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THE EFFECTS OF SKIPPING AND HURDLE JUMP TRAINING ON VOLLEYBALL SMASH ABILITY AMONG FEMALE ATHLETES OF SRIKANDI VOLLEYBALL CLUB

Dwi Sekarwati^{1*}, Bambang Hermansyah¹, M. Taheri Akbar¹

¹Physical Education Study Program, Faculty of Teacher Training and Education, Universitas PGRI Palembang, Indonesia

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Abstract

Objectives: This study aimed to determine the effects of skipping and hurdle jump training on improving volleyball smash ability among female athletes of Srikandi Volleyball Club.

Materials and Methods: This study used a quantitative experimental method with a two-group pretest-posttest design. The participants were 16 female volleyball athletes from Srikandi Volleyball Club, Ogan Komering Ilir, Indonesia, selected using total sampling. The participants were divided into two groups: the skipping training group and the hurdle jump training group, with eight athletes in each group. The intervention was carried out for 16 training sessions, three times per week. Smash ability was measured using a volleyball smash accuracy test. Data were analyzed using descriptive statistics, normality test, homogeneity test, paired sample t-test, and independent sample t-test with a significance level of 0.05.

Results: The results showed that hurdle jump training significantly improved smash ability, with the mean score increasing from 10.75 to 13.13, representing an improvement of 2.38 points or 22.09% ($t = 2.421$; $p = 0.046$). Skipping training also significantly improved smash ability, with the mean score increasing from 5.63 to 9.38, representing an improvement of 3.75 points or 66.67% ($t = 7.638$; $p < 0.001$). The independent sample t-test showed a significant difference between the two groups ($t = 3.435$; $p = 0.004$), indicating that the hurdle jump group achieved a higher posttest mean score than the skipping group.

Conclusions: Both skipping and hurdle jump training significantly improved volleyball smash ability among female athletes of Srikandi Volleyball Club. Hurdle jump training produced a higher final smash score, while skipping training showed a greater relative improvement from pretest to posttest. These findings suggest that both training methods can be used as practical alternatives for improving lower-limb power and smash performance in volleyball training programs.

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Correspondence:

Dwi Sekarwati
Email: dwisekarwati20@gmail.com



INTRODUCTION

Volleyball is a team sport that requires the integration of technical skill, tactical awareness, physical fitness, and psychological readiness. In volleyball, players must master several fundamental techniques, including service, passing, setting, blocking, and smash. Among these techniques, the smash is one of the most decisive attacking skills because it allows a team to create direct pressure on the opponent and gain points during the game.

Smash performance is closely related to lower-limb explosive power, arm swing coordination, timing, and body control during take-off and landing. A player with good jump ability and accurate hitting mechanics is more likely to execute an effective smash. Therefore, physical training programs designed to improve leg power are essential in volleyball coaching, particularly for developing young athletes.

Preliminary observation at Srikandi Volleyball Club showed that the athletes' smash performance was still not optimal. Several athletes experienced difficulty producing high jumps and powerful attacks, which made their smash easier to block or return by the opponent. This condition indicated the need for specific training methods that could improve the physical components supporting smash ability.

Skipping training is a simple and practical exercise that involves repeated jumping movements using a rope. This training can improve coordination, rhythm, ankle strength, lower-limb endurance, and neuromuscular control. These physical components are important for volleyball players because smash performance requires repeated explosive jumps during training and competition.

Hurdle jump training is a plyometric exercise that requires athletes to jump over obstacles of various heights. This type of training emphasizes the development of lower-limb power, movement speed, and explosive take-off ability. In volleyball, hurdle jump training is considered relevant because the jumping pattern is similar to the take-off phase in smash and block movements.

Previous studies have reported that plyometric-based training can improve jump performance and volleyball-specific skills. Plyometric jump training has been shown to increase vertical jump height in volleyball players, while structured lower-limb power training contributes to improved explosive movement during attacking actions. However, the comparative effect of skipping and hurdle jump training on smash ability among club-level female volleyball athletes still requires further investigation.

Therefore, this study aimed to determine the effects of skipping and hurdle jump training on volleyball smash ability among female athletes of Srikandi Volleyball Club. This study also compared which training method produced a greater improvement in smash performance.

METHOD

Study Design

This study used a quantitative experimental method with a two-group pretest-posttest design. The design was used to compare the athletes' smash ability before and after the training intervention. The participants were divided into two experimental groups: the skipping training group and the hurdle jump training group. Both groups completed a pretest, received different training treatments, and completed a posttest using the same smash accuracy test.

Participants

The population of this study consisted of female volleyball athletes from Srikandi Volleyball Club, Desa Kandis, Kecamatan Pampangan, Kabupaten Ogan Komering Ilir, Indonesia. The sample consisted of 16 active female athletes selected using total sampling because all members of the population were included in the study. The participants were divided into two groups, with eight athletes in the skipping training group and eight athletes in the hurdle jump training group.

Instrument

The instrument used in this study was a volleyball smash accuracy test. The athletes were asked to perform smash attempts toward target areas marked with different scores. The score was determined based on the first landing point of the ball in the target area. Higher scores indicated better smash accuracy.

Training Procedure

The training program was conducted for 16 sessions from April to May 2026. Training was carried out three times per week. Before the intervention, all participants completed the pretest to measure their initial smash ability. After that, the skipping group received skipping training, while the hurdle jump group received hurdle jump training. At the end of the intervention period, both groups completed the posttest using the same smash accuracy test.

Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics were used to present the mean scores and improvement percentages. The normality test was used to determine whether the data were normally distributed, while Levene's test was used to examine homogeneity of variance. The paired sample t-test was used to determine the effect of each training method on smash ability. The independent sample t-test was used to compare the posttest scores between the skipping and hurdle jump groups. The level of significance was set at 0.05.

RESULTS

Descriptive Statistics

The descriptive analysis demonstrated improvements in volleyball smash performance following both training interventions. Athletes in the hurdle jump group increased their mean smash score from 10.75 ± 3.34 during the pretest to $13.13 \pm$

2.23 in the posttest, representing an average improvement of 2.38 points (22.09%). Six of the eight athletes improved their performance, whereas two athletes showed slight decreases in posttest scores.

In the skipping group, the mean smash score increased from 5.63 ± 2.07 to 9.38 ± 2.13 , corresponding to an average improvement of 3.75 points (66.67%). All athletes in this group demonstrated improvements following the intervention. These findings indicate that both training programs positively influenced smash performance, although the hurdle jump group achieved a higher absolute posttest score, whereas the skipping group demonstrated a greater relative improvement.

Table 1.

Descriptive Statistics of Volleyball Smash Performance

Group	Pretest Mean	Posttest Mean	Mean Difference	Improvement (%)
Hurdle Jump	10.75	13.13	+2.38	22.09
Skipping	5.63	9.38	+3.75	66.67

Normality and Homogeneity Tests

The assumptions for parametric statistical analysis were examined using the Shapiro–Wilk normality test and Levene's homogeneity test. The Shapiro–Wilk results showed significance values ranging from 0.063 to 0.767, all exceeding the threshold of 0.05, indicating that the data were normally distributed.

Levene's test also confirmed homogeneous variances between groups. The hurdle jump group produced a significance value of 0.456, whereas the skipping group yielded 0.573, both greater than 0.05. Therefore, the assumptions of normality and homogeneity were satisfied, allowing further analysis using parametric t-tests.

Table 2.

Results of Assumption Testing

Test	Variable	p-value	Interpretation
Shapiro–Wilk	Hurdle Jump Pretest	0.063	Normal
Shapiro–Wilk	Hurdle Jump Posttest	0.561	Normal
Shapiro–Wilk	Skipping Pretest	0.767	Normal
Shapiro–Wilk	Skipping Posttest	0.129	Normal
Levene's Test	Hurdle Jump	0.456	Homogeneous
Levene's Test	Skipping	0.573	Homogeneous

Effect of Hurdle Jump Training

The paired-sample t-test demonstrated that hurdle jump training significantly improved volleyball smash performance. The mean score increased from 10.75 to 13.13, with an average improvement of 2.38 points. Statistical analysis revealed $t(7) = 2.421$, $p = 0.046$, indicating a significant difference between pretest and posttest measurements.

Table 3.
Paired-Sample t-Test for the Hurdle Jump Group

Variable	Mean	Mean Difference	t	p
Pretest	10.75			
Posttest	13.13	2.38	2.421	0.046

Effect of Skipping Training

The skipping intervention also produced a significant improvement in smash performance. The average score increased from 5.63 during the pretest to 9.38 after training, representing an average improvement of 3.75 points.

The paired-sample t-test showed a highly significant effect ($t(7) = 7.638$, $p < 0.001$), indicating that skipping training effectively enhanced volleyball smash ability.

Table 4.
Paired-Sample t-Test for the Skipping Group

Variable	Mean	Mean Difference	t	p
Pretest	5.63			
Posttest	9.38	3.75	7.638	<0.001

Comparison Between Training Methods

An independent-sample t-test was conducted to compare posttest smash performance between the hurdle jump and skipping groups. The hurdle jump group achieved a significantly higher posttest mean (13.13 ± 2.23) than the skipping group (9.38 ± 2.13).

The analysis demonstrated a statistically significant difference between interventions ($t(14) = 3.435$, $p = 0.004$), suggesting that hurdle jump training produced superior post-intervention smash performance. However, it should be noted that the hurdle jump group also demonstrated substantially higher baseline performance before the intervention, whereas the skipping group exhibited a greater relative improvement throughout the training period. This finding should therefore be interpreted considering the initial differences between groups rather than attributing superiority solely to the intervention.

Table 5.
Independent-Sample t-Test Comparing Both Training Methods

Group		Posttest Mean	SD	t	p
Hurdle Jump		13.13	2.23		
Skipping		9.38	2.13	3.435	0.004

DISCUSSION

The present study demonstrated that both hurdle jump and skipping training significantly improved volleyball smash performance among female athletes of Srikandi Volleyball Club. The paired-sample analyses confirmed statistically significant improvements following both interventions, while the independent-sample comparison indicated that athletes who performed hurdle jump training achieved

significantly higher posttest smash scores than those who completed the skipping program. These findings suggest that both training methods are effective for enhancing offensive performance in volleyball, although hurdle jump training appears to provide greater sport-specific adaptations.

The superior effectiveness of hurdle jump training can be explained through the principle of training specificity. Hurdle jumps are classified as plyometric exercises that maximize the utilization of the stretch-shortening cycle (SSC), allowing muscles and tendons to store elastic energy during the eccentric phase and rapidly release it during the concentric phase. This mechanism increases explosive force production, jump height, and movement velocity, all of which are essential determinants of successful volleyball smashing. Because the movement pattern closely resembles the take-off phase of a volleyball spike, neuromuscular adaptations are transferred more effectively to sport performance than less specific exercises.

In contrast, skipping training also produced meaningful improvements in smash ability. Although skipping generated a larger relative percentage increase, this finding should be interpreted cautiously because the skipping group started with considerably lower baseline performance than the hurdle jump group. Athletes with lower initial performance generally demonstrate larger relative improvements due to greater potential for adaptation during the early stages of training. Physiologically, skipping enhances lower-limb muscular endurance, ankle stiffness, coordination, rhythm, and neuromuscular synchronization, which collectively contribute to improved jumping efficiency and movement control during spike execution. However, because skipping emphasizes repetitive low-amplitude jumps rather than maximal explosive take-offs, its transfer to volleyball-specific jumping performance may be less direct than hurdle jump exercises.

These findings are consistent with previous investigations reporting the effectiveness of plyometric training for volleyball performance. A systematic review by Ramírez-Campillo et al. concluded that plyometric training significantly improves vertical jump height, lower-body power, sprint ability, and sport-specific performance in volleyball players, with greater benefits observed when exercises closely replicate competitive movement patterns. Similarly, Slimani et al. reported that plyometric interventions consistently enhance explosive strength and jumping performance across various team sports through neuromuscular adaptations and improved motor unit recruitment. The present findings support these conclusions by demonstrating that hurdle jump exercises, which closely mimic volleyball spike movements, produce greater improvements in smash performance.

The effectiveness of skipping training observed in this study also agrees with previous evidence indicating that rope-jumping exercises improve lower-limb coordination, reactive strength, and movement efficiency. Although skipping may not produce the same magnitude of sport-specific adaptation as hurdle jump training, it

remains an inexpensive, accessible, and practical conditioning method for developing fundamental physical capacities, particularly among beginner athletes and clubs with limited training facilities.

An important consideration when interpreting the present findings is the difference in baseline performance between the two intervention groups. The hurdle jump group demonstrated substantially higher pretest scores than the skipping group before the intervention began. Consequently, the superior posttest performance observed in the hurdle jump group cannot be attributed exclusively to the intervention itself. Future studies should employ randomized allocation procedures or statistical methods such as analysis of covariance (ANCOVA) to control baseline differences and estimate treatment effects more accurately.

From a practical perspective, the findings suggest that volleyball coaches should prioritize hurdle jump exercises when the primary objective is to improve explosive jumping and smash performance. Nevertheless, skipping exercises remain valuable as complementary conditioning because they improve coordination, movement rhythm, and lower-limb endurance while requiring minimal equipment and financial resources. Integrating both exercises within a periodized training program may therefore provide a more comprehensive approach to developing volleyball-specific physical performance.

CONCLUSION

This study demonstrated that both hurdle jump and skipping training are effective training methods for improving volleyball smash performance among female athletes. The findings indicate that exercises designed to enhance lower-limb explosive power contribute positively to the execution of offensive volleyball skills by improving jump performance and movement efficiency during spike execution.

Among the two interventions, hurdle jump training appears to provide greater sport-specific benefits because its movement pattern closely resembles the take-off phase of a volleyball smash, thereby promoting more effective neuromuscular adaptations. Meanwhile, skipping training remains a practical and accessible alternative for developing lower-limb coordination, rhythm, and general explosive capacity, particularly in training environments with limited facilities.

From a practical perspective, volleyball coaches are encouraged to incorporate hurdle jump exercises as a primary component of plyometric training programs while using skipping exercises as complementary conditioning to support comprehensive physical development. Future studies should employ larger sample sizes, randomized group allocation, longer intervention periods, and additional performance indicators such as vertical jump height, spike velocity, and match performance to provide stronger evidence regarding the comparative effectiveness of plyometric training methods in volleyball.

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