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Effect of Bodyweight Training on Basketball Skills for Middle School in the People's Republic of China

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Abstract

Background and Aims: Basketball is a widely popular sport in China, contributing significantly to physical development and professional opportunities for young athletes. However, limited muscle power in shooting skills among high school players remains a barrier to competition success. This study aimed to investigate the effects of plyometric training on muscle power related to basketball shooting among high school students in Yichun, Jiangxi Province.

Methodology: The study utilized a quasi-experimental design. A sample of 60 students was selected from an initial population of 84 through performance-based screening in free-throw shooting. Participants were divided into an experimental group and a control group, each comprising 30 students. The experimental group engaged in plyometric training combined with regular basketball shooting drills, while the control group practiced standard shooting exercises. Training occurred three times weekly (Monday, Wednesday, Friday) over eight weeks. Pre-tests and post-tests were administered at the start, the 4th week, and the 8th week. Data were analyzed using dependent and independent t-tests.

Results: Both groups showed improvements in basketball shooting performance over time. However, the experimental group that received plyometric training demonstrated significantly greater enhancements in muscle power and shooting performance compared to the control group. At week 8, the experimental group's shooting scores increased from a pre-test mean of 37.33 (SD = 1.03) to 42.16 (SD = 0.49), which was statistically significant at the 0.05 level.

Conclusion: Plyometric training effectively enhanced muscle power and improved basketball shooting performance among high school students. This suggests that integrating plyometric exercises into basketball training programs could be beneficial for skill and strength development.

Keywords: Plyometric Training; Muscle Power; Basketball Shooting; High School Athletes; Sports Performance

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Introduction

Basketball is one of the most popular sports in China, playing a crucial role in promoting physical development, recreation, and professional opportunities for athletes (Bertollo, 2021; Yin, 2022). Introduced by the YMCA in the early 20th century, basketball became widely adopted in Chinese society, not only for promoting physical health but also as part of cultural and educational development (Wang, 2020). Over the years, China has produced internationally recognized basketball players, further enhancing the sport's reputation and inspiring young athletes (Feng, 2021; Zang, 2019).

Despite the sport's popularity, fundamental skills, particularly shooting accuracy, remain a challenge among young athletes. Effective shooting is critical for winning games, and deficits in shooting performance have often been cited as a major reason for unsuccessful competition outcomes (Jessica, 2018). In particular, schools such as Yichun Middle School have identified a need to enhance players' shooting abilities to improve competitive performance at provincial and national levels.

Plyometric training, characterized by exercises that involve rapid stretching and contracting of muscles to develop explosive strength, has emerged as an effective method to enhance athletic performance, including basketball shooting (Donald, 2018; Gregory, 2018). Plyometric exercises can significantly improve muscular strength, agility, and neuromuscular coordination, all of which are critical to shooting efficiency (Pakulano, 2019). Studies have shown that plyometric programs can lead to improvements in both lower and upper body power, contributing directly to shooting accuracy and scoring potential (Hardayal, 2019).

Thus, this study aims to examine the effects of plyometric training on muscle power and shooting performance among high school basketball players. By implementing a structured plyometric training program, this research seeks to determine whether targeted muscle power development can translate into improved basketball shooting ability, ultimately enhancing overall game performance.

Objectives

1. To examine the effect of plyometric training on muscle power and shooting performance in middle school basketball players.

2 . To compare the shooting performance outcomes between athletes undergoing plyometric training and those following conventional training methods.

Literature Review

Basketball Development and Shooting Skill Importance

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Basketball has been a prominent sport in China for over a century, with historical roots dating back to its introduction by the YMCA in 1910 (Bertollo, 2021; Wang, 2020). Initially used as a tool for physical education and cultural promotion, basketball rapidly evolved into a national phenomenon, contributing significantly to student development from elementary to university levels (Feng, 2021; Yin, 2022).

Shooting skill, in particular, is a critical determinant of success in basketball competitions. Without strong shooting ability, teams struggle to capitalize on offensive opportunities, resulting in poor performance outcomes (Jessica, 2018). Mastery in shooting involves not only technical accuracy but also sufficient muscle strength, agility, and coordination all of which are physical qualities influenced by targeted training programs.

Plyometric Training and Its Influence on Key Performance Metrics

Plyometric training consists of exercises that enable muscles to exert maximum force in short intervals, enhancing both strength and speed (Donald, 2018; Gregory, 2018). These exercises rely on the stretch-shortening cycle, which stimulates explosive muscle contractions to generate power. As such, plyometric training serves as the independent variable in this study, operationalized through specific drills such as jump squats, bounding, and clap push-ups (Pakulano, 2019).

These exercises are directly linked to two dependent outcomes: muscle power and shooting accuracy. The development of explosive leg and core strength improves vertical force generation and stabilization, which enhances shooting distance and control. Simultaneously, improvements in neuromuscular coordination contribute to shooting consistency under dynamic game conditions.

Physical Fitness Components Related to Basketball

Physical fitness, comprising cardiovascular endurance, muscular strength, muscular endurance, flexibility, and body composition, plays a vital role in athletic performance (Masurier, 2022; Corbin et al., 2022). Among these, muscular power and coordination are most directly related to basketball shooting proficiency. Athletes with greater lower body strength and core stability can achieve higher jump shots and better shooting form.

Skill-related fitness components such as speed, agility, and balance also interact with muscle power to influence shooting outcomes. Plyometric training enhances all of these interconnected factors, supporting its role in performance optimization.

Related Research

Numerous studies have demonstrated that plyometric training enhances muscle performance across various sports. Hardayal (2019) reported that explosive training improved neuromuscular response and force production, leading to greater sport-specific skills. Donald

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(2018) highlighted that youth athletes particularly benefit from structured plyometric routines, improving movement efficiency and sport performance.

In basketball-specific contexts, Gao (2021) and Rean Soi (2016) found that plyometric training improved vertical jump, sprinting ability, and shooting accuracy. These studies reinforce the conceptual link between plyometric exercises (independent variable) and physical shooting performance outcomes (dependent variables), validating the research framework of the current study.

Summary

In summary, the reviewed literature supports a clear conceptual relationship: plyometric training (independent variable) leads to improvements in muscle power and shooting accuracy (dependent variables). These connections justify the design of this study and suggest that targeted interventions in training programs can yield measurable improvements in basketball shooting performance, particularly among adolescent athletes in the Chinese educational system.

Conceptual Framework

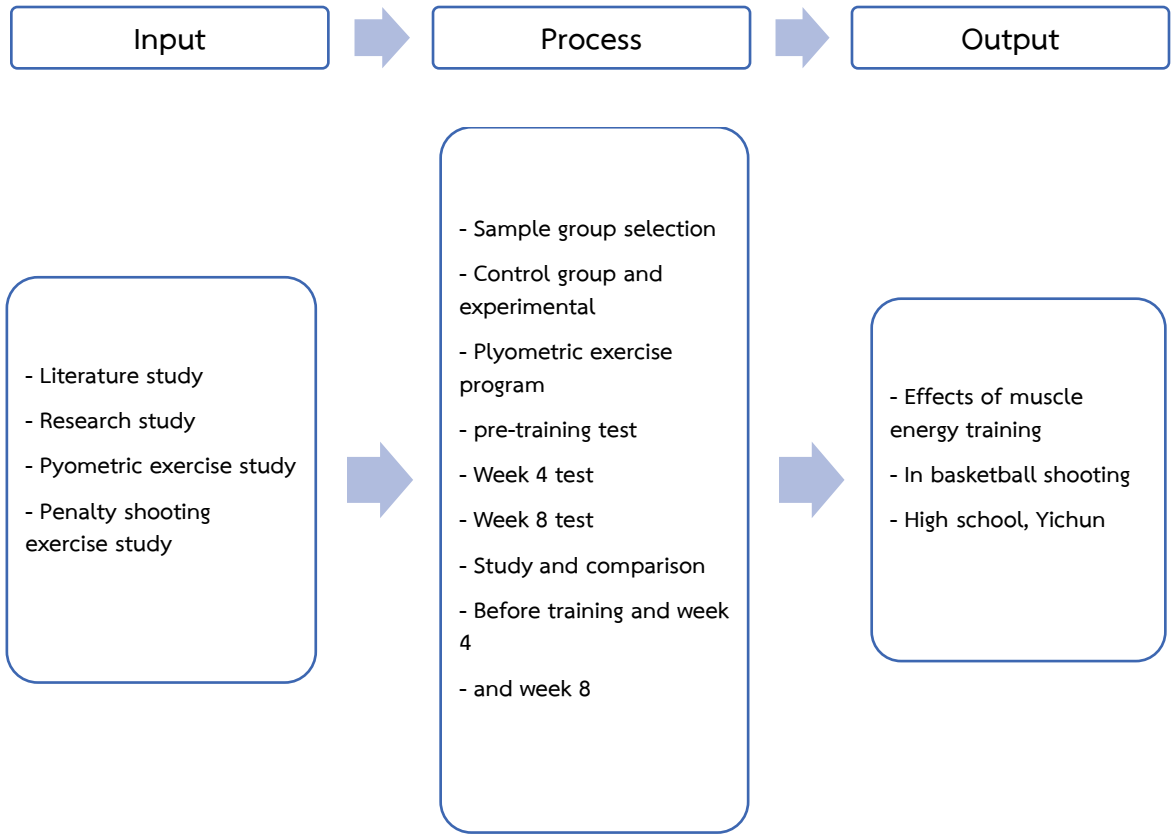

Figure 1 Conceptual framework of the study

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Methodology

Participants

The participants in this study consisted of 60 high school basketball players from Yichun Middle School, Jiangxi Province, China. The sample was selected from an initial population of 84 students through performance-based screening using free-throw shooting scores. Based on Krejcie and Morgan's (1970) sample size table, the top 60 performers were randomly assigned into two groups: an experimental group and a control group, each comprising 30 participants.

Research Design

This study employed a quasi-experimental design with a pre-test and post-test control group format. The experimental group participated in a plyometric training program combined with basketball shooting practice, while the control group engaged only in standard basketball shooting drills without plyometric exercises.

Instruments

The primary instrument used to measure performance was a basketball shooting test. Participants were instructed to perform **10** free-throw attempts, and the number of successful shots was recorded.

1. Validity: The test was reviewed by three sports science experts to ensure content validity.

2. Reliability: A pilot test with 15 similar participants was conducted, yielding a Cronbach's alpha coefficient of 0.82, indicating high internal consistency.

Procedures

The intervention lasted eight weeks, with training sessions conducted three times per week (Monday, Wednesday, Friday).

1. The experimental group trained from 1:00 p.m. to 3:00 p.m., performing plyometric exercises such as jump squats, bounding, and lunge jumps, followed by basketball shooting practice.

2. The control group trained from 3:00 p.m. to 5:00 p.m., focusing on traditional basketball shooting drills.

Each participant completed a pre-test before the training began, a mid-test at week 4, and a post-test at week 8.

All tests were conducted in a standard indoor basketball court under consistent environmental conditions to minimize bias.

Data Collection

During each test phase, participants performed 10 free-throw shots. Scores were recorded based on the number of successful baskets out of 10. The same basketballs, courts, and test

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administrators were used for all groups to ensure consistency across all measurement points.

1. Pre-test (before training)

2. Mid-test (week 4)

3. Post-test (week 8)

The shooting tests were standardized and evaluated using criteria aligned with basketball shooting skills, focusing on scoring accuracy and consistency.

Data Analysis

Statistical analysis was performed using SPSS software.

The following methods were employed:

1. Mean and standard deviation were calculated to describe the central tendency and dispersion of the scores.

2. Dependent t-tests were used to compare pre-test and post-test results within groups.

3. Independent t-tests were used to compare differences between experimental and control groups. Statistical significance was set at $p < 0.05$.

Results

The results of this study are based on the analysis of pre-test, mid-test (week 4), and post-test (week 8) scores in basketball shooting performance among the experimental and control groups.

Table 1 Summary of Shooting Performance

Group	Pre-test Mean (SD)	Mid-test Mean (SD)	Post-test Mean (SD)
Control	36.96 (1.06)	39.63 (0.74)	41.39 (0.69)
Experimental	37.33 (1.03)	40.63 (0.78)	42.16 (0.49)

1. Pre-test Results

Before the intervention, the control group had a mean score of 36.96 (SD = 1.06), and the experimental group had a mean score of 37.33 (SD = 1.03).

An independent t-test showed no significant difference between the two groups at baseline ($p > 0.05$), indicating that both groups started from a comparable level.

2. Mid-test Results (Week 4)

At week 4, both groups showed improvement: The control group's mean score increased to 39.63 (SD = 0.74). The experimental group's mean score increased to 40.63 (SD = 0.78).

The experimental group exhibited greater improvement compared to the control group. The differences between pre-test and mid-test scores were statistically significant within both

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groups ($p < 0.05$). Furthermore, the experimental group's improvement was significantly greater than that of the control group ($p < 0.05$).

3. Post-test Results (Week 8)

At week 8, the control group's mean score further improved to 41.39 (SD = 0.69). The experimental group's mean score increased markedly to 42.16 (SD = 0.49).

A dependent t-test revealed that both groups showed significant improvements between pre-test and post-test ($p < 0.05$).

However, the independent t-test analysis indicated that the experimental group's post-test scores were significantly higher than those of the control group ($p < 0.05$).

4. Summary of Results

The findings demonstrated that: Plyometric training significantly enhanced the basketball shooting performance of the experimental group.

Although the control group improved through regular basketball shooting practice, the improvement in the experimental group (which incorporated plyometric training) was statistically greater.

Discussion

The findings of this study demonstrated that both the experimental and control groups improved their basketball shooting performance after the intervention. However, the experimental group, which engaged in plyometric training combined with basketball shooting practice, showed significantly greater improvement compared to the control group.

The enhancement of muscle power observed in the experimental group aligns with previous research indicating that plyometric training effectively develops explosive strength and power necessary for athletic movements (Donald, 2018; Gregory, 2018). Plyometric exercises stimulate the neuromuscular system through the stretch-shortening cycle, allowing muscles to generate force more rapidly, which is essential for basketball shooting, where quick, explosive movements are required (Hardayal, 2019; Pakulano, 2019).

The results also support findings by Gao (2021), who reported that plyometric interventions significantly improved muscle strength and shooting performance among adolescent basketball players. These effects are likely due to enhanced motor unit recruitment, synchronization, and firing rate, which contribute to increased shot power and control.

However, not all studies have reported consistent improvements in shooting performance from plyometric training. For instance, Zhang et al. (2017) found no significant differences in shooting accuracy after a six-week plyometric regimen among intermediate-level players. Such

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findings suggest that the effectiveness of plyometric training may depend on factors such as training duration, exercise type, intensity, and the initial skill level of athletes.

Mechanistically, the improvements observed in this study may be attributed to the enhanced efficiency of the neuromuscular pathways activated by plyometric exercises. These exercises optimize the use of the elastic energy stored during the eccentric phase and released during the concentric contraction, enabling faster and more powerful movements. This process, governed by the stretch-shortening cycle (SSC), improves the timing, coordination, and control essential for shooting accuracy in dynamic game scenarios (Gregory, 2018; Pakulano, 2019).

The results also reinforce the importance of muscle power as a crucial component of physical fitness in basketball performance, particularly in shooting tasks (Masurier, 2022; Corbin et al., 2022). Effective shooting requires a combination of strength, agility, coordination, and balance—all of which are positively influenced by plyometric training.

In summary, this study's findings are consistent with theoretical frameworks in sports science that emphasize physical conditioning as a foundation for technical skill enhancement. However, future research should continue to explore the contextual variables that influence training outcomes and compare the efficacy of various conditioning strategies.

Conclusion

This study examined the effects of plyometric training on muscle power and basketball shooting performance among high school athletes. The results revealed that while both the experimental and control groups showed improvements over the eight-week training period, the experimental group that incorporated plyometric exercises demonstrated significantly greater enhancement in shooting performance.

The findings affirm that plyometric training effectively increases muscle power, which in turn improves shooting accuracy and performance in basketball. By engaging the neuromuscular system through explosive movements, athletes are able to generate greater force and improve coordination, agility, and balance—key components in successful basketball shooting.

The results support previous research emphasizing the benefits of plyometric training for athletic development, particularly in sports requiring rapid and powerful movements. Therefore, integrating plyometric exercises into regular basketball training programs is recommended for coaches and trainers aiming to enhance the shooting skills and overall performance of young athletes.

Further research is suggested to explore the long-term effects of plyometric training, its application across different age groups, and its combination with other conditioning methods to optimize basketball performance.

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Recommendation

Recommendations for Practice

1. Incorporate Plyometric Training: Coaches should integrate plyometric exercises into regular basketball practice to enhance players' muscle power and shooting performance.

2. Follow Progressive Overload Principles: Plyometric training should follow a progressive structure. For example, athletes should begin with low-impact drills such as squat jumps and skipping in the first two weeks, then gradually advance to higher-intensity movements like bounding and depth jumps by week six. This progression helps improve muscular adaptation while minimizing injury risk.

3. Ensure Qualified Supervision: All plyometric sessions should be supervised by certified physical education teachers or athletic trainers. Proper supervision ensures correct technique execution, prevents injuries, and allows for individual adjustments based on players' physical conditions and readiness.

Recommendations for Future Research

1. Conduct Longitudinal Studies: Future research should investigate the long-term effects of plyometric training on shooting performance and overall athletic development.

2. Explore Different Populations: Studies should examine the impact of plyometric training on different age groups, female athletes, and players with varying skill levels.

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