12 (1) (2025) 157 - 161

Journal of Physical Education, Health and Sport

https://journal.unnes.ac.id/journals/jpehs

The Effect of Core Stability Exercises on The Accuracy of Jump Serve Volleyball Athletes

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History Article

Received July 2025
Approved July 2025
Published vol 12 no 1 2025

Keywords

Core Stability; Jump Serve Accuracy; Volleyball Training

Abstract

This study aimed to investigate the effect of core stability exercises on the accuracy of jump serves in volleyball athletes. The research was conducted using a quasi-experimental design with a two-group pre-test and post-test approach. The participants consisted of volleyball athletes from the Star Sport Rancaekek Club, who were divided into an experimental group and a control group. The experimental group received a five-week core stability training program, while the control group continued their regular training routine. Jump serve accuracy was measured using the AAHPER Serving Accuracy Test. Data analysis showed that the experimental group demonstrated a significant improvement in serve accuracy compared to the control group. These findings indicate that core stability training effectively enhances body balance, postural control, and coordination—key components in executing accurate jump serves. The results highlight the importance of incorporating core stability exercises into volleyball training programs, especially for improving specific technical skills. This study contributes to the field of sports coaching by offering practical insights into effective methods for developing skill-based performance in young volleyball athletes.

How to Cite

Hidayat, R., Sidik, D. Z., & Mulyana. The Effect of Core Stability Exercises on The Accuracy of Jump Serve Volleyball Athletes. Journal of Physical Education, Health and Sport, 12 (1), 157-161.

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p-ISSN 2354-7901
e-ISSN 2354-8231

INTRODUCTION

Volleyball is a team sport that relies heavily on individual technical skills and team coordination. One of the fundamental techniques that is crucial to the course of a match is the jump serve. This technique not only serves as an opening attack but also can put pressure on the opponent by speeding up the tempo of the game and creating immediate scoring opportunities (Maghfur & Irawan, 2022). In a competitive context, the success of a jump serve is determined not solely by power, but also by precision and good control of the ball›s direction and speed. Jump serve accuracy, which requires neuromuscular coordination and dynamic balance, is significantly influenced by athletes' postural stability and core control (Šćepanović et al., 2020).

However, in practice, the jump serve remains a challenge for many athletes, particularly in terms of accuracy. Service errors often occur due to a lack of body stability during the jump and hit phases. When the body is unbalanced, the ball is thrown off target and control of the shot is reduced. This results in serves that miss or fail to clear the net, directly impacting the loss of points in the match (Kilic et al., 2020). Therefore, a training approach is needed that focuses not only on technique but also on the physical components that support body stability during the serve (Dalamitros et al., 2019).

Core stability is a key factor underlying an athlete›s ability to maintain efficient and stable posture during dynamic movements. Strong core muscles, such as the abdominals, lower back, and pelvic floor, maintain the body›s center of gravity and support energy transfer from the lower to upper extremities during explosive movements such as the jump serve (Zemková & Hamar, 2019). When core stability is weak, athletes tend to lose body control, impairing movement coordination, and increasing the risk of injury, particularly to the back and lower joints (Akuthota et al., 2008).

Core stability exercises are designed to strengthen the body›s stabilizing muscles with the goal of improving balance, muscular endurance, and postural control (Sun, 2023). Numerous studies have shown that these exercises can improve athlete performance in various sports, including improving overall volleyball serving ability (Yapıcı, 2019). Exercises such as the plank, crunch, bird dog, and bridge are known to increase the effectiveness of functional movements involving rotation and jumping, two essential elements of the jump serve (Sedaghati et al., 2023). Moreover, core strengthening has been positively associated with increased hitting accuracy and body control during complex movements, especially in overhead sports like volleyball and tennis (Reed et al., 2016).

However, most existing research focuses on the effect of core stability training on balance or general performance in volleyball. Few studies have specifically and focused on the direct relationship between this training and jump serve accuracy as the dependent variable. The jump serve technique itself has complex biomechanical characteristics, as it involves the coordination of a vertical jump, an overhead shot, and ball control simultaneously (Marion Alexander, 2017). This simultaneous involvement of various body systems is what makes this technique require optimal core stability.

The novelty of this study lies in exploring the direct relationship between a structured core stability training program and jump serve accuracy in volleyball athletes, particularly in the context of club-level youth athletes. This research fills a gap in the literature that has not previously explored the specific technical dimensions of the volleyball serve. Furthermore, this study used a population relevant to the local context: athletes from the Star Sport Rancaekek Club, who possess superior physical posture but whose jump serve performance remains inconsistent. This demonstrates that physical potential does not always translate into technical performance without targeted training interventions.

By designing a five-week core stability intervention and quantitatively measuring jump serve accuracy using the AAHPER Serving Accuracy test, this study is expected to provide concrete empirical data regarding the effectiveness of this exercise in improving service technique performance.

The purpose of this study is to examine the effect of core stability training on the accuracy of jump serves in volleyball athletes, to provide empirical evidence of its influence on skill-based performance, and to fill the gap in existing literature regarding the role of physical conditioning—particularly core strengthening—in the development of specific technical abilities in volleyball.

The novelty of this study lies in its specific focus on the direct relationship between core stability training and jump serve accuracy, which has rarely been examined in previous research. While most prior studies explore general performance or balance, this research isolates technical execution—specifically jump

serve precision—as the primary outcome. Furthermore, the study uses a unique sample of youth club athletes who possess strong physical characteristics but inconsistent serving performance, highlighting the need for targeted core-based interventions in technical skill development.

By implementing a five-week core stability intervention and assessing performance using the AAHPER Serving Accuracy Test, this study contributes valuable data to inform training methodologies for volleyball players and coaches focused on precision-based skill development.

METHOD

This study used a quantitative approach with a quasi-experimental method, designed using a two-group pre-test and post-test design (Sugiyono, 2020). This design allows for evaluation of changes that occur after an exercise intervention is administered by comparing pre- and post-test scores in two different groups: the experimental group and the control group.

The study subjects were 20 volleyball athletes from the Rancaekek Star Sport Club, selected using a total sampling technique. Subjects were randomly divided into two groups of 10. The experimental group received core stability training for five weeks, three times per week, while the control group continued their regular training without additional intervention. The training program included movements focused on strengthening core muscles such as planks, side planks, crunches, bird dogs, and supermans, with a gradual progression of training volume (Sedaghati et al., 2023).

The instrument used to measure jump serve accuracy is the AAHPER Serving Accuracy Test, a service test conducted 10 times using the jump serve technique, and each attempt is scored based on the accuracy of the ball entering the target zone. This test has been widely used and proven valid and reliable in measuring the serving ability of volleyball athletes (Yapıcı, 2019).

Data were collected in two stages: before and after treatment (pre-test and post-test) Data processing was performed using SPSS version 25 (Fadluloh et al., 2024). The analysis began with the Shapiro-Wilk normality test to ensure data distribution. A paired sample t-test was then conducted to measure the significance of differences between pre-test and post-test scores, with a significance level of 0.05.

This method was chosen to be able to answer precisely whether core stability training has a significant effect on jump serve accuracy, as well as to provide a scientific basis for the development of more effective training methods in the sport of volleyball.

RESULTS AND DISCUSSION

Based on the descriptive statistics, it was found that the experimental group showed a significant increase in average scores from before to after treatment. The average pretest score for the experimental group was 25.30 with a minimum score of 24 and a maximum score of 27, and a standard deviation of 0.949. After undergoing the core stability training program, the average posttest score increased to 31.40 with a minimum score of 30 and a maximum score of 34 and a standard deviation of 1.350. Meanwhile, the control group, which was not given additional intervention, only showed a small increase from an average score of 25.10 in the pretest to 26.20 in the posttest. This indicates that core stability training has a positive effect on jump serve accuracy.

The Shapiro-Wilk normality test showed that all data groups, both experimental and control, both in the pretest and posttest, had significance values above 0.05. The significance value for the experimental pretest was 0.287, the experimental posttest 0.198, the control pretest 0.152, and the control posttest 0.575. Thus, it can be concluded that all data are normally distributed. This means that the requirements for conducting parametric statistical analysis, such as the t-test, have been met.

The results of the homogeneity test using Levene's Test showed a significance value of 0.903 based on the mean. Since this value is greater than 0.05, it can be concluded that the data from both groups have homogeneous variance. This homogeneity is important to ensure that comparisons between the experimental and control groups are conducted fairly without being influenced by differences in data distribution.

The results of the independent samples t-test showed that there was a significant difference between the experimental group and the control group in the posttest scores. The t-value obtained was 8.721 with degrees of freedom (df) = 18 and a significance value (Sig. 2-tailed) of 0.000. Because the significance value <0.05, the null hypothesis was rejected. This means that there is a significant effect of core stability training on the accuracy of volleyball athletes' jump serves. The average difference between the two groups of 5.20 indicates that the increase in performance of the experimental group was much greater than

that of the control group.

The results of the study showed that core stability training significantly improved jump serve accuracy in volleyball athletes from the Rancaekek Star Sport Club. This was demonstrated by an increase in the average score from 25.30 in the pretest to 31.40 in the posttest in the experimental group, and a t-test significance value of 0.000, indicating a highly significant difference. These findings support the hypothesis that systematic core muscle strengthening can improve control and precision in jump serves.

Core stability training plays a crucial role in improving body balance, which is the foundation for executing the jump serve technique. When performing a jump serve, athletes must maintain body stability in three main phases: the run-up, the mid-air, and the landing. Imbalance in any of these phases will result in a missed or inaccurate serve. As stated by (Sedaghati et al., 2023), in their thesis, core stability training can improve muscle strength and coordination, thus supporting postural control during explosive activities such as the jump serve.

Exercises such as the plank, side plank, crunch, bird dog, and superman in a five-week training program have been shown to be effective in developing stable core strength. This study confirms (Yapıcı, 2019), findings that six weeks of core training can improve serve power and accuracy. These exercises help reduce unnecessary compensatory body movements and maximize biomechanical efficiency, allowing the ball to be directed more precisely into the target zone.

In addition to muscle strength, improving serve accuracy is also related to fine motor coordination and visual focus during ball contact. A study by (Luo et al., 2022), found that core training combined with technique training can improve athletes' functional skills, including movement-specific accuracy. These results support the importance of a holistic training approach that addresses not only strength but also balance and neuromuscular control.

In the context of this thesis, the population studied came from the Star Sport Rancaekek Club, which boasts a physical advantage in the form of tall stature, but has not previously demonstrated optimal service technique performance. This shows that physical excellence alone is not enough without being supported by a targeted training program. Therefore, core stability intervention is relevant and has a real impact on improving basic technique performance. "When the core muscles are stronger and more balanced, athletes are better able to maintain optimal posture during the jump serve movement.

This study also confirms the view of (Zemková & Hamar, 2019), that the ability to maintain body balance while in the air is greatly influenced by core muscle function. By improving the ability to stabilize the body during the jump and torso rotation during the serve, athletes can produce more precise movements with fewer errors. Furthermore, a stable body posture also contributes to increased energy transfer from the lower to upper extremities, as explained by (Akuthota et al., 2008).

In terms of training methods, a five-week program applied progressively, three times per week, has yielded positive results in improving specific technique performance. Each session, consisting of a warm-up, core exercises, and cool-down, ensures proper muscle adaptation without causing excessive fatigue. This training not only improves accuracy but also reduces the risk of injury by improving muscle control.

These findings also support those of (Samson et al., 2020), who demonstrated that core stability training improves athletes' static and dynamic balance, which directly impacts serving technique. Similarly, (Laksana et al., 2024), stated that physical strengthening through core training impacts mental aspects such as confidence and focus, two crucial components when executing a jump serve under match pressure.

Overall, the results of this study demonstrate that core stability training not only provides physiological benefits to the core muscles but also supports technical skills by improving stability, coordination, and body control. Therefore, integrating this training into volleyball training programs is highly recommended, especially for coaches looking to improve their players' serve accuracy. This program can also serve as a model for broader training development in technique-based and precision-based sports coaching.

CONCLUSION

This study demonstrates that core stability training significantly improves jump serve accuracy in volleyball athletes from the Star Sport Rancaekek Club. A training program focused on core strengthening improves body stability, balance, and postural control, all of which play a crucial role in executing a high-accuracy serve.

By improving core muscle strength, athletes can execute jump serves with greater stability, control, and accuracy. These results demonstrate that strengthening core stability not only impacts physical performance but also effectively supports

mastery of specific volleyball techniques.

Thus, core stability training can be used as an applicable training method in developing service skills, especially in the jump serve technique, and can be an important part of volleyball athlete development programs in clubs and schools.

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