



The Contribution of Arm Muscle Strength to the Under-Passing Ability of Youth Women's Athletes Volleyball

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Abstract

Volleyball is a sport that requires a lot of physical fitness, but judging by the Pervos Kendal Club, their training methods appear to be mediocre. Furthermore, players frequently make errors when passing, especially when facing fast serves. This issue is believed to be related to arm muscle stability, but there is limited research evaluating specific physical factors in young female athletes aged 10 to 15. The purpose of this study is to analyze the contribution of arm strength to the lower passing ability in KU Youth female athletes at the Kendal Pervos Club. The type of research conducted was a correlational descriptive research using a correlation test to find out how much of a relationship between variables, with a sample of 15 KU Youth female athletes at the Pervos Kendal Club. The study was conducted by taking data on the strength of athletes' arm muscles using Modified Push-ups and taking athletes' lower passing data using the Brumbach Forearms Pass Wall-Volley Test. The results showed that the average push-up ability was 20.93 and the average lower passing was 24.60. Hypothesis test through simple linear regression revealed a significant influence with a significance value of 0.002 ($p < 0.05$) and indigo tcount of 3.818. The results of the determination coefficient showed that the strength of the arm muscles contributed 52.9% to the ability to pass the bottom. It can be concluded that the results of this study show that arm muscle strength has a significant and strong relationship with the ability to pass under volleyball in female athletes of KU Belia Klub Pervos Kendal.

How to Cite

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INTRODUCTION

Due to its increasing popularity, volleyball is played in many countries, including Indonesia. Volleyball is a team sport that has a dynamic, intermittent, and unpredictable nature with short and long rallies, and demands high reaction speed, quick decisions, and physical condition (Syamsuryadin, Suharjana, Ambardini, & Fauzi, 2025). Fitting The bottom is the basic skill that is the foundation for the skill Passing Complex bottom in volleyball (Maylitha et al., 2023). In fast-paced play, this tactic acts as a major defensive barrier and a gateway to the possibility of a targeted attack (Rocha et al., 2023). Fitting A stable bottom requires good ball control, which is greatly influenced by the athlete's level of physical fitness (Nawir, Jamaluddin, Hudain, D, & Arga, 2023).

Fitting Below, which uses the arm as the main touch point to control the trajectory of the ball, is an important volleyball technique (Batez, Petrušić, Bogataj, & Trajković, 2021). This vital ability allows players to attack by catching the opponent's serve or punch while still controlling the ball (Info, 2021). Precise and constant reflection on Passing bottom, is a stable arm platform, consistent angles, and thrust from the legs as well as the focus of instruction on the bounce of the ball (Giatsis & Tilp, 2022).

Efficient operatives according to (Millán-Sánchez, Parra-Royón, Benítez, & Espa, 2020), includes receiving the ball and producing precise and reliable bounces towards the setter. Because it allows players to create attack zones and handle chances with skillful passes, this ability is essential for both defense and offense. In addition, it encourages smooth passing between positions and highlights the importance of play (Sotiropoulos, Drikos, & Barzouka, 2021).

Physical ability, especially arm muscle strength, is essential for the success of athletes. (Dewantara & Raya, 2022) emphasizing that having strong muscles is essential to control the ball, which volleyball allows for more accurate delivery and reliable passes. The role of arm-shoulder strength and stability in Passing The bottom is able to withstand the energy of the ball and control the bounce when receiving the ball (Zarei, Eshghi, & Hosseinzadeh, 2021). Therefore, a study by (Deng et al., 2023) shows that arm muscle strengthening activities can improve overall technical skills. Additionally, players with stronger arm muscles can control the ball more accurately than those with weaker arm muscles (Muslimin & Desrtiana, 2025).

The Pervos Kendal Club is a coaching of adolescent athletes involved in the regeneration of strategic volleyball athletes throughout the region. However, preliminary observations show that the training pattern applied is still very conventional and relies heavily on the coach's subjective observation and the trainer's experience without being influenced by the evaluation of the physical parameter. Phenomena on the field show that many female athletes often make technical mistakes in anticipating the direction of the ball's arrival (Passing Error) when receiving quick service, which is thought to be related to arm muscle stability. Data-driven evaluation of this specific physical component is still quite limited, therefore the potential for performance improvement has not been fully realized (Oliveira, Marinho, Jacinto, Sampaio, & Morais, 2025).

With these limitations, Passing The bottom is often considered a fundamental talent, but in modern games, its effectiveness determines the shift from defense to attack (De Conti Teixeira Costa et al., 2024). Previous research has primarily examined eye-hand coordination or general biomechanics of arm swings in adult athletes. However, the unique contribution of arm muscle strength in female athletes in the young age range (10-15 years) who are still in the stage of biological development, remains unexplored in the literature. This is reinforced by (Camacho-Villa et al., 2024) which states that arm muscle strength is the mechanical basis that allows athletes to withstand the opponent's high-speed serving force, not just the supporting features.

Therefore, the aim of this study was to objectively test how arm muscle strength affects the accuracy of the lower passes performed by female athletes. The study is novel in that it focuses on a group of adolescent female athletes competing at the local club level, who are physiologically different from professional athletes.

METHOD

Descriptive correlational research was used in this study. This study aims to measure the strength of the relationship between independent and dependent variables and to investigate the interaction between the two. The main objective of this study was to assess how arm muscle strength affects the ability of volleyball players at the Pervos Kendal club to make down passes. If there is a strong enough relationship between the variables in the correlational study, the correlation coefficient will be high; If there is a weak relationship

between independent and dependent variables, the correlation results will be low.

In this case, arm muscle strength is an independent variable (X) while the lower passing ability in volleyball is a dependent variable (Y). This study used a complete sampling technique and involved 15 female athletes aged 10-15 years. The data collected was statistically processed using Pearson's Moment Product correlation test with the SPSS device. The study used two tools to collect valid data. The first is a 60-second Modified Push-up, which evaluates the strength of the arm muscles of a wnaite athlete. The second is the Wall Pass Test, which involves passing down to the wall past a predetermined boundary line to evaluate the accuracy, consistency, and control of the ball.

RESULTS AND DISCUSSION

Data collection for this study began on January 25, 2026 which has been planned in accordance with the activity plan of the Kendal Pervos Club. To test the validity and reliability of the data collected, the study involved 15 female athletes in the 10-15 year age category who were taken using a complete sampling technique from the athlete population at the club. In the next section, it will be discussed in depth about the descriptive statistical results of the variables of arm muscle strength and lower passing ability, the results of the analysis requirements test, and the results of the hypothesis test to see the contribution between these variables.

Table 1. Descriptive Statistics

Variable	N	Min	Max	Red	Std. Deviation
Push Up	15	10	35	20.93	6.431
Bottom Passing	15	8	47	24.60	13.010

Based on **Table 1** the number of samples was 15 people with an average push up score of 20.93 with a standard deviation of 6,431 and had the highest score of 35 and the lowest score of 10. Then in the table, the average passing score of 24.60 with a standard deviation of 13.010 with the highest score of 47 and the lowest score of 8.

Table 2. Normality Test

Variable	Sig.	Description
Push Up	0.071	Significant
Bottom Passing	0.907	Significant

Based on the results of the **Table 2.** Nor-

mality Test using the Shapiro-Wilk technique, the significance value for the variable of lower passing strength was 0.071 and the variable of push-up ability was 0.907. Because the significance value of the two variables is greater than 0.05 ($p > 0.05$), it can be concluded that the data of this study are normally distributed.

Table 3. Linearity Test

Variable	Sig.	Description
Push Up - Bottom Passing	0.991	Significant

Based on the results of the **Table 3.** Linearity Test, a significance value at Deviation from Linearity was obtained of 0.991. Because the significance value is greater than 0.05 ($p > 0.05$), it can be concluded that there is a significant linear relationship between arm muscle strength and lower passing ability in KU-Belia Kendal Kendal Club's female athletes.

Table 4. Correlation Test

Variable	Sig.	Pearson Correlation	Description
Push Up - Bottom Passing	0.015	0.614	Significant

Based on the **Table 4.** Correlation Test in the table above on the push up and bottom passing variables shows a sig. 0.015 result so that it can be stated that the two variables have a correlation or relationship because the sig value < 0.05 , besides that a Pearson correlation value of $0.614 > 0.610$ is also obtained which shows a strong relationship between the push up variable and the bottom passing variable.

Table 5. Coefficient Determination Test

Variable	R Square	Description
Push Up - Bottom Passing	0.529	Significant

Based on the **Table 5.** Determination Efficiency Test in the table, it can be found that the value of R Square is 0.529, so it can be concluded that the amount of push up contribution to the ability to pass under volleyball in KU-Youth athletes (10-15 years old) of the Pervos Kendal Club is 52.9%.

Table 6. T Test

Variable	T Count	T Table	Sig.	Description
Push Up - Bottom Passing	3.818	1.77093	0.002	Significant

Based on the results of the **Table 6**. T Test analysis, a t_{cal} value of 3.818 was obtained which was greater than the t_{table} of 1.77093 with a significance value of $(0.002 < 0.05)$. This shows that there is a significant influence between arm muscle strength and lower passing ability in female athletes of the Pervos Kendal Club.

With 15 female athletes from the KU-Belia Pervos Club Kendal participated in a study that revealed variations in their arm muscle strength and basic engineering skills. Descriptive analysis showed that the push-up variable had an average score of 20.93, ranging from 10 to 35. With a low score of 8 and a high score of 47, the lower passing variable has an average of 24.60. A preparatory test is carried out before evaluating the hypothesis. The Shapiro-Wilk test showed that the data was distributed normally, with significance values of 0.907 for push-ups and 0.071 for lower passing ability. Further, the linearity test showed a substantial linear relationship between arm muscle strength and a considerable variation of linearity of 0.991.

The results of the hypothesis test using Pearson correlation analysis, which yielded a value of 0.614, showed a significant relationship between the two variables. The results of the t-test with a significance level of 0.002 showed that the t_{count} value of 3.818 was higher than the t_{table} value of 1.77093. This shows that the ability of the study subjects to perform underhand passing is influenced by the strength of their arm muscles. In addition, arm muscle strength added 52.9% to the underhand passing ability of KU-Belia Club Pervos Kendal women's volleyball athletes, as shown by the results of the determination coefficient test with an R^2 value of 0.529.

The research findings show that Passing An effective lower requires strong arm muscles. Specifically, a contribution of 52.9% suggests that an athlete's arm muscle strength affects more than half of their ball control ability. The remaining contribution comes from elements outside the scope of this study that affect the athlete's abilities. Arm muscle strength is needed by a player because when receiving a low ball the player must produce enough force to be able to control the direction of the ball, in addition to that the contribution of arm muscle strength also keeps the arm plane firm so that the ball bounce is consistent and helps optimize hand swing so that the ball can reach the target accurately (Putra, Haetami., & Yanti, 2025). In this case, the research muscle highlights the contribution of the muscles of M. Triceps Brachii, Deltoid and Brachioradialis, the

three muscles have a great influence such as the Tricep muscle which is able to help players in controlling the ball so that Passing More stable (Martin, Gavra, & Martin-Hadmaş, 2024). Then swing while doing Passing The bottom volleyball will affect the quality Passing, in this case the deltoid will help by strengthening and maintaining the stability of the joints when receiving the ball (Zhang, Tian, & Chen, 2025). Brachiodialis in Passing The bottom of the volleyball will help with elbow flexion and keep the elbow stable when in contact with the ball as well as resist the impact force of the ball so that the direction of the bounce is more consistent (Chen et al., 2025), in its application, these three vehicles do not stand alone but complement each other to work together to support the ability to Passing Bottom Volleyball (Shuzhen et al., 2024).

In volleyball, the strength of the arm muscles will affect the amount of force or force exerted by the ball head, therefore it will affect the speed and distance of the ball (De Leeuw, van Baar, Knobbe, & Zwaard, 2022). This is because arm muscle strength and size consistently contribute to volleyball control and technique (De La Rosa et al., 2025). However, in the in-depth biomechanical analysis to control the distance of the ball, the feet and the position of the body provide strong power, so that in the game of volleyball the arm becomes additional power and the ball direction at the time of the Passing (Ozawa, Yamada, Ozawa, Vogt, & Kanosue, 2022). Overall arm muscle strength provides a foundation of strength that will have implications for quality Passing volleyball because it improves joint flexibility, muscle readiness to receive ball impacts, coordination and movement efficiency (Książek, Dziubek, Pietraszewska, & Słowińska-Lisowska, 2018).

The strength of the arm muscles is a provision for volleyball players, with the strength of the arm significantly able to improve the quality Passing Bottom Volleyball (Kudus, 2021). This happens because with good muscle strength it allows an increase in muscle contraction before and during contact with the ball, thereby helping to control the balance of the muscles so that the vibrations received are not too large and quickly subside quickly (Sollic et al., 2024). Increased muscle activation during the impact phase motivated by muscle strength is the main mechanism in reducing the vibration of muscle tissue during contact with the ball, then the vibration and force of impact received will be distributed throughout the arm so that it does not accumulate in just one joint (Cristea, Bălcău, & Haragăş, 2025).

In volleyball, the quality of passing is also measured by consistency Passing, with good arm muscle strength will tend to raise the consistency Passing volleyball bottom with good quality. Fatigue decreases the ability of the neuromuscular system to maintain force and speed of movement, resulting in acumen and technique Passing Downhill (Lambrich & Muehlbauer, 2025). Thus training the strength of the arm muscles becomes an inseparable thing to achieve the ability to Passing nice bottom (De Leeuw et al., 2022). This is also in line with research (Renanda & Henjilito, 2023) which states arm strength does indeed contribute to performance Passing later, another study also stated that the contribution of arm strength was significantly able to increase Passing Bottom Volleyball (Fajar, Kamarudin, & Zulraflil, 2023).

Therefore, this study shows that the quality of an athlete's basic technique is positively and significantly influenced by arm strength. When the weight of the ball is received, the trained arm muscles provide more precise stability and thrust. According to sports physiology, the main biomotor basis for new athletes to master techniques effectively is strength. In addition, previous research has shown that the development of muscle strength in the age range of ten to fifteen years has a major impact on the efficiency of technical maneuvers in the field. Thus, this study shows that improved lower-hand passing can be achieved by strengthening the arm muscles through activities such as push-ups. These findings became the basis for Club Pervos Kendal coaches to include arm strengthening exercises in their technical training program to achieve the best results.

CONCLUSION

Based on the results of data analysis and discussion, this study concludes that there is a positive and substantial influence between arm muscle strength and lower passing ability in KUBelia female athletes at the Pervos Kendal Club. Arm muscle strength contributed 52.9% in determining the success of the lower passing technique, while the remaining 47.1% was influenced by other factors such as eye-hand coordination, balance, and mental focus. The better the strength of the arm muscles that an athlete has (measured through push-up skills), the higher the level of accuracy and consistency in making lower passes. These results provide practical implications for coaches to make strengthening physical components, especially arm muscles, a priority in basic technique training programs for athletes in the age range of 10-15 years.

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