



Developing a Plyometric Training Program to Improve Jumping and 3-Point Shooting Ability in Basketball

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Abstract

Background and Aim: Improving jumping ability is not merely about increasing an athlete's vertical height or jumping higher; it's about refining the player's overall game performance through effective jump techniques. In basketball, jumping is far more than just a basic movement; it is crucial for key skills like shooting, blocking, and rebounding. The level of competition in basketball continues to rise, and the importance of physical attributes like jumping ability has become more pronounced. Despite the critical role of jumping in basketball performance, many athletes struggle to reach their full potential in this area due to inadequate or improperly structured training methods. Therefore, this research was to develop a plyometric training program to improve jumping and 3-point shooting ability in basketball.

Materials and Methods: This research was quasi-experimental. Consisted of 232 male basketball athletes and 7 coaches from the basketball club of Yunnan University of Finance and Economics. All 232 male basketball athletes will participate in the vertical jump test, and their scores will be recorded. The 40 male athletes with the lowest test scores, who volunteered to take part in the experiment, will be selected as the sample group. Using a systematic sampling method, the sample will be divided into two groups, with 20 athletes assigned to the experimental group and 20 athletes assigned to the control group. The experiment will be conducted for 8 weeks, the experimental group will be trained using a plyometric training program, and the control group will be trained using a traditional training program. The vertical jump test and three-point jump shot test will be administered to all 40 athletes before the start of the training (pre-test), after 4 weeks of training, and upon completion of the 8-week program. In this research, mean, standard deviation, one-way repeated measures ANOVA, Bonferroni post hoc, and independent t-tests were used to analyze the data.

Results: The results showed a significant difference between the experimental and control groups in the post-test outcomes for both the vertical jump and three-point jump shot tests. Additionally, within the experimental group, significant improvements were observed in the vertical jump and





three-point jump shot results across all time points: pretest to mid-test, pretest to posttest, and mid-test to posttest, with significant differences at the 0.05 level.

Conclusion: The plyometric training program developed was more effective in improving jumping performance in basketball.

Keywords: Plyometric Training Program; Jumping Ability; 3-Point Shooting Ability; Basketball

Introduction

Basketball, as a team sport, has evolved far beyond being a simple physical activity to become one of the most influential and widely followed sports in the world. From the debut of young players to the high-stakes contests of professional athletes, the game is consistently infused with passion and intensity. Its global reach and impact extend to every corner of society. Each match is a fierce competition where players must demonstrate exceptional skills and athleticism within mere minutes—or even seconds. More than just a sport, basketball embodies the dreams, sweat, and dedication of athletes, serving as both a goal and a lifelong passion for countless individuals.

The appeal of basketball lies not only in its competitive spirit but also in its speed, unpredictability, and technical complexity, which together create endless possibilities in every game. As the global standard of play has risen, the level of competition has intensified, placing greater demands on athletes. Historically, the focus of basketball training centered on ball-handling, shooting accuracy, and tactical execution. However, with increasingly fierce competition, physical fitness has emerged as a decisive factor in determining outcomes. At the elite level, athletes are now expected to not only master fundamental skills but also demonstrate exceptional physical conditioning and rapid reflexes, which are crucial for success.

Among the physical attributes that define basketball performance, jumping ability is particularly significant. It directly influences key aspects of the game, including shooting, blocking, and rebounding. Effective jumping can determine whether a player secures possession or loses it to an opponent. Those with superior jumping ability gain a competitive edge, enabling them to execute technical skills and create scoring opportunities at critical moments. Conversely, limited jumping capacity often results in missed chances, especially under high-pressure conditions where aerial dominance is essential. Consequently, improving jumping ability has become a central focus in basketball training, underscoring its critical role in both athletic performance and competitive success (Tian & Liu, 2011).

At the university level, however, basketball athletes often face significant challenges in developing optimal jumping performance despite their athleticism and technical proficiency. While these athletes generally maintain good overall fitness, many lack the specific strength and





explosive power required for effective jumping. Traditional strength training routines may not adequately target the muscle groups most responsible for generating explosive jumps—such as the quadriceps, hamstrings, and calves—leading to limited vertical leap and slower reactions during crucial in-game moments (Harman, 2008). Furthermore, many university players emphasize general conditioning rather than sport-specific preparation. Yet in basketball, jumping ability depends not only on leg strength but also on agility, coordination, and endurance to perform repeated jumps under fatigue. Without specialized conditioning, players may fall short in developing the explosive endurance necessary to maintain high-quality jumps throughout a game (Wang, 2016).

As competition continues to intensify, the importance of jumping ability has become even more pronounced. Despite its central role in performance, many athletes struggle to maximize their potential due to insufficient or improperly structured training programs. Plyometric training—which focuses on rapid stretching and contracting of muscles to build explosive power—is recognized as a highly effective method for improving jumping ability. However, such training is often underutilized in university-level programs, leaving athletes without the targeted drills needed to enhance their performance (Komi, 2003). This highlights the urgent need for a structured, evidence-based plyometric training program to develop jumping ability in basketball athletes. Such a program would not only improve vertical leap but could also enhance shooting performance, including 3-point accuracy, and strengthen athletes' ability to excel in high-pressure game situations.

Research Objectives

To develop a plyometric training program to improve jumping and 3-point shooting ability in basketball.

Literature Review

Jumping ability

Jumping performance is a fundamental physical ability in many sports, including basketball, volleyball, track and field, and soccer, and is often regarded as a direct indicator of an athlete's explosive lower-body power. Vertical jump height is one of the most common measures used to assess this capability (Markovic et al., 2004). The mechanics of jumping rely on a combination of strength, power, and neuromuscular coordination. During a jump, muscles engage in a rapid stretch-shortening cycle (SSC), enabling them to generate maximal force within a short time frame. Proper technique in both take-off and landing is vital not only for optimizing performance but also for minimizing the risk of injury. Key physical qualities influencing jump performance include



lower-body strength, particularly in the quadriceps, glutes, and calves, as well as muscle power—the ability to produce force quickly—which has been shown to correlate more strongly with jump height than strength alone (Cormie et al., 2010). Body composition is another determining factor: excess fat acts as a non-functional load, reducing jump capacity, while lean muscle mass, especially in the legs, is associated with superior jumping ability (Malisoux et al., 2006). For this reason, conditioning programs typically combine strength training with body composition management.

Plyometric training is among the most widely recognized methods for enhancing jumping ability. By incorporating explosive exercises such as jump squats, bounding, and depth jumps, plyometric training exploits the SSC to improve muscle stiffness and neuromuscular efficiency—both essential for maximizing vertical jump height (Markovic, 2007). Strength training also plays a complementary role, with foundational exercises such as squats, deadlifts, and lunges targeting the glutes, quadriceps, hamstrings, and calves. These exercises expand the muscles' force production capacity, a primary determinant of jump performance (Cormie et al., 2011). In basketball-specific contexts, training often emphasizes both bilateral and unilateral lower-body movements to match the sport's dynamic demands.

However, the development of jumping ability extends beyond strength and flexibility, requiring mastery of correct jump techniques across all phases—from initiation to airborne control. Even minor technical errors can reduce efficiency and performance outcomes. In particular, the early phase of reverse jumping demands rapid conversion of lower-limb strength into upward thrust, which is critical for achieving greater height. Research demonstrates that technical proficiency in power transfer significantly enhances overall jump performance, while maintaining proper posture and stability in the airborne phase ensures effective execution. Therefore, combining technical skill training with targeted strength development is essential for improving both jump height and consistency (McMahon et al., 2018).

Plyometric training

Plyometric exercises are generally divided into lower-body and upper-body movements. Lower-body drills include squat jumps, box jumps, depth jumps, and bounding, while upper-body plyometrics consist of exercises such as clap push-ups and medicine ball throws. These movements can be adjusted according to the athlete's sport, skill level, and performance goals (Davies et al., 2015). Plyometric training is widely applied in sports like basketball, volleyball, soccer, and track and field. For instance, in basketball, plyometric drills enhance vertical jump performance for rebounding and dunking, while in soccer, they improve sprint speed and change-of-direction ability. Designing plyometric programs that reflect the specific demands of each sport leads to more effective performance outcomes (Potach & Chu, 2000).





Plyometric training is regarded as one of the most effective methods for developing muscular power, the ability to generate force rapidly. By enhancing the efficiency of the stretch-shortening cycle (SSC), plyometrics enable muscles to contract with greater force following a rapid stretch. Research consistently demonstrates that plyometric training improves speed, agility, and vertical jump height, leading to significant gains in overall athletic performance (Miller et al., 2006). In basketball, plyometric exercises such as box jumps and depth jumps specifically condition the neuromuscular system for explosive actions and improve reactive strength, the ability to quickly transition from eccentric to concentric muscle action. This quality is essential for performing “second jumps,” such as leaping again immediately after a missed shot or blocked attempt. Reactive strength is commonly measured by the Reactive Strength Index (RSI), which has been shown to improve substantially through consistent plyometric training. Collectively, the physical benefits of plyometrics, including enhanced speed, strength, agility, and energy efficiency, translate into superior on-court performance, enabling athletes to become more explosive in attack, faster in transition, and more effective defensively (Sáez-Sáez de Villarreal et al., 2010).

Principle of training

The principle of specificity emphasizes that training should closely replicate the unique demands of a sport or activity by targeting relevant movement patterns, energy systems, and muscle groups. Developing sport-specific skills in environments that mimic competition enhances the transfer of training to performance (Magill, 2007). The principle of progressive overload highlights the need for gradually increasing training demands to stimulate physiological adaptations. Incremental increases in resistance or intensity challenge the musculoskeletal and cardiovascular systems, prompting them to adapt and grow stronger (Zatsiorsky & Kraemer, 2006). In contrast, the principle of reversibility, often summarized as “use it or lose it,” acknowledges that training adaptations are temporary; if training is reduced or stopped, fitness and performance benefits decline at varying rates depending on fitness level, training intensity, and duration (Wilmore & Costill, 2005). The principle of individualization recognizes that responses to training are influenced by factors such as age, gender, genetics, health status, and training history, meaning programs must be tailored to the individual. Novices require a very different approach compared to elite athletes (McArdle et al., 2010). Finally, recovery and variation are essential to long-term progress. Adequate rest allows the body to repair and strengthen, while systematic variation or periodization of training variables prevents stagnation and reduces the risk of overtraining, ensuring continual adaptation (Wilmore & Costill, 2005).

In conclusion, a holistic training approach that integrates plyometric exercises with strength and agility drills has been proven most effective for enhancing overall athletic performance, as it develops explosive power, movement efficiency, and injury resilience, key qualities for basketball



players who frequently perform high-intensity actions. Plyometric training, involving rapid muscle stretch–shortening activities such as jumps, bounds, and hops, has consistently been shown in the literature to improve lower-body power, coordination, and speed, with even short programs of six weeks producing significant gains when properly structured. However, current university-level basketball training still relies heavily on traditional methods and lacks specialized programs targeting jumping performance. Thus, developing a structured plyometric training program is essential to improve athletes’ jumping ability and elevate their overall athletic performance. By applying training principles, specificity, progressive overload, individualization, recovery, and variation, coaches can tailor plyometric drills to closely mimic the explosive demands of basketball, including repeated jumps for rebounding and quick second jumps for offensive plays. Improved vertical jump height and reactive strength directly support in-game actions such as rebounding, shot-blocking, and dunking, while also contributing to shooting performance.

Conceptual Framework

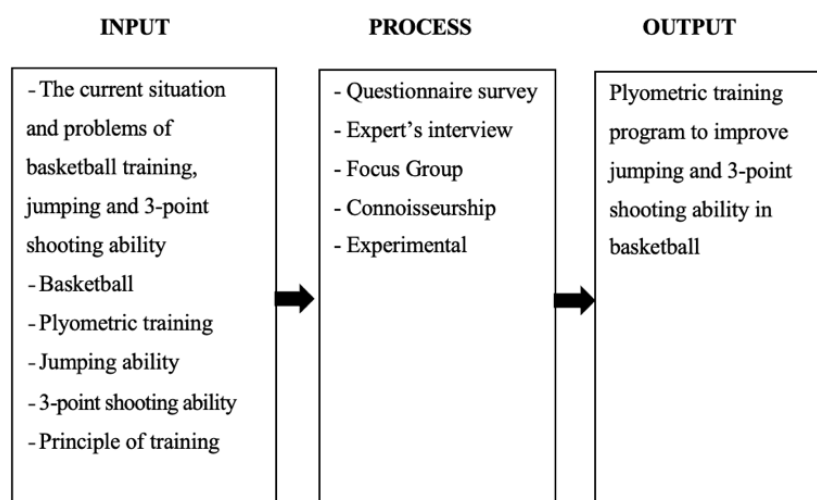


Figure 1 Conceptual framework

The input stage identifies the foundation, including the current situation and problems in basketball training, as well as key concepts such as basketball fundamentals, plyometric training, jumping ability, 3-point shooting ability, and training principles. The process stage employs multiple research methods, questionnaire surveys, expert interviews, focus groups, connoisseurship, and experimental studies, to gather insights and validate the program design. Finally, the output is a structured plyometric training program specifically aimed at improving both vertical jump performance and 3-point shooting accuracy in basketball athletes.



Methodology

Research Tools

In this research, the following instruments were employed to carry out the study: (1) Questionnaire for athletes and questionnaire for coaches; (2) Interviewing form; (3) Focus group outline; (4) Connoisseurship outline; (5) Plyometric training program; (6) Vertical jump test; (7) Three-point jump shot test.

Population and Sample

The population of this research is 232 male basketball athletes and 7 coaches from the basketball club of Yunnan University of Finance and Economics. The population will be surveyed to determine the current situation and problems related to basketball training and jumping performance.

A total of 232 male basketball athletes from the basketball club of Yunnan University of Finance and Economics will undergo a vertical jump test, and their performance scores will be recorded. From these, the 40 athletes with the lowest scores who voluntarily agree to participate will be selected as the study sample. Using a systematic sampling method, the sample will then be divided into two groups: 20 athletes will be assigned to the experimental group, and 20 athletes will be assigned to the control group.

Data Collection

1. Questionnaires will be distributed online to 232 male basketball athletes and 7 coaches from the basketball club at Yunnan University of Finance and Economics. The survey will collect detailed data on the current situation and problems of basketball training and jumping, and the 3-point shooting ability of basketball athletes.

2. Seven experts will be invited for face-to-face expert interviews to analyze the components of the plyometric training program to improve the jumping and 3-point shooting ability of basketball.

3. Twelve experts will be invited to participate in a focus group discussion. The discussion aimed to develop a plyometric training program designed to improve the jumping and 3-point shooting ability of basketball players.

4. Seven experts will be invited to participate in a connoisseurship discussion. This will help confirm the effectiveness and applicability of the training program.

5. The training program will be conducted over 8 weeks with 40 athletes, with sessions held three days a week (Monday, Wednesday, and Friday), each lasting 2 hours. The experimental group will follow the developed plyometric training program, while the control group will follow the traditional training program.





6. Both the experimental and control groups will conduct a vertical jump test and three-point jump shot test before the training, after 4 weeks of training, and at the conclusion of the 8-week program.

4. Data Analysis

This research will primarily utilize a software package for data analysis.

1. Descriptive statistics, such as mean ($\bar{x}$) and standard deviation (S.D.), will be used to analyze the data from the questionnaires for athletes and coaches.

2. The results of the experts' interviews, focus group discussions, and connoisseurship discussions will be analyzed using content analysis.

3. An independent t-test was used to compare the test results of pre-test, after 4 weeks of training, and post-test between the experimental group and the control group.

4. The pre-test, mid-test (after 4 weeks of training), and post-test (after 8 weeks of training) results for the experimental group will be analyzed using one-way repeated measures ANOVA, followed by a Post Hoc test.

5. The content validity of the questionnaire items and the questions of the interview form will be evaluated using the Index of Item-Objective Congruence (IOC). The IOC value of the questionnaire for athletes = 0.93, the IOC value of the questionnaire for coaches = 0.90, and the IOC value of the interview form = 0.95.

Results

The research process and findings are presented in four major parts:

Part 1: Study of the current situation and challenges in basketball training, the jumping and 3-point shooting ability of athletes.

Part 2: Expert interviews to collect professional insights into training practices and to identify components for designing a plyometric training program to improve jumping and 3-point shooting ability.

Part 3: Development of the plyometric training program through expert focus group discussions, ensuring its relevance and applicability.

Part 4: Evaluation of the effectiveness of the developed plyometric training program through an experimental research design.

Part 1: Study of the current situation and challenges in basketball training, the jumping and 3-point shooting ability of athletes

To assess the current situation and challenges related to basketball training and the jumping and 3-point shooting ability of athletes, this study utilized a questionnaire survey method. A total



of 232 male basketball athletes and 7 coaches from the basketball club at Yunnan University of Finance and Economics participated in the survey, which was conducted online. The following presents the survey results from the athletes.

Table 1 The results of the athletes' questionnaire survey to study the current situation and the problem of basketball training, the jumping and 3-point shooting ability of athletes (N=232)

Questionnaire Items	Total Score		Result
	$\bar{X}$	S.D.	
1. I understand the benefits of plyometric training for physical performance	2.30	0.65	Poor
2. I have previous experience with plyometric exercises.	1.45	0.50	Very Poor
3. I believe plyometric training enhances my on-court speed and agility.	4.70	0.45	Highest
4. I believe there is a risk of injury with plyometric training if not supervised	4.60	0.60	Highest
5. I am interested in regularly participating in plyometric training	4.40	0.55	High
6. I think plyometric training should be integrated into the regular training schedule.	4.20	0.48	High
7. I would like to train in plyometrics to improve my vertical jump ability	4.55	0.45	Highest
8. I prefer to receive guidance from a coach during plyometric training.	3.95	0.52	High
9. I would like plyometric training tailored to my playing position.	4.05	0.50	High
10. I feel more motivated to train in plyometrics when working with teammates.	4.10	0.46	High
11. I can train consistently if I have a clear and structured plyometric program.	3.15	0.60	Moderate

From Table 1, the results of the athletes' questionnaire survey to study the current situation and the problem of basketball training and the jumping performance of athletes,



showed that most students have limited prior exposure and understanding of plyometric training. This is evident from the low mean scores in items related to their knowledge ($\bar{X} = 2.30$, S.D. = 0.65) and prior experience ($\bar{X} = 1.45$, S.D. = 0.50), which were interpreted as poor and very poor, respectively. These results suggest a clear gap in students' familiarity with plyometric training, which may affect their ability to use it effectively without guidance. However, despite the lack of experience, students expressed very strong beliefs in the benefits of plyometric training, particularly its impact on speed, agility, and vertical jump performance. The highest mean scores were recorded for statements such as believing it enhances on-court performance ($\bar{X} = 4.70$, S.D. = 0.45), prevents injury with proper supervision ($\bar{X} = 4.60$, S.D. = 0.60), and helps improve vertical jump ability ($\bar{X} = 4.55$, S.D. = 0.45).

After distributing the questionnaires to 7 coaches from the basketball club at Yunnan University of Finance and Economics, the survey results from the coaches were as follows:

Table 2 The results of the coaches' questionnaire survey to study the current situation and the problem of basketball training and the jumping performance of athletes (N=7)

Questionnaire Items	Total Score		Result
	$\bar{X}$	S.D.	
1. I have sufficient knowledge to design plyometric training programs.	2.10	0.72	Poor
2. I consider 2–3 sessions per week to be the optimal frequency for plyometric training.	3.40	0.42	Moderate
3. I have previously implemented plyometric training with my basketball athletes.	2.40	0.44	Poor
4. I can modify plyometric exercises to suit individual athletes.	2.10	0.50	Poor
5. Plyometric training plays an important role in developing basketball athletes.	4.70	0.32	Highest
6. I am open to developing training programs collaboratively with athletes and specialists.	3.80	0.50	High
7. I believe plyometrics are effective for improving explosive power.	4.20	0.38	High



Questionnaire Items	Total Score		Result
	$\bar{X}$	S.D.	
8. I can effectively manage athlete safety during plyometric sessions.	4.60	0.40	Highest
9. I would benefit from having a standardized plyometric training manual or guide.	4.00	0.42	High
10. I believe athletes should be assessed before and after plyometric training.	4.20	0.36	High
11. Plyometric training should be integrated with rehabilitation and recovery practices.	2.90	0.60	Moderate

From Table 2, the results of the coaches' questionnaire survey to study the current situation and the problem of basketball training and the jumping performance of athletes, showed that respondents generally lack sufficient knowledge and practical experience in designing and implementing plyometric training programs. Items such as “I have sufficient knowledge to design plyometric training programs” ($\bar{X} = 2.10$, S.D. = 0.72), “I have previously implemented plyometric training with my basketball athletes” ($\bar{X} = 2.40$, S.D. = 0.44), and “I can modify plyometric exercises to suit individual athletes” ($\bar{X} = 2.10$, S.D. = 0.50) were all rated as poor, indicating a need for professional development. Even knowledge regarding the optimal frequency for plyometric training ($\bar{X} = 3.40$, S.D. = 0.42) was only rated as moderate, suggesting that foundational understanding of program structure is still underdeveloped among the participants.

Part 2: Expert interviews to collect professional insights into training practices and to identify components for designing a plyometric training program to improve jumping and 3-point shooting ability.

7 experts were interviewed to gain additional insights. The purpose of these interviews was to explore issues related to basketball training and the improvement of jumping and 3-point shooting ability, as well as to develop a framework for a plyometric training program aimed at enhancing jumping and 3-point shooting ability. The expert interviews highlighted several key insights regarding basketball training, jumping, and 3-point shooting ability. Experts identified the primary challenges faced by athletes, including a lack of explosive power, strength, and proper coordination. They emphasized the critical role of strength training in developing the foundation



for vertical jump improvement and agreed that plyometric exercises are highly effective for enhancing explosiveness and jump height. However, experts noted common deficiencies in current training programs, such as insufficient focus on jump-specific exercises and inadequate integration of plyometric training. They recommended structuring plyometric programs with gradual progression, proper intensity, and recovery to minimize injury risks. Key exercises like depth jumps, box jumps, and bounding were suggested, with an emphasis on tailoring programs to the needs of university-level athletes. Success indicators included measurable improvements in jump height and in-game explosiveness, while injury prevention through proper technique and recovery was considered essential for the program's success.

Part 3: Development of the plyometric training program through expert focus group discussions, ensuring its relevance and applicability.

A focus group discussion was held with twelve experts, comprising four basketball coaches, four physical education teachers specializing in basketball, and four basketball referees, to collaboratively design a plyometric training program aimed at improving the jumping and 3-point shooting ability of basketball athletes. From the focus group discussion with experts, a plyometric training program can be developed as follows:

Program Structure by Phase	
Weeks 1–2	Base Conditioning & Jump Form <ul style="list-style-type: none">- Focus: Proper jump mechanics, body control, basic plyometrics (squat jumps, jump rope)- Shooting: Fundamental shooting with jump-shot integration
Weeks 3–4	Explosive Power & Stability <ul style="list-style-type: none">- Focus: Introduce depth jumps, broad jumps, sprint starts, single-leg reactive hops- Strength: Bulgarian split squats, goblet squats, core circuits- Shooting: Integrated sprint + jump shooting, lateral movement to shot
Weeks 5–6	Max Power & Fatigue Tolerance <ul style="list-style-type: none">- Focus: Maximal effort plyometrics (depth + sprint combos, hurdle hops, bounding)- Combine jump training with shooting under fatigue and pressureDrills simulate real-game conditions (defensive slide → shot, sprint → shot)
Week 7	Peak Power & In-Game Shooting <ul style="list-style-type: none">- Focus: Mastery of explosive jumping and quick execution of 3-point shots

Program Structure by Phase

	- Drills simulate high-speed in-game transitions and shooting under time constraints
Week 8	Performance Testing & Game Simulation
	- Focus: Test improvements in vertical jump, 3-point accuracy, agility, and shooting under fatigue
	- Scrimmages and controlled game simulations are used to evaluate applied performance

Following the focus group discussion, a connoisseurship discussion was conducted to validate the appropriateness and practical applicability of the developed plyometric training program. The seven experts unanimously affirmed the plyometric training program's structure, scientific grounding, and practical relevance for improving jumping and 3-point shooting ability in basketball athletes. They expressed high confidence in the program's ability to yield measurable improvements in vertical jump and shooting under fatigue.

Part 4: Evaluation of the effectiveness of the developed plyometric training program through an experimental research design.

This research was conducted over 8 weeks involving 40 athletes, with training sessions scheduled three times per week, on Monday, Wednesday, and Friday, each lasting 2 hours. The experimental group will participate in the developed plyometric training program, while the control group will engage in a traditional training program.

Table 3 Mean and standard deviation of the results of the vertical jump test and the three-point jump shot test of the experimental group

Variables	Experimental Group					
	Pre-test		Mid-test		Post-test	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Vertical jump (cm)	67.79	4.02	71.05	4.00	72.22	4.00
Three-point jump shot (score)	6.25	1.40	8.50	1.53	10.45	1.46

Table 3 shows the results of the vertical jump test and the three-point jump shot test of the experimental group. 1) Vertical jump test was pre-test $\bar{X} = 67.79$ and $SD = 4.02$, mid-test $\bar{X} = 71.05$ and $SD = 4.00$, and post-test $\bar{X} = 72.22$ and $SD = 4.00$. 2) Three-point jump shot was

pre-test $\bar{X}$ = 6.25 and SD = 1.40, mid-test $\bar{X}$ = 8.50 and SD = 1.53, and post-test $\bar{X}$ = 10.45 and SD = 1.46.

Table 4: Mean and standard deviation of the results of the vertical jump test and the three-point jump shot test of the control group

Variables	Control Group					
	Pre-test		Mid-test		Post-test	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Vertical jump (cm)	67.68	4.06	69.16	4.04	70.17	3.71
Three-point jump shot (score)	6.00	1.37	7.50	1.50	8.75	1.06

Table 4 shows the results of the vertical jump test and the three-point jump shot test of the control group. 1) Vertical jump test was pre-test $\bar{X}$ = 67.68 and SD = 4.06, mid-test $\bar{X}$ = 69.16 and SD = 4.04, and post-test $\bar{X}$ = 70.17 and SD = 3.71. 2) Three-point jump shot was pre-test $\bar{X}$ = 6.00 and SD = 1.37, mid-test $\bar{X}$ = 7.50 and SD = 1.50, and post-test $\bar{X}$ = 8.75 and SD = 1.06.

Table 5 The comparison between the experiment and control groups with the pre-test results of the vertical jump test and a three-point jump shot test, by t-test independent.

Variables	Exp. G		Cont. G		95% Confidence Interval of the Difference		t	p
	$\bar{X}$	SD	$\bar{X}$	SD	Lower	Upper		
Vertical jump (cm)	67.79	4.02	67.68	4.06	-0.13	0.34	0.11	0.36
Three-point jump shot (score)	6.25	1.40	6.00	1.37	-0.11	0.61	0.17	0.17

Table 5 showed that the pre-test results of vertical jump and a three-point jump shot were not significantly different

Table 6: The comparison between the experiment and control groups with the mid-test results of the vertical jump test and a three-point jump shot test, by t-test independent.

Variables	Exp. G		Cont. G		95% Confidence Interval of the Difference		t	p
	$\bar{X}$	SD	$\bar{X}$	SD	Lower	Upper		
Vertical jump (cm)	71.05	4.00	69.16	4.04	1.75	2.03	0.06	0.00*
Three-point jump shot (score)	8.50	1.53	7.50	1.50	0.84	1.15	0.07	0.00*

Table 6 showed that the mid-test results for vertical jump and three-point jump shot were significantly different, $p < .05$.

Table 7: The comparison between the experiment and control groups with the post-test results of the vertical jump test and the three-point jump shot test, by t-test independent.

Variables	Exp. G		Cont. G		95% Confidence Interval of the Difference		t	p
	$\bar{X}$	SD	$\bar{X}$	SD	Lower	Upper		
Vertical jump (cm)	72.22	4.00	70.17	3.71	1.73	2.37	0.15	0.00*
Three-point jump shot (score)	10.45	1.46	8.75	1.06	1.21	2.18	0.23	0.00*

Table 7 showed that the post-test results for vertical jump and three-point jump shot were significantly different, $p < .05$.

Table 8 The comparison of the test results of the vertical jump test and the three-point jump shot test within the experimental group by using one-way ANOVA repeated measurement and Bonferroni post hoc

Dependent variables / Test		Bonferroni			$\bar{X}$	SD	F	p
		Mean Difference	Std. Error	p				
Vertical jump (cm)								
Pre-test	Mid-test	-3.26	0.07	.00*	67.79	4.02	5729.55	.00*

Dependent variables / Test		Bonferroni			$\bar{X}$	SD	F	p
		Mean Difference	Std. Error	p				
	Post-test	-4.43	0.07	.00*				
Mid-test	Pre-test	3.26	0.07	.00*	71.05	4.00		
	Post-test	-1.17	0.01	.00*				
Post-test	Pre-test	4.43	0.07	.00*	72.22	4.00		
	Mid-test	1.17	0.01	.00*				
Three-point jump shot (score)								
Pre-test	Mid-test	-2.25	0.12	.00*	6.25	1.40		
	Post-test	-4.20	0.11	.00*				
Mid-test	Pre-test	2.25	0.12	.00*	8.50	1.53	1221.61	.00*
	Post-test	-1.95	0.05	.00*				
Post-test	Pre-test	4.20	0.11	.00*	10.45	1.46		
	Mid-test	1.95	0.05	.00*				

Table 8 showed that the test results of vertical jump and a three-point jump shot in the experimental group had a significant difference, $p < .05$, between pretest-mid-test, pretest-posttest, and mid-test-posttest

The evaluation of the program's effectiveness showed that, while no significant differences were found between the experimental and control groups in pre-test results, post-test comparisons revealed that the experimental group significantly outperformed the control group in both vertical jump height and three-point jump shot accuracy ($p < .05$). Within-group analysis further confirmed consistent and significant improvements for the experimental group across all testing stages, pre-, mid-, and post-tests, demonstrating the effectiveness of the developed plyometric training program. Overall, these findings provide strong evidence that the program is more effective than traditional training methods in enhancing basketball athletes' jumping and 3-point shooting ability.

Conclusion

After 8 weeks of training with the developed plyometric program, athletes in the experimental group showed significant improvements in both vertical jump height and three-point jump shot performance, with statistically significant differences ($p < .05$) observed across all testing stages, pre-test to mid-test, pre-test to post-test, and mid-test to post-test. Additionally,



independent t-test results revealed that the experimental group outperformed the control group on the post-test, with a significant difference ($p < .05$). These results confirm that the developed plyometric training program was more effective than traditional training methods in enhancing the jumping and 3-point shooting abilities of basketball athletes.

Discussion

Improving vertical jump height and explosive power is essential for enhancing overall basketball performance, as these qualities directly influence rebounding, shot blocking, dunking, and offensive execution. To achieve this, training programs must specifically target lower-body strength, explosive power, coordination, and correct movement techniques. Among the most effective methods for developing these attributes is plyometric training, which incorporates explosive exercises such as jump squats, bounding, and depth jumps to utilize the stretch-shortening cycle (SSC) for maximizing force production and athletic output. After completing the 8-week plyometric training program, athletes in the experimental group demonstrated significantly greater vertical jump height than those in the control group, with post-test results confirming a statistically significant difference ($p < .05$). These findings validate the effectiveness of plyometric training in improving basketball athletes' jumping performance, aligning with Markovic (2007), who emphasized its ability to enhance muscle power and neuromuscular function through drills such as box jumps, tuck jumps, depth jumps, and hurdle hops. By replicating the explosive jump actions required in basketball, these exercises not only increase jump height but also refine landing mechanics, while long-term adaptations improve muscle elasticity, tendon responsiveness, and energy efficiency during takeoff. Similarly, Miller et al. (2006) found that plyometric training significantly enhances vertical leap performance and explosive power while also improving agility and quickness, critical for defensive slides, fast breaks, and rapid transitions.

Jump performance, however, depends not only on physical strength and flexibility but also on mastery of proper technique across all phases of the jump, from initiation to the airborne movement. Even minor technical errors can hinder power transfer and reduce performance outcomes. Upon completion of the training program, athletes in the experimental group also exhibited significantly improved three-point jump shot performance compared to the control group, with post-test results again revealing a significant difference ($p < .05$). These results indicate that plyometric training enhances both physical ability and technical execution. This finding is consistent with McMahon et al. (2018), who emphasized that during the initial phase of a jump, the rapid conversion of lower-limb strength into upward force is critical for achieving maximum height and efficiency. Proper posture and body control during the airborne phase are also vital for stability and coordination. Therefore, combining technical training with strength and power





development is key to maximizing jump performance. Additionally, as noted by Sáez-Sáez de Villarreal et al. (2010), plyometric training improves reactive strength, the ability to quickly switch from eccentric to concentric muscle action, which is particularly important for basketball's "second jump" situations, such as leaping again immediately after a missed shot or blocked attempt. The improvement of the Reactive Strength Index (RSI) through plyometric training demonstrates enhanced neuromuscular efficiency. Collectively, these physical and technical gains translate into more explosive offense, faster defensive transitions, improved energy economy, and sustained high-level performance throughout gameplay.

Recommendation

Recommendation for current research

The program may be adapted to suit different playing positions (e.g., guards, forwards, centers) and athlete levels (beginner to advanced), allowing for more targeted development of position-specific jump skills and performance demands.

For optimal transfer to in-game performance, plyometric exercises should be combined with basketball-specific drills, such as shooting.

Recommendation for further research

It is recommended to conduct longitudinal research to examine the long-term effects and sustainability of performance gains from plyometric training beyond the 8 weeks.

Comparative studies examining plyometric training versus other performance-enhancing methods, such as resistance training, agility training, or combined approaches, would provide clearer insights into the most effective training strategies for jump performance.

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