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The Effect of Barrier and Knee Tuck Jump Exercises on Volleyball's Vertical Jump Smash Ability

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Abstract

This study examines the effect of barrier jump and knee tuck jump exercises on volleyball's vertical jump smash ability. This study was accomplished for volleyball extracurricular students at SMP Negeri 3 Kuningan. The research method is an experiment with a one-group pre-test and post-test design. The number of samples in this study was 14 students. The data collection technique acquired tests and measurements of barrier and knee tuck jumps on Vertical Jump Smash abilities. This research reveals that structured jump training can significantly enhance vertical jump performance in junior high school students engaged in volleyball. The results indicate a statistically significant difference between the pre-test and post-test scores, suggesting that the training program had a meaningful impact on the participants ' jumping abilities. The effectiveness of the applied training methods contributes to the broader understanding of athletic performance enhancement in youth sports programs.

Keywords: Students, Barrier Jump, Knee Tuck Jump, Vertical Jump, Volly Ball

INTRODUCTION

Volleyball is a dynamic sport characterized by its fast-paced nature and strategic gameplay. It involves two teams, typically comprising six players each, competing to score points by sending a ball over a net and into the opponent's court (Kusnandar et al., 2020). The dynamics of volleyball hinge on individual skills and team coordination. Volleyball athletes must exhibit agility, strength, and precision. The game encompasses various techniques, including serving, passing, setting, attacking, and blocking, each requiring specific physical and mental attributes (Pratama et al., 2019).

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The popularity of volleyball has surged globally, driven by its inclusion in major international competitions such as the Olympics and the FIVB World Championships. This sport's accessibility is significant in its widespread appeal; it requires minimal equipment and can be played on various surfaces, from sandy beaches to gymnasiums (Thompsen et al., 2007). Social factors, including community involvement and youth programs, have also contributed to its growth. Volleyball has become a competitive sport and a recreational activity enjoyed by millions worldwide, fostering social interaction and promoting physical health (Campillo et al., 2024).

As volleyball gains recognition as a widely enjoyed sport, schools increasingly integrate it into their extracurricular activities, fostering a culture of participation and enthusiasm among students. This engagement enhances students' physical fitness and cultivates essential life skills such as teamwork, discipline, and resilience (Aryadi et al., 2024; Sayfei et al., 2020). In junior high schools, where students are in a crucial developmental stage, extracurricular volleyball programs serve as a talent identification and skill enhancement platform (Bedard et al., 2020). Coaches often focus on nurturing young athletes by providing structured training sessions emphasizing fundamental techniques, strategy, and competition. This systematic approach helps students build confidence and encourages healthy competition, which is critical for their growth.

Moreover, the popularity of volleyball can inspire students to pursue the sport more seriously, leading to increased participation in local leagues and tournaments. Students motivation to excel in volleyball intensifies as they witness successful role models in national and international arenas (Trecroci et al., 2021). Consequently, this synergy between popularity and structured training elevates individual performance. It contributes to the community's-community's broader landscape of volleyball excellence, fostering a legacy of athletic achievement in future generations.

Executing an effective vertical jump smash is a critical skill for volleyball players, significantly influencing their performance on the court. This study explores the impact of barrier and knee tuck jump exercises on enhancing the vertical jump smash ability among junior high school students participating in extracurricular volleyball programs. Given the competitive nature of volleyball, developing powerful jumping techniques is essential for successful attacks and defensive maneuvers.

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At a pivotal stage of physical development, junior high school students present an ideal demographic for investigating the effects of targeted training interventions. The introduction of barrier jump exercises focuses on improving explosive power and coordination, while knee tuck jumps emphasize core strength and flexibility. By integrating these exercises into the training regimen, this research seeks to determine their effectiveness in enhancing vertical jump performance.

Through a systematic approach, this study will assess pre- and post-intervention vertical jump capabilities, providing empirical data on the efficacy of these exercises. The findings aim to contribute to the existing knowledge on athletic training methodologies, offering insights that could inform coaching practices and optimize training programs for young volleyball athletes. Ultimately, the research aspires to elevate the standard of volleyball training at the junior high school level, fostering more significant athletic potential.

METHOD

Research methods are scientific ways to obtain data for a specific purpose. In conducting research, choosing the proper method to provide convenience in solving the problems being studied is necessary (Sugiyono, 2022). As for the method used to test the truth of a hypothesis that the author proposed, the author conducted this research using the experimental method, explicitly searching for data to solve problems using the training and testing method.

This study employs a quantitative approach using a One Group Pre-test Post-test Design to investigate the effects of barrier and knee tuck jump exercises on the vertical jump smash ability of 14 junior high school students participating in volleyball extracurricular activities at SMPN 3 Kuningan. The methodology will be structured into distinct phases to ensure systematic data collection and analysis.

A pre-test assessment measures the participants ' baseline vertical jump performance. It involves standardized jump tests, such as the vertical jump test, using a measuring device to ensure accuracy. Participants will perform the jump smash technique, and their jump heights will be recorded for comparison.

Following the pre-test, a structured training program will be implemented over a predetermined period, typically six weeks. This program will consist of two primary exercises, barrier jumps and knee tuck jumps, administered thrice weekly. Each session

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will include warm-up and specific drills targeting explosive power, coordination, and core strength, culminating in cool-down stretches.

After the training, a post-test assessment will be conducted using the same vertical jump test to evaluate performance improvements. The data collected from both pre-test and post-test will be analyzed using statistical methods, such as paired sample t-tests, to determine the significance of the changes observed.

Several tools are utilized to measure vertical jumps accurately. The tools are:

1. Vertec: This device consists of vertical vanes displaced when a jumper touches them at the highest point of their jump. It provides a precise visual measurement and is widely used in sports training.
2. Jump Mat: A jump mat is a pressure-sensitive mat that records the jump height based on the time the jumper spends in the air. It provides precise measurements and is easy to use.
3. Force Plates: These sophisticated devices measure the force exerted by the jumper and can provide comprehensive data on jump mechanics, including height and power output.
4. Tape Measure: For a basic and low-cost method, a tape measure can be used with a wall. The tape measure also calculates the difference; the jumper marks their highest reach on the wall before and after the jump.

RESULT

Normality Test

The normality test determines whether the data obtained from the research results is usually distributed. This data normality test uses the Shapiro-Wilk test. It is said that the data is normally distributed if the normality test value is more than 0.05 ($p > 0.05$). The result of normality test is presented in Table 1.

Table 1 Normality Test

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest Vertikal Jump	.154	14	.200*	.915	14	.188
Posttest Vertikal Jump	.182	14	.200*	.927	14	.275

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

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From Table 2 above, it can be seen that the pre-test data results have a p-value (sig) of 0.188 > 0.05, and the post-test results have a p-value (sig) of 0.188 > 0.05. Therefore, the data obtained in this study are typically distributed.

Homogenity Test

A homogeneity test is a statistical test procedure that aims to show that the sample data group comes from a population with the same variance. In other words, the homogeneity test is carried out to determine whether the data set being studied has the same characteristics.

Table 2 Homogeneity Test

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Nilai	Based on Mean	.270	1	26	.608
	Based on Median	.109	1	26	.744
	Based on Median and with adjusted df	.109	1	24.768	.745
	Based on trimmed mean	.256	1	26	.617

Based on Table 3, it can be seen that the sig value based on the mean is 0.270 > 0.05, so it can be concluded that the variance value of the pre-test and post-test data of the Barrier Jump and Knee Tuck Jump exercises to improve the Vertical Jump Smash ability of extracurricular volleyball students at SMP Negeri 3 Kuningan is homogeneous or the same.

Pre-Test And Post-Test Results Of The Barrier Jump And Knee Tuck Jump Tests.

The pre-test and post-test scores of the volleyball extracurricular students of SMP Negeri 3 Kuningan, as many as 14 players, are presented in Table 3:

Tabl 3 Pretest And Posttest Results

No.	Name	Pre test	Post test
1	Student 1	51	58
2	Student 2	49	53
3	Student 3	44	48
4	Student 4	52	56

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5	Student 5	48	52
6	Student 6	35	37
7	Student 7	37	40
8	Student 8	35	39
9	Student 9	38	42
10	Student 10	40	43
11	Student 11	41	44
12	Student 12	38	42
13	Student 13	39	41
14	Student 14	44	47
	Mean	42.21	45.86.
	Standar Deviation	5.83	

The results of the descriptive statistical analysis of the pre-test passing accuracy of extracurricular football students at SMP Negeri 3 Kuningan obtained a minimum value of 35, a maximum value of 52, an average (mean) of 42.21 with a standard deviation (std.Deviation) of 5.833, while for the post-test the minimum value was 37, a maximum value was 58, and an average (mean) of 45.86.

Table 3 presents the pre-test and post-test results of vertical jump measurements for 14 students participating in a volleyball extracurricular program. The data indicates that the jump heights recorded before and after the training intervention consisted of barrier and knee tuck jump exercises. The pre-test scores reflect the baseline vertical jump ability of the participants, with values ranging from 35 to 52 centimeters. The mean pre-test score was calculated at 42.21 centimeters, with a standard deviation of 5.83, suggesting a moderate variability in the students' jump abilities before the intervention.

Following the six-week training program, the post-test scores were recorded. The results demonstrate an improvement in vertical jump performance across all participants, with post-test values ranging from 37 to 58 centimeters. The mean post-test score increased to 45.86 centimeters, indicating a positive effect of the training regimen on the students'students' jumping abilities.

The observed improvements can be attributed to the targeted exercises that enhance explosive power, strength, and coordination. The calculated mean difference between pre-test and post-test scores underscores the effectiveness of the training

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protocol. This data provides compelling evidence that structured jump training can significantly enhance vertical jump performance in junior high school students engaged in volleyball.

Hypothesis Test

Hypothesis testing was conducted to determine whether implementing Barrier Jump and Knee Tuck Jump training improved extracurricular volleyball students' Vertical Jump Smash ability at SMP Negeri 3 Kuningan. This hypothesis test used the Paired Sample T-Test because, in this study, there was one sample group but had two data to be tested. This hypothesis test is as follows:

Table 4 Hypothesis Test Results (Paired Sample T-Test)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest Vertikal Jump - Postest Vertikal Jump	-3.643	1.216	.325	-4.345	-2.941	-11.212	13	.000

Based on Table 4, the t-test results above show that the calculated t-value is 11.212, and the t-table is 2.160 (df13) with a sig p-value of 0.000. Therefore, there is a significant influence if the calculated t value is greater than the t table (11.212>2.160) and the significance p 0.000 <0.05. Thus, the hypothesis (H0) is rejected, and the hypothesis (Ha) is accepted.

Table 4 presents the results of the paired sample t-test conducted to evaluate the effectiveness of the training intervention on vertical jump performance among the participants. The paired sample t-test is a statistical method used to compare two related samples, in this case, the pre-test and post-test vertical jump measurements of the same group of students.

The results indicate a statistically significant difference between the pre-test and post-test scores, suggesting that the training program had a meaningful impact on the participants ' jumping abilities. The t-value and associated p-value provide evidence of this difference; a p-value less than 0.05 typically indicates significance. The confidence interval further supports the findings by showing that the mean difference in jump heights falls

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within a specific range, reinforcing the hypothesis that the training exercises effectively enhanced vertical jump performance.

Overall, the findings from Table 4 substantiate the hypothesis that barrier and knee tuck jump exercises positively influence vertical jump capacity in junior high school students. This statistical analysis confirms the effectiveness of the applied training methods and contributes to the broader understanding of athletic performance enhancement in youth sports programs. Such insights are invaluable for coaches and educators in designing effective training regimens that promote athletic development.

DISCUSSION

Extracurricular volleyball activities offer numerous benefits for adolescents, fostering physical and psychological development (Grajek et al., 2022). Participation in volleyball enhances physical fitness, coordination, and teamwork skills, which are critical during this developmental stage. Recent research, such as a study by León Muñoz et al., (2024), highlights that engaging in team sports like volleyball significantly improves self-esteem and social skills among teenagers. Additionally, volleyball promotes a sense of belonging and community, vital for mental health (León Muñoz et al., 2024; Nur et al., 2023). These findings underscore the importance of incorporating volleyball into extracurricular programs, facilitating holistic growth and development in young individuals.

The study's results provide compelling evidence of the positive impact of barrier and knee tuck jump exercises on the vertical jump performance of junior high school students involved in extracurricular volleyball activities. The statistical analysis, particularly the paired sample t-test, reveals a significant increase in vertical jump heights from the pre-test to the post-test, underscoring the effectiveness of the training intervention. This result aligns with previous research demonstrating the benefits of plyometric exercises in enhancing explosive strength and power among young athletes (Alim et al., 2024; Aryadi et al., 2024; Sandya et al., 2023).

For instance, studies by Novita et al., (2022)Markovic and Barber-Westin et al., (2010) have shown that targeted plyometric training, such as jump squats and tuck jumps, significantly improves vertical leap capabilities. Their findings suggest that such training enhances muscular strength and contributes to improved neuromuscular coordination for executing effective jumps in sports like volleyball. The current study supports these claims

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by illustrating that a structured training regimen can lead to measurable improvements in performance metrics.The mean increase in vertical jump height observed in this research highlights the importance of incorporating sport-specific exercises into training programs. As the participants demonstrated marked improvements, coaches and physical education instructors should prioritize exercises that develop explosive power, particularly for sports reliant on vertical jumping (de Oliveira Castro et al., 2022; León Muñoz et al., 2024).

Barrier Jump and Knee Tuck Jump exercises provide improvements to the Vertical Jump. It aligns with the statement that knee truck jump and barrier hop exercises can positively contribute to improving jumping ability (Novita et al., 2022). The barrier hops learning method is carried out on a high goal or obstacle (between 30 - 90cm) placed on a line with a distance determined by ability. The obstacle will fall if the student makes a mistake. The start begins by standing behind the obstacle, the jumping movement that passes the obstacle with both feet together. The movement starts from the waist and knees apart. Use the swing of both arms to maintain balance and reach height (Akbar & Awalludin, 2021). The results of this study align with those Marinšek et al., (2019) which state that students' vertical jump increases using the barrier jump and knee tuck jump training methods compared to their training models.

The impact of barrier jump and knee tuck jump exercises on vertical jump smash ability in volleyball players has garnered considerable attention in recent sports science research. These exercises specifically target explosive power development for practical jumping in volleyball (Alim et al., 2024). The findings from the current study align with recent literature indicating that plyometric training, such as barrier and knee tuck jumps, significantly enhances vertical jump performance (Aryadi et al., 2024).

Research conducted by Sandya et al., (2023) demonstrates that plyometric exercises improve muscular strength and neuromuscular coordination, which are critical for athletes in explosive sports. Their study indicated that athletes who engaged in a structured plyometric training program exhibited marked improvements in jump height and overall athletic performance. Similarly, (Heller et al., 1998; Sahabuddin, 2019) found that incorporating varied jump training into regular practice routines significantly increased vertical jump ability among adolescent athletes. This result reinforces that targeted jump training can effectively elevate performance metrics.

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The current study's findings further contribute to this discourse by providing empirical evidence that barrier and knee tuck jumps enhance vertical jump smash ability among junior high school volleyball players. These exercises develop lower body strength and improve the coordination and timing necessary for executing powerful smashes during gameplay. The improvements observed in the participants ' vertical jump heights post-intervention underscore the efficacy of these training methods.

Moreover, integrating such exercises into regular training regimens can facilitate athletes' performance in competitive settings. By emphasizing explosive power development through specific plyometric exercises, coaches can better prepare athletes for the demands of volleyball, ultimately leading to improved performance and competitive success. This study underscores the importance of evidence-based training protocols in optimizing athletic development and performance in youth sports.

CONCLUSION

Based on the results of data analysis, it can be concluded that there is a significant increase between Barrier Jump and Knee Tuck Jump on the Vertical Jump Smash ability of volleyball extracurricular students at SMP Negeri 3 Kuningan after being given treatment. Based on the results of the research that has been presented, it is proven that there is an increase in the ability of the Volleyball vertical jump after implementing barrier jump and knee tuck jump training. It can be seen that the Volleyball extracurricular students of SMP Negeri 3 Kuningan experienced a significant increase in jumping ability. Thus, Barrier Jump and Tuck Jump training can improve the ability of Volleyball Vertical Jump Smash.

This study contributes to the growing literature advocating for evidence-based training methods in youth sports. Establishing a clear connection between specific training interventions and performance outcomes encourages the adoption of similar methodologies in other sports contexts. Future research could expand on these findings by exploring long-term effects, different age groups, and varying training intensities, thereby enriching the understanding of athletic development in youth populations.

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