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The Effect of Adding Core Stability Training to Plyometric Training on Increasing Jump Height in Basketball Athletes

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Abstract

The purpose of this study was to investigate the effect of adding core stability training to plyometric training on increasing the jump height of basketball athletes. The method used in this study was an experimental method with a Pretest-Posttest Control Group Design research design. The study population consisted of 20 Kamimasae KU Club basketball athletes aged 16-18 years, who were also the research sample, selected using a total sampling technique. The instrument used in this study was the Vertical Jump Test. Data analysis was conducted using the Paired Sample T-Test statistical test with the aid of the SPSS version 30 application. The results showed that there was a significant effect of adding core stability training to plyometric training on increasing the jump height of basketball athletes. The experimental group that received plyometric training with additional core stability experienced an average increase of 6%, while the control group that was only given plyometric training experienced an average increase of 3%. The conclusion is that adding core stability training to plyometric training is significantly more effective in increasing vertical jump height than plyometric training alone.

How to Cite

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INTRODUCTION

Jump height ability is one of the important indicators in basketball because it affects the athlete›s performance on the field, such as rebound, jump shoot, lay-up, blocking, and slam dunk (Okta et al., 2023). Jump height is greatly influenced by leg muscle strength and explosive muscle ability which is included in the power component (Yulifri et al., 2018). Physiologically, power is a combination of strength and speed needed to perform dynamic movements such as jumping (Srivastav et al., 2016). Basketball requires agility and vertical jumps, so plyometrics can help players improve agility, strength, and speed (Kryeziu et al., 2019). Optimal power allows athletes to produce explosive force in a short time, making it very helpful in performing fast and powerful actions such as vertical jumps in basketball (Liu & Tulyakul, 2025).

Field observations indicate that Indonesian basketball athletes still lag behind their international counterparts in terms of vertical jump performance, despite having comparable body proportions. This gap suggests limitations in physical conditioning, particularly in leg strength and explosive power (Sharma et al., 2017). A well-structured physical training program plays a vital role in enhancing an athlete's jumping ability. Improvements in vertical jump height can be achieved through plyometric training, which emphasizes the stretch-shortening cycle of muscle activity (Kosova et al., 2022), as well as core stability exercises that enhance movement efficiency and body stabilization (Kurt et al., 2023). Plyometric exercises involve high-intensity explosive movements such as squat jumps, drop jumps, and bounding (Stojanović et al., 2017), while core stability training focuses on strengthening the core muscles to maintain balance and support energy transfer during jumps (Aslan & Kahraman, 2023). When combined, these two training methods are believed to produce a synergistic effect, leading to significant improvements in athletes' vertical jump performance.

Several previous studies have shown the effectiveness of each method. Research conducted by Sannicandro & Cofano, (2017) showed that a 4-week core stability training program had a positive impact on the jumping performance of young athletes. Research by Bouteraa et al., (2020) also showed that the combination of plyometric training and balance training provided significant improvements in squat jumps, countermovement jumps, and drop jumps. In addition, Verma et al. (2015) proved that 6 weeks of plyometric training can significantly increase vertical jump height in high school basketball athletes. However, there is still limited research that combines both training methods in one program to see their synergistic impact on improving vertical jump performance.

However, there is still limited research that integrates core stability training directly into plyometric programs, especially in the context of adolescent basketball athletes in Indonesia. This is the novelty of this study, namely to empirically test whether the integration of core stability training into a plyometric program is more effective in increasing vertical jump height compared to plyometrics alone. Thus, this study not only contributes to the field of coaching adolescent basketball athletes, but also enriches scientific studies on the right training methods used to improve athletes› physical performance, especially jump height ability. The purpose of this study was to investigate the effect of adding core stability training to plyometric training on increasing the jump height of basketball athletes.

METHOD

This research is an experimental research with a Pretest-Posttest Control Group Design. (Fraenkel et al., 2022). The research sample was 20 Kamimasae Basketball Club athletes in the 16–18 year old category. The sampling technique used total sampling. The sample was divided into two groups, namely the experimental group and the control group, each consisting of 10 people. The experimental group underwent a plyometric training program combined with core stability, while the control group only underwent plyometric training.

The instrument used to measure the height of the jump is the Vertical Jump Test, which is conducted before (pre-test) and after (post-test) the training program. This tool was chosen because it is valid and reliable for measuring explosive leg strength vertically (Santos et al., 2022). Program latihan diberikan selama 4 minggu dengan frekuensi 3 kali per minggu, sehingga total terdapat 12 sesi latihan (Kryeziu et al., 2019). The intensity of the exercise is increased gradually, starting from 70% in the first week and reaching 100% in the fourth week (Susanti et al., 2021) because this high intensity allows the muscles to work maximally in a short time through the muscle stretching and shortening cycle (stretch-shortening cycle) (Huang et al., 2023) with a rest time between sets of 30-120 seconds (Correia et al., 2020).

Table 1. Plyometric and Core Stability Combination Training Program.

Week	Item	Duration	Set	Intensity	Rest
1	Pogo Jump	12	3	70%	60 s
	Plank	30 s	3		30 s
	Lateral Jump	10	3		60 s
	Bird Dog	30 s	3		30 s
	Box Jumps	10	3		60 s
2	Side Plank	30 s	3	80%	30 s
	Split Squat Jump	10	3		60 s
	Crunch	30 s	3		30 s
	Depth Jump	6	4		90 s
	Up & Down Plank	30 s	3		30 s
3	Bounding	6	4	90%	90 s
	Mountain Climber	30 s	3		30 s
	Squat Jump	6	4		90 s
	Hurdle Hop	5	4		120 s
	Russian Twist	30 s	3		30 s
4	Tuck Jump	5	4	100%	120 s
	Leg Raises	30 s	3		30 s
	Approach Jump	5	4		120 s

RESULTS AND DISCUSSION

This study measures physical ability in the form of jump height that affects basketball playing performance. The results of the analysis of the increase in jump height of KU 16 basketball athletes from the Kamimasae Club can be explained as follows:

Table 2. Anthropometric Data

Group	Age (years)	Height (m)	Weight (kg)
Experiment	16.4 ± 1.17	1.64 ± .07	49.60 ± 4.58
Kontrol	16.4 ± 1.17	1.68 ± .08	55.50 ± 12.30

Based on **Table 2** the average age of both groups is the same, which is 16.4 ± 1.17 years. The height of the experimental group (1.69 ± .07 m) is slightly higher than the control (1.68 ± .08 m). The weight of the experimental group (49.60 ± 4.58 kg) is lower than the control group (55.20 ± 12.30 kg). Next, a description of the statistical data of the pre-test and post-test of the experimental and control groups is presented.

Table 3. Description of Statistical Data

Group	Pre-test	Post-test
Experiment	51.7 ± 10.5	54.6 ± 11.1
Control	50.1 ± 8.7	51.5 ± 8.8

Based on **Table 3** the mean value and standard deviation of the vertical jump test results in both groups. The experimental group experienced an increase from 51.7 ± 10.5 cm in the pre-test to 54.6 ± 11.1 cm in the post-test. Meanwhile, the control group only increased from 50.1 ± 8.7 cm to 51.5 ± 8.8 cm. This difference indicates that the addition of core stability training to plyometric training is more effective in increasing vertical jump height.

After conducting descriptive data analysis, the next step is to process the data to test the hypothesis. This process begins by conducting a normality test using the Shapiro-Wilk approach and a homogeneity test using the Levene Statistics approach as a prerequisite for statistical analysis.

Table 4. Normality Test

Group	Test	Shapiro-Wilk		
		Statistic	df	Sig.
Experiment	Pre-test	.935	10	.499
	Post-test	.923	10	.383
Control	Pre-test	.888	10	.162
	Post-test	.896	10	.200

Based on **Table 4** the results of the normality test show the significance value of the pre-test and post-test data of the experimental group (.499 and .383) and the pre-test and post-test of the control group (.162 and .200). Since all of these significance values are ≥ .05, it can be concluded that the pre-test and post-test data in both groups are normally distributed.

Based on the results of the homogeneity test obtained a sig value (.429) > .05 then Ho is accepted, so it can be concluded that the data comes from the same variance (homogeneous). After the data is declared normally distributed and homogeneous, it is continued with a hypothesis test using the Paired Sample T-Test and the Independent Sample T-Test.

Based on the results of the Paired Sample T-Test, the significance value (Sig. 2-tailed) = .001 < .05 is obtained, so Ho is rejected, so it can be concluded that there is a significant difference between the pre-test and post-test results.

TBased on the results of the Independent T-Test, the significance value (Sig. 2-tailed) was obtained as .497 > .05, so Ho is accepted, so it can be concluded that there is no significant difference between the post-test results of the experimental group and the control group.

Overall, the experimental group showed an increase twice as large (6%) compared to the control group (3%). This shows that core stability plays an important role in increasing the effecti-

veness of plyometric training. Plyometric training increases maximum leg explosive power (Chouhan et al., 2022), but without good core stability, the efficiency of force transfer is reduced. Core stability helps maintain balance, movement efficiency, and force transfer, resulting in higher jumps and lower risk of injury (Boyaci & Afyon, 2017).

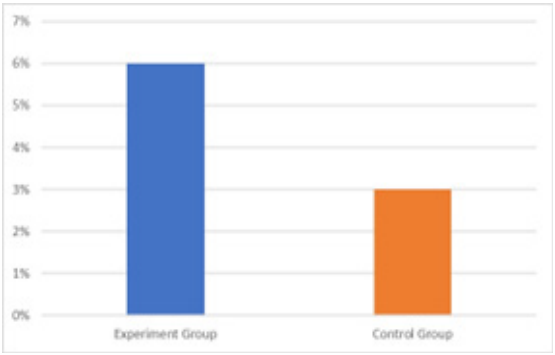

Figure 1. Percentage of Performance Improvement

Plyometric training has been shown to increase the explosive power of leg muscles, thus contributing directly to increasing the jump height of basketball athletes (Chouhan et al., 2022; Stojanović et al., 2017).However, in dynamic game conditions, body stability also plays an important role so that the jump remains efficient and controlled. This is where core stability training has an important contribution, namely in maintaining balance and body control during the take-off and landing phases (Boyaci & Afyon, 2017; Cao et al., 2024). When the core muscles become stronger, the core muscles will also be stable, this is due to the strength of the spinal and pelvic muscles (Imene, 2022). This is very important because body stability when jumping determines the efficiency of the propulsion force generated by the leg muscles. The combination of plyometric and core stability training results in better performance improvements than plyometric alone. This is evidenced by the results of a higher increase in jump height in the experimental group (6%) compared to the control group (3%).

Core stability training helps the efficiency of force transfer from the lower to the upper extremities and supports body stability in game situations such as aerial contact or jumping from a moving position (Dong et al., 2023; (Gür et al., 2022). With better stability, athletes can generate more power when jumping, which contributes to increased jump height (Bouteraa et al., 2020). This study is in line with previous findings that core training improves postural control, strength, and basic motor performance such as speed and jumping (Gao et al., 2024; Rodríguez-perea et al., 2023). Plyometrics work through neuromuscular activation and the stretch-shortening cycle (Zheng et al., 2025; Kosova et al., 2022), while core stability provides a foundation for body balance and stabilization to produce more efficient explosive movements (Kurt et al., 2023; Gong et al., 2023). Therefore, the compound training approach is superior because it not only improves jump height, but also the quality of the jump in terms of body control and stability.

CONCLUSION

In this study, the authors concluded that the vertical jump ability of basketball athletes increased after training intervention. The experimental group that received a combination of plyometric and core stability training showed a greater increase (6%) compared to the control group (3%) that only received plyometric training. This shows that core stability makes a significant contribution to the effectiveness of plyometric training in improving jumping performance. Core stability plays an important role in supporting explosive movements through improved balance, posture control, and energy transfer. Therefore, the integration of core stability into a plyometric training program is recommended to maximize the vertical jump ability of basketball athletes.

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