Kinestetik : Jurnal Ilmiah Pendidikan Jasmani 9 (4) (2025)
Kinestetik : Jurnal Ilmiah Pendidikan Jasmani
https://ejournal.unib.ac.id/index.php/kinestetik/index
DOI : 10.33369/jk.v9i4.46378

The Relationship Between Arm Muscle Strength, Back Muscle Strength, Leg Muscle Strength, And Hand-Eye Coordination With The Overhead Volleyball Serving Ability Of Male Junior High School Students

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Article Info

Article History ;
Received : November 2025
Revised : December 2025
Accepted : December 2025

Keyword:
arm muscle strength, back muscle strength, leg muscle strength, hand–eye coordination, overhand serve

Abstract

In performing a volleyball serve, arm muscle strength, back muscle strength, leg muscle strength, and hand–eye coordination make a fairly dominant contribution. Therefore, this study aims to determine the relationship between arm muscle strength, back muscle strength, leg muscle strength, and hand–eye coordination with the overhand serving ability of male students at junior high school 12 bengkulu city. this research is correlational and uses a survey method with test and measurement instruments. the subjects of the study were 16 male students of junior high school 12 bengkulu city. the data analysis technique used regression analysis at a 5% significance level. based on the results of the study, the first hypothesis test obtained a calculated r value of 0.770 > r table (0.05)(15) = 0.412. the second hypothesis test obtained a calculated r value of 0.698 > r table (0.05)(15) = 0.412. the third hypothesis test obtained a calculated r value of 0.784 > r table (0.05)(15) = 0.412. the fourth hypothesis test obtained a calculated r value of 0.809 > r table (0.05)(15) = 0.412. the fifth hypothesis test obtained a calculated f value of 17.443 > f table (3.36). it can be concluded that there is a significant relationship between arm muscle strength, back muscle strength, leg muscle strength, and hand–eye coordination with the overhand volleyball serving ability of male students at junior high school 12 bengkulu city.

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ISSN 2685-6514 (Online)
ISSN 2477-331X (Print)

INTRODUCTION

Physical education is essentially an integral part of the overall education system, aimed at developing aspects of health, physical fitness, critical thinking skills, emotional stability, social skills, reasoning, and moral actions through physical activities and sports. According to Fitriandi (2019:1), in the intensification of educational implementation as a lifelong human development process, the role of physical education is very important because it provides opportunities for students to be directly involved in various learning experiences through physical activities, play, and sports carried out systematically. The provision of these learning experiences is directed toward fostering and shaping a healthy and active lifestyle throughout life.

In the process of physical education learning, teachers are expected to teach various fundamental movement skills, game techniques and strategies, the internalization of values (such as sportsmanship, honesty, and cooperation), as well as healthy lifestyle habits. The activities provided in teaching must receive didactic-methodical guidance so that the activities carried out can achieve the instructional goals.

The learning process of physical education in schools still emphasizes physical activities aligned with the competency standards of the subject, which include games and sports, developmental activities, self-testing or gymnastics, rhythmic activities, aquatics, and outdoor education (Depdiknas, 2018: 8). One of the sports taught to students is volleyball. Volleyball is one of the sports that students are interested in.

Volleyball is a sport that has been widely known by people of all ages, from children to adults, both male and female. This is in line with the opinion of M. Yunus (2022:1), who stated that, “Volleyball has begun to develop into a sport that is highly favored by the public, and according to experts, volleyball is currently recorded as the second most popular sport in Indonesia after soccer.”

Volleyball is one of the sports included in the curriculum at the junior and senior high school levels. Initially, the basic idea of volleyball was to send the ball into the opponent’s area across an obstacle in the form of a rope or net, and to win the game by grounding the ball in the opponent’s court. At the junior high school level, volleyball material is taught in grades VII, VIII, and IX, so the time available for learning volleyball at this level is quite extensive.

The techniques in volleyball are a very important factor. Suharno (2018 : 51) states that mastery of the basic techniques of playing volleyball is one of the elements that determines whether a team wins or loses a match, in addition to physical condition, technique, and mentality. According to M.

Yunus (2022: 68), technique in volleyball can be defined as a way of playing the ball effectively and efficiently in accordance with the applicable game rules in order to achieve optimal results.

Mastering the basic techniques of volleyball and achieving good physical condition is not easy. It requires hard training that starts from an early age. If the basic techniques are well developed, one will be able to play volleyball well. This is something that is naturally expected of every athlete in various branches of sports.

Volleyball consists of several techniques, including ball-handling skills such as serving, underhand passing, overhead passing, spiking, and blocking (Suharno, 2018: 14). The serve is the opening action in volleyball and several other sports that marks the start of a rally for earning points. It is also the only technique that is entirely determined by the individual's own ability (Didiek sismaldi, 2016: 26). To make it difficult for opponents to receive the ball, the serve must be powerful and directed toward areas that are hard for opponents to reach. A powerful serve requires coordinated strength from various muscles, including the arm and finger muscles, back muscles, and leg muscles. Arm strength is used to propel the ball, while finger strength helps determine the target, direction, and spin of the serve. Back strength refers to the force generated by the muscle groups in the back to move loads during contraction or exertion, and leg strength is used to achieve proper standing posture and generate optimal jumps when performing overhead or jumping serves. These muscle groups can perform optimally when the power they generate is properly controlled. Furthermore, to optimize the serving motion, good hand–eye coordination and accuracy are required. Factors that determine accuracy include a high level of coordination and the strength or weakness of a movement (Suharno, 2018: 32). Coordination is needed to harmonize movements and to ensure energy efficiency and movement effectiveness.

Of the five techniques mentioned above, the serve plays a significant role because a volleyball game cannot begin without a serve. By adhering to all applicable rules, the serve functions as the opening of the game.

A good service execution must of course be supported by proper timing, intensity, and frequency in practicing the service. With all of these, it is expected that players will understand how to deliver an accurate service that can trouble the opponent. To practice effectively, an appropriate training method that matches the service movement is also needed. With the right and balanced portion of training, players can further improve their ability in performing the overhead service.

Based on the explanation above, arm muscle strength, back muscle strength, leg muscle strength, and hand–eye coordination have a fairly dominant contribution to service ability. Theoretically, the determining factors of this ability can be justified, but it needs to be empirically proven how much these factors contribute to service performance.

from the explanation above, the researcher aims to determine the extent of the relationship between arm muscle strength, back muscle strength, leg muscle strength, and hand-eye coordination with volleyball serving ability, particularly among students of junior high school 12 bengkulu city. the variables to be examined consist of several test items, namely: arm muscle strength, back muscle strength, leg muscle strength, and hand-eye coordination.

PROCEDURE

The initial step in this study was to determine a sample of 25 athletes. The samples in this research were eighth-grade students at JUNIOR HIGH SCHOOL Negeri 12 Bengkulu City. Then, tests were conducted, which included an arm muscle strength test, a back muscle strength test, a leg muscle strength test, and a hand–eye coordination test.

DESIGN OR DATA ANALYSIS

1. Requirements Test

"To determine whether the data to be analyzed meets the required criteria or not, a prerequisite test is conducted. The prerequisite test in this research uses a linearity test."

a. Uji Linearitas

The linearity test is used to determine whether the independent variables used as predictors have a linear relationship with the dependent variable. Therefore, a linearity test needs to be conducted because it is a fundamental requirement that must be fulfilled. For the purpose of the linearity test, an F-test is performed, and the formula is:

$$F_{reg} = \frac{RK_{reg}}{RK_{res}}$$

Explanation:

F_{reg} = The numerical value for the regression line

RK_{reg} = Mean square of the regression line

RK_{res} = Mean square of the residuals

2. Hypothesis Testing

A hypothesis is a temporary answer to the research problem that has been formulated. Therefore, this temporary answer must be empirically tested. The collected data will show whether it supports the proposed hypothesis or rejects it. In this research, there are two types of hypotheses: the null hypothesis and the alternative

hypothesis. The null hypothesis (Ho) states that there is no relationship between one variable and another. Meanwhile, the alternative hypothesis (Ha) states that there is a relationship between one variable and another.

The analysis used to test the proposed hypothesis is to determine whether there is a contribution from the independent variables (X1, X2, X3, and X4) to the dependent variable (Y). To test the proposed hypothesis, the following analysis is used:

1. **Finding the Simple Correlation Coefficient**

a. To determine the relationship and prove the hypothesis between arm muscle strength and service accuracy, the following formula is used:

$$r_{x_1 y} = \frac{\sum x_1 y}{\sqrt{(\sum (x_1)^2 y^2}}$$

Description:

Rx_1y = Correlation between variable x_1 (arm muscle strength) and Y (overhand service ability)

X_1 = Arm muscle strength

Y = Overhand service accuracy

b. To find the relationship and prove the hypothesis between back muscle strength and service accuracy, the following formula is used:

$$r_{x_2 y} = \frac{\sum x_2 y}{\sqrt{\sum (x_2)^2 y^2}}$$

Rx_2y = The correlation between variable x_2 (leg muscle strength) and Y (overhead service ability)

X_2 = Leg muscle strength

Y = Overhead service accuracy

c. To find the relationship and prove the hypothesis between leg muscle strength and service accuracy, the following formula is used:

$$r_{x_3 y} = \frac{\sum x_3 y}{\sqrt{\sum (x_3)^2 y^2}}$$

Description:

Rx_3y = The correlation between variable x_3 (leg muscle strength) and Y (overhead service ability)

X_3 = Leg muscle strength

Y = Overhead service accuracy

d. To find the relationship and prove the hypothesis between hand–eye coordination and volleyball playing ability, the following formula is used:

$$r_{x_4 y} = \frac{\sum x_4 y}{\sqrt{\sum (x_4)^2 y^2}}$$

Description:

Rx_4y = The correlation between variable x_4 (hand–eye coordination) and Y (overhead serve ability)

X_4 = Hand–eye coordination

Y = Overhead serve accuracy

RESULTS

1. Description of Research Data

a. this study aims to analyze the relationship between arm muscle strength, back muscle strength, leg muscle strength, and hand-eye coordination with the overhand serve ability of male volleyball students at junior high school negeri 12, bengkulu city. to describe the research data, each variable in this study is as follows:

1) Arm Muscle Strength

The results of the data calculation for the arm muscle strength variable show: a minimum value of 26.5, a maximum value of 35, an average (mean) of 30.78, a median of 30, a mode of 30, and a standard deviation of 2.75. The descriptive analysis table for the Arm Muscle Strength data is as follows:

Table 1. Description of Arm Muscle Strength Frequency

No	Interval	Frekuensi	%
1	26 - 27	3	20
2	28 - 29	2	13
3	30 - 31	4	27
4	32 - 33	3	20
5	34 - 35	3	20
Jumlah		**15**	**100**

The results, when presented in the form of a diagram, can be seen as follows:

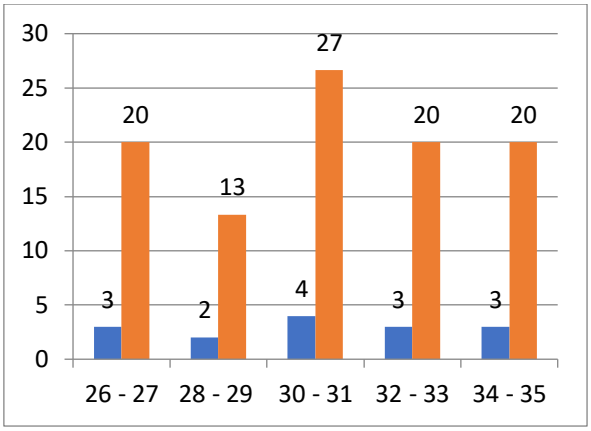

Figure 1. Arm Muscle Strength Diagram

2) Back muscle strength

The results of the calculation of back muscle strength data show that the minimum value = 82, maximum value = 96, average (mean) = 87.81, median = 87.5, mode = 85; and the standard deviation = 3.6. The descriptive table of back muscle strength data is as follows:

Table 2. Frequency Description of Back Muscle Strength

No	Interval	Frekuensi	%
1	82 - 84	1	7
2	85 - 87	6	40
3	88 - 90	5	33
4	91 - 93	2	13
5	94 - 96	1	7
Jumlah		**15**	**100**

The results, when presented in the form of a diagram, can be seen as follows:

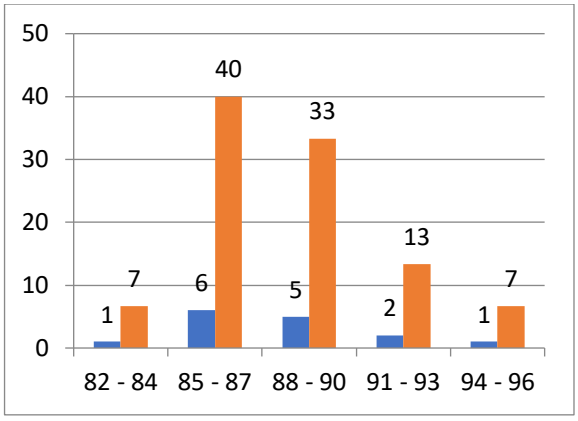

Figure 2. Diagram of Back Muscle Strength

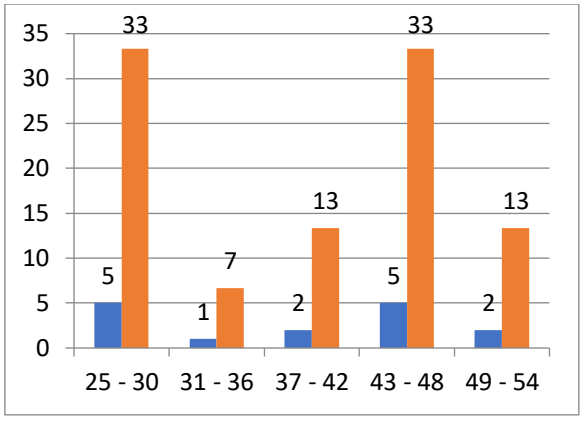

Figure 3. Diagram of leg muscle strength

3) Leg muscle strength

The results of the calculation of leg muscle strength data showed a minimum value of 19, a maximum value of 54, an average (mean) of 39.43, a median of 42, a mode of 46, and a standard deviation of 9.98. The descriptive table of leg muscle strength data is as follows:

Table 4. Frequency Description of Leg Muscle Strength

No	Interval	Frekuensi	%
1	25 - 30	5	33
2	31 - 36	1	7
3	37 - 42	2	13
4	43 - 48	5	33
5	49 - 54	2	13
Jumlah		**15**	**100**

These results, when presented in the form of a diagram, can be seen as shown below:

4) Hand-Eye Coordination

The results of the hand–eye coordination data analysis show a minimum value of 5, a maximum value of 13, an average (mean) of 7.75, a median of 8, a mode of 8, and a standard deviation of 1.91. The descriptive table of leg muscle strength data is as follows:

Table 4. Frequency Description of Hand–Eye Coordination

No	Interval	Frekuensi	%
1	5 - 6	2	13
2	7 - 8	10	67
3	9 - 10	2	13
4	11 - 12	0	0
5	13 - 14	1	7
Jumlah		**15**	**100**

These results, if presented in the form of a diagram, can be seen as shown below:

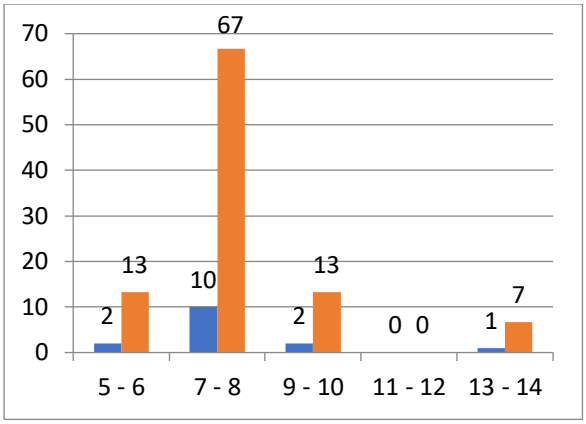

Figure 4. Hand–eye coordination diagram

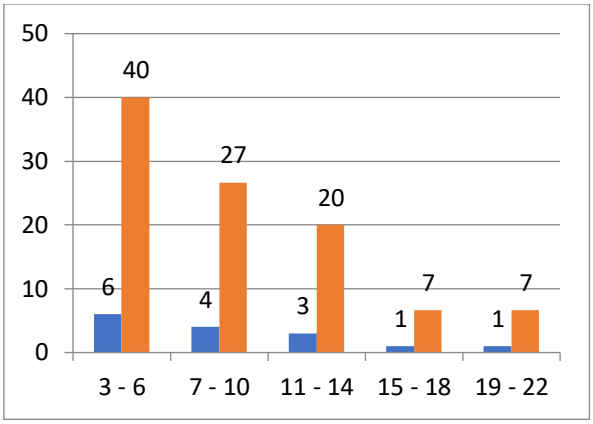

Figure 5. Top Service Diagram

5) Overhead Serve Ability

The results of the calculation of overhand service ability data obtained a minimum score of 5, a maximum score of 20, an average (mean) of 9.31, a median of 7, a mode of 6, and a standard deviation of 4.78. The descriptive table of Overhand Service Ability data is as follows:

Table 5. Frequency Description of Overhand Service Ability.

No	Interval	Frekuensi	%
1	3 - 6	6	40
2	7 - 10	4	27
3	11 - 14	3	20
4	15 - 18	1	7
5	19 - 22	1	7
Jumlah		**15**	**100**

These results, when presented in the form of a diagram, can be seen as shown below

DISCUSSION

The game of volleyball is a team sport played with a large ball, consisting of two teams, each with 6 players. The game is played by volleying the ball in the air and passing it over the net with the aim of landing the ball on the opponent's court to achieve victory. To win in volleyball, a player is required to have good basic volleyball skills, one of which is the ability to serve.

Service in volleyball is a signal for the start of the game and serves as the first attack to score points for the team that has the opportunity to serve. To score points directly, the serve must be performed properly and effectively. Usually, the overhand serve is a serving technique executed with a strong ball aimed to score directly. To support a good overhand serving ability, a good level of physical condition is also required. This study aims to examine the relationship between hand muscle strength, back muscles, leg muscles, and hand-eye

coordination with the ability to perform overhand serves in volleyball.

1. **The Relationship Between Arm Muscle Strength and Overhead Serve Ability**

   Based on the analysis results above, the calculated coefficient rcount=0.770>rtable(0.05)(49)=0.412r_{\text{count}} = 0.770 > r_{\text{table}}(0.05)(49) = 0.412rcount =0.770>rtable(0.05)(49)=0.412. Thus, it can be interpreted that there is a relationship between arm muscle strength and overhead serve ability. These results indicate that arm muscle strength contributes to the ability to perform an overhead serve. When executing an overhead serve, the arm is a key element; therefore, to propel the ball effectively, strength is essential so that the ball can travel with high speed.

2. **The Relationship Between Back Muscle Strength and Overhead Serve Ability**

   Based on the analysis results above, the coefficient obtained was **r_calculated = 0.693 > r_table (0.05)(15) = 0.412**. Therefore, the hypothesis is interpreted as indicating that there is a relationship between back muscle strength and overhead serve ability. When performing an overhead serve, the back acts as a support for the body, so a strong back is required. During the serve, the back functions like a spring, so when hitting the ball, the back must be strong and provide a push to the arm to strike the ball with power.

3. **The Relationship Between Leg Muscle Strength and Overhead Serve Ability**

   Based on the results of the analysis above, the obtained coefficient is r_{hitung} = 0.784 > r table (0.05)(18) = 0.412. Thus, it can be interpreted that there is a relationship between leg muscle strength and overhead serve ability.

   When performing a serve, the legs function as the body's support. Therefore, during an overhead serve, the leg position moves from a bent to a straightened position, which provides a push and strength to the arm while performing the serve.

4. **The Relationship Between Hand-Eye Coordination and Overhead Serve Ability**

   Based on the results of the analysis above, the coefficient obtained is r_calculated = 0.809 > r(0.05)(18) = 0.412. Thus, it can be interpreted that there is a relationship between hand-eye coordination and the ability to perform an overhead serve. When performing an overhead serve, a player must be able to see the target of the ball to be hit. Therefore, accuracy is created between the eyes and the hands; the eyes function

to see the target, and the hands function as the striking part of the ball, resulting in a powerful and accurate hit.

5. **The Relationship of Arm Muscle Strength, Back Muscle Strength, Leg Muscle Strength, and Eye-Hand Coordination with Overhead Serve Ability**

   Based on the analysis, the calculated F coefficient is 17.443 > F table (2.58) at a 5% significance level, and the calculated R (Rhitung) = 0.929 > R(0.05)(14) = 0.412. Thus, it is interpreted that there is a significant relationship between arm muscle strength, back muscle strength, leg muscle strength, and eye-hand coordination with the overhead serve ability of male students at JUNIOR HIGH SCHOOL Negeri 12, Bengkulu City.

   This relationship indicates that these variables are interconnected and affect overhead serve ability. When performing an overhead serve, the strength of the arms, legs, and back muscles, as well as eye-hand coordination, contribute to the performance of the serve. The contribution of each factor is as follows: arm muscle strength 11.19%, back muscle strength 6.55%, leg muscle strength 3.82%, eye-hand coordination 64.83%, and the remaining 13.6% is influenced by other factors not examined in this study.

CONCLUSION

From the results of the research and discussion presented in the previous chapter, several conclusions can be drawn from this study as follows:

1. based on the research results, the calculated r-value is 0.770 > r table (0.05)(15) = 0.412. thus, it can be concluded that there is a significant relationship between arm muscle strength and the overhand serve ability of male students at junior high school negeri 12 kota bengkulu.
2. based on the research results, the calculated r-value is 0.698 > r table (0.05)(15) = 0.412. therefore, it can be concluded that there is a significant relationship between back muscle strength and the overhand serve ability of male students at junior high school negeri 12 kota bengkulu.
3. based on the research results, the calculated r-value is 0.784 > r table (0.05)(15) = 0.412. from this result, it can be concluded that there is a significant relationship between leg muscle strength and the overhand serve ability of male students at junior high school negeri 12 kota bengkulu.
4. based on the research results, the calculated r-value is 0.809 > r table

(0.05)(15) = 0.412. from this result, it can be concluded that there is a significant relationship between hand-eye coordination and the overhand serve ability of male students at junior high school negeri 12 kota bengkulu.

5. the research results show that the calculated f-value is 17.443 > f table (3,36), so it can be concluded that there is a significant relationship between arm muscle strength, back muscle strength, leg muscle strength, and hand-eye coordination with the overhand volleyball serve ability of male students at junior high school negeri 12 kota bengkulu.

ACKNOWLEDGEMENT

Gratitude is expressed to the Principal of Junior High School Negeri 12 Kota Bengkulu for providing support, allowing this research to be carried out successfully.

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