International Journal of Sociologies and Anthropologies Science Reviews
Volume 5 Issue 6: November-December 2025: ISSN 2985-2730
Website: **https://so07.tci-thaijo.org/index.php/IJSASR/index**

Effects of Plyometric Training on Lower Limb Muscle Power and Agility of College Basketball Students at Luoyang Normal University

Zhehua Hao[1], Jakrin Duangkam[2]*, Ekasak Hengsukho[3] and Kreeta Promthep[4]
[1]Ph.D., Physical Education and Health Education Program, Udon Thani Rajabhat University, Udon Thani Province, Thailand
[2,3,4] Lecturer, Physical Education and Health Education Program, Udon Thani Rajabhat University, Udon Thani Province, Thailand
[1]E-mail: 275799249@qq.com, ORCID ID: https://orcid.org/0009-0003-4558-9517
[2]E-mail: jakrin.d@udru.ac.th, ORCID ID: https://orcid.org/0009-0006-3621-9794
[3]E-mail: ekasak.he@udru.ac.th, ORCID ID: https://orcid.org/0009-0008-1797-3905
[4]Email: kreeta.pr@udru.ac.th, ORCID ID: https://orcid.org/0009-0001-6322-0655

Received 04/04/2025 Revised 13/04/2025 Accepted 25/05/2025

Abstract

Background and Aim: Power, muscle, and Agility are widely used to improve athletic performance, particularly in sports requiring movements. This study aimed to study and compare the effects of plyometric training on the lower limb muscle power as well as the agility of basketball college students, before training, after the 4th week, and after the 8th week of the training program. This research is quasi-experimental. The sample consisted of 80 college basketball students from Luoyang Normal University who passed the test criteria. The researcher used the simple random sampling method for an experimental 40 students and a control group of 40 students.

Materials and Methods: Research instruments included 1) a plyometric training program, 2) a regular training program, 3) a lower limb muscle power test, a Bouncing Force Measuring Platform, and 4) a Zigzag Run Test for agility measurement. The study assessed lower limb muscle strength, including Peak Power, Peak Vertical Ground Reaction Force, Peak Velocity, and agility movement. In this research, mean, standard deviation, one-way repeated measures ANOVA, and dependent t-tests were used to analyze the data.

Results: Findings indicated that plyometric training significantly improved lower limb muscle power (Peak Power, Peak Vertical Ground Reaction Force, and Peak Velocity) and agility movement compared to regular training.

Conclusion: Plyometric training effectively improves lower limb muscle power and agility in college basketball students, showing greater benefits than regular training after 8 weeks.

Keywords: Plyometric Training; Lower Limb Muscle Power; Agility

Introduction

In China, basketball continues to be one of the most popular sports, having been introduced to the country as early as 1895, just four years after its birth in the United States. According to the 2018 Digital Sports Global Summit in Beijing, China has about 143 million basketball fans. Statistical surveys show that people under the age of 20 and those between the ages of 25 and 35 have the highest interest in basketball, accounting for 52% and 42%, respectively. These figures underscore the significance of basketball in China's sports culture and the substantial government support it receives.

Basketball is a fast-paced, dynamic sport that forces players to change directions very quickly and perform explosive maneuvers. The object of the game is to earn points by putting the ball through the opposing team's basket, which may range from one to three points, the number of which depends on how far away the shot was taken from and the circumstances of the shot. Basketball players are constantly required to carry out various actions such as offensive acceleration, wide-ranging defensive maneuvers, as well as a variety of jumping movements such as jump shots, layups, contested rebounds, and caps. These movements highlight how important lower limb muscle strength, flexibility, and agility are in the game of basketball (Stojanović et al., 2017). Moreover, basketball has a unique competitive nature that demands athletes to possess a high level of strength, particularly explosive strength, which is essential for executing quick and forceful movements during gameplay (Wang et al., 2023).

Jumping is a particularly important ability for basketball players as it directly impacts their scoring and defensive success throughout a game. The height of a player's jump is closely related to weight-related maximal muscle strength and is an important measurement for assessing athletic ability. In addition, Moran et al. (2017) noted that short-term resistance training significantly improves neuromuscular connections

Citation Hao, Z., Duangkam, J., Hengsukho, E., & Promthep, K. (2025). Effects of Plyometric Training on Lower Limb Muscle Power and Agility of College Basketball Students at Luoyang Normal University. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 1-10; DOI: **https://doi.org/10.60027/ijsasr.2025.7354**

like enhanced coordination, explosiveness, and overall muscle strength, all three of which are large parts of the many explosive movements in basketball.

One of the most important assets for basketball players to have is agility. It is agility that allows players to perform precisely, even when frequently and quickly changing directions. This ability is a result of the coordination between the body's nervous system and its muscles, which allows players to break away from their opposition to score points and lower the risk of injury caused by improper movement or poor body control (Young et al., 2021). Basketball players can use tests to measure their agility and, if needed, implement training based on the test results to improve their agility and therefore their standard of play.

The purpose of this study was to investigate the effects of plyometric training on lower limb strength and the agility of college basketball students. By comparing the plyometric training group with the traditional training group, we investigated how these two training methods affect lower limb strength as well as agility. The results of this study are expected to provide a valuable reference for basketball players to complete their training framework and improve their performance.

Objectives

1. To study the effects of plyometric training on the lower limb muscle power and agility of basketball college students before training, after the 4th week, and after the 8th week of the training program.
2. To compare the effects of plyometric training on the lower limb muscle power and agility of basketball college students before training, after the 4th week, and after the 8th week of the training program.

Literature review

1. Plyometric Training

Plyometric training involves explosive, high-intensity movements such as jumps and bounds that enhance muscle responsiveness and power. It is commonly used in sports like basketball that require quick, explosive movements. This form of training activates the stretch-shortening cycle of muscles, improving neuromuscular efficiency. According to Cao et al. (2024), plyometric programs can significantly improve physical fitness and sport-specific skills in basketball athletes.

2. Lower Limb Muscle Power

Lower limb muscle power is essential for performance in basketball, particularly for actions like sprinting, jumping, and quick directional changes. A recent meta-analysis by Wang et al. (2025) reported that plyometric training improves lower limb strength and explosive power, especially in adolescent athletes. However, another study noted that while plyometric training may not significantly affect pure muscle strength, it substantially enhances jump height and sprint ability (Zhang et al., 2024).

3. Agility in Basketball Athletes

Agility, the ability to rapidly change direction while maintaining balance and control, is a critical attribute in basketball. Plyometric training has been found to enhance agility by improving reaction time, coordination, and dynamic balance. A narrative review by Li et al. (2024) and colleagues highlighted the effectiveness of basketball-specific plyometric drills in improving agility and emphasized the benefit of varying training surfaces, such as sand or water, for additional gains.

Citation
Hao, Z., Duangkam, J., Hengsukho, E., & Promthep, K. (2025). Effects of Plyometric Training on Lower Limb Muscle Power and Agility of College Basketball Students at Luoyang Normal University. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 1-10; DOI: https://doi.org/10.60027/ijsasr.2025.7354

Conceptual Framework

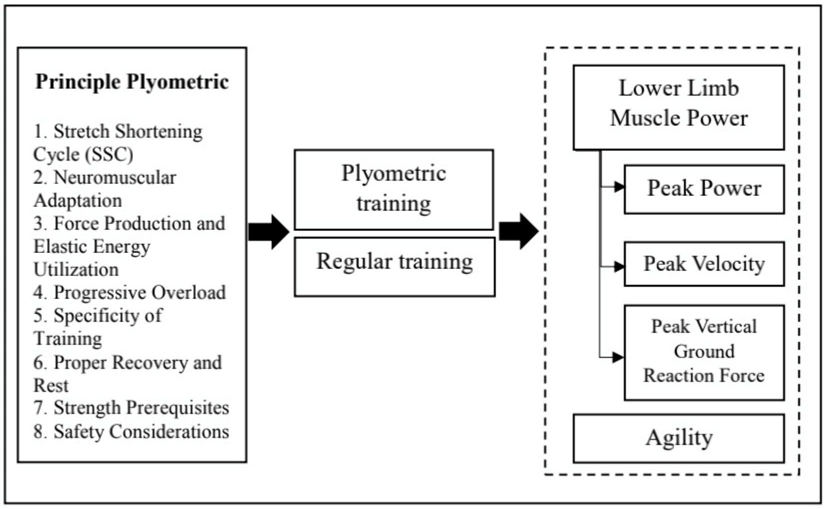

Figure 1 Conceptual Framework

Methodology

Population and sample

The study population consisted of 1,500 college basketball students majoring in physical education at Luoyang Normal University, Henan Province. From this group, 80 participants were initially selected using were volunteers and free from health conditions that could affect their training. The Standing Broad Jump Test was utilized to assess relative strength, and ultimately. This research was subjected to ethical review by the Ethics Board of the Udon Thani Rajabhat University (HECUD.267/2024).

Standing broad jump test criteria

1. Male athletes: Minimum 2.20 meters.
2. Female athletes (if applicable): Minimum 1.80 meters.
3. Each participant performed 2-3 trials, with the best score recorded.

Participants were matched into two groups ($n = 40 \pm 8$ each) based on their Barbell Back Squat relative strength, ensuring comparable fitness levels.

Sample size calculation using G*Power

The sample size was calculated using G*Power software, with an effect size of 0.80, statistical power of 0.90, and a significance level of $p<0.05$. Although the minimum required sample size was 68 participants, 80 participants were selected as the primary sample group to account for potential dropouts and enhance the statistical validity of the study.

Group allocation

Each group was further divided into subgroups of 10 participants per session for better supervision, optimal training intensity, and more precise individual feedback.

1. Inclusion Criteria:
   1.1 Active members of the Luoyang Normal University basketball team.
   1.2 Minimum 2 years of competitive experience.
   1.3 Free from chronic diseases (e.g., heart disease, asthma, hypertension).
   1.4 Passed the Physical Activity Readiness Questionnaire (PAR-Q).
   1.5 No recent injuries affecting muscles, joints, or ligaments.
   1.6 Successfully passed the Standing Broad Jump test.
   1.7 Informed consent form.
2. Exclusion Criteria:
   2.1 Sustained injuries or illnesses during the study.
   2.2 Attended less than 50% of training sessions.

Citation
Hao, Z., Duangkam, J., Hengsukho, E., & Promthep, K. (2025). Effects of Plyometric Training on Lower Limb Muscle Power and Agility of College Basketball Students at Luoyang Normal University. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 1-10; DOI: https://doi.org/10.60027/ijsasr.2025.7354

2.3 Voluntarily withdraw from participation.

Research design

The researcher used a quasi-experimental design to investigate specific effects of plyometric training on lower limb muscle power and agility among college basketball players. The participants were divided into two groups:

1. Experimental Group (n = 40): Trained using the plyometric training program.
2. Control Group (n = 40): Trained using the regular training program.

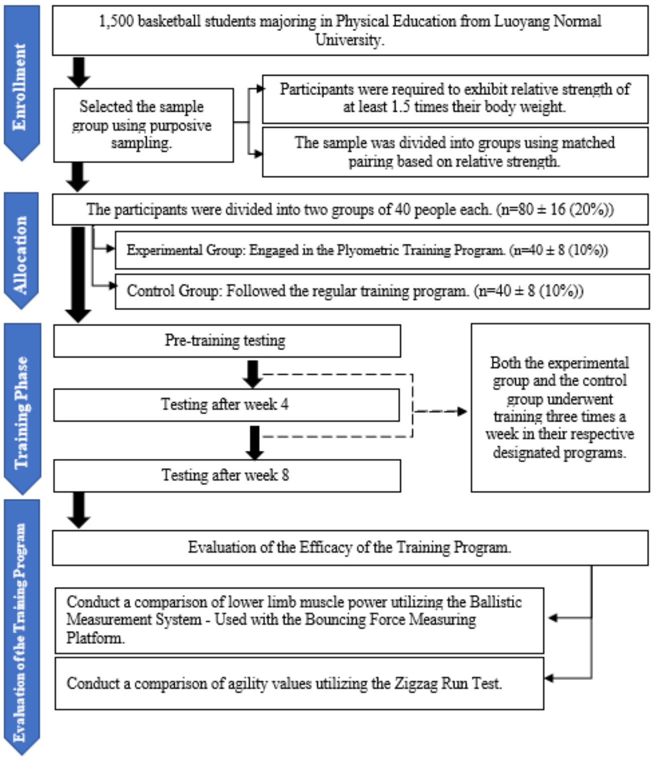

Figure 2 Diagram Illustrating the Research Design

Research instruments

Four research instruments were used in this study:

1. Plyometric Training Program: Developed and validated with an IOC score between 0.80-1.00
2. Regular Training Program: Developed and validated with an IOC score between 0.80-1.00
3. Explosive muscle training and strength testing: Utilized the Ballistic Measurement System (BMS) in conjunction with the Bouncing Force Measuring Platform to measure lower limb muscle power (e.g., peak power, vertical ground reaction force, and velocity).
4. Zigzag Run Test: Used to measure agility by recording completion time and efficiency of runners/players changing directions.

Data collection

Data were collected over 8 weeks, with measurements taken at three time points:

1. Pre-Test: Before training began.
2. Mid-Test: During the 4th week of training.
3. Post-Test: After the 8th week of training.

Data Analysis

The analysis methods are as follows:

Citation
Hao, Z., Duangkam, J., Hengsukho, E., & Promthep, K. (2025). Effects of Plyometric Training on Lower Limb Muscle Power and Agility of College Basketball Students at Luoyang Normal University. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 1-10; DOI: https://doi.org/10.60027/ijsasr.2025.7354

1. The mean and standard deviation for age, weight, height, and muscle mass for both the experimental and control groups.

2. Compared lower limb muscle power (Peak Power, Peak Vertical Ground Reaction Force, Peak Velocity) and agility at three time points (before training, after 4 weeks, and after 8 weeks) using:

2.1 One-Way ANOVA with Repeated Measures to analyze within-group differences, with pairwise comparisons performed using the Scheffe method.

2.2 Independent t-test to compare differences between the experimental and control groups, significance at $p<0.05$.

Results

The participants were divided into two groups: the experimental group (n = 40) and the control group (n = 40). The mean and standard deviation for age, weight, height, and muscle mass were analyzed and showed no significant differences between the groups at the baseline, ensuring comparability. The results are presented in Table 1.

Table 1 Baseline Characteristics of the Participants

Variable	Experimental Group (Mean ± SD)	Control Group (Mean ± SD)
Age (years)	20.5 ± 1.3	20.6 ± 1.2
Weight (kg)	70.3 ± 5.2	70.8 ± 5.1
Height (cm)	175.4 ± 6.1	175.8 ± 6.0
Muscle Mass (kg)	33.5 ± 2.4	33.7 ± 2.3

The mean and standard deviation of lower limb muscle power and agility between experimental and control groups were compared at pre-test, after 4 weeks, and after 8 weeks. The results are presented in Table 2.

Table 2 The basic statistics of lower limb muscle power and agility between the experimental group and the control group.

Variable	Pre-Test		After 4 weeks		After 8 weeks	
	Mean	**S.D.**	**Mean**	**S.D.**	**Mean**	**S.D.**
Experimental Group (n=40)						
1. Lower Limb Muscle Power						
1.1 Peak power	5418.53	249.05	5965.27	269.59	6318.79	284.23
1.2 Peak vertical ground reaction force	2675.79	115.34	2752.27	118.73	2788.53	118.85
1.3 Peak velocity	3.52	0.23	3.59	0.23	3.72	0.23
2. Agility	21.82	1.33	21.17	1.29	20.20	1.28
Control Group (n=40)						
1. Lower Limb Muscle Power						
1.1 Peak power	5408.45	263.48	5752.98	284.72	6019.71	309.13
1.2 Peak vertical ground reaction force	2645.40	121.22	2685.97	120.53	2709.22	120.49
1.3 Peak velocity	3.51	0.22	3.55	0.22	3.61	0.21
2. Agility	21.83	1.31	21.40	1.30	20.90	1.28

Citation
Hao, Z., Duangkam, J., Hengsukho, E., & Promthep, K. (2025). Effects of Plyometric Training on Lower Limb Muscle Power and Agility of College Basketball Students at Luoyang Normal University. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 1-10; DOI: https://doi.org/10.60027/ijsasr.2025.7354

To determine whether the variance in mean lower limb muscle power and agility in the experimental group and the control group was different at the time before the experiment, 4 weeks after the experiment, and 8 weeks after the experiment. The researcher therefore performed a One-Way ANOVA with repeated measures analysis of variance, as shown in Table 3.

Table 3 Results of One-way Anova with repeated measures for lower limb muscle power and agility across time points in experimental and control groups at the time before the experiment, 4 weeks after the experiment, and 8 weeks after the experiment

Variable	**Source of Variation**	**df**	**Experimental Group (n=40)**		**Control Group (n=40)**	
			F	***p***	**F**	***p***
1. Lower Limb Muscle Power						
1.1 Peak power	Between	2	111.699	< .001*	44.659	< .001*
	Within	117				
	Total	119				
1.2 Peak vertical ground reaction force	Between	2	9.333	< .001*	2.791	.065
	Within	117				
	Total	119				
1.3 Peak velocity	Between	2	7.134	< .001*	1.935	.149
	Within	117				
	Total	119				
2. Agility	Between	2	15.292	< .001*	5.053	< .008*
	Within	117				
	Total	119				

*$p<0.05$

As shown in Table 3, a one-way repeated measures ANOVA was conducted to examine the effects of plyometric training on lower limb muscle power and agility across three time points (pre-training, after 4 weeks, and after 8 weeks) in both experimental and control groups.

1. Lower Limb Muscle Power

1.1 Peak Power: The analysis revealed statistically significant improvements in Peak Power in both the experimental and control groups (p<.05). However, the experimental group demonstrated a substantially higher F-value (F=111.699) compared to the control group (F=44.659), indicating that participants who underwent plyometric training experienced greater gains in muscle power over time.

1.2 Peak Vertical Ground Reaction Force (vGRF): A significant improvement in Peak Vertical Ground Reaction Force was found in the experimental group across the three time points (p<.05), while the control group did not reach statistical significance (p=.065). This suggests that plyometric training had a more pronounced effect on vGRF compared to the regular training program.

1.3 Peak Velocity: The experimental group exhibited statistically significant improvements in Peak Velocity across the training period (p<.05), indicating enhanced explosive movement capability. In contrast, the control group did not show significant changes (p=.149), suggesting limited impact from regular training.

2. Agility: Both groups demonstrated significant improvements in agility over time. However, the experimental group showed a markedly greater improvement (p<.05) compared to the control group

Hao, Z., Duangkam, J., Hengsukho, E., & Promthep, K. (2025). Effects of Plyometric Training on Lower Limb Muscle Power and Agility of College Basketball Students at Luoyang Normal University. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 1-10; DOI: https://doi.org/10.60027/ijsasr.2025.7354

(p=.008), highlighting the effectiveness of plyometric training in enhancing quick directional movement and coordination.

To know which stages of the experimental group and the control group are different. The researcher, therefore, tested the differences in pairs using the Scheffe method, as shown in Table 4.

Table 4 Results of pairwise comparisons of the mean lower limb muscle power and agility of the experimental group and control group at different times.

Variable	Time	Mean	S.D.	Comparison	*p*
Experimental Group (n=40)					
1. Lower Limb Muscle Power					
1.1 Peak power (A)	Pre-Test (A_E1)	5418.53	249.05	A_E1 - A_E2	< .001*
	Mid-Test (A_E2)	5965.27	269.59	A_E2 - A_E3	< .001*
	Post-Test (A_E3)	6318.79	284.23	A_E1 - A_E3	< .001*
1.2 Peak vertical ground reaction force (B)	Pre-Test (B_E1)	2675.79	115.34	B_E1- B_E2	< .019*
	Mid-Test (B_E2)	2752.27	118.73	B_E2 - B_E3	.339
	Post-Test (B_E3)	2788.53	118.85	B_E1 - B_E3	< .001*
1.3 Peak velocity (C)	Pre-Test (C_E1)	3.52	0.23	C_E1 - C_E2	.400
	Mid-Test (C_E2)	3.59	0.23	C_E2 - C_E3	.064
	Post-Test (C_E3)	3.72	0.23	C_E1 - C_E3	< .001*
2. Agility (D)	Pre-Test (D_E1)	21.82	1.33	D_E1 - D_E2	.09
	Mid-Test (D_E2)	21.17	1.29	D_E2 - D_E3	< .006*
	Post-Test (D_E3)	20.20	1.28	D_E1 - D_E3	< .001*
Control Group (n=40)					
1. Lower Limb Muscle Power					
1.1 Peak power (A)	Pre-Test (A_E1)	5408.45	263.48	A_E1 - A_E2	< .001*
	Mid-Test (A_E2)	5752.98	284.72	A_E2- A_E3	< .001*
	Post-Test (A_E3)	6019.71	309.13	A_E1 - A_E3	< .001*
2. Agility (D)	Pre-Test (D_E1)	21.83	1.31	D_E1 - D_E2	.340
	Mid-Test (D_E2)	21.40	1.30	D_E2 - D_E3	.239
	Post-Test (D_E3)	20.90	1.28	D_E1 - D_E3	< .008*

*p<0.05

As presented in Table 4, the mean values for lower limb muscle power and agility were compared between the Plyometric Training Group and the Regular Training Group across three time intervals: pre-training, after 4 weeks, and after 8 weeks. The following findings were observed:

1. **Peak Power:** Participants in the Plyometric Training Group demonstrated statistically significant improvements in Peak Power at all measured time points compared to pre-training values (p<.05). This consistent enhancement reflects the effectiveness of plyometric training in developing lower limb explosive strength over time.
2. **Peak Vertical Ground Reaction Force and Peak Velocity:** The experimental group exhibited notable improvements in both Peak Vertical Ground Reaction Force and Peak Velocity across specific time intervals. In contrast, the control group showed no significant changes in these parameters, suggesting that regular training alone was insufficient to elicit marked gains in lower limb muscle function.
3. **Agility:** Agility performance in the Plyometric Training Group improved significantly over the course of the training program. A statistically significant difference (p<.05) was observed between pre-training and 8 weeks post-training. The control group also demonstrated some improvement; however, the magnitude of change was notably lower compared to the experimental group, indicating the superior effectiveness of plyometric training in enhancing agility-related movements.

Citation
Hao, Z., Duangkam, J., Hengsukho, E., & Promthep, K. (2025). Effects of Plyometric Training on Lower Limb Muscle Power and Agility of College Basketball Students at Luoyang Normal University. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 1-10; DOI: https://doi.org/10.60027/ijsasr.2025.7354

Table 5 The Comparison of lower limb muscle power and agility between the experimental group and the control group

Variable	Experimental Group (n=40)		Control Group (n=40)		T	*p*
	Mean	S.D.	Mean	S.D.		
Pre-Test						
1. Lower Limb Muscle Power						
1.1 Peak power	5418.53	249.05	5408.45	263.48	.174	.863
1.2 Peak vertical ground reaction force	2675.79	115.34	2645.40	121.22	1.134	.260
1.3 Peak velocity	3.52	0.23	3.51	0.22	.220	.827
2. Agility	21.82	1.33	21.83	1.31	- .038	.970
After 4 weeks						
1. Lower Limb Muscle Power						
1.1 Peak power	5965.27	269.59	5752.98	284.72	3.381	< .001*
1.2 Peak vertical ground reaction force	2752.27	118.73	2685.97	120.53	2.447	< .017*
1.3 Peak velocity	3.59	0.23	3.55	0.22	.852	.397
2. Agility	21.17	1.29	21.40	1.30	- .782	.436
After 8 weeks						
1. Lower Limb Muscle Power						
1.1 Peak power	6318.79	284.23	6019.71	309.13	4.448	< .001*
1.2 Peak vertical ground reaction force	2788.53	118.85	2709.22	120.49	2.926	< .004*
1.3 Peak velocity	3.72	0.23	3.61	0.21	2.145	< .035*
2. Agility	20.20	1.28	20.90	1.28	- 2.399	< .019*

*$p < 0.05$

Table 5 presents the results of the comparison of lower limb muscle power and agility between the experimental group and the control group. The findings:

1. Lower Limb Muscle Power: The independent t-test revealed statistically significant differences between the two groups in all measured components of lower limb muscle power, including peak power, peak vertical ground reaction force, and peak velocity ($p<.05$). These results indicate that the plyometric training group achieved significantly greater improvements in muscular power than the regular training group by the end of the training period.
2. Agility: In terms of agility performance, the experimental group showed a statistically significant enhancement at 8 weeks post-training compared to the control group (p=.019). The control group demonstrated only minimal improvement, underscoring the effectiveness of the plyometric training intervention in promoting superior agility development among basketball athletes.

These findings support the conclusion that plyometric training is more effective than regular training in improving both muscular power and agility among college basketball players over an 8-week training period.

Summary

The research results concluded that the experimental group receiving plyometric training showed significantly greater improvements in lower limb muscle power and agility compared to the control group ($p <.05$). These findings confirm the effectiveness of plyometric training in enhancing explosive performance and movement agility in college basketball players over 8 weeks.

Citation
Hao, Z., Duangkam, J., Hengsukho, E., & Promthep, K. (2025). Effects of Plyometric Training on Lower Limb Muscle Power and Agility of College Basketball Students at Luoyang Normal University. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 1-10; DOI: https://doi.org/10.60027/ijsasr.2025.7354

Conclusion

This study investigated the effects of plyometric training on lower limb muscle power and agility among college basketball players. The results confirmed that the experimental group, which received plyometric training, exhibited significant and consistent improvements in peak power, peak vertical ground reaction force, peak velocity, and agility, particularly evident after 8 weeks of intervention.

Table 4 showed significant within-group improvements over time in all performance variables, indicating that plyometric training led to progressive development in lower limb power. Table 5 demonstrated that, at the 8-week post-test, the experimental group significantly outperformed the control group in all measured components ($p<.05$), including agility.

Overall, the findings reveal that plyometric training is superior to regular training in enhancing explosive strength and agility. These outcomes align with the study's objectives. However, the rate of improvement was more pronounced during the second half of the intervention period (weeks 4–8), suggesting that a longer or more sustained training program may be necessary to observe early-phase adaptation. Additionally, while agility improved significantly, its progression was not as rapid as expected in the early stages, indicating a potential need for more specific agility-focused components in the training design.

Discussion

The present study aimed to evaluate the effectiveness of plyometric training on lower limb muscle power and agility among college basketball students. The findings indicated that the plyometric training group demonstrated significant improvements in Peak Power, Peak Vertical Ground Reaction Force, Peak Velocity, and agility, especially when compared to the control group undergoing regular training. These results reinforce the value of plyometric training in enhancing explosive strength and movement efficiency essential for basketball performance. Consistent with prior studies, plyometric training was shown to promote neuromuscular adaptations by enhancing the activation of fast-twitch muscle fibers, intermuscular coordination, and the stretch-shortening cycle. Ramírez-Delacruz et al. (2022) reported that muscle strength training leads to structural and functional enhancements in musculature and tendons, improving neuromuscular responsiveness and overall physical ability. Similarly, Kons et al. (2023) emphasized that strength-based interventions, including plyometric methods, significantly improve key athletic attributes such as jump height, sprint speed, and agility across various athletic populations.

The combination of strength and speed in plyometric training is particularly beneficial for sports like basketball, where athletes are required to execute explosive movements, such as jumping, accelerating, and rapid directional changes. Improvements in Peak Velocity observed in this study further suggest an enhancement in the rate of muscle contraction, which is crucial in fast-paced gameplay. These findings align with previous evidence indicating the efficacy of strength-based programs in boosting physical performance.

Furthermore, a comparative analysis of performance over time (pre-training, after 4 weeks, and after 8 weeks) revealed a consistent and progressive improvement in the experimental group. Notably, agility improvements measured via the Zigzag Run Test showed statistically significant gains after 8 weeks of plyometric training. These results agree with findings by Arifin et al. (2019) and Hardini et al. (2020), who demonstrated that plyometric interventions lead to reduced sprint times and enhanced directional responsiveness in athletes.

This improvement in agility likely stems from neural adaptations, including faster and more efficient communication between the central nervous system and muscles. Plyometric training is known to improve neuromuscular coordination and muscle–tendon interaction, both of which are crucial for agility and explosive performance (Kons et al., 2023). In contrast, the regular training group displayed only limited and inconsistent progress, highlighting the importance of dynamic stimulus in driving adaptation. Hasan (2023) also confirmed that plyometric training surpasses traditional training approaches in improving functional performance indicators such as speed, agility, and explosive power. These results, supported by consistent improvements across all time points in the present study, emphasize the unique benefits of plyometric training in both mechanical and perceptual domains of agility and performance.

Citation
Hao, Z., Duangkam, J., Hengsukho, E., & Promthep, K. (2025). Effects of Plyometric Training on Lower Limb Muscle Power and Agility of College Basketball Students at Luoyang Normal University. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 1-10; DOI: https://doi.org/10.60027/ijsasr.2025.7354

In summary, the evidence presented confirms that plyometric training is a superior method for enhancing lower limb muscle power and agility, particularly in sports contexts demanding speed, explosiveness, and rapid movement changes.

Recommendations

Recommendations for Current Research

1. Plyometric training should be incorporated into standard strength and conditioning routines for collegiate basketball players to effectively improve lower limb power and agility.
2. Training programs should include progressive, basketball-specific plyometric exercises that reflect the sport's biomechanical and physiological demands.
3. Emphasis should be placed on integrating both strength and agility components in training to optimize explosive movements required in basketball performance.

Recommendations for Future Research

1. Future studies should explore the long-term impact of plyometric training, including performance sustainability and its effects on injury prevention beyond 8 weeks.
2. Research should be expanded to include broader populations such as female athletes, younger or older age groups, and participants across various sports to assess generalizability.
3. Further investigation is recommended into the effectiveness of plyometric training as a strategy for reducing lower limb injury risk in competitive athletic settings.

References

Arifin, M. H., Fikri, M., & Hidayat, R. (2019). The effect of zigzag run training on increasing the agility of soccer players. *Journal Advances in Health Sciences Research*, *21(3)*, 222-225.

Cao, S., Wang, Z., & Guo, J. (2024). The effects of plyometric training on physical fitness and skill-related performance in female basketball players: A systematic review and meta-analysis. *Journal Frontiers in Physiology*, 15(3),1-16.

Hardini, H., Nugroho, H. S., & Handoyo, A. (2020). Pump it up and zig-zag run training improves children's agility at age 7–8 years old. *STRADA Journal lmiah Kesehatan*, *9*(1), 209-216.

Hasan, S. (2023). Effects of plyometric vs. strength training on strength, sprint, and functional performance in soccer players: A randomized controlled trial. *Journal of Sports Sciences*, 39(5), 1234-1242.

Kons, R. L., Orssatto, L. B. R., Ache-Dias, J., De Pauw, K., Meeusen, R., Trajano, G. S., Dal Pupo, J., & Detanico, D. (2023). Effects of plyometric training on physical performance: An umbrella review. *Journal of Sports Medicine*, 53(1), 45-60.

Li, X., Zhao, M., & Sun, R. (2024). Basketball-specific agility: A narrative review of execution plans and training programs. *Journal Frontiers in Physiology*, 103(6),1-16.

Moran, J., Sandercock, G. R. H., Ramírez-Campillo, R., Meylan, C., Collison, J., & Parry, D. A. (2017). A meta-analysis of maturation-related variation in adolescent boy athletes' adaptations to short-term resistance training. *Journal of Sports Science*, 39(9), 1045-1054.

Ramírez-delaCruz, M., Bravo-Sánchez, A., Esteban-García, P., Jiménez, F., & Abián-Vicén, J. (2022). Effects of plyometric training on lower body muscle architecture, tendon structure, stiffness, and physical performance: A systematic review and meta-analysis. *Journal Sports Medicine-Open*, 8(1), 1-20.

Stojanović, E., Ristić, V., McMaster, D. T., & Milanović, Z. (2017). Effect of plyometric training on vertical jump performance in female athletes: A systematic review and meta-analysis. *Sports Medicine*, 47(5), 975-986.

Wang, D., Taek, J. Y., & Wang, S. (2023). Combined training and explosive strength in basketball players' lower limbs. *Revista Brasileira de Medicina do Esporte*, 29, 1-3. https://doi.org/10.1590/1517-8692202329012023020l

Wang, J., Qin, Z., Zhang, Q., & Wang, J. (2025). Lower limb dynamic balance, strength, explosive power, agility, and injuries in volleyball players. *Journal of Orthopaedic Surgery and Research*, 20(1), 211-220.

Young, W. B., Rayner, R., & Talpey, S. W. (2021). It's time to change direction on agility research: A call to action. *Journal of Sports Medicine*, 51(11), 2213-2215.

Zhang, Y., Liu, H., & Chen, L. (2024). Meta-analysis of the effect of plyometric training on the athletic performance of youth basketball players. *Journal of Sports Science and Medicine*, 23(2), 144–152.

Citation
Hao, Z., Duangkam, J., Hengsukho, E., & Promthep, K. (2025). Effects of Plyometric Training on Lower Limb Muscle Power and Agility of College Basketball Students at Luoyang Normal University. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 1-10; DOI: https://doi.org/10.60027/ijsasr.2025.7354