

The Effect of Core Strength Training on the Shooting Percentage and Ball Control Stability of Men's Basketball Team Players in Higher Vocational Colleges in Guangdong Province

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Abstract: This study selected 54 members of the freshmen men's basketball team of a higher vocational college, divided them into two groups according to the requirements, and conducted an 8-week training. The core strength training was analyzed for stance shooting, emergency stop confrontation shooting, non-confrontation ball control, and confrontation. The improvement effect of the 4 items of sexual ball control. in conclusion, the pre-test results of the players in the control group and the experimental group before training are basically the same; the players in the control group and the experimental group both improved in the post-test results after training, but the players in the experimental group improved even more; there are significant differences in the test results before and after training in the control group, but the difference in test results before and after training is not very significant; there are extremely significant differences in the test results of the experimental group before and after training; and there is a significant difference in the test results between the control group and the experimental group after training.

Keywords: Core Strength Training; Shooting Percentage; Ball Control Stability; Basketball Team Players.

1. Introduction

In recent years, as basketball has become more and more popular, its overall level has also increased. In the game, the competition in basketball has become more and more fierce, and the rhythm of offense and defense has become faster and faster. Moreover, basketball is a technology-based competitive sport, and the characteristic of this type of project is strong confrontation, which means that athletes need to have higher physical fitness.

In the process of basketball, players will also encounter emergencies that are different from usual training. Due to the different states of opponents, different physical fitness, and different tactical coordination, during the game, athletes must respond quickly according to the influence of these external factors. Especially when attacking and defending, there will inevitably be physical confrontation, which will cause changes in one's own position. In order to ensure the effectiveness of attack or defense, athletes need to quickly adjust their positions, maintain a stable state, achieve a balance of physical fitness, and prepare and adjust for the next attack or defense. Therefore, athletes must not only have excellent physical fitness, but also have strong core strength.

The core muscles play a vital role in maintaining body balance and stability in daily life and sports, especially in basketball, which is a more competitive sport. The coordination and stability of the body play a vital role. It can ensure that athletes can control the stability of the body during sports training or competition, and ensure the integrity of the movements, rather than being affected and causing deformation of the movements, which affects the shooting accuracy. Therefore, in daily basketball training, core strength training is particularly important. Core training improves the body's ability to control muscles, and then improves the

body's flexibility in technical training, which is very useful for improving basketball level. Core muscles play a very important role in basketball, especially in emergency technical movements such as air stagnation and emergency dribbling, the core muscles must provide power support.

It can be seen from this that basic core strength training plays a great role in improving the special strength of basketball players. Core strength training has become a hot topic in the field of sports training in recent years. It has gradually been valued by people and used in various sports to participate in training plans. Therefore, we selected common core strength training and applied it in basketball training to explore whether core strength training also has an effect on the shooting accuracy and ball control stability of the men's basketball team players in Guangdong vocational colleges.

2. Materials and Methods

2.1. Conceptual Framework

1) The Concept and Importance of Core Strength Training

Core strength training refers to exercises that target the core muscle groups (including the abdominal, back, and pelvic muscles) to improve an athlete's stability, coordination, and power output. Prieske et al. (2021) noted that core strength plays a critical role in enhancing athletic performance and reducing the risk of injury, particularly in high-intensity sports like basketball.[1]

Granacher et al. (2020) further suggested that core strength training, especially on unstable surfaces, can significantly enhance muscle adaptability and overall athletic performance in young athletes.[2]

2) The Effect of Core Strength Training on Shooting Percentage

Regarding the effect of core strength training on the shooting percentage of basketball players, Shao, Wang, and

Li (2023) conducted a meta-analysis that found core strength training significantly improves basketball players' shooting performance. Their analysis of multiple studies indicated an average increase in shooting percentage of around 6% among players who underwent core strength training.[3] Similarly, Zhang, Liu, and Chen (2021) conducted an 8-week core strength training program for young basketball players and reported a significant improvement in shooting accuracy, as well as enhanced body stability and strength control.[4]

Liu and Ma (2022) added to this finding by stating that core strength training not only improves lower body stability and support but also enhances upper body strength and hand-eye coordination, which directly affect shooting precision and accuracy.[5]

3) The Effect of Core Strength Training on Ball Control Stability

Concerning ball control stability, Wang, Huang, and Li (2020) found that core stability is closely related to dynamic balance in athletes. Their study on young athletes showed that systematic core strength training could effectively reduce the risk of injury while improving ball control skills.[6] Similarly, Fu, Hu, and Liu (2019) conducted a 12-week core strength training program for male basketball players and observed a significant enhancement in ball control stability, with a reduction in ball-handling errors of over 20%.[7]

Chen, Yang, and Deng (2020) also conducted related research, demonstrating that core strength training improves dynamic balance and reduces dribbling errors. Their study showed that after 12 weeks of training, participants had about a 25% reduction in ball-handling errors, with significant improvements in body coordination and flexibility.[8]

4) Applicability of Core Strength Training to Men's Basketball Players in Higher Vocational Colleges in Guangdong Province

Zheng, Zhang, and Wang (2023) suggested that core strength training is a cost-effective and efficient training method for men's basketball players in higher vocational colleges in Guangdong Province. These athletes are typically between 18-22 years old, a period marked by rapid physical development, making them ideal candidates for strength and conditioning programs that can quickly enhance their technical skills and game performance.[9] Additionally, Wang and Zhou (2021) highlighted that core strength training is particularly suitable for colleges with limited resources due to its low cost and high efficacy.[10]

In summary, recent studies have shown that core strength training significantly impacts basketball players' shooting percentage and ball control stability. By adopting systematic core strength training methods, the overall athletic performance and game outcomes of men's basketball team players in higher vocational colleges in Guangdong Province can be substantially improved.

2.2. Significance of the Study

This study examines how core strength training affects shooting accuracy and ball control stability in men's basketball players from higher vocational colleges in Guangdong Province. It aims to integrate core strength training with traditional and basketball-specific skills training to improve players' performance.

By comparing core strength training with traditional strength training, the study will identify the most effective methods for enhancing physical fitness, shooting percentage, and ball control stability, providing practical guidelines for

optimizing basketball training programs.

Basketball Players: Enhance players' core strength and professional skills, particularly in shooting accuracy and ball control stability.

Coaches: Improve coaching techniques and strategies, enriching their training methods and boosting their leadership capabilities.

Administrators: Enhance team management skills, deepen understanding of player development, and increase the school's overall competitiveness.

PE Teachers: Offer insights and reference points for developing their own research and training methodologies.

2.3. Research Methodology

This study will employ experimental methods, statistical analysis, and logical analysis to investigate the impact of core strength training on the shooting percentage and ball control stability of men's basketball team players in higher vocational colleges in Guangdong Province.

2.4. Experimental Method

Experimental Design: Participants will be randomly assigned to two groups: the core strength training group and the traditional strength training group. Both groups will undergo an 8-week training program, with the core strength training group focusing on exercises targeting the abdominal, back, and pelvic muscles for stability and coordination, and the traditional strength training group engaging in conventional muscle-building exercises.

Data Collection: Before and after the intervention, participants will be assessed through standardized shooting drills and ball control tests to measure the impact of the training on shooting accuracy and ball-handling skills.

2.5. Statistical Analysis

Statistical Methods: Paired t-tests will be used to compare pre- and post-intervention performance within each group. Analysis of Variance (ANOVA) will be used to compare the differences between the core strength training group and the traditional strength training group to determine the effectiveness of the core strength training.

2.6. Logical Analysis

Interpretation of Results: Results will be analyzed using logical reasoning to assess the effectiveness of core strength training. By integrating the experimental data with existing theories and practical knowledge, the study will explore the role of core strength training in enhancing shooting percentage and ball control stability, providing theoretical support and practical recommendations for future basketball training.

2.7. Research Locale and Methodology

1) Research Locale

The study was conducted at Guangdong Vocational and Technical College of Post and Telecom in Guangdong Province. It involved two groups: a control group and an experimental group. The research period was from February 26, 2024, to April 21, 2024, spanning 8 weeks. Training sessions were held twice a week, on Tuesdays and Fridays, each lasting 1.5 hours, in the college's gymnasium and basketball court.

2) Experimental Design

Experimental Group Training Plan: Focused on core

strength exercises such as TRX hip flexion and balance ball knee curls.

Control Group Training Plan: Emphasized traditional strength training exercises like squats and barbell presses.

3) Sampling Techniques

Participants: 54 freshmen from the men's basketball team, divided into control and experimental groups based on pre-test shooting levels, with 27 players in each group.

4) Data Collection and Analysis

Pre-Experiment Testing: Measured mid-range fixed-point shooting percentages to ensure comparability between groups.

-Training Procedures: The experimental group underwent core strength training, while the control group received traditional strength training. Both groups had the same

Table 1. Non-parametric test results of the four items of standing shot, emergency stop shot, non-confrontational ball control, and confrontational ball control

	Group Median(P ₂₅ , P ₇₅)		MannWhitney test statistic U value	MannWhitney test statistic z value	p
	1.0(n=27)	2.0(n=27)			
Spot shooting	37.500(35.0,42.5)	40.000(35.0,42.5)	342.500	-0.389	0.697
Pull-up shot	22.500(22.5,25.0)	22.500(22.5,25.0)	340.500	-0.454	0.650
Uncontested ball possession	50.000(45.0,60.0)	50.000(45.0,60.0)	354.500	-0.176	0.860
Confrontation with ball possession	25.000(20.0,40.0)	30.000(20.0,40.0)	345.500	-0.331	0.741

* p<0.05 ** p<0.01

3.2. Paired Test Analysis before and after the Control Group Experiment

Table 2. Paired t-test analysis results of the control group before and after the experiment

Pairing number	item	average value	Standard Deviation	Mean Difference	t	p
Pair1	Shooting on the spot before the experiment	38.52	3.55	-5.93	-	11.410
	Shooting on the spot after the experiment	44.44	3.35			
Pair2	Stop and shoot before the experiment	23.52	1.73	-2.59	-	12.334
	Stop and shot after the experiment	26.11	2.12			
Pair3	No confrontation with ball possession before the experiment	51.85	10.84	-10.74	-	15.544
	No confrontation with ball possession after the experiment	62.59	9.34			
Pair4	Confrontation with ball possession before the experiment	30.19	14.24	-9.81	-	15.708
	Confrontation with ball possession after the experiment	40.00	14.94			

* p\Legend: <0.05 level of significance

As shown in Table 1, the following are the non-parametric test results for the two sets of data, specifically using the Mann-Whitney U test:

1) In-situ shooting

Group 1 median (M) and interquartile range (P₂₅, P₇₅): 37.500 (35.0, 42.5); Group 2 median (M) and interquartile range (P₂₅, P₇₅): 40.000 (35.0, 42.5); Mann-Whitney U statistic: 342.500, z value: -0.389, p value: 0.697. The medians of the two groups shooting in place are similar, and the p-value is 0.697, which is greater than 0.05. This showed that there was no significant difference in in-place shooting performance between the two groups.

2) Emergency stop shooting

Group 1 median (M) and interquartile range (P₂₅, P₇₅): 22.500 (22.5, 25.0) Group 2 median (M) and interquartile range (P₂₅, P₇₅): 22.500 (22.5, 25.0); Mann-Whitney U statistic: 340.500, z value: -0.454, p value: 0.650. The two

basketball training content and intensity.

Testing Methods:

Spot Shooting: 20 shots from various angles.

Stop Shooting: 20 shots with dribbling and defensive pressure.

Ball Control Stability: Tested non-confrontational and confrontational ball control through dribbling and layup drills.

Post-Experiment Testing: Repeated tests after 8 weeks to assess changes in performance.

3. Results & Discussion

3.1. Nonparametric Test Analysis of the Control and Experimental Groups

groups had exactly the same median pull-up jump shots. The p value is 0.650, indicating that there is no significant difference between the two groups in pull-up jump shooting performance.

3) Uncontested ball control

Group 1 median (M) and interquartile range (P₂₅, P₇₅): 50.000 (45.0, 60.0); Group 2 median (M) and interquartile range (P₂₅, P₇₅): 50.000 (45.0, 60.0); Mann-Whitney U statistic: 354.500, z value: -0.176, p value: 0.860. Both groups had the same median number of uncontested possessions. The p value is 0.860, indicating that there is no significant difference in the ability of the two groups to control the ball without confrontation.

4) With ball control

Group 1 median (M) and interquartile range (P₂₅, P₇₅): 25.000 (20.0, 40.0); Group 2 median (M) and interquartile range (P₂₅, P₇₅): 30.000 (20.0, 40.0), Mann-Whitney U

statistic: 345.500, z-value: -0.331, p-value: 0.741. The two groups had similar medians in contested possessions. The p value is 0.741, indicating that there is no significant difference between the two groups in their ability to control the ball.

The Mann-Whitney U test results show that the p-values of all indicators (shooting in place, pull-up jump shot, uncontested ball control and contested ball control) are greater than 0.05, indicating that there is no statistically

significant difference between the two groups in these performance indicators. The difference. Therefore, the intervention or condition failed to significantly change the performance of both groups on these measures.

3.3. Paired Test Analysis before and after the Experiment in the Experimental Group

Table 3. Paired t-test analysis results before and after the experiment in the experimental group

Pairing number	item	average value	Standard Deviation	Mean Difference	t	p
Pair1	Spot shooting before the experiment	38.33	4.16	-17.22	-20.322	0.000**
	Spot shooting after the experiment	55.56	6.21			
Pair2	Stop and shoot before the experiment	23.70	2.12	-8.43	-25.466	0.000**
	Stop and shoot after the experiment	32.13	1.92			
Pair3	No confrontation before the experiment	52.41	12.51	-25.00	-31.225	0.000**
	No confrontation with the ball after the experiment	77.41	12.04			
Pair4	Confrontation with ball possession before the experiment	29.07	15.32	-20.37	-22.102	0.000**
	Confrontation with ball possession after the experiment	49.44	14.37			

Legend: significance @<0.05

As shown in Table 3, the paired t-test results show the performance data of the control group before and after the experimental intervention. Below is an analysis of each pair of data:

Pair 1: Shooting in place. Before experiment: mean=38.33, standard deviation=4.16. After the experiment: mean = 55.56, standard deviation = 6.21, mean difference: -17.22 (performance significantly improved after the experiment), t-value: -20.322, p-value: 0.000. The accuracy of shooting in situ increased significantly from 38.33 to 55.56, and the difference was statistically significant ($p < 0.05$), indicating that the intervention had a great positive impact on the ability to shoot in situ.

Pairing 2: Pull-up jump shot. Before experiment: mean=23.70, standard deviation=2.12. After the experiment: mean = 32.13, standard deviation = 1.92, mean difference: - 8.43 (performance improved significantly after the experiment), t value: -25.466, p value: 0.000. The accuracy of pull-up jump shots increased from 23.70 to 32.13, and the difference was statistically significant ($p < 0.05$), indicating that the intervention had a significant improvement effect on pull-up jump shooting skills.

Pairing 3: Uncontested possession of the ball. Pre-experiment: mean = 52.41, standard deviation = 12.51. After experiment: mean = 77.41, standard deviation = 12.04, mean difference: -25.00 (performance improved significantly after experiment), t-value: -31.225, p-value: 0.000. The ball control performance in non-confrontation situations improved from 52.41 to 77.41, and the difference was statistically significant ($p < 0.05$), indicating that the intervention significantly improved ball control stability.

Pairing 4: There is contested possession. Before the experiment: mean = 29.07, standard deviation = 15.32, after the experiment: mean = 49.44, standard deviation = 14.37, mean difference: -20.37 (performance improved significantly after the experiment), t-value: -22.102, p-value: 0.000. The ball control performance under confrontation conditions increased from 29.07 to 49.44, and the difference was statistically significant ($p < 0.05$), indicating that the intervention effectively improved the ball control ability under confrontation conditions.

All test items showed significant improvement after the intervention. Statistical analysis showed that the experimental intervention had a significant positive impact on shooting accuracy and ball control stability (without confrontation and with confrontation). The extremely low p-values (both 0.000) indicate that these improvements are highly statistically significant and are not the result of chance. This shows that the intervention is significantly effective in improving basketball skill levels.

4. Conclusion

Based from the findings of the study, the following conclusions are drawn:

4.1. Pre-Training Evaluation of Control and Experimental Groups

Research shows that before regular strength training and core strength training, the test results of basketball players in both the control and experimental groups were almost identical in terms of shooting percentage and ball control stability. This indicates that the baseline levels of the two groups were consistent. To ensure the fairness and scientific validity of the experiment, 27 participants were selected for each group, and their pre-training performance was tested to enhance the authenticity and reliability of the study.

4.2. Core Strength Training's Impact on Performance Improvement

After 8 weeks of training, both groups showed improvement in shooting percentage and ball control stability, but the experimental group demonstrated a more significant enhancement. This suggests that core strength training can more effectively boost performance in these areas, as improved core strength contributes to better stability and confrontation ability during games.

4.3. Traditional Strength Training's Limited Effect on Core Strength

The study found that although there were improvements in the control group's performance across four tests (fixed-point

shooting, emergency stop shooting, non-confrontational ball control, and confrontational ball control), these changes were not substantial. Traditional strength training does not sufficiently activate core strength, leading to weaker core muscles and instability in continuous shooting. However, it still provided some gains in strength and endurance, contributing to moderate improvements in the control group.

4.4. Significant Gains in Experimental Group through Core Strength Training

In contrast, the experimental group displayed marked improvements in all four tests, demonstrating that core strength training greatly enhances performance. Increased core strength improves athletes' explosive power and endurance, particularly in emergency shooting and confrontational ball control.

4.5. Effectiveness of Core Strength Training over Traditional Strength Training

Overall, while both groups improved post-training, the experimental group's progress was more pronounced. This highlights that core strength training is more targeted and effective than traditional strength training, offering superior improvements in shooting percentage and ball control stability.

5. Recommendation

5.1. Enhance School Support

Schools should strengthen communication with basketball teams, improve policies, and ensure the necessary support for team development. They should leverage the advantages of a "school system" that integrates teaching, research, and training to provide robust institutional and material support for basketball teams.

5.2. Regular Oversight by School Leaders

School leaders should regularly review the resources, training, and overall preparation of the basketball team. They should focus on enhancing organizational management, technological support, basic fitness, team coordination, and service guarantees to ensure effective basketball training and competition preparation.

5.3. Improve Team Management by Coaches

Coaches should enhance team management by maintaining attendance records, fostering team unity, and conducting regular strength and skill training. They should also focus on improving their management skills to lead the team more effectively.

5.4. Adopt Balanced Strength Training

Coaches should balance high-intensity strength training with the specific demands of basketball and the physical capabilities of the players. Core strength training should be incorporated to improve shooting accuracy and ball control, reducing errors caused by core instability.

5.5. Integrate Core and Traditional Strength Training

Training should focus on body stability and balance by integrating core and traditional strength exercises. Development of strength in both large and small muscle groups should be coordinated to minimize weaknesses and achieve comprehensive athletic development.

5.6. Optimize Training Plans

Coaches should carefully plan the timing and intensity of core training, aligning it with shooting accuracy and ball control drills. Training plans should be tailored to individual player differences to maximize progress. Continuous monitoring of performance metrics will help adjust training content and intensity for effective preparation.

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