# Intervention Design Based on Functional Movement Screen (FMS) for College Students

### Yuhang Lin, Chengcai You, Zhaoyuan Huang

School of Physical Education, Ningde Normal University, Fujian, Ningde, China

Abstract: Through in-depth analysis of Functional Movement Screen (FMS) test results, this study identified common issues among college students, including problems with major joints during movement and imbalanced muscle strength distribution. Based on these findings, a scientific and rational exercise intervention program was developed. The intervention targeted seven fundamental movement skills of sophomore students in general physical education courses: deep squat, hurdle step, in-line lunge, shoulder mobility, active straight-leg raise, trunk stability push-up, and rotary stability. The program aims to achieve significant improvement, providing new research perspectives for sports education and training fields, while offering targeted training solutions to enhance athletic performance in sophomore physical education curricula.

Keywords: College Sophomores; Functional Movement Screen (FMS); Exercise intervention

# 1. Introduction

With the widespread promotion of national fitness concepts, participation in physical exercise among sophomore students in general physical education courses has significantly increased. However, this has also led to a corresponding rise in sports injury risks. This study utilized the Functional Movement Screen (FMS) system to assess seven standardized movements (deep squat, hurdle step, etc.), revealing prevalent issues among participants including insufficient joint mobility, weak core stability, and imbalanced muscle strength distribution. These movement dysfunctions not only affect the quality of technical movement execution but also increase susceptibility to sports injuries. The FMS assessment technology can precisely identify weak links in the kinetic chain,

providing scientific basis for designing targeted exercise interventions. This approach holds significant practical value for improving fundamental movement abilities and preventing sports injuries among sophomore students in general physical education courses [1].

Using a standardized FMS testing procedure, the subjects were tested for seven basic movement patterns, including deep squat, hurdle step, straight-line lun, etc., and the movement quality, muscle activation, and performance of body balance and stability during each movement were observed and recorded. The scores of each movement were given according to established scoring criteria, and the basic movement patterns, muscle control ability and motor nerve stability of college students in the second year of public physical education courses were comprehensively evaluated.

A analysis of the FMS test result score value, accurately locate the problems of the subjects, such as lack of flexibility of the joints during activity, difficulty in maintaining a stable state the core area, and unbalanced distribution of muscle strength, etc. A scientific and reasonable exercise intervention program was formulated.

# 2. Basic Characteristics of FMS Testing

The FMS test evaluates the body's flexibility, stability, symmetry, and overall movement quality through a series of standardized. The basic characteristics of the FMS test include: comprehensiveness: The FMS test includes seven basic movements, each targeting different body parts and functions. These seven movements are deep, lunge step-up, straight-line lunge, shoulder mobility, active straight leg raise, plank stability, and rotational stability. [2] Through these movements, a comprehensive understanding the body's mobility and potential issues can be gained. standardization: Each movement has clear testing methods and scoring criteria. Test takers need to strictly follow the prescribed methods for and score each movement based on the scoring criteria. This standardized approach ensures the reliability and comparability of the test results. objectivity: The FMS test emphasizes the observation and recording abnormal performance during movements rather than subjective judgment. Test takers need to objectively record the performance of each movement and give the corresponding score based on the scoring criteria. The main purpose of the FMS test is to prevent sports injuries. By identifying functional disorders and imbalances early, targeted training and rehabilitation measures can be taken in time to reduce risk of sports injuries. individualization: The results of the FMS test can provide personalized training recommendations for individuals. [3] Based on the score of each movement, targeted training plans can be to help individuals improve their physical function and enhance their sports performance. dynamicity: The FMS test is a dynamic process that requires regular evaluation. [4] Through multiple tests, the changes in individual's physical function can be tracked, the training effects can be evaluated, and the training plans can be adjusted in time. comprehensive assessment: In addition to the seven basic movements the FMS test also includes three exclusionary checks, namely arm-across overhead lift, prone back extension, and kneeling forward flexion. These exclusionary checks can help identify potential pain and issues in the body.

# **3. FMS-Based Intervention Design**

#### **3.1 FMS Scoring Criteria**

Certified testers conducted initial functional movement screenings on all subjects following standardized FMS testing procedures and protocols. [5] For each test item, the evaluators carefully observed and recorded the subjects' movement execution, including: starting posture, movement trajectory, joint range of motion, body balance status, and any abnormalities such as pain. Each movement was scored according to established FMS criteria (0-3 points), with total FMS scores and individual item scores calculated for each subject. These scores served as the basis for assessing movement function levels and identifying potential issues.

# 3.2 Specific Interventions for FMS Functional Movement Screening

3.2.1 Deep Squat

(1) Basic Squat (Score 0):

Movement Instructions: Feet shoulder-width apart, toes slightly outward, planted firmly on the ground. Descend slowly as if sitting back into a chair. Maintain spinal neutral position: chest lifted, back straight. Extend arms forward to assist balance. Lower until thighs are parallel to the ground, ensuring knees don't extend beyond toes. Perform movement smoothly and slowly, focusing on contraction and extension of lower limb muscles.

Training Protocol: Perform 10-15 repetitions per set for 3-5 sets, resting 30-60 seconds between sets.

### (2) Wall Sit (Score 1):

Movement Instructions: Stand with back against wall, feet approximately one foot length away, Feet shoulder-width apart, slowly lower into squat position until thighs and calves form 90-degree angle. Maintain full back contact with wall. Hands may rest at sides or on thighs. Hold position without lumbar collapse or knee valgus.

Training Protocol: Perform 30-60 second holds per set for 3-5 sets, resting 30-60 seconds between sets.

(3) Single-Leg Squat (Score 2):

Movement Instructions: Stand on one leg with opposite foot slightly lifted. After stabilizing balance, descend slowly. Movement pattern similar to double-leg squat. Maintain upright torso position. Ensure supporting knee doesn't extend beyond toes. Lower until thigh is parallel or near parallel to ground. Slowly return to starting position. May extend arms forward for balance assistance.

Training Protocol: Perform 8-12 repetitions per leg per set for 3-4 sets, resting 60-90 seconds between sets.

3.2.2 Hurdle Step

(1) Active Straight Leg Raise (Score 0):

Movement Instructions: Lie supine on yoga mat or floor with legs extended. Slowly raise one leg upward while keeping it straight. Maximize elevation while feeling quadriceps contraction. Use hands to gently press opposite thigh toward torso to enhance stretch. Hold each repetition for 5-10 seconds before controlled lowering. Training Protocol: Perform 10-15 repetitions per leg per set for 3-5 sets, resting 30-60 seconds between sets.

(2) Dynamic Hurdle Step Simulation (Score 1):

Movement Instructions: Place a low horizontal bar on the ground or simulate a hurdle using colored tape. Begin with the bar at a lower height and gradually increase it (adjust according to individual ability). [6] Stand with feet in a staggered stance, the front foot close to the bar and the rear foot positioned slightly back. Slowly lift the front leg to step over the bar while the rear leg pushes off to assist, smoothly shifting the body's center of gravity forward. Land on each foot sequentially, then repeat the movement in the opposite direction. Mimic the motion of actual hurdling but perform the movement slowly and with controlled rhythm.

Training Protocol: Perform 10-15 repetitions per set for 3-5 sets, resting 60-90 seconds between sets.

(3) Lateral Hurdle Step (Score 2):

Movement Instructions: Position the hurdle laterally to your body. Stand with feet together on one side of the hurdle. Lift one leg laterally to clear the hurdle while shifting your center of gravity. After both feet land, return the leg to starting position by stepping back over the hurdle. Alternate legs while maintaining body balance and movement fluidity.

Training Protocol: Perform 8-12 repetitions per leg per set for 3-4 sets, resting 60-90 seconds between sets.

3.2.3 In-Line Lunge

(1) Static Lunge Hold (Score 0):

Movement Instructions: Assume staggered stance with front foot flat and rear foot on toes. Maintain proper spacing: front knee aligned vertically over front toes. Lower rear knee toward ground without touching. Hands on hips or relaxed at sides. Keep torso upright without leaning forward/backward.

Training Protocol: Perform 30-60 second holds per set for 3-5 sets, resting 30-60 seconds between sets.

(2) Slow-Tempo In-Line Lunge (Score 1):

Begin by assuming the starting position identical to the static lunge hold. Slowly lower your body's center of gravity by bending the front knee into a squat while simultaneously extending the rear leg. During this movement, smoothly transfer your body weight from the front leg to the rear leg. Maintain slow, even pacing throughout the entire motion while carefully controlling your body posture. Then slowly return to the starting position. Alternate legs for each repetition.

Training Protocol: Perform 10-15 repetitions per set for 3-5 sets, resting 60-90 seconds between sets.

(3) Walking Lunge (Score 2):

Movement Instructions: Stand with feet together, then step forward into a lunge position. As the front foot lands, lower into the lunge while allowing the rear foot to follow naturally. After completing one repetition, step forward with the opposite foot to continue the movement in a walking pattern. Maintain smooth, continuous motion with stable rhythm, keeping the torso upright and center of gravity balanced throughout.

Training Protocol: Perform 10-15 continuous repetitions per set for 3-4 sets, resting 60-90 seconds between sets.

3.2.4 Shoulder Mobility

(1) Active Shoulder Range of Motion Exercise (Score 0):

Movement Instructions: can be performed standing or seated. Begin with shoulder flexion by slowly raising arms straight forward and upward to maximum height, feeling the stretch and contraction in front shoulder muscles. Next perform abduction by extending arms out to sides until parallel or near parallel to ground. [7] Then perform internal and external rotations with elbows bent at 90 degrees and arms close to body - rotate inward to bring back of hand toward abdomen, then outward to bring palm toward abdomen. Alternate arms and perform all movements slowly and evenly, maximizing range of motion in each direction.

Training Protocol: Perform 3-5 sets per movement direction, resting 30-60 seconds between sets.

(2) Wall-Assisted Shoulder Stretch (Score 1):

Movement Instructions: Stand facing wall with palms placed slightly wider than shoulder-width, fingers pointing upward. Lean torso forward to bring chest close to wall while keeping abdomen engaged, feeling stretch in front shoulders and chest. Without moving hand positions, rotate fingers to point sideways and continue leaning to stretch lateral shoulder muscles. Finally rotate fingers downward and lean forward to stretch posterior shoulder muscles.

Training Protocol: Perform 3-5 repetitions per position per set for 3-5 sets, resting 30-60 seconds between sets.

(3) Band-Resisted Shoulder Rotation (Score 2):

Movement Instructions: Secure one end of resistance band to stable object and hold other end in hand with elbow bent 90 degrees (band should angle forward during internal rotation and backward during external rotation). Perform controlled internal and external rotations against band resistance, moving slowly and maintaining proper force. Alternate arms.

Training Protocol: Perform 10-15 repetitions per arm per set for 3-5 sets, resting 60-90 seconds between sets.

3.2.5 Active Straight Leg Raise

(1) Supine Straight Leg Raise (Score 0):

Movement Instructions: Lie flat on yoga mat or bed with legs straight and together. Slowly raise one leg upward as high as possible while keeping knee extended and opposite leg pressed against surface. Hands may rest at sides or behind head. Feel contraction in raised leg's muscles. Alternate legs.

Training Protocol: Perform 10-15 repetitions per leg per set for 3-5 sets, resting 30-60 seconds between sets.

(2) Side-Lying Straight Leg Raise (Score 1):

Movement Instructions: Lie on side with bottom leg straight against surface. Slowly raise top leg upward while keeping it straight, feeling contraction in outer thigh muscles. Alternate sides.

Training Protocol: Perform 10-15 repetitions per leg per set for 3-5 sets, resting 30-60 seconds between sets.

(3) Resisted Straight Leg Raise (Score 2):

Movement Instructions: Using resistance band (anchored at ankle) or ankle weights, perform straight leg raises while overcoming resistance. Maintain knee extension and controlled movement throughout. This added resistance effectively strengthens lower extremity muscles and improves neuromuscular control during leg raises, making it suitable for trainees with foundational experience to enhance performance. Also helps correct improper form caused by strength deficiencies. Training Protocol: Perform 8-12 repetitions per set for 3-4 sets, resting 60-90 seconds between sets.

3.2.6 Trunk Stability Push-up

(1) Kneeling Push-up (Score 0):

Movement Instructions: Kneel on the ground with legs together and calves crossed. Place hands slightly wider than shoulder-width apart with fingers pointing forward. Keep back straight, maintaining a straight line from head to knees. Bend elbows to slowly lower your body until chest nearly touches the ground, feeling the contraction in upper body muscles. Then push back up to starting position, controlling the speed throughout for smooth movement.

Training Protocol: Perform 10-15 repetitions per set for 3-5 sets, resting 30-60 seconds between sets.

(2) Standard Push-up (Score 1):

Movement Instructions: Place hands slightly wider than shoulder-width with fingers forward and feet together, toes on ground. Maintain a straight, rigid line from head to heels. Slowly lower by bending elbows until chest approaches the ground while engaging abdominal muscles to prevent arching. Then push back up steadily to starting position with continuous, even motion.

Training Protocol: Perform 8-12 repetitions per set for 3-5 sets, resting 60-90 seconds between sets.

(3) Unstable Surface Push-up (Score 2):

Movement Instructions: Using equipment like yoga balls or balance pads, place hands on unstable surface (e.g., both hands on yoga ball) with feet on ground or another stable surface. [8] Perform standard push-up technique while emphasizing core muscle engagement for balance control, as the unstable surface increases difficulty and stability demands.

Training Protocol: Perform 6-10 repetitions per set for 3-4 sets, resting 60-90 seconds between sets.

3.2.7 Rotary Stability

(1) Supine Bent-Knee Rotation (Score 0):

Movement Instructions: Lie supine on mat with knees bent together and feet flat. Place hands behind head or by ears. Slowly rotate legs to one side while upper body follows in same direction, feeling abdominal and lumbar muscle contraction/stretch. Lift shoulders off mat if possible. After reaching maximum rotation, slowly return to start and repeat opposite side.

Training Protocol: Perform 10-15 repetitions per side for 3-5 sets, resting 30-60 seconds 126

between sets.

(2) Quadruped Rotation (Score 1):

Movement Instructions: Assume quadruped position with hands under shoulders and knees under hips, keeping back straight and abdomen engaged. [9] Simultaneously extend one arm forward while extending opposite leg backward, creating diagonal body line. Then rotate both limbs diagonally downward toward body before returning to start. Alternate sides with slow, controlled motion, emphasizing core stabilization throughout.

Training Protocol: Perform 8-12 repetitions per side for 3-5 sets, resting 60-90 seconds between sets.

(3) Standing Rotational Throw-Catch (Score 2):

Movement Instructions: Stand shoulder-width apart in open area holding light ball (e.g., soft volleyball). Rotate body to one side while swinging ball backward. At full rotation, use body's rotational force to throw ball forward, then quickly turn to catch it. Alternate sides, using core muscles to control rotation speed/range and maintain balance while coordinating upper/lower limbs.

Training Protocol: Perform 6-10 repetitions per set for 3-4 sets, resting 60-90 seconds between sets.

# 4. Safety Considerations

First, safety protocols must be reinforced. This includes conducting thorough warm-up routines before training sessions, scientifically planning venue layouts, and comprehensively inspecting equipment to minimize accident risks. [10] Second, teaching methodology should be optimized. Instructors must develop personalized training programs based on Functional Movement Screen (FMS) avoiding assessment results. "one-size-fits-all" approach. The principle of progressive overload should be strictly followed, sudden prohibiting intensity increases. Continuous monitoring of students' movement patterns is essential, with immediate correction of improper techniques. Third. student self-discipline should be cultivated. Participants must strictly adhere to the intervention protocol, adjusting intensity feedback according to physical and immediately terminating exercises upon experiencing pain. Maintaining training consistency is crucial for accumulating

exercise benefits.

# 5. Conclusion

In the past, many people might have just judged their health based on their own feelings or some simple physical tests. However, these are often not accurate methods or enough. Now, with comprehensive the emergence of FMS movement function tests, we can more accurately understand our physical condition, so as to better formulate training plans and maintain health. The Functional Movement Screen (FMS) serves as a scientific foundation for targeted corrective training by identifying movement pattern deficiencies among sophomore physical education students, significantly enhancing their motor function and physical health. This approach demonstrates triple practical value for collegiate physical education: Firstly, improving movement quality effectively enhances athletic performance, boosting both competitive abilities and confidence in daily activities. Secondly, reducing sports injury risks decreases class absenteeism and medical costs, safeguarding students' physical and mental wellbeing. Thirdly, establishing a scientific exercise cognition system promotes sustainable healthy behavior patterns among sophomores, creating positive societal demonstration effects for the national fitness strategy.

# Acknowledgments

This research was supported by the Ningde Normal University College Students' Innovation and Entrepreneurship Training Program (Grant No. 202210398019), and the National Social Science Foundation Project (No. 23XTY007).

# References

- Lin Ruiqi. Effects of FMS-based Functional Training on Physical Fitness Test Scores of Non-Sports Major College Students. Sports Goods and Technology, 2024(13):100-102.
- [2] Zhang Zhiyong, Chen Lunxin, Qin Ziqing, et al. Impact of Functional Corrective Exercises on College Students' Movement Patterns and Physical Health//Chinese Society of Sports Science. Proceedings of the 13th National Sports Science Conference-Special Report (Physical

Fitness and Health Section). Beijing: Chinese Society of Sports Science, 2023:646-648.

- [3] Yan Yutong. Preventive Effects of Functional Movement Screening on Sports Injuries Among Adolescent Basketball Players. Bulletin of Sport Science and Technology, 2022, 30(08):199-202. DOI:10.19379/j.cnki.issn.1005-0256.2022. 08.053.
- [4] Qi Yanwei, Zhang Chaomeng, Guo Qianrong, et al. FMS-based Injury Risk Prediction for Male College Students with Different BMI. Sport Science, 2023, 43(5):874-877.
- [5] Shen Jinsong. FMS-based Functional Training Effects on College Students' Athletic Ability. Journal of Heihe University, 2023, 14(09):185-188.
- [6] Li Yan'ang. Experimental Study on Functional Training's Impact on College

Students' Physical Fitness. Harbin Engineering University, 2023.

- [7] Sang Yuan. FMS-based Injury Risk Assessment for College Male Basketball Players. Journal of Yanbian University (Natural Science Edition), 2024, 50(04):131-135.
- [8] Li Kunpeng. Improving FMS Scores of College Basketball Players Through Functional Training. Sports Vision, 2023, (15):110-112.
- [9] Zhang Qiuyue. Application of FMS in Vocational College Male Basketball Teams. Sports Vision, 2022, (04):98-100.
- Haiyan. [10]Yang Bin, Liu FMS Characteristics Analysis by Position Among College Male Basketball Players-Case Study of Shenyang Normal University. Contemporary Sports Technology, 2021, 11(30):204-206.