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The relationship between hand muscle strength and hand eye coordination with lower passing skills in volleyball extracurricular students of SMPN 1 Talegong

Asep Gunawan[1]*, Akhmad Olih Solihin[2], Bangbang Syamsudar[3]
[1,2,3]Sekolah Tinggi Keguruan dan Ilmu Pendidikan Pasundan, Indonesia
gunawanyeni17@gmail.com

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ABSTRACT

This study aims to determine the relationship between hand muscle strength and hand-eye coordination with underhand passing skills in volleyball extracurricular students at SMPN 1 Talegong. This study uses a quantitative approach with a correlational method. Data were collected directly during extracurricular training sessions through a series of tests conducted in sequence. Each student participated in a hand muscle strength test, a hand–eye coordination test, and an underhand passing skills test. The study sample consisted of 20 male students who actively participate in volleyball training. The results showed that the data were normally distributed and the relationship between variables was linear. The correlation test showed a positive and significant relationship between hand muscle strength and underhand passing skills, as well as between hand-eye coordination and underhand passing skills. In addition, the double correlation between hand muscle strength and hand-eye coordination with underhand passing skills was also significant. These findings indicate that increasing hand muscle strength and hand-eye coordination together can improve underhand passing skills in volleyball students. Therefore, it is recommended that volleyball training programs in schools emphasize the development of these two aspects to improve player performance. This research provides an important contribution to sports development, particularly in the development of volleyball underhand passing techniques.

INTRODUCTION

Volleyball is one of the most popular sports in Indonesia, both at the school and community levels (Alfaisal et al., 2023). Volleyball not only requires excellent physical ability, but also good technical skills in order to play effectively and competitively. One of the very important basic skills in the game of volleyball is the bottom passing. Underpassing is a basic technique used to receive and control the ball from the opponent's serve or attack so that the ball can be passed to teammates properly. Success in doing the bottom pass is highly dependent on several factors, including the strength of the hand muscles and the coordination of the eyes.

According to Hidayat et al., (2023), hand muscle strength is one of the physical components that plays a very important role in various sports movements, including volleyball. Good hand muscle strength allows players to control the ball more steadily and provide accurate passing. In addition, hand-eye coordination is also an important factor that affects bottom passing skills. This coordination refers to the ability to integrate vision and hand movements simultaneously so that they can perform precise and efficient movements (Iorga et al., 2023).

Research conducted by Mubarok et al., (2021) shows that there is a significant positive relationship between hand muscle strength and lower passing skills in high school volleyball players. This indicates that the stronger a player's hand muscles, the better his lower passing ability. In addition, the study also emphasized the importance of hand-eye coordination in supporting volleyball technical skills, especially in receiving and controlling the ball.

In the context of coaching sports in schools, particularly volleyball extracurriculars, an understanding of the factors that affect bottom passing skills is essential (Zetou et al., 2022). By knowing the relationship between hand muscle strength and hand coordination against lower passing skills, coaches can design more effective and targeted training programs. This is in line with the opinion of Maulidiyyah & Purwoko, (2023) who states that exercises that focus on improving muscle strength and motor coordination can significantly improve athlete performance.

In addition, the physical and motor development of students in adolescence is also an important consideration in sports coaching. During this time, physical abilities such as muscle strength and motor coordination are in a rapid stage of development, so the right exercise intervention can have a great positive impact (Han et al., 2018). Therefore, this study aims to examine the relationship between hand muscle strength and hand eye coordination with lower passing skills in volleyball extracurricular students at SMPN 1 Talegong.

This research is expected to contribute to the development of more effective volleyball training methods, especially in improving lower passing skills. In addition, the results of this research can also be considered for coaches and sports teachers in designing exercise programs that suit students' physical and motor needs.

Based on the description above, it can be concluded that hand muscle strength and hand eye coordination are the two main factors that affect bottom passing skills in volleyball games. Therefore, this study will empirically test the relationship between the two variables and bottom passing skills in volleyball extracurricular students.

RESEARCH METHODS

This study uses a quantitative approach with a correlational method to determine the relationship between hand muscle strength and hand eye coordination with lower passing skills in volleyball extracurricular students at SMPN 1 Talegong.

Population and Sample

The population in this study is all students who participate in volleyball extracurricular activities at SMPN 1 Talegong. The sample taken was 20 male students who were selected by purposive sampling, namely students who actively participated in the exercise and met the health criteria to take the physical test.

Research Variables

1. Independent variables: hand muscle strength and hand eye coordination.
2. Bound variable: bottom passing skills.

Research Instruments

1. Hand Muscle Strength Test: Performed by the push up method for a certain time to measure the strength of the hand muscles.
2. Hand Eye Coordination Test: Performed with a test that measures the ability to coordinate between vision and hand movements, for example a ball throw test.
3. Lower Passing Skill Test: Conducted by observing and assessing students' lower passing techniques during practice or simulation matches.

Data Collection Procedures

Data are collected through the implementation of these tests directly in the field of extracurricular exercises. Each student undergoes a hand muscle strength test, a hand eye coordination test, and a lower passing skill test in order.

Data Analysis

The collected data was analyzed using a normality test to ensure the data was distributed normally, a linearity test to find out the linear relationship between variables, and a correlation test to test the relationship between hand muscle strength and hand eye coordination with lower passing skills. The analysis was carried out with the help of the SPSS version 23 program.

RESULTS AND DISCUSSION

Results

1. Normality Test

Table 1. Normality Test

Variable Relationship	Significance Value	Interpretation
Hand muscle strength and lower passing skills	0.200	Data is normally distributed (0.200 > 0.05)
Hand-eye coordination and lower passing skills	0.200	Data is normally distributed (0.200 > 0.05)

Before conducting a correlation analysis, a normality test is carried out to ensure that the data obtained is distributed normally (Abiodun et al., 2022). The results of the normality test showed that the data on hand muscle strength and lower passing skills had a significance value of 0.200, which is greater than 0.05. This indicates that the data is distributed normally. Similarly, data on hand-eye coordination and lower passing skills were also normally distributed with significance values of 0.200 > 0.05.

2. Linearity Test

Table 2. Linearity Test

Variable Relationship	Significance Value	Interpretation
Hand muscle strength and lower passing skills	0.378	Relationship is linear (0.378 > 0.05)
Hand-eye coordination and lower passing skills	0.213	Relationship is linear (0.213 > 0.05)

A linearity test is carried out to find out whether the relationship between the free variable and the bound variable is linear (Septiari, 2020). The results of the linearity test showed that the relationship between hand muscle strength and lower passing skills was linear with a significance value of 0.378 > 0.05. Likewise, the relationship between hand eye coordination and linear under-passing skills with a significance value of 0.213 > 0.05.

3. Correlation Test

Table 3. Correlation Test

Variable Relationship	Significance Value	Interpretation
Hand muscle strength and lower passing skills	0.000	Positive and significant correlation (0.000 < 0.05)
Hand-eye coordination and lower passing skills	0.044	Positive and significant correlation (0.044 < 0.05)
Double correlation (hand muscle strength & hand-eye coordination) with lower passing skills	0.000	Strong positive relationship (correlation coefficient = 0.771, 0.000 < 0.05)

Correlation analysis is carried out to find out the strength and direction of the relationship between variables. The results of the correlation test showed:

a Hand muscle strength has a positive and significant correlation with lower passing skills, with significance values of 0.000 < 0.05. This means that the stronger the student's hand muscles, the better the lower passing skills they have.

b Hand eye coordination also had a positive and significant correlation with lower passing skills, with a significance value of 0.044 < 0.05. This shows that good hand-eye coordination skills support effective under-passing skills.

c A double correlation between hand muscle strength and hand-eye coordination on lower passing skills showed a correlation coefficient of 0.771 with a significance of 0.000 < 0.05. This indicates a strong and positive relationship between the two free variables together with the bottom passing skills.

Discussion

This study examines the relationship between hand muscle strength and hand-eye coordination with lower passing skills in volleyball extracurricular students at SMPN 1 Talegong. The results of the analysis showed that the two variables had a positive and significant relationship with lower passing skills, either partially or together. These findings are in line with various theories and previous studies that affirm the importance of physical aspects and motor coordination in mastering basic volleyball techniques.

This study examines the relationship between hand muscle strength and hand-eye coordination with underhand passing skills in volleyball extracurricular students at SMPN 1 Talegong. The analysis shows that both variables have a positive and significant relationship with underhand passing skills, both partially and jointly.

These results support the proposed hypothesis, which states that hand muscle strength and hand-eye coordination contribute significantly to underhand passing skills. This finding aligns with existing literature, which emphasizes the importance of physical aspects, such as muscle strength, and motor coordination in mastering basic volleyball techniques. Previous research, such as that conducted by (Astuti, 2017), indicates that increasing hand muscle strength can improve passing performance. Furthermore, research by Putra (2020) also found that good hand-eye coordination enables students to execute passing movements more accurately and effectively.

Therefore, the results of this study are acceptable because they are consistent with theory and previous research, which demonstrate that both variables play a significant role in sports skills. However, it should be noted that while these results align with many previous studies, there is also research suggesting that other factors, such as playing experience and training techniques, may influence passing skills. For example, research by Cronin et al., (2017) found that longer playing experience contributed more to passing skills than muscle strength. Furthermore, showed that improper training techniques can hinder skill development even when muscle strength and coordination are adequate. herefore, further research is needed to explore other factors that may contribute to this skill.

1. Hand Muscle Strength and Lower Passing Skills

Hand muscle strength is one of the physical components that plays a very important role in the implementation of the lower passing technique. Underpassing requires good stability and control when receiving the ball, which relies heavily on the strength of the hand muscles. Hidayat et al., (2023) stated that the strength of the hand muscles allows players to hold and direct the ball precisely, so that passing can be done effectively. In this study, a significant positive correlation was found between hand muscle strength and lower passing skills, which means that the stronger the student's hand muscles, the better the lower passing ability they have. Here's a graph showing a strong positive relationship with an upward trendline, according to the study's results.

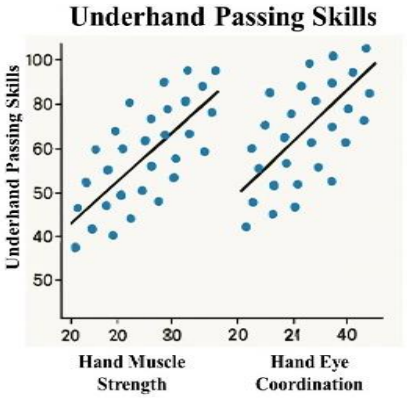

Figure 1. Underhand Passing Skills

This is also supported by Esposito et al., (2024) who emphasizes that exercises to increase the strength of hand muscles can improve the performance of basic techniques in volleyball. Adequate muscle strength helps players in controlling the ball stably, reducing passing errors, and improving the accuracy of passes to teammates. Therefore, the development of hand muscle strength should be the main focus in volleyball training programs, especially for beginners and teenagers who are in a period of physical development.

2. Hand Eye Coordination and Lower Passing Skills

In addition to hand muscle strength, hand eye coordination has also been shown to have a significant effect on lower passing skills (Rizzo et al., 2017). Eye coordination is the ability to integrate vision and hand movements simultaneously so that they can perform precise and efficient movements (Rizzo et al., 2017). In the context of volleyball, this coordination is essential to respond quickly to the ball and make accurate passes.

Research by Mubarok et al., (2021) and Syahruddin et al., (2022) also found that hand-eye coordination plays an important role in improving volleyball technical skills, especially in receiving and controlling the ball. Good coordination allows players to estimate the direction and speed of the ball so that they can adjust the position of the hands and body appropriately. In this study, a positive correlation between hand-eye coordination and lower passing skills showed that students with good coordination tended to have better passing skills as well.

According to Szabo et al., (2021), adolescence is an important period in motor development and coordination, so exercises that stimulate hand-eye coordination can have a significant positive impact on sports technical skills (Chirazi et al., 2025). Therefore, exercises that involve coordination activities such as throwing catches, reflex exercises, and dynamic vision exercises are highly recommended to improve bottom passing skills.

3. Dual Correlation of Hand Muscle Strength and Hand-Eye Coordination

The results of the double correlation showed that the combination of hand muscle strength and hand-eye coordination together made a strong contribution to lower passing skills, with a correlation coefficient of 0.771. This indicates that the two variables complement each other in supporting the performance of the bottom passing technique.

Granacher & Borde (2017) and Purwanto & Ockta (2024) emphasized that integrated physical and motor development will result in a more optimal increase in athlete performance compared to if they only focus on one aspect. In volleyball, hand muscle strength without good coordination will make it difficult to produce effective passing, just as coordination without adequate muscle strength will limit ball control ability.

Therefore, an exercise program that combines hand muscle strength training and hand-eye coordination exercises is essential to be applied in the coaching of volleyball extracurricular students (Setiawan & Makorohim, 2024). Strength exercises can be push ups, light weight lifting, or other

resistance exercises, while coordination exercises can include catching ball throws, reflex exercises, and dynamic vision exercises.

4. Practical Implications

The findings of this study provide practical implications for sports coaches and teachers in designing volleyball training programs. Focusing on improving hand muscle strength and hand-eye coordination can help students master lower passing techniques better, which will ultimately improve the team's overall performance. In addition, structured and continuous exercises will help students develop the physical and motor abilities necessary in the sport of volleyball.

5. Research Limitations

This study has a relatively small sample size and only involves male students from one school. Therefore, the results of this study may not be generalized widely. Further research is recommended to involve a larger and more diverse sample, as well as consider other variables that may affect bottom passing skills, such as flexibility, speed, and playing experience.

CONCLUSION

Based on the results of the research that has been conducted, it can be concluded that there is a positive and significant relationship between hand muscle strength and hand-eye coordination with lower passing skills in volleyball extracurricular students at SMPN 1 Talegong. Hand muscle strength plays an important role in providing stability and control when making down passes, while hand-eye coordination supports the precision and speed of response in receiving the ball. In addition, the combination of these two variables together makes a strong contribution to improving the bottom passing skills. Therefore, coaches and sports teachers are advised to develop an exercise program that focuses on improving hand muscle strength and hand eye coordination to improve the performance of volleyball players.

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