



The Contribution Ratio of Some Body Lengths to the Accuracy of the Volleyball Spike Among Third-Year Female Students at the College of Physical Education and Sports Sciences at the University of Kufa

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ABSTRACT

Original Research Article

The spike represents one of the most important offensive techniques in volleyball, as its successful execution depends on a set of specific physical characteristics and performance capabilities that enable players to apply it effectively during competition. In practice, coaches often prefer players who specialize in spiking and meet the height requirements that support efficient performance in this role. Accordingly, this aspect forms the core problem examined in the present study. In light of this, the study primarily aims to identify the body height variables associated with spike performance among the target population and to determine the relative contribution of each anthropometric variable to performance outcomes. To address these aims, the researcher adopted a descriptive research design using both survey and correlational approaches. The study sample consisted of female students enrolled in the College of Physical Education and Sports Sciences at the University of Kufa during the academic year (2024–2025). A range of data collection instruments and procedures was applied throughout the research process. Following a sequence of field-based procedures including determining the body measurements most closely linked to spike execution, establishing the validity of the spike test, conducting the primary experiment, and applying appropriate statistical analyses the findings indicated that spike performance is significantly associated with several anthropometric measurements, particularly forearm length and hand length. Moreover, increases in these measurements were found to correspond with greater spike accuracy among female students at the College of Physical Education and Sports Sciences, University of Kufa.

Keywords: Volleyball, Spike Accuracy, Anthropometric Measurements, Body Lengths.

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1. Introduction

1.1 Introduction to the Research and Its Importance

Scientific research in the field of sports represents a fundamental foundation for advancing athletes' performance levels, as it constitutes a systematic scientific framework that contributes to the discovery of new knowledge and provides diverse insights capable of supporting performance development and improvement.

Volleyball is one of the fastest-growing sports, experiencing rapid growth in popularity, player numbers, and fan base. The development of the sport is a primary objective of the International Volleyball Federation (FIVB), as evidenced by the emphasis placed on technical aspects through numerous tournaments across all age groups. Developing players is no easy task, requiring significant attention to cognitive, physical, and psychological factors, as well as personal and cultural development. For the player, reaching high levels in volleyball and achieving victory requires attention to training and mastering basic skills, without neglecting any of them.

The powerful spike is one of the important skills that has a clear impact on deciding the results of matches if it is used correctly.

It is noticeable that coaches pay attention to this skill and allocate sufficient time to train on it in training sessions. The matter has reached the point of appointing a distinguished player who specializes in executing it and who possesses qualifications and capabilities that make her able to play the ball in the right place and position.

Given the role that body measurements play in skill performance, and in light of studies that have proven the link between the smash shot and the skillful throw, it has become very important to choose the player who specializes in executing it according to its body requirements.

From this standpoint, it became necessary for the player who performs the smash to have the body lengths that qualify her to perform this task successfully. Therefore, it is important to identify the body lengths that contribute to the smash, and from here the scientific importance of this study emerges.

Its practical importance is highlighted by the attempt to benefit those working in the field of volleyball training, as its results and recommendations may help in selecting specialized players to carry out the spike according to body lengths, as well as focusing on those who contribute most to it in training units, in a way that achieves the implementation of game plans.

1.2 Research Problem

Through repeated observation and a review of multiple volleyball classes at the College of Physical Education and Sports Sciences, the researcher noted noticeable variation in the body heights of female students, reflecting clear individual differences. These variations appear to be associated with differences in spike accuracy among students. From an anthropometric perspective, body measurements are considered key determinants influencing the precision of spike performance.

Accordingly, the researcher chose to examine this topic in greater depth by identifying the most influential anthropometric variables related to spike performance among female students. In addition, the study seeks to propose objective criteria that may assist in selecting students or players who are best suited to represent their teams in both academic sessions and competitive matches.

1.3 Research Objectives

The research aims to:

1. To profile key anthropometric characteristics among a group of female students enrolled in the College of Physical Education and Sports Sciences at the University of Kufa.
2. To evaluate the level of proficiency in volleyball spiking demonstrated by these students.

3. To investigate the extent to which variations in body segment measurements are associated with differences in spike performance.
4. To estimate the predictive value of selected anthropometric dimensions in explaining variations in spiking accuracy.

1.4 Research Hypothesis

The researcher assumes that:

1. There is a statistically significant relationship between selected anthropometric length variables and the accuracy of spike performance in volleyball among female students at the College of Physical Education and Sports Sciences, University of Kufa.

1.5 Research Areas

1.5.1 Human Field: Third-year female students in the College of Physical Education and Sports Sciences at the University of Kufa for the academic year (2024–2025).

1.5.2 Spatial Area: The playground belonging to the College of Physical Education and Sports Sciences at the University of Kufa.

1.5.3 Time Frame: The period from (1/1/2025) to (1/3/2025).

2. Research Methodology and Fieldwork Procedures

2.1 Research Methodology

The researcher used the descriptive method—Studying correlational relationships is appropriate for the research topic and to solve the research problem.

2.2 Research Population and Sample

The study population comprised third-year students from the College of Physical Education and Sports Sciences at the University of Kufa during the 2024–2025 academic year, with a total of 22 students. From this group, a sample of 10 students was selected to participate in the main study, representing approximately 50% of the population. The remaining students were involved in the pilot procedures to support the preliminary phase of the research.

2.3 Research Tools and Equipment Used

2.3.1 Search Tools

Research tools can be understood as the practical means through which data are collected, research questions are addressed, and study objectives are achieved. To carry out the experimental procedures effectively, the researcher relied on a set of appropriate instruments and equipment that facilitated the implementation of the study and supported the accuracy of its outcomes. Accordingly, the following tools were utilized:

1. Sources, References, Research, and Related Studies

The researcher consulted many scientific sources and references, as well as research and studies related to the subject of the current study, in order to support it with everything that is scientific and sound.

2. Note

Through following and observing the volleyball matches and volleyball lessons in the college, as well as using modern technologies (the Internet), the researcher identified the problem of the study.

3. Survey

The researcher prepared a questionnaire (*). Two separate tests, one to determine the anthropometric measurements contributing to the accuracy of the smashing action, and another to demonstrate the validity of the smashing accuracy test, were presented to a number of expert specialists (**). The answers provided in them made it possible to determine those measurements and to identify the validity of the crushing multiplication test.

4. Testing and Measurement

To obtain the data required for addressing the study objectives, the researcher employed a set of suitable tests and measurement procedures aligned with the nature of the research.

2.3.2 Devices Used

To facilitate accurate data collection, the researcher relied on a range of supporting instruments and equipment suited to the requirements of the study. These included the following:

- Measuring tape
- Volleyball
- Volleyball court
- Manual calculator
- Personal computer
- Anthropometric measurement recording form and crushing test results

2.4 Field Research Procedures

To meet the central aim of the research identifying which anthropometric length measurements among third-year female students at the College of Physical Education and Sports Sciences, University of Kufa have the greatest effect on spike accuracy the researcher adopted an organized sequence of methodological procedures. These procedures involved core stages as well as supporting operational steps, presented as follows:

2.4.1 Identifying Some Anthropometric Measurements That Contribute To the Smashing Action among Fourth-Year Female Students in the College of Physical Education and Sports Sciences

To verify the appropriateness of the selected anthropometric variables, the researcher examined their potential effect on

(*)See Appendix (1)

(**)See Appendix (2)

volleyball spike performance among third-year female students at the College of Physical Education and Sports Sciences, University of Kufa. This process was supported by a review of relevant literature and earlier studies, followed by consultation with experts and specialists through a structured questionnaire designed to determine the body measurements most closely associated with spike accuracy.

After collecting the completed forms, the data were analyzed using the Chi-square (χ^2) test. The findings confirmed the adequacy of the selected body length variables, as the calculated χ^2 values exceeded the tabulated value (3.84) at one degree of freedom and a significance level of (0.05) (see Table 1).

Table 1. This shows the validity of the body lengths that contribute to the accuracy of the volleyball spike.

| No. | Body Measurement | Number of Responses | | Calculated χ^2 Value | Significance |
|-----|-------------------|---------------------|--------------|---------------------------|--------------|
| | | Suitable | Not Suitable | | |
| 1 | Total body height | 4 | – | 4.000 | Significant |
| 2 | Arm length | 4 | – | 4.000 | Significant |
| 3 | Thigh length | 4 | – | 4.000 | Significant |
| 4 | Leg length | 4 | – | 4.000 | Significant |
| 5 | Hand length | 4 | – | 4.000 | Significant |

2.4.2 Identifying the Test to Measure the Variables under Investigation (The Crushing Test)

The researcher defined the scope of her study by the skill indicator: (the smash hit). In order to determine the test that would measure this indicator, she conducted a survey of relevant scientific sources and references. A set of tests was also selected and presented to a group of experts to nominate one of them.⁽¹⁾

❖ The purpose of the test:

Measuring the accuracy of the smashing skill from center (4) towards center (5) of area (A).

❖ Tools used:

Volleyball court - goal line - measuring tape - 10 volleyballs.

❖ Performance specifications:

The coach sets the ball for the participant, who executes a spike from position (4) and directs it toward position (5) within area (A).

❖ Registration requirements:

The laboratory made three attempts:

- (4) points in area (A)
- (3) points in area (B)

⁽¹⁾Marwan Abdul-Majeed, *The Scientific Encyclopedia of Volleyball: Skills, Tactics, Physical and Skill Tests, Anthropometric Measurements, Criticism and Penalties, Refereeing, 1st ed., Amman: Al-Warraq Publishing and Distribution, 2001, p. 310.*

- (2) points in area (C)
- (1) point in area (D)
- Zero when the ball falls outside these areas.
- When the ball falls on a line common to two regions, the score of the higher region is calculated.
- The attempt is cancelled if a legal error is committed.

2.4.3 Exploratory Experiment

Verifying the validity of the procedures followed, determining the availability of the conditions related to body lengths, as well as the crushing test, and implementing those conditions is a fundamental requirement. Achieving this required conducting a two-stage exploratory study during the period from (2/17/2025) to (2/21/2025) on a sample of (10) female students who were randomly selected from the research population.

First stage:

The first phase of the exploratory experiment was conducted on (Sunday), to achieve several objectives, including:

1. Ensuring the accuracy of the methods used when performing body length measurements and the crushing test.
2. Clarity of instructions regarding body lengths and the crushing multiplication test, and understanding the contexts in which they are performed on female students.
3. The suitability of the specified time period for conducting body length measurements and the crushing test.
4. The necessary facilities were available, including appropriately prepared locations for conducting anthropometric measurements and spike testing, along with the required equipment and instruments.
5. Sufficiency of assistants (*) and their training.
6. The extent of students' motivation and responsiveness when conducting body length measurements and applying the crushing test.

The results of this experiment showed that all the aforementioned purposes were achieved, indicating the good response of the students and their eagerness to carry out the measurements of body lengths, the appropriateness of the time allotted for it, and the quality of its execution and organization, as well as the adequacy of the assistants and their understanding of how to conduct the measurements, apply the test, and record its results, in addition to the adequacy and appropriateness of the devices and tools.

Second stage:

The goal of this stage of the exploratory experiment is to verify the scientific parameters of the test and to analyze its items, to ensure its validity in measuring the crushing multiplication and its suitability for the items of the research population.

2.5 Scientific Procedures (Formative Foundations) For the Crushing Test

2.5.1 Honesty

The researcher established the content validity of the test by assessing how well it represents the skill it is intended to measure (the spike). A questionnaire was distributed to six specialists, and the test was considered valid when it achieved 100% agreement among the experts that it adequately reflects the targeted phenomenon.

After collecting and analyzing the data, the researcher applied the Chi-square (χ^2) test. The results indicated that the test was acceptable, as the calculated χ^2 value was greater than the tabulated value (3.84) at a significance level of (0.05) and one degree of freedom.

2.5.2 Stability

To verify the test's reliability, the test-retest method was used, and the test was re-administered six days after the first administration. The Pearson correlation coefficient between the scores of the first and second administrations was (0.88), confirming the test's high degree of reliability. This is further supported by the fact that the aforementioned squared correlation coefficient was (0.77), which is greater than (0.75), indicating a very strong relationship.⁽²⁾

It should be noted here that it is not necessary to verify the validity and reliability of anthropometric measurements, as they are a type of relative measurement. The possibility of error in them is small, and they are characterized by high validity and reliability coefficients.⁽³⁾

2.5.3 Objectivity

The researcher derived the objectivity coefficient by finding the correlation between the results of two judges (*) who evaluated the performance of the pilot study sample in its second phase (retesting). This approach is widely applied by specialists working in measurement within physical education and sports sciences. In this context, test objectivity refers to the consistency of scoring procedures across participants, such that the evaluation is not influenced by who performs the assessment. A smaller variation among judges' ratings indicates a higher level of objectivity in the obtained measurements.⁽⁴⁾

Overall, the correlation coefficient between the two judgments was (0.97). This confirms the test's high objectivity, given that the aforementioned squared correlation

⁽²⁾Muhammad Jassim Al-Yasiri; *Principles of Educational Statistics, 1st ed.*: (Najaf Al-Ashraf Dar Al-Dhiyaa for Printing and Design, 2010, p. 213

⁽³⁾ Kirkendall, B. Gruber, J. Johnson,. (1987). *measurement and evaluation in physical education. (2nd,ed Champaign, Illinois: Human kinetics publishers*

^(*)First Judge , Second Judge

⁽⁴⁾Kamal Abdel Hamid and Mohamed Sobhi Hassanin; *Measurement in Handball: (Cairo, Dar Al-Fikr Al-Arabi, 1980), p. 38*

coefficient was (0.941), which is greater than (0.75), indicating a very strong relationship. ⁽⁵⁾

2.6 Main Experiment

After completing the pilot study and obtaining its results, which demonstrated the validity of the crushing multiplication test and the fulfillment of the conditions for measuring certain body lengths, the researcher proceeded to measure the variables under investigation (body lengths) and apply the test. The researcher then applied the measurements and the test to the remaining members of the research population on February 24, 2025.

2.7 Statistical Methods Used in the Research

Data analysis was carried out using the Statistical Package for the Social Sciences (SPSS) to organize the dataset and present the findings. The statistical procedures applied in this study are outlined below:

1. Arithmetic mean
2. Standard deviation
3. Simple correlation coefficient (Pearson's)
4. Torsion coefficient
5. The loom
6. Test (F)

3. Results – Presentation, Analysis

3.1 Statistical Description of Anthropometric Distributions and the Crushing Test

The collected data were analyzed statistically to obtain the mean and standard deviation values for the selected anthropometric variables and the spike performance test. In addition, the standard error was calculated to support the interpretation of the results. The outcomes are presented in Table (2).

Table 2. The data show the arithmetic means, standard deviations, and standard errors of the research sample in body lengths and the crushing multiplication test.

| T | Variables | Statistical measures | | |
|---|-------------------|----------------------|-------|-------|
| | | Mean (\bar{X}) | SD | SE |
| 1 | Total body length | 1.771 | 0.057 | 0.011 |
| 2 | arm length | 2.046 | 0.055 | 0.011 |
| 3 | thigh length | 45.480 | 1.636 | 0.327 |
| 4 | leg length | 39,800 | 2.179 | 0.436 |
| 5 | palm length | 10,400 | 1.081 | 0.216 |
| 6 | crushing blow | 22.385 | 1.912 | 0.382 |

Table (2) presents the values of the mean, standard deviation, and skewness coefficient for the study variables. The results show that the mean values are higher than the corresponding standard deviations, suggesting limited variability among the participants in the research sample. The skewness coefficients

⁽⁵⁾Muhammad Jassim Al-Yasiri, *previous source*, p. 213

ranged from (0.01 to 0.72), falling within the acceptable range of (+1 to -1), which indicates that the data follow a normal distribution.

Table 3. Explanation of correlation coefficients between anthropometric measurements and smashing skill

| No. | Variables | Spike Skill | T value | Statistical Significance |
|-----|-------------------|-------------|---------|--------------------------|
| 1 | Total body height | 0.91 | 6.06 | Significant |
| 2 | Arm length | 0.80 | 3.87 | Significant |
| 3 | Thigh length | 0.92 | 6.50 | Significant |
| 4 | Leg length | 0.91 | 6.06 | Significant |
| 5 | Hand length | 0.87 | 4.92 | Significant |

The value reached the tabular T value of (2.31) at (8) degrees of freedom and a significance level of (0.05).

Table (3) shows a statistically significant correlation between total body height and the spike skill. The data indicate that the height variable achieved a correlation coefficient of (0.91) with the spike skill. The researcher attributes this to the fact that height is a logical characteristic for volleyball players, as the taller the player, the higher the center of gravity of the body, and therefore the greater the jump distance, enabling the player to overcome the height of the net and perform the skill successfully. This agrees with Hara, who indicated that volleyball is a game for tall players, and according to Hara's assertion, "Tall and agile bodies are the most suitable example for volleyball." ⁽⁶⁾

The data also showed a statistically significant correlation between the variable of arm length and the spike skill. The correlation coefficient reached (0.80), and the researcher explains this by stating that the length of the upper limb results in an increase in the force produced by the arm, according to the law:

$$\text{Power} \times \text{arm} = \text{Resistance} \times \text{its arm.}$$

Amin Anwar also points out that "the arm is the basic element used in performing motor skills of all kinds." ⁽⁷⁾

Table (3) also shows that the body measurements that contribute to the performance of the smashing skill are total body height, arm length, leg length, and hand length. This is confirmed by the correlation coefficients between these measurements and the spike skill.

These measurements play a significant role in the performance level of the smashing skill in terms of the player's ability to achieve the best level. Essam Abdel-Khaleq

⁽⁶⁾Hara, *Principles of Training*, translated by Abdul-Amir Naseef, Baghdad: Al-Tahrir Printing Press, 1975, p. 33.

⁽⁷⁾Amin Anwar, *Badminton: History, Skills and Tactics, and Rules of the Game*, 3rd ed., Cairo: Dar Al-Fikr Al-Arabi, 2001, p. 178.

also points out that there is a relationship between the components of the body as a whole and the possibility of reaching higher athletic levels.⁽⁸⁾

4. Conclusions and Recommendations

4.1 Conclusions

In light of the study objectives, the adopted methodology, the characteristics of the research sample, and the statistical analyses conducted, the following conclusions were drawn:

1. The accuracy of the spike is functionally associated with selected body length measurements among third-year female students at the College of Physical Education and Sports Sciences.
2. Higher values of body length variables among third-year female students at the College of Physical Education and Sports Sciences are accompanied by improved spike accuracy.

4.2 Recommendations

In light of the research findings, the researcher recommends the following:

1. University volleyball coaches must pay attention to the skill of the spike, select specialized players to execute it, and include specific drills for it in the training curriculum.
2. The necessity of selecting players specializing in performing the crushing multiplication in light of the body lengths extracted in this study.
3. The need to find scientific methods for selecting players specializing in smashing.
4. Studying the relationship between the crushing distance and other variables, identifying their contribution ratios, and deriving predictive equations to forecast them based on those variables.

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⁽⁸⁾Essam El-Din Abdel-Khaleq, *Sports Training: Theories and Applications*, 5th ed., Cairo: Dar Al-Kutub Al-Jami'ya, 1994, p. 33.

Appendices

Appendix (1) Names of Experts

| No. | Academic Title | Name | Specialization | Workplace |
|-----|------------------|-----------------|-----------------------|--------------------|
| 1 | Prof. Dr. | Basim Hassan | Training / Volleyball | University of Kufa |
| 2 | Assoc. Prof. Dr. | Hatem Fleih | Learning / Volleyball | University of Kufa |
| 3 | Assoc. Prof. Dr. | Ghaith Mohammed | Training / Volleyball | PhD Student |
| 4 | Assoc. Prof. Dr. | Mahmoud Nasser | Training / Volleyball | PhD Student |

Appendix (2) Form for Determining Anthropometric Lengths

| No. | Variables | Suitable | Not Suitable |
|-----|-------------------|----------|--------------|
| 1 | Total body height | | |
| 2 | Arm length | | |
| 3 | Thigh length | | |
| 4 | Leg length | | |
| 5 | Hand length | | |