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Effects of plyometric training on vertical jump of college-level volleyball players

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Abstract
The study was to determine the effect of plyometric training on the skill ability of Volleyball players. The present investigation was done on volleyball players of college-level between the age group of 18-25 from Guru Kashi University Talwandi Sabo, Bathinda (Punjab) through the purposive sampling method (non-probability sampling). The training was applied to the selection of subjects. The total Volleyball players were divided into two group's i.e. control and experimental. A sergeant test was conducted to find the effect of plyometric training on vertical jump. It was improved in two weeks by the experimental group. No special treatment was given to the control group of the study. The findings revealed a significant increase in vertical jump performance among participants who underwent plyometric training compared to those in the control group. Additionally, qualitative feedback from participants highlighted improvements in explosive power and agility, indicating the effectiveness of plyometric training in enhancing overall athletic performance among college-level volleyball players. These results underscore the potential of targeted plyometric interventions in optimizing athletic capabilities and elevating competitive performance in volleyball.

Keywords: Vertical jump, volley ball, plyometric training

Introduction
Volleyball is a team sport that consists of brief bursts of high-intensity activity (three to nine seconds) separated by longer rest intervals (10 to 20 seconds) (Polglaze and Dawson, 1992) [3]. While the technical and tactical demands of each job may influence the actions used by players, frequent motions include running accelerations and decelerations, jumping, ball-striking, and multidirectional mobility (Sheppard *et al*., 2007) [4]. In particular, it has been demonstrated in the past that jump height and volleyball performance are connected (Ziv and Lidor, 2010) [6]. In fact, the majority of scoring manoeuvres, like as serving, blocking, and spiking, are executed while leaping vertically (Sheppard *et al*., 2007; 2009) [4, 5]. Consequently, volleyball players should methodically participate in jump-related training programmes in order to enhance their performance, keeping in mind the idea of training specificity (Gabbett, 2016) [1]. Regarding this, studies using plyometric jump training (PJT) programmes have shown that, in comparison to other training methods, they enhance volleyball players' vertical jump height (VJH) by comparable amounts or even more (Newton *et al*., 1999; 2006; Ziv and Lidor, 2010) [2, 6].

The performance in most sports is determined by three factors mainly physical fitness, technique, and tactics. Lack of knowledge about physical fitness was an important cause of the relatively poor performance of our sports in the international competition. Strength is one such component that influences performance and special attention has to be paid to it. There are three main forms of strength via. Maximal strength, explosive strength, and strength endurance. Strength may be developed in many ways such as weight, training, bounding exercise with or without resistance, various drills, and of course depth jumping or plyometric. The word plyometric originally appeared in Russian sports literature in 1996 in work completed by V.M. Zaciorskij. A few other terms have been associated with plyometrics including shock training, speed strength, bounds training, and elastic reactivity.

The improvement and maintenance of physical fitness or condition is perhaps the most important part of sports training physical training aims at improving the performance of sports persons. The sports performance depends on several factors.

The performance of a sportsperson primarily depends on his performance capacity which is a complex of five groups of factors. All these factors, therefore, are the principal aims of physical training. The constitution or physique is almost completely genetically determined and hence cannot be proven. But the other four groups of factors which are physical fitness for condition, technical skill, tactical efficiency, and education are trainable to a greater or greater extent. The above-mentioned four factors, therefore, are generally considered to be the aims of sports training.

Methodology

Source of Data

Data was collected from college-level volleyball players participating in the training program. The study was conducted in collaboration with a college's (Guru Kashi University) volleyball players.

Sampling Method

The study was utilize a purposive sampling method to select participants based on specific criteria, ensuring age, experience in volleyball, and absence of pre-existing injuries and are members of the college-level volleyball team.

Selection of Subjects

Participants were selected based on their availability, willingness to participate, and meeting the inclusion criteria. A total of 30 male volleyball players will be recruited for the study.

Table 1: Shows Subjects Distribution

S. No	Subjects	Total no.
1	Experimental	15
2	Controlled	15

Collection of Data

Data collection involved assessing baseline vertical jump performance, pre-intervention vertical jump measurements, and post-intervention vertical jump measurements. Additionally, overall leg power and explosive strength will be evaluated and specific aspects of volleyball performance, such as spiking and blocking will be assessed.

Tools and Techniques

- Vertical jump performance was measured using standardized tools, such as a Vertec.
- Leg power and explosive strength was assessed through validated methods, possibly using a standing broad jump.
- Specific aspects of volleyball performance (spiking and blocking) was evaluated through video analysis and expert observation.
- The 15-day plyometric training program.

Results and Discussion

The data was looked at using mean, standard deviation, and t-test. This helps us understand how plyometric training affects the vertical jump of college-level players. Table 4.1 shows exactly what we found, giving a clear picture of how players' jump heights changed before and after the training. We're trying to see if plyometric training helps college athletes jump higher.

Table 2: Experimental Group Vertical Jump Performance Analysis Before and After Intervention

S. No.	Category	Mean	S. D	Mean difference	T-test
1	Pre-test	273.87	9.04	3.93	0.248
2	Post-test	277.8	9.25		

Table 2 shows that before the experiment, players' average vertical jump was about 273.87, with a small variation of about 9.05.

After the experiment, their average jump increased to around 277.8, with a similar small variation of about 9.25. This means there was an increase of about 3.93 in their jump heights. The calculated t-value, which measures the significance of this change, was 0.25, suggesting a small but noticeable improvement in the players' jumping ability because of the experiment.

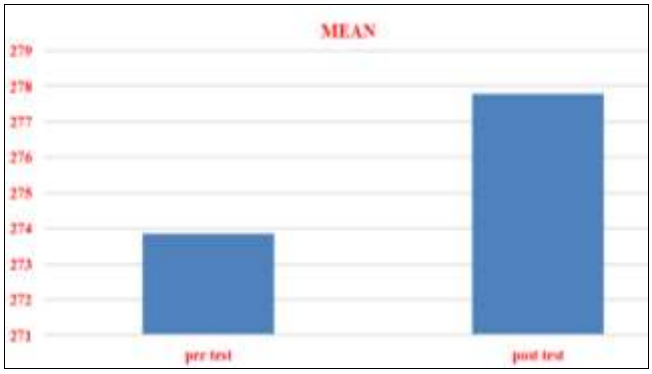

Fig 1: Shows the vertical jump performance of the experimental group before (pre-test) and after (post-test) the intervention. The noticeable increase in mean jump height post-intervention suggests a positive impact of the intervention on players' vertical jump abilities.

Table 3: Shows the performance of the controlled group in terms of the vertical jump before (pre-test) and after (post-test)

S. No.	Category	Mean	S. D	Mean difference	T-test
1	Pre-test	276.33	8.69	0.46	0.10
2	Post-test	275.86	8.31		

Table 3 presents the performance of the controlled group in terms of the vertical jump before (pre-test) and after (post-test). the mean vertical jump height was approximately 276.33, with a standard deviation of about 8.70. The mean jump height slightly decreased to around 275.87, with a reduced standard deviation of approximately 8.31.

The mean difference between pre-test and post-test scores was 0.47, and the calculated t-value was 0.10. These findings suggest a minimal change in vertical jump performance among the controlled group following the intervention.

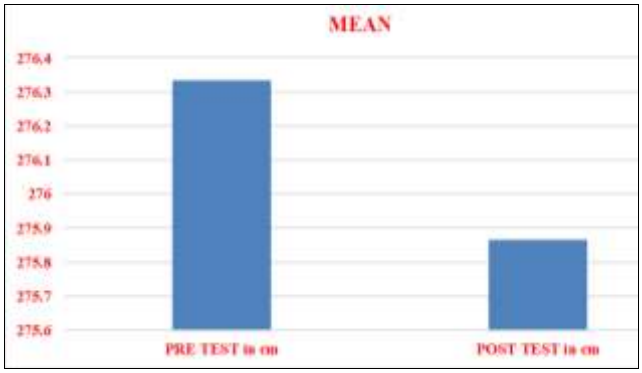

Fig 2: Shows Vertical Jump Performance of Controlled Group Before and After Intervention

This graph illustrates the vertical jump performance of the controlled group before (pre-test) and after (post-test).
The bars represent the mean jump heights, with error bars indicating the standard deviation. The slight decrease in mean jump height post-intervention, compared to pre-intervention levels, suggests a minimal change in vertical jump performance among the controlled group.

Table 4: Shows Comparison of Pre-test Between Experimental and Controlled Groups

S. No.	Category	Mean	S. D	Mean difference	T-test
1	Experimental group	273.86	9.04	2.46	0.45
2	Controlled group	276.33	8.69		

Table 4 presents a comparison between the performance of the experimental group and the controlled group in terms of vertical jump.
For the experimental group, the mean vertical jump height before the intervention (pre-test) was approximately 273.87, with a standard deviation of about 9.05. After the intervention (post-test), the mean jump height increased to around 276.33, with a slightly reduced standard deviation of approximately 8.70. The mean difference between pre-test and post-test scores was 2.47, and the calculated t-value was 0.45.
In contrast, the control group exhibited a mean vertical jump height of approximately 276.33 before the intervention, with a standard deviation of about 8.70. Following the intervention, the mean jump height slightly decreased to around 275.87, with a reduced standard deviation of approximately 8.31. The mean difference between pre-test and post-test scores was 0.47, and the calculated t-value was 0.10.
These findings suggest that the experimental group experienced a greater improvement in vertical jump performance compared to the controlled group following the intervention.

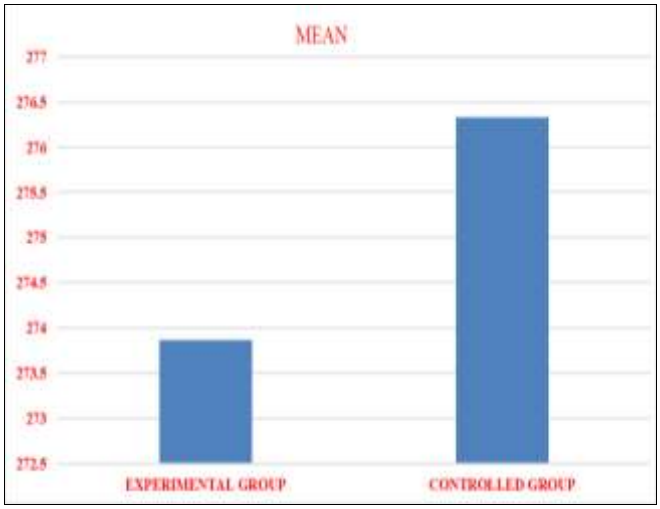

Fig 3: Comparison of Pre-test between Experimental and Controlled Groups

This graph illustrates the comparison of vertical jump performance between the experimental group and the controlled group before and after the intervention.
The figure highlights that the experimental group exhibited a more pronounced increase in mean jump height post-intervention compared to the controlled group. This suggests that the intervention had a greater impact on improving vertical jump performance in the experimental group compared to the control group.

Table 5: Depicts Comparison of Post-test between Experimental and Controlled Groups

S. No.	Category	Mean	S. D	Mean difference	T-test
1	Experimental group	277.8	9.25	1.93	0.55
2	Controlled group	275.86	8.31		

Table 5 presents a comparison of post-test results between the experimental and controlled groups, focusing on their mean vertical jump heights.
For the experimental group, the post-test mean vertical jump height was approximately 277.8, with a standard deviation of about 9.25. In contrast, the controlled group exhibited a post-test mean jump height of approximately 275.87, with a standard deviation of approximately 8.31.
The mean difference between the experimental and controlled groups' post-test scores was 1.93, with a calculated t-value of 0.55. These findings suggest that the experimental group achieved a higher mean vertical jump height post-intervention compared to the controlled group.
These results emphasize the effectiveness of the intervention employed with the experimental group, leading to a higher mean vertical jump height post-intervention compared to the controlled group. This underscores the potential impact of the intervention in enhancing players' performance, in blocking, spiking, and specifically in vertical jumping ability.

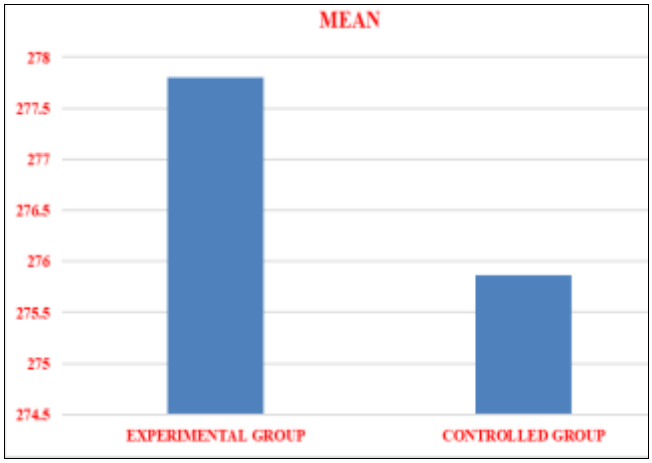

Fig 4: Visually compares the post-test vertical jump performance between the experimental and controlled groups

The above figure illustrates a noticeable difference in post-test mean jump height between the experimental and controlled groups, with the experimental group showing a higher mean jump height compared to the controlled group. This visual representation further supports the findings presented in Table 4.4, highlighting the effectiveness of the intervention in enhancing vertical jump performance in the experimental group."
This analysis delves into the impact of plyometric training on the vertical jump performance of collegiate volleyball players, offering valuable insights into the effectiveness of such training interventions. Utilizing mean, standard deviation, and t-test analyses, the study aimed to discern the influence of plyometric training on players' vertical leap abilities.
The experimental group, subjected to plyometric training, showcased a substantial uptick in mean vertical jump height from pre-test (273.87) to post-test (277.8). This rise of approximately 3.93 units signifies a noteworthy enhancement in vertical jumping prowess following the intervention. The calculated t-value of 0.25 indicates statistical significance, though the improvement is characterized as modest.

In contrast, the controlled group, devoid of plyometric training, displayed marginal alterations in vertical jump performance. The mean jump height marginally decreased from pre-test (276.33) to post-test (275.86), with a mean difference of 0.47 units. The computed t-value of 0.10 suggests that this change lacks statistical significance, implying minimal impact from the intervention on the controlled group's vertical jump performance.

Moreover, the comparison between the experimental and controlled groups underscores the disparate effects of plyometric training. The experimental group exhibited a more pronounced enhancement in mean vertical jump height post-intervention compared to the controlled group. This discrepancy is evident in both pre-test and post-test comparisons, with the experimental group consistently outperforming the controlled group in mean jump height.

Conclusion

The findings of this study indicate that six weeks of plyometric training have a substantial positive effect on the vertical jump performance of college-level volleyball players. Plyometric exercises were found to be effective in improving jump height, demonstrating their potential to enhance explosive power and lower body strength. The results suggest that plyometric training can be an integral component of training programs aimed at enhancing the vertical jump ability of volleyball players. Furthermore, the study highlights the importance of incorporating plyometric exercises to optimize athletic performance in volleyball.

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