Augmentation Percentage*. *International Journal of Sports Physical Therapy*, 20 (8), 1152–1159.
- Gasparín Rodríguez, E.I., Gutiérrez Vera, S.O., Castineyra Mendoza, S., Levet Rivera, L., & Roldán Cruz, C.A. (2024). *Perfil Antropométrico en Jugadores de Voleibol de La Universidad Veracruzana*. *International Journal of Kinanthropometry*, 4 (1), 72–80. <https://doi.org/10.34256/ijk2419>
- Khanna, A., & Koley, S. (2020). *Comparison of anthropometric profile and handgrip strength between inter-university volleyball players and a reference group*. *Biomedical Human Kinetics*, 12 (1), 95–101.
- Pawlik, D., Bobula, G., & Mroczek, D. (2024). *The effectiveness and types of services used in elite women's and men's volleyball in the 2021/2022 season*. *Scientific Reports*, 14, 17286.
- Pocsek, S., Milosevic, Z., Lakicevic, N., et al. (2021). *Anthropometric Characteristics and Vertical Jump Abilities by Player Position and Performance Level of Junior Female Volleyball Players*. *International Journal of Environmental Research and Public Health*, 18 (16), 8377.
- Rosalina, R., Janah, R., & Hartanto, H. (2024). *Analysis of Anthropometric Measurements and Physical Fitness Levels: A Survey Study on the Men's Volleyball Team*. *Indonesian Journal of Physical Education and Sport Science*, 4 (3), 303–310.
- Sarafyniuk, L., Stepanenko, I., Khapitska, O., Lezhnova, O., & Vlasenko, R. (2024). *Anthropometric Features of Limbs in Volleyball Players of Different Somatotypes*. *Bulletin of Medical and Biological Research*, 6 (1), 52–63.



Yarar, H., Ervüz, E., Sarı, E., & Atalay, M. O. (2025). *Investigation of Motoric and Anthropometric Characteristics Affecting Serve Performance in Volleyball Players* . *Uluslararası Bozok Spor Bilimleri Dergisi*, 6 (2), 140–150.

Sugiyono. (2022). *Quantitative, Qualitative, and Re&D Research Methods* . Bandung: Alfabeta.

Arikunto, S. (2021). *Research Procedures: A Practical Approach* (Revised Edition). Jakarta: Rineka Cipta.

Bompa, T.O., & Buzzichelli, C. (2019). *Periodization: Theory and Methodology of Training* (6th ed.). Human Kinetics.

FIVB. (2021). *Official Volleyball Rules 2021–2024* . Fédération Internationale de Volleyball .