

Enhancing of Overhead Serving Skill Through Overhead Tricep Extension Training in Female Volleyball Athletes

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Abstract

The ability to perform on overhead serve as a basic technique is an important skill that must be mastered by volleyball players, as it determines the course of the game. However, most female volleyball players still have poor overhead serving skills. This study aims to determine the effect of *overhead tricep extension* training on the overhead serving skills of female volleyball players at a volleyball club in Bogor. This study used an experimental method with a *purposive sampling* design. The instrument used was an overhand serve skill test with an assessment of directional accuracy and consistency of the hit. The results showed that *Overhead Tricep Extension* training had an effect on the overhand serve ability of female volleyball players. The overhand serve ability of female volleyball players increased significantly after 16 sessions of training. The t-test produced a t-value of 9.77 > t-table = 1.7291 ($\alpha = 0.05$), which means that there is a significant effect of *overhead tricep extension* training on overhead serving ability. The results of this study recommend the importance of *tricep* muscle strength training for the overhead serving performance of volleyball athletes.

Keywords: arm muscle strength, overhead tricep extension, overhead serve, volleyball

1 INTRODUCTION

Volleyball is one of the most popular team sports in the world, including in Indonesia. The game is enjoyed by people from all walks of life because of its dynamic and challenging nature, which requires solid teamwork. In addition to being a recreational sport loved by the community, volleyball has also become an important part of physical education and official competitions at school, university, and sport community levels (Izah et al., 2025). Its widespread popularity makes volleyball a means of character building, discipline, and sportsmanship for its players.

Over time, volleyball has evolved into a highly organized competitive sport. Volleyball competitions are not only limited to the national level but have also reached the international level through world championships, professional leagues, and international tournaments. In Indonesia itself, volleyball training is carried out in stages through clubs, sports schools, and regional associations under the auspices of PBVSI. This development requires an improvement in the quality of coaches and athletes, as well as the application of more scientific and structured training methods to support the optimal performance of players.

As a sport that requires a combination of teamwork and individual skill, every volleyball player must master a number of basic techniques. These basic techniques include passing, smashing, blocking, and serving (Program Studi Pendidikan Jasmani dan Kesehatan et al., 2024). Mastery of these techniques is an important foundation in building effective and efficient performance. Without strong basic skills, team strategies will not run optimally

because coordination between players depends on the accuracy and strength of individual techniques (muhamad et al., 2025).

Of these various basic techniques, the serve occupies a very strategic position because it is the start of every rally and the opener of the match. Especially in the overhead serve, this skill not only serves to move the ball to the opponent's area, but also plays a role in controlling the tempo of the game, putting psychological pressure on the opponent, and creating opportunities to score points directly. Therefore, the quality of the overhead serve is often used as one of the main indicators of an athlete's success and competitiveness in various levels of volleyball competition (muhamad et al., 2025).

Under ideal conditions, a volleyball athlete should be able to perform an overhead serve with high accuracy, optimal power, and good consistency. A serve executed with such quality allows the team to better control the flow of the game. However, the reality on the court shows a different picture. Many athletes, especially those in the adolescent or club level categories, still struggle to produce an effective serve. The ball they deliver often lacks power, accuracy, or consistency, making it easier for the opponents to return it (Syntia et al., 2022).

One of the main causes of weakness in performing the overhead serve technique in volleyball is the strength factor of the arm muscles, particularly the triceps brachii muscle. This muscle is located at the posterior part of the upper arm and functions as the primary extensor of the elbow joint. According to (Kuncoro, 2021), the triceps brachii muscle plays a vital role in generating propulsion and arm swing speed during the final phase of the overhead serve when contact is made with the ball. Weakness in this muscle directly affects the reduction of hitting power and velocity, causing the ball to lose strength and making it easier for the opponent to receive. Therefore, physical training that focuses on increasing the strength of the triceps brachii muscle is essential to support optimal serving performance.

Upper arm muscle strength is one of the main biomechanical factors determining the effectiveness of hitting and serving movements in sports that involve throwing or striking actions (Shodiq Basuki et al., 2025) emphasized that improving triceps muscle strength can enhance the propulsion force during the final phase of the arm swing, which directly increases the velocity of the ball. Furthermore, (*Periodization-6th Edition: Theory and Methodology of Training - Bompa, Tudor O., Buzzichelli, Carlo - Google Buku*, n.d.) explained through the principle of specificity of training that exercises specifically designed to target certain muscle groups will result in significant improvements in sports skills that dominantly utilize those muscles. Therefore, training programs such as the *Overhead Tricep Extension* are highly relevant for developing triceps strength, which in turn supports better performance in overhead serving.

In a study (Izah et al., 2025) was found that there is a very strong correlation between arm muscle strength and the accuracy of the ball's direction when serving. Athletes with greater arm muscle strength tend to be able to control the ball more accurately and produce a more stable serve speed. Good arm muscle strength has a positive impact on the use of power when striking the ball. Having greater power is advantageous when hitting the ball (Febranto et al., 2024)

In addition to strength factors, muscular endurance also plays a role in influencing the quality of overhead serves. According (*Periodization-6th Edition: Theory and Methodology of Training - Bompa, Tudor O., Buzzichelli, Carlo - Google Buku*, n.d.), good arm muscle endurance allows players to maintain the quality of their serves for long periods of time without experiencing a decline in performance. This is particularly important in long-duration matches, where consistency in both strength and technique significantly determines the final outcome. Therefore, strength training exercises such as the *Overhead Tricep Extension*, when performed periodically and systematically, not only enhance maximum strength but also improve muscle endurance in maintaining consistent technical performance during serves. Therefore, developing triceps strength and endurance through well-planned and programmed exercises contributes directly to improving the quality of overhead serves in volleyball.

One effective exercise for strengthening the triceps is the Overhead Tricep Extension, which focuses on contracting the rear arm muscles with a full extension movement above the head. This exercise focuses on strengthening the triceps brachii muscle, which plays a direct role in the overhead serve movement.

However, there is still a lack of research specifically highlighting the effectiveness of the Overhead Tricep Extension exercise in adolescent female volleyball athletes. In fact, this age group is an important phase in athlete development as it forms the basis for skill development at higher competitive levels. Therefore, this research is relevant to provide scientific contributions in the field of sports coaching science as well as practical recommendations for coaches at the club and school levels.

Based on the above, the purpose of this study is to analyse the effect of the Overhead Tricep Extension exercise on the overhead serve ability of LVC female volleyball athletes. With this research, it is hoped that coaches will obtain more effective training strategies to improve the quality of athletes' basic techniques, especially in the aspect of the overhead serve.

2 RESEARCH METHODS

This study used an experimental method with a *one-group pretest = posttest design*. This design was chosen because it is suitable for measuring differences in ability before and after treatment.

In this design, the research subjects were first given a pretest, then received treatment in the form of a training programme, and finally were measured again through a posttest. In general, this research design can be described as follows:

Pretest→Treatment(Overhead Tricep Extension Exercise)→ Posttest.

Research Procedure

1. Pre-test: an overhead serve skill test was conducted to measure initial ability.
2. Treatment: The *Overhead Tricep Extension* training programme was administered 16 times over 6 weeks (3 times per week). Each session lasted approximately 30 minutes with gradual intensity (2–5 kg load).
3. Post-test: an upper serve skill test was conducted again to measure the results of the treatment.

The research instrument consisted of an overhead serve skill test with accuracy (number of balls hitting the target) and consistency (successful repetitions) assessments.

The research data were then analysed using descriptive and inferential statistics. Descriptive statistics were used to calculate the mean, total score, and standard deviation of the pretest and posttest values. Next, to test the hypothesis, a paired sample t-test was used with a significance level of 5% ($\alpha = 0.05$).

If the calculation results show that the t-value is greater than the t-table, it can be concluded that there is a significant effect of the *Overhead Tricep Extension* exercise on the overhead serving ability of LVC female volleyball athletes.

3 RESULT AND DISCUSSION

3.1 Research Result

The results of this study were based on a one-group pretest-posttest experimental design. The purpose of this design was to measure changes in overhead serving ability after being given treatment in the form of Overhead Tricep Extension training. The results were obtained through a pretest and posttest.

The pretest results showed that the average overhead serving ability of LVC female athletes was still in the adequate category with an average score of 14.7. After participating

in the training programme for 16 sessions, the average *posttest* score increased to 22. The descriptive results of the pretest and posttest can be seen in Table 1 below:

Table 1. Descriptive data results of pre-test and post-test

Variable	Pretest	Posttest	Increase
Total Score	294	440	146
Average	14,7	22	7,3
Standar Dev.	2,15	2,48	-

Table 1 shows that the average post-test score increased by 7.3 compared to the pre-test. Then, from the data above, normality will be tested to determine whether the data is normal or not. The data can be seen in Table 2 below:

Table 2. Results of the Liliesfors Normality Test

Type of test	L Calculated $\alpha=0,05$	L Table	Description
<i>Pre test</i>	0,0256	0,190	Normal
<i>Post test</i>	0,0207	0,190	Normal
Increase	-0,0115	0,190	Normal

Based on the data in Table 2, it can be concluded that the distribution of the initial and final tests as well as the improvement are normally distributed. Because L count $<$ L table, L count can be accepted. Next, the data will be tested for homogeneity to determine whether the data is homogeneous or not. The data can be seen in Table 3 below:

Table 3. Homogeneity calculation of the initial and final tests

Type of test	F Calculated $\alpha=0.05$	F Table	Description
Pre-test and Post-test	1,467	2,168	Homogeneous

Based on the data in Table 3, it can be stated that the initial and final test data from the homogeneity calculation obtained a calculated F value = 1.467 $<$ F table = 2.168 at a significance level (α) = 0.05 and df (19), so it can be concluded that the homogeneity test values from the initial and final tests have homogeneous variance.

Based on the above data, a difference test or t-test will be conducted to determine the effect or difference in the pre-test and post-test as follows:

Table 4. Results of the Pre-test and Post-test t-test

Statistics	Value
Calculated	9,77
Ttable ($\alpha=0,05$)	1,7291
Conclusion	Significant

Based on the t-test results in the table above, the calculated t-value = 9.77 > t-table = 1.7291 ($\alpha=0.05$), so the null hypothesis is rejected.

Based on the pre-test and post-test results table, the following diagram illustrates the results more clearly:

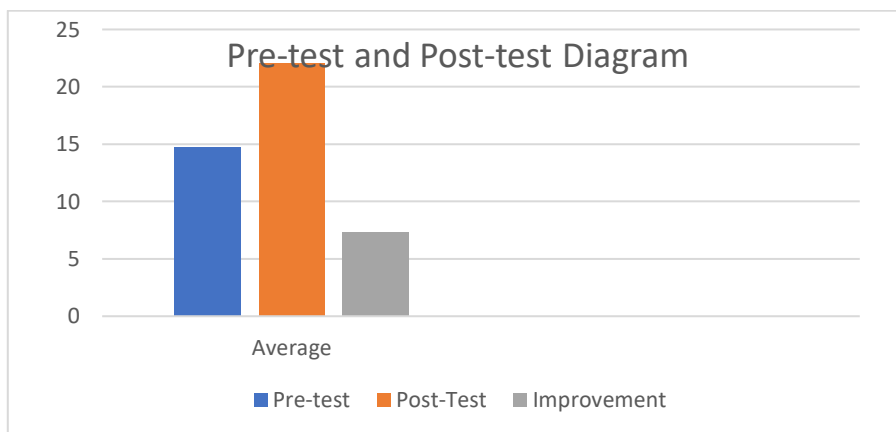


Figure 1. Diagram of Pre-test and Post-test Results

From the diagram above, it can be seen that there is a difference between the pre-test and post-test, with an increase after the final test or post-test. Furthermore, the t-test results will be illustrated in the following diagram:

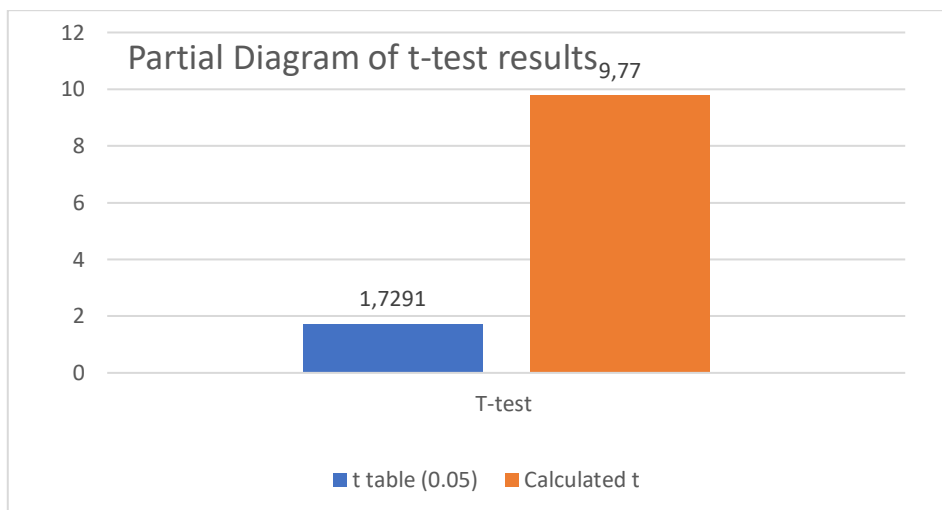


Figure 2. Diagram of T-test Results

Based on the t-test results in the diagram above, it can be seen that $t_{count} = 9,77 > t_{table} = 1,7291$ ($\alpha=0,05$). The results of the hypothesis test using the t-count formula from the initial test and final test show that $t_{count} > t_{table}$, so the null hypothesis is rejected while the alternative hypothesis is accepted.

3.2 Discussion

This improvement confirms that the Overhead Tricep Extension exercise has a significant effect on arm muscle strength, particularly the triceps, which impacts the accuracy and

strength of the overhead serve. This aligns with the research by (Syntia et al., 2022) which states that tricep extension exercises positively contribute to overhead serving skills.

In addition to the average increase, the paired sample t-test also supports this finding. The t-value of 9.77 is greater than the t-table value of 1.7291 at a significance level of 5%. Thus, the null hypothesis is rejected and the alternative hypothesis is accepted.

These results are consistent with the findings of (muhamad et al., 2025) which show a strong relationship between arm muscle strength and volleyball serving skills. In addition, these findings are also in line with the principle of specificity of training described by (*Periodization-6th Edition: Theory and Methodology of Training - Bompa, Tudor O., Buzzichelli, Carlo - Google Buku, n.d.*).

The conclusion drawn from the above data is that there is a difference between the initial and final tests, indicating that the Overhead Tricep Extension training programme has a significant impact on the overhead serving ability of female volleyball athletes at LVC.

4 CONCLUSION

This study concludes that the application of overhead triceps extension training has a significant effect on improving the overhead serving ability of female volleyball athletes. This exercise strengthens the triceps brachii muscle, which is a major component in the arm thrusting motion when serving, thereby affecting the power, accuracy, and consistency of the serve. This is in line with (*Teori Dan Aplikasi Latihan Kondisi Fisik - IDA BAGUS WIGUNA - Google Buku, n.d.*) opinion, which emphasises that the principles of sports training require the specificity of the muscles that are dominant in a particular skill. Strengthening the triceps muscles also supports energy efficiency and arm stability, which ultimately improves the effectiveness of the game (Arismanda et al., 2024). These findings are supported by research by (Sahabuddin, 2020) as well as (Pahrian et al., 2017), which shows that arm muscle strength is closely related to volleyball serving skills. Additionally, biomechanical aspects also play a crucial role, where coordination of upper body strength determines the success of the serve (Kesehatan et al., 2025).

Therefore, coaches are advised to regularly incorporate tricep strengthening exercises such as overhead tricep extensions into training programmes to optimise overhead serving performance, enhance contributions to match outcomes, and support the overall development of athletes' upper body strength.

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