

The Effect of Plyometric Hurdle Training on the Vertical Jump of Volleyball Extracurricular Students

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Keywords

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Jump; Vertical Jump;
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Abstract

Vertical jump ability is one of the key components of volleyball, especially for executing successful smashes and blocks. Based on observations at SMP Negeri 1 Jambu, the vertical jump ability of students in the volleyball extracurricular program is still not optimal, and the training provided has not specifically focused on improving lower-body explosive power. This study aimed to determine the effect of plyometric hurdle jump training on the vertical jump ability of students in the volleyball extracurricular program at SMP Negeri 1 Jambu. This study employed an experimental method with a one-group pretest-posttest design. The sample consisted of 13 students selected through purposive sampling. The research instrument was a vertical jump test. The plyometric hurdle jump training program was conducted over 12 sessions, three times a week. Data were analyzed using a normality test and a paired-sample t-test. The results showed that the average vertical jump increased from 52.85 cm in the pretest to 59.31 cm in the posttest, an increase of 6.46 cm. The statistical analysis yielded a significance value of 0.000 ($p < 0.05$). Therefore, plyometric hurdle jump training significantly improved the vertical jump ability of students in the volleyball extracurricular program at SMP Negeri 1 Jambu.

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INTRODUCTION

Volleyball is a popular sport in Indonesia, both in schools and among the general public (Bumburo et al., 2023). Volleyball players must understand basic tactics and be in high physical condition to perform at their peak (Keswando et al., 2022). In volleyball, key fitness components include strength, speed, agility, endurance, coordination, and explosive lower-limb power. These skills are required to perform various playing methods like as serving, receiving, spiking, and blocking (Sistiasih & Pradana, 2022).

The vertical jump is a key physical component in volleyball (Junianto & Widodo, 2023). This talent represents a player's capacity to jump vertically as high as possible while also reflecting the explosive strength of their leg muscles. This ability has a direct impact on the success of smashes and blocks because both are performed at the highest point above the net (Joyokusumo et al., 2025). The higher a player's jumping power, the more likely he is to make good attacks and play solid defence (Fauzi, 2021).

Low jumping ability is still a widespread problem among school-aged volleyball players (Aguss et al., 2021). This makes it difficult for players to hit the ball at the right time, resulting in poor smashes and blocks (Praja et al., 2024). This emphasises the significance of training programmes to develop lower-extremity explosive strength, which is a major determinant in enhancing leaping performance (Palinata, 2023).

Plyometric exercises are one of the most popular ways to build lower extremity strength. The stretch-shortening cycle is designed to improve the muscle's ability to create force swiftly and explosively. Hurdle leaping is an example of plyometric training that may be easily introduced into a school sports programme. This exercise involves regularly leaping over a series of obstacles, which helps to increase lower extremity strength, coordination, balance, and power (Setiawan et al., 2024).

Several previous studies have shown that plyometric exercise improves jumping ability (Shodiq et al., 2019). A study by Miftahul Naim et al. (2025) revealed that plyometric exercise considerably improved volleyball players' jumping abilities. Putra and Sugiharto (2023) found that hurdle training effectively increased jumping ability. Furthermore, a study Anggreani and Setiawan (2023) reported that different hurdle training methods affected lower-body muscle strength in volleyball players.

Nevertheless, these research findings still leave several research gaps that require attention. First, most previous studies were conducted on adult athletes, college students, or high school students, so empirical evidence regarding the effectiveness of plyometric hurdle training for junior high school volleyball players remains limited (Zhang et al., 2026). Second, there is no consensus yet on the optimal dose of hurdle jump training for adolescents, particularly regarding the frequency, intensity, volume, and duration of training capable of producing an optimal increase in jumping ability (Ramirez-Campillo et al., 2023). Third, studies implementing short-term training programs, such as four-week interventions, remain relatively limited, so the effectiveness of such programs cannot yet be comprehensively concluded (Zhang et al., 2026). Fourth, responses to plyometric hurdle training are thought to vary based on individual characteristics, such as age, gender, playing experience, and level of biological maturity, but these aspects have not been extensively explored in previous research (Ramirez-Campillo et al., 2023).

Therefore, although various studies have shown that plyometric exercises and hurdle training have the potential to improve jumping ability, scientific evidence regarding the effectiveness of plyometric hurdle training among junior high school volleyball club members remains limited. Furthermore, to date, no research has been conducted on plyometric hurdle training among volleyball club members at SMP Negeri 1 Jambu. Based on this research gap, the purpose of this study is to analyze the effect of a four-week plyometric hurdle training program on improving the jumping ability of participants in the volleyball extracurricular program at SMP Negeri 1 Jambu.

Preliminary observations conducted at the volleyball club of SMP Negeri 1 Jambu revealed that several students still demonstrated inadequate jumping ability. This limitation was particularly evident during spiking and blocking, as some students were unable to reach the ball at its highest point, resulting in less effective offensive and defensive performance.

Existing training programs mainly focused on basic volleyball techniques and had not incorporated structured exercises specifically designed to improve lower-limb explosive power and jumping ability. This condition indicates a gap between the need to improve students' vertical jump performance and the implementation of evidence-based training programs (Ozona & Sistiasih, 2023). Therefore, this study is expected to contribute theoretically to the development of sports science while also providing practical implications for coaches, physical education teachers, and schools in designing more effective training programs to improve students' jumping ability (Pratiwi et al., 2018).

METHODS

This study employed a pre-post-test design on a single group. This study looked into changes in vertical jump strength after plyometric hurdle training (Imandaqurani & Pratama, 2025). This investigation was carried out on the volleyball court at SMP Negeri 1 Jambu in Semarang Province. The training programme lasted four weeks and included three training sessions per week for a total of twelve.

The sample comprised of 13 students chosen using targeted sampling. Inclusion criteria included active involvement in the volleyball club programme, willingness to complete the entire training programme, and no injuries during the study period. The independent variable in this study was plyometric hurdle training, while the dependent variable was jump strength. The training program is shown in **Table 1**.

Table 1. Training Program

Week	Hurdle Height	Training Program	Volume	Intensity	Rest
1	40 cm	Double Leg Hurdle Jump, Continuous Hurdle Jump, Hurdle Jump with Landing Hold	3 sets × 6–8 repetitions	Low	60–75 seconds
2	40 cm	Double Leg Hurdle Jump, Lateral Hurdle Jump, Continuous Hurdle Jump	3 sets × 6–8 repetitions	Low–Moderate	75 seconds
3	50 cm	Hurdle Jump with Landing Hold, Lateral Hurdle Jump, Continuous Hurdle Jump	4 sets × 6–8 repetitions	Moderate–High	90 seconds
4	50 cm	Combination (Forward + Lateral), Double-Leg Hurdle Jump	4 sets × 6–8 repetitions	High	90 seconds

A vertical jump test was used to collect data prior to and after the intervention. Each participant made two jumps, with the higher jump determining the measurement conclusion. The data were analysed with IBM SPSS Statistics. The Shapiro-Wilk normality test and the dependent sample t-test with a significance level of 0.05 were used to assess the impact of plyometric hurdle training on students' vertical jump ability in the volleyball club programme at SMP Negeri 1 Jambu.

RESULTS AND DISCUSSION

This study was carried out for four weeks at SMP Negeri 1 Jambu, using three training sessions per week. The sample comprised of 13 volleyball club members chosen using directed sampling. The purpose of this study was to investigate the effect of plyometric obstacle training on boosting students' vertical jump strength. **Table 2** shows the vertical jump strength data taken prior to (pretest) and after (posttest) intervention.

Table 2. Description of Vertical Jump Data

	N	Min	Max	Mean	Std. Deviation
Pre-test Vertical Jump	13	47	63	52.85	5.030
Post-test Vertical Jump	13	54	69	59.31	3.383

Table 2 shows that the average jump height rose by 6.46 cm between pre-test (52.85 cm) and post-test (59.31 cm). This increase in average jump height suggests that hurdle plyometric training improved students' lower extremity explosive power. Furthermore, the maximum jump went from 63 cm to 69 cm, while the minimum jump increased from 47 cm to 54 cm. These findings suggest that the majority of study participants increased their jumping skill. The increase in minimum scores suggests that even participants with poorer baseline performance improved after completing the training programme. Simultaneously, the increase in maximum scores suggests that the training intervention helped to improve performance in subjects with greater baseline performance. The standard deviation reduced from 5.03 to 3.38, indicating that the data were more homogenous after the test than before. Thus, the descriptive data indicate a trend of better leaping ability following the intervention, which included plyometric hurdle training.

Prior to conducting a hypothesis test to investigate the influence of plyometric obstacle training on vertical jump strength, the data were normalised using the Shapiro-Wilk test. The normalcy test results are presented in **Table 3**.

Table 3. Results of the Shapiro-Wilk Normality Test

		statistic	df	Sig.
Vertical Jump Test Results	Pre-test	0,896	13	0,119
	Post-test	0,911	13	0,191

The normal distribution of the data was evaluated using the Shapiro-Wilk test, as shown in **Table 3**. The significance level was 0.119 for the pre-test data and 0.191 for the post-test data ($p > 0.05$). These results show that the pre-test and post-test data are regularly distributed, as the significance level is greater than 0.05. The research data can be analysed using parametric statistical tests because the normal distribution assumption is met. To assess the hypothesis about the influence of plyometric obstacle training on vertical jump strength, a dependent sample t-test was utilised (Ruman, 2021). **Table 4** shows the results of the dependent sample t-test.

Table 4. Results of the Paired-Sample t-Test

Paired Sample t-Test								
Paired Difference								
95% confidence Interval of the Difference								
	mean	Std. deviation	Std. Error mean	lower	upper	t	df	Sig.(2- tailed)
Pre-test Post-test vertical jump	-6.462	2.665	.739	-8.072	-4.851	- 8.742	12	.000

Table 4 indicated a significance level of 0.000 ($p < 0.05$). The results show a substantial difference in vertical jump scores before and after the intervention. Thus, plyometric hurdle training considerably increased the vertical jump ability of volleyball club students at SMP Negeri 1 Jambu. The observed improvement in vertical jump performance following the intervention suggests an increase in lower body muscle strength.

The findings revealed that plyometric hurdle training greatly increased the jumping power of volleyball club students at SMP Negeri 1 Jambu. According to the descriptive analysis in **Table 2**, the average jump height improved by 6.46 cm after completing the 12-part training programme. This finding suggests that plyometric hurdle training improves leg muscular explosive power, which is important for higher jumps (Lestari et al., 2025). Furthermore, the

decrease in standard deviation in the post-test suggests that participants' performance became more consistent after training than before the intervention (Anggara et al., 2026).

Plyometric training uses the stretch-shortening cycle (DSC), which contributes to an improvement in jumping power. This cycle consists of an eccentric contraction followed by a rapid concentric contraction, which increases the muscle's ability to create force quickly (Mustofa & Wahyudi, 2025). The obstacle course's repetitive leaping motion stimulates the lower extremity muscles, causing adaptations that increase strength, contraction speed, and neuromuscular coordination (Febrianti & Hariyanto, 2025). These changes improve the student's propelling force, resulting in a higher jump height.

The Shapiro-Wilk test for normality in **Table 3** found that the pre- and post-test data were normally distributed, with significance values of 0.119 and 0.191, respectively ($p > 0.05$). These results show that the research data fits the conditions for parametric analysis, allowing hypothesis testing with the dependent sample t-test. The fulfilment of the normalcy assumption gives confidence that the statistical analysis results can be used to study the influence of treatment on leaping ability (Sianturi, 2025).

Table 4 dependent sample t-test findings indicate a significant difference ($p < 0.05$) between pre- and post-test scores. These findings show that plyometric hurdle training greatly increased students' jumping power in the volleyball club programme at SMP Negeri 1 Jambu. This improvement suggests that the training programme successfully boosted students' lower body muscle explosive power, allowing them to jump higher (Herwin et al., 2020).

The findings of this study are comparable with those of Seno & Siskariyanti (2025), who found that plyometric exercise can increase lower extremity explosive power and jumping ability. These findings are corroborated by Praja et al. (2024), who found that systematic and frequent plyometric training enhances leaping performance by increasing muscle strength and motor coordination. As a result, plyometric obstacle training can be an efficient way to develop jumping ability in students involved in extracurricular volleyball programmes.

CONCLUSION

The results of this study indicate that a four-week plyometric hurdle training program effectively improved the jumping power of students in the volleyball extracurricular program at SMP Negeri 1 Jambu. However, these findings should be interpreted with caution, given that the study used a one-group pretest–posttest design, involved a relatively small sample, and was conducted at a single school. In practical terms, these findings can serve as a reference for developing training programs to improve students' lower-body explosive strength. Future research is recommended to involve a larger sample size, include a control group, and examine variations in training duration and intensity, as well as individual characteristics that may influence the response to plyometric hurdle training.

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