RESEARCH ARTICLE

Study on the impact of compound training on defensive sliding movements in basketball players

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The defensive sliding technique can significantly influence the outcome of a basketball game. Compound training is a comprehensive approach that integrates conventional lower limb training with targeted exercises for sliding movements. This study provided a concise overview of the basketball defensive slide and compound training methods through a case study. Twenty male varsity basketball players from Huanghe Science & Technology University were divided into experimental and control groups with ten players in each group. The control group underwent conventional slide training, while the experimental group participated in compound training. Defensive slide ability tests were conducted before and after the training for both groups, which included the reaction-light sliding test, the triangle sliding test, and the combined sliding test. The results showed that the disparity in defensive sliding ability between the two groups was not substantial before the training. After the training, the control group showed no significant improvement in defensive sliding ability, while the experimental group demonstrated a significant enhancement in the defensive sliding ability. In addition, the post-training performance of experimental group surpassed that of the control group with a significant margin. This study confirmed the effectiveness of compound training in improving the defensive sliding ability of basketball players and provided a reference for basketball players to develop scientific training plans.

Keywords: basketball; sliding step; compound training; agility reaction-light.

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Introduction

As a highly competitive sport, basketball demands players to maintain body coordination and flexibility during confrontations [1, 2]. Defensive sliding movements are crucial in maintaining an appropriate distance between oneself and the opponent, which facilitates better observation and defense against the opponent's attacks [3]. Key factors influencing defensive sliding skills include the standardization, speed, and agility of the sliding movement. Standardization refers to the degree of precision in the movement. The more standardized the movement, the more effectively it fulfills defensive objectives and minimizes the risk of injury [4]. Speed refers to the speed of the sliding step, while agility involves the ability to adjust movement quickly in response to changing circumstances such as altering speed or direction. Traditional training typically focuses on lower limb strength exercises to enhance speed and explosive force. Coaches often provide verbal instructions to guide technical aspects, and repetitive training is employed to promote standardization. However, the aforementioned exercise methods for training the sliding movement are relatively

limited [5]. Although these methods allow for a quick grasp of the key points of individual movements, they are difficult to combine and apply flexibly, resulting in rigidity and potential bottlenecks. In contrast, compound training emerges as a comprehensive approach that integrates various methods to enhance overall player quality and skill level. In the context of defensive sliding step technique training, compound training includes conventional lower limb strength training, exercises focused on understanding movements, comprehensive exercises for sliding movements, and agility training.

In a previous study, Liu selected 20 basketball team members from a university as test subjects and validated that core strength training could enhance muscle strength and coordination balance [6]. Peebles *et al*. used wireless load-sensing insoles to collect load data and predicted knee joint extension torque and power symmetry in healthy recreational athletes during bilateral stop-jump tasks. The results validated the effectiveness of this approach [7]. Singh *et al*. examined the effects of agility training on the spatiotemporal parameters of gait cycles in Indian taekwondo athletes. The results found that this approach could enhance overall performance [8]. Those past studies have all conducted corresponding research on improving the athletic abilities of athletes. Some of them focused on the strength and coordination balance of muscle groups, while others examined the movement of lower limb joints or various training methods.

This research aimed to improve the defensive sliding ability and techniques of basketball players by applying the compound training method. The tested basketball players were evenly divided into a control group and an experimental group with the control group adopted the traditional training method and the experimental group adopted the compound training method. The defensive sliding ability test was conducted before and after the training in both groups to verify the effectiveness of the compound training method. The results of this study provided evidence for verifying the effectiveness of compound training in improving the defensive sliding tackle ability of basketball players and provided an effective reference for formulating scientific training programs for basketball players.

Materials and methods

Study subjects

A total of 20 male basketball players from the varsity basketball team of Huanghe Science and Technology College (Zhengzhou, Henan, China) with a mean age of 19 ± 1 year and a mean height of 182 ± 2 cm were selected for this study. All participants were divided into a control group and an experimental group with ten players in each group. The control group underwent conventional training, while the experimental group participated in compound training. All procedures of this study were approved by the Institutional Review Committee of Huanghe Science and Technology College (Zhengzhou, Henan, China).

Training programs

Both groups underwent training three times a week for a duration of nine weeks. During weeks 1 to 3, both groups performed four laps of slow jogging around the basketball gymnasium [9], two sets of side squats (20 repetitions per set with 30 s rest between sets), two sets of forward lunge walking (20 repetitions per set with 30 s of rest between sets), two sets of sliding movement training (20 repetitions per set with 30 s of rest between sets), while the control group received two sets of quick sprints on command (50 m per set with 1 min of rest between sets), and the experimental group received two sets of sliding step change training (six movements per set with 1 min of rest between sets). During weeks 4 to 6, both groups performed four laps of slow jogging around the basketball gymnasium, four sets of trot (10 m per set with 30 s of rest between sets), four sets of running with swinging legs (10 m per set with 30 s of rest between sets), and two sets

of sliding movement training, while the control group received two sets of quick sprints on command and the experimental group received two sets of lateral movement touch-light training (1 min of rest between sets) [10]. During weeks 7-9, both groups performed four laps of slow jogging around the basketball gymnasium, two sets of hip-turn run (30 m per set, with 1 min of rest between sets), two sets of sliding movement training, while the control group received two sets of quick sprints on command and two sets of sitting on the ground and running upon command (15 m repetitions per set with 30 s of rest between sets), and the experimental group received two sets of sliding step change training [11] and two sets of lateral movement touch-light training. The control group participated in standard physical training and received instructions on sliding movements, while the experimental group not only received guidance on sliding movements and a portion of physical training but also participated in sliding change training and lateral movement touch-light training. The sliding step change training of this study involved executing all six sliding step movements sequentially, which included hip elastic band + fingertip touch slide, foot elastic band + V-shaped positive slide, foot elastic band + Z-shaped positive slide, foot elastic band +V-shaped positive slide, V-shaped slide with the ball in hand, and foot elastic band + lateral slide with the ball in hand. The hip elastic band + fingertip touch slide was performed by securing one end of the elastic band to the hip and the aide pulling on the other end. The player initiated a sliding step following a preparatory movement and stretched the elastic band in the direction of the sliding step. During this process, the fingertips of the hand on the same side as the elastic band remained in contact with the ground. The foot elastic band + V-shaped positive slide was performed by connecting the two ankles with an elastic band [12]. The player moved from the baseline on one side of the court to the midpoint of the sideline. Then, without changing body orientation, the player slid to the opposite side of the court at a 45° angle. The foot elastic band + Z-shaped positive slide was performed by connecting both ankles with an elastic band. The player moved from the bottom line on one side of the court to the bottom boundary of the opposite side using sliding steps to move along a zigzag path. The foot elastic band + V-shaped positive slide was that the player held the basketball against the chest with both hands and then performed sliding steps along the line of the restricted area. The V-shaped slide with the ball in hand was that the player held the basketball against the chest with both hands and moved from the baseline on one side of the court to the midpoint of the sideline. Then, without changing body orientation, the player slid to the opposite side of the court at a 45° angle. The foot elastic band + lateral slide with the ball in hand was performed by connecting the two ankles with an elastic band and holding the ball against the chest with both hands. The player used sliding steps to move between the two sidelines of the court. The lateral movement touch-light training aimed to enhance players' defensive sliding agility. In this training, two reaction lights were positioned at each end of the free-throw line. Players stood at the midpoint of the free-throw line to prepare for sliding steps while attentively monitoring the status of the lights. When a light illuminated, players executed a sliding step to move towards it, touched the light, and then employed the sliding step to return to the midpoint. Eighteen light activations were set as one group.

Defensive sliding ability testing

Both groups were assessed for their defensive sliding ability before and after a 9-week training session.

(1) Reaction-light sliding test

The configuration of the test site for the reaction-light sliding was illustrated in Figure 1. Four touch lights were positioned 5 m away from the "starting point". When the light was illuminated at the beginning of the test, the subjects employed the sliding step technique to move toward and turn off the light. The player was then using the sliding step back to the starting point and waiting for the activation of the next light. The test duration was set at 30 s, during which a

random light would illuminate 1 - 1.5 s after the preceding light turned off. The average reaction time of the subject was measured and recorded [13].

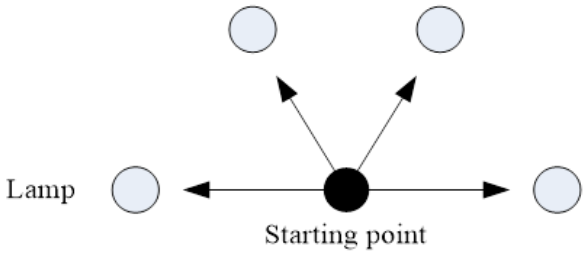

Figure 1. Schematic of the site layout for the reaction-light sliding test.

(2) Triangle sliding test

The setup for the triangular sliding test was depicted in Figure 2. Three marked points were spaced 5 m apart. At the beginning of the test, participants executed a preparatory sliding step movement from point 1 outward followed by one lap of a side-sliding step in a counterclockwise direction, and then one lap of a side-sliding step in a clockwise direction. The total time taken this sequence was recorded. The test was conducted twice, and the better performance obtained was retained.

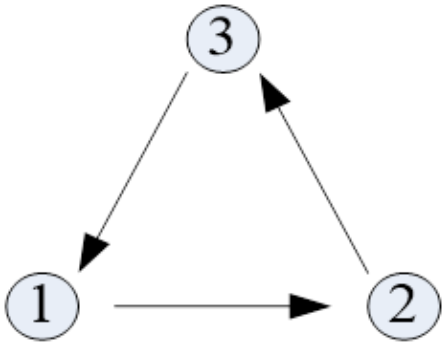

Figure 2. Schematic diagram of the site layout for the triangular sliding test.

(3) Combined sliding test

The venue for the combined sliding test was the entire basketball court, and the movement route was shown in Figure 3. A defensive sliding step was employed throughout the course with the start timing from the starting point in the corner. When moving along the route and returning to the starting point, the timing ended, and the elapsed time was recorded. The test was repeated twice with the better performance being retained.

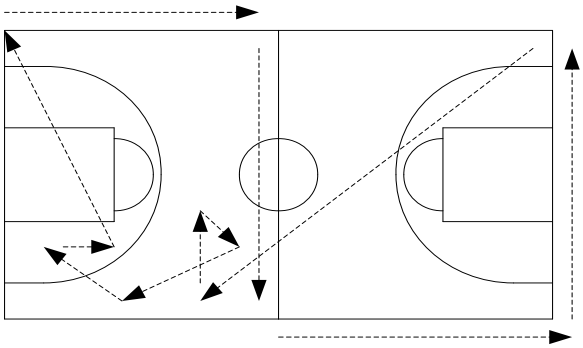

Figure 3. Combined sliding test route.

Statistical analysis

Microsoft Excel (Microsoft, Redmond, WA, USA) and SPSS (IBM, Armonk, NY, USA) were employed for data recording and statistical analysis. The test results were expressed as $\bar{x} \pm s$. The student t-test was applied to compare the difference between two groups with *P* value less than 0.05 as the significant difference between two groups.

Results and discussion

Reaction-light sliding test

The difference in pre-training performance between the two groups was insignificant (Table 1). After the training, the completion time for both groups in the reaction-light sliding test decreased. However, there was no statistically significant difference in performance within the control group before and after the training ($P > 0.05$). In contrast, the statistically significant differences were observed in the performance of experimental group before and after the training ($P < 0.05$) and between the two groups after the training ($P < 0.05$).

Table 1. Reaction-light sliding test results of the two groups before and after the training period.

	Control group	Experimental group	*P* value between groups
Pre-training	3.17 ± 0.35	3.15 ± 0.45	0.978
Post-training	3.16 ± 0.22	2.87 ± 0.12	0.025
***P* value before and after the training**	0.875	0.032	-

Table 2. Results of the triangular sliding test before and after training in the two groups.

	Control group	Experimental group	*P* value between groups
Pre-training	14.75 ± 1.03	14.73 ± 0.99	0.868
Post-training	14.63 ± 1.11	12.89 ± 0.87	0.015
***P* value before and after the training**	0.975	0.022	-

Table 3. Combined sliding test results of the two groups before and after training.

	Control group	Experimental group	*P* value between groups
Pre-training	100.22 ± 2.87	100.13 ± 1.89	0.787
Post-training	99.98 ± 1.89	96.33 ± 1.02	0.011
***P* value before and after the training**	0.755	0.012	-

Triangle sliding test

The results of the triangle sliding tests before and after the training for both groups showed that there was no significant difference between two groups before the training ($P > 0.05$). However, after the training, the experimental group exhibited significantly shorter time consumption than that in the control group ($P < 0.05$). When assessing the results within the same group before and after the training, no significant change was observed in the control group before and after the training, while a remarkable reduction of time consumption in the experimental group was observed after the training ($P < 0.05$) (Table 2).

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The combined sliding test

The results of the combined sliding test demonstrated similar trends of the results from the previous two tests. Before the training, the two groups demonstrated an insignificant difference. After the training, the control group's performance showed no significant improvement, while the experimental group exhibited a noteworthy enhancement, significantly surpassing that of the control group ($P < 0.05$) (Table 3).

The results of defensive sliding ability tests clearly showed that there was a minimal disparity in the level of defensive sliding between the two groups before the training. However, after the training, a significant difference emerged in the proficiency between the two groups with the experimental group exhibiting a notably higher level. Additionally, when comparing the sliding proficiency within the same group of players before and after training, it was apparent that the control group demonstrated no statistically significant difference in improvement, while the experimental group experienced a notable increase in proficiency. The outcomes observed might be attributed to the training methodologies employed. The control group that relied on traditional training methods primarily focused on developing lower limb strength. During the training of the control group, coaches described the key technical aspects of sliding step movements followed by repetitive practice. While this approach enhanced lower limb strength and facilitated a quicker adaptation to

sliding movements, it lacked the integration of sliding step movements and flexibility for real-world applications. In contrast, the experimental group underwent compound training, which combined lower limb strength training with practical exercises for sliding step movements. This approach included sliding step transformation training and lateral movement touch-light training, emphasizing the practical application of sliding step movements and the articulation between different sliding movements. This research explored basketball defensive sliding steps and compound training using the college basketball players. The results showed that, after the training period, the experimental group exhibited significant improvements by either achieving a performance level that was notably higher than that of the control group or a remarkable improvement surpassing itself before the training.

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