



## Investigation on the Current Status of Functional Movement Screen (FMS) for Male Specialized Football Athletes in Colleges and Universities

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### Abstract

Football is a high-intensity competitive sport that requires complex coordination of the shoulders, torso, and lower limbs. Movements such as footwork, sprinting, turning, and jumping demand a high level of physical fitness, which often increases the risk of sports injuries. Functional Movement Screening (FMS) is used to assess the quality of basic movement patterns and predict injury risks, allowing coaches to adjust training plans and provide corrective exercises. However, the application of FMS among university-level specialized football athletes remains limited. This study aims to examine the overall and sub-score characteristics of FMS among male university football players and to explore the relationship between FMS results and sports injuries. The study involved 18 male physical education students from Lvliang University who participated in the Shanxi Province Campus Football League. Before testing, participants completed a questionnaire on training duration and injury history over the past year. Their movement quality was then evaluated using the FMS kit. The collected data were analyzed to determine score distribution and its correlation with injury occurrence. Results showed that the highest total FMS score was 17 and the lowest was 7, each achieved by one participant. Most participants (72.2%) scored between 11 and 14. Nine athletes scored below 14, indicating a high risk of injury. Sub-scores were mostly in the range of 1–2 points. The highest scores appeared in the deep squat test, while the lowest were found in trunk rotation stability, which requires advanced coordination. The study concludes that core stability, ankle flexibility, quadriceps and rectus femoris strength, pelvic stability, and lower-limb coordination need improvement. Regular corrective training and routine FMS assessments are recommended to reduce injury risks and enhance team performance.

**Keywords:** *Credit Risk, ESG Rating, Green Credit, Integrated Learning, Random Forest, Support Vector Machine.*

### A. Introduction

The Healthy China 2030 Planning Outline defines health as a foundation for building a socialist society with advanced spiritual civilization, resolving the principal challenges of the new era, and fulfilling the people's aspirations for a better life. It encourages individuals to prioritize physical well-being, actively participate in various forms of exercise, and achieve the goal of enhancing overall physical fitness and health levels (Central Committee of the Communist Party of China & State Council of the People's Republic of China, 2016). In recent years, the popularity of university football (soccer) has grown significantly. The size of the football-playing population is fundamental to the development of the sport within a nation (Chen, 2022). Alongside the progress of Chinese football and the continuous improvement of living standards, an increasing number of people are paying attention to and participating in university football activities. Building a large football community and fostering a positive football environment are crucial for the sustainable development of football in China (Huo, 2023). On March 17, 2015, the state released the Chinese Football Reform and Development

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Overall Plan, which emphasizes that realizing the Chinese Dream is closely linked to building a leading sports nation, and that revitalizing football is key to achieving this sports powerhouse status (People's Daily, 2015).

Football is characterized by long duration and belongs to a category of team sports dominated by technique and tactics, involving alternating periods of high-intensity and intermittent activity over extended periods (Chen, 2022). In recent years, the physical fitness of the university student population has declined. Influenced by lifestyle factors and personal habits, sports injuries have become increasingly common. The "Campus Football" initiative in universities should place sufficient emphasis on the prevention and management of football-related injuries, reinforcing the principle of "health first" at all levels. Injuries not only cause physical harm to students but also adversely affect their academic performance and daily lives, significantly impeding the development of university football (Zhang, 2018). Ensuring athletes possess good physical conditioning and effectively enhancing sports performance necessitates strengthened efforts in injury prevention and prediction (Li et al., 2020). However, there is currently a lack of effective tools for monitoring sports injuries within the university setting.

The Functional Movement Screen (FMS) is a prevalent assessment method, widely used in the United States within physiotherapy rehabilitation and physical conditioning fields. It serves as an evaluation system for an athlete's fundamental movement capacity, primarily used for rehabilitation and by professionals to assess body strength and coordination (Hu et al., 2022). The FMS can identify individuals at risk of movement dysfunction (Hua et al., 2016) who do not yet present symptoms or signs of musculoskeletal injury (Kiesel et al., 2007). Consequently, this study employs the FMS to evaluate university football-specialized athletes, aiming to assess their athletic capabilities and improve movement patterns.

Current research on football-related sports injuries in mainland China still lags significantly behind international high-standard studies and lacks unified protocols. There is a pressing need for high-quality research adhering to international consensus guidelines to systematically monitor and investigate the characteristics, prevention, and treatment of sports injuries among both professional and amateur football athletes in mainland China (Shen, 2022). Injury prevention in football players has become a focal point in international football injury research. Systematic, scientific, and scalable injury prevention exercises are being promoted globally (Jia & Wu, 2019). However, domestic research on football injury prevention remains scarce. Within the context of the nationwide promotion of campus football, the importance and urgency of developing systematic football injury prevention strategies are self-evident (Liang, 2024). This study, integrating the specific characteristics of football, utilizes the FMS to identify weaknesses in the physical fitness of football-specialized athletes at Lvliang University. Based on the assessment results, corresponding corrective training is recommended to enhance the players' balance, stability, and flexibility.

Conducted within the framework of the "Healthy China" and "Sports Power" national strategies, this study focuses on university football-specialized athletes. By employing the FMS for functional movement screening and investigating the current status of sports injuries, it contributes to understanding the athletic capabilities of football players at Lvliang University, analyzing existing challenges and deficiencies. The findings provide strategies and methods for the sustainable and healthy development of the Lvliang University football team. Ultimately,

this research aims to assist athletes in preventing movement pattern limitations, improving and enhancing athletic performance, and strengthening the construction and advancement of competitive sports at Lvliang University.

## B. Methods

The subjects of this study consisted of 18 male football players from Lvliang University who participated in the 2023 Shanxi Provincial University Campus Football League. All participants were students majoring in football-specific physical education within the Department of Sports and Health. This group was selected because they represent specialized football athletes with consistent training backgrounds, making them suitable for examining functional movement quality and potential injury risks (Cook et al., 2006a; Kiesel et al., 2007).

The research employed multiple methods, beginning with a comprehensive literature review. Relevant studies were retrieved from major academic databases such as CNKI and Wanfang Data, including journal articles, theses, and conference papers. Keywords such as “campus football,” “university football players,” “football specialization,” and “Functional Movement Screen (FMS)” guided the search process. Additional references were identified through citation tracing, ensuring a strong theoretical and empirical foundation for the study (Gao & Liu, 2021; Li, 2020).

An experimental method was then used to collect primary data. The testing equipment included an official FMS kit, tape measure, electronic scale, resistance bands, foam rollers, and a wooden stick. Before testing, participants completed personal information forms. Functional movement screening was conducted individually following standard FMS protocols, with bilateral assessments for most tests, adequate rest intervals, and a maximum possible score of 21 points (Cook et al., 2006b; Frost et al., 2015). Testing took place at the Lvliang University football training field and the AQ Fitness Club, beginning at 2:00 PM on Saturday. The athletes were divided into groups, given detailed demonstrations, and performed each movement three times, with the best score recorded. All seven FMS components were assessed, along with three clearance tests to identify pain (Cook et al., 2014).

The collected data were processed using mathematical statistics methods. Valid responses from questionnaires, interviews, and FMS test results were entered into Excel for systematic statistical analysis. This approach provided a structured basis for evaluating the athletes’ functional movement performance and examining its relationship with sports injury risks (Kiesel et al., 2014; Dorrel et al., 2015).

## C. Results and Discussion

A comprehensive investigation was conducted to analyze the basic physical characteristics of the 18 athletes participating in the Functional Movement Screen (FMS). The assessment of physical fitness and football skills referred to the 2024 specialized football entrance examination standards. Physical fitness was evaluated through a 5×25-meter shuttle run, while football skills were measured using three performance indicators: passing accuracy, dribbling and shooting ability, and overall practical performance. Because none of the athletes had achieved the level of a second-grade football player, a subjective scoring system based on 100 points was employed. The evaluation produced the following data

**Table 1.** Statistical Table of Basic Physical Characteristics of the Subjects (N=18)

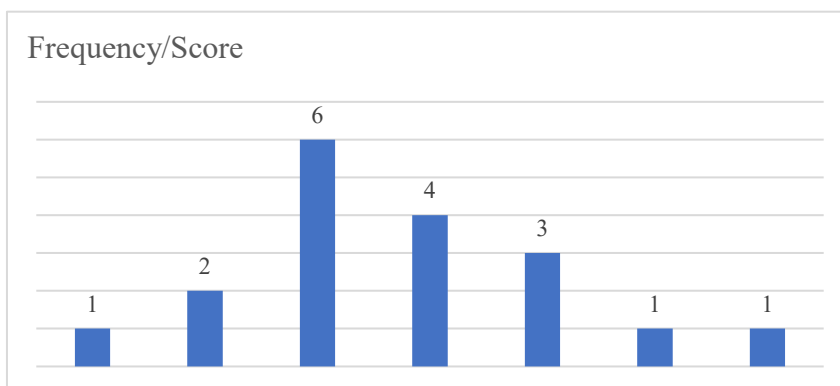
	Age	Height (m)	Weight (kg)	Physical Fitness (points)	Football Skills (points)
<b>Measurement Results</b>	20±1.21	1.78±0.34	75±1.28	79.67±1.71	78.64±0.96

As shown in Table 1, the athletes were primarily around 20 years old, indicating a relatively young age structure. Their average height was approximately 1.78 meters, which corresponds to the general physical profile of players in ordinary university football teams, and their body weight also fell within the normal range. Overall, both the physical fitness and football skills of the athletes were at a relatively low average level. Although the assessment adopted a subjective scoring system, the results still showed a considerable gap when compared to high-level university football teams. Additionally, a survey was conducted to assess the athletes' sports backgrounds and training durations for all 18 participants, providing further insight into their athletic experiences and training histories.

**Table 2.** Statistical Table of Sports Background and Training Duration of the Subjects (N=18)

	Sports Background	Training Duration
<b>Result</b>	General Sports Exam Students	No systematic training undergone

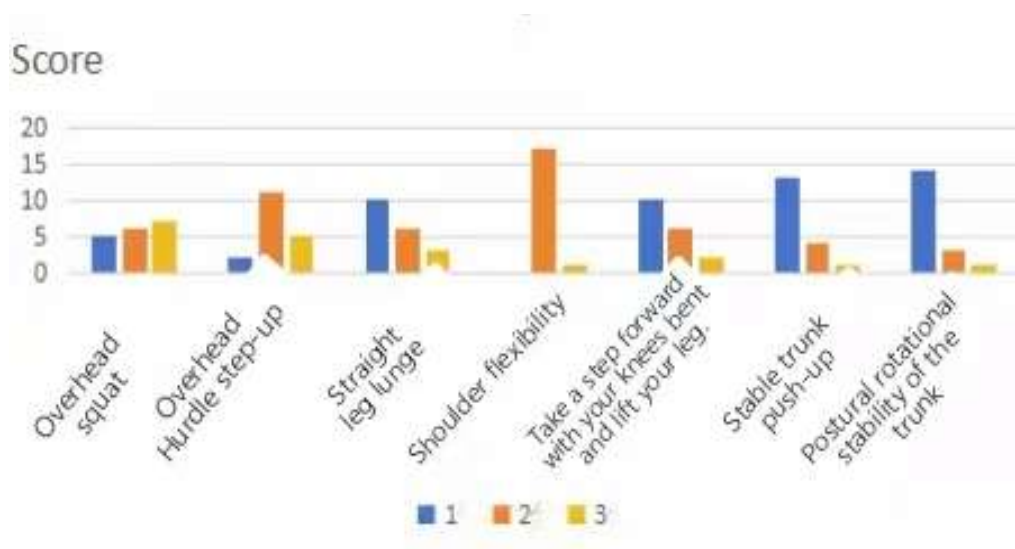
As indicated in Table 2, none of the 18 athletes possessed an official athlete grade certificate. All participants were general sports exam students who had not undergone systematic, long-term training; instead, their preparation consisted only of short-term, unified pre-competition sessions. Due to the brief duration and relatively low quality of their training, the football-specialized athletes at Lvliang University demonstrate a weak athletic foundation and significantly lower training capacity compared to higher-level university teams. The Functional Movement Screen (FMS) results further illustrate their overall condition. The FMS consists of seven test movements—Overhead Squat, Hurdle Step, In-line Lunge, Shoulder Mobility, Active Straight Leg Raise, Trunk Stability Push-up, and Rotary Stability—along with three clearance tests. The Hurdle Step, In-line Lunge, Shoulder Mobility, Active Straight Leg Raise, and Rotary Stability must be assessed on both the left and right sides, while Shoulder Mobility, Trunk Stability Push-up, and Rotary Stability also require completion of clearance tests. Each movement is scored on a scale of 0 to 3 points, with a total maximum score of 21; a score of 0 is given if the participant experiences pain during any clearance test or test movement. The overall FMS scores for the football-specialized athletes at Lvliang University are presented as follows.



**Figure 1.** Overall Scores of FMS Testing for Participants

According to Kiesel [15] and others in their research, subjects with an FMS total score below 14 points are more prone to sports injuries. As can be seen from the figure, there are 9 people with scores below 14 points, which is half of the team. The highest score is 17 points, and only one person achieved it. This indicates that the overall level of the team members is not high, and the quality of performing the FMS movements is poor. The likelihood of sports injuries is very high.

By statistically organizing and analyzing the scores for each individual FMS test item, the following data were obtained, allowing for a comparison of performance across the different movement patterns assessed



**Figure 2.** Score Statistics for Different Items of Participants

Figure 2 shows that in each test item, most athletes scored 1 or 2 points, indicating generally low performance levels. The overhead squat had the highest number of 3-point scores, likely because this movement can meet standard requirements after a short period of targeted training. In contrast, the shoulder flexibility test showed many athletes scoring 2 points, which may be attributed to frequent shoulder-related activities during classes, training sessions, and recreational play, thus improving shoulder mobility. The test that produced the most 1-point scores was trunk rotational stability, reflecting the high coordination demands of this movement, which are difficult to meet without systematic training.

In the overhead squat test, most participants achieved 3 points, demonstrating strong performance in this movement pattern. This result suggests well-functioning shoulder joints and thoracic spine mobility, as well as solid core and pelvic stability. The five athletes who scored only 1 point may have limited lower limb flexibility and should focus on training the shoulder and thoracic spine areas. For the hurdle step test, most participants scored 2 points, showing adequate lower limb strength and body control. The movement requires one leg to lift while the other maintains stability, relying on lower limb symmetry and coordinated hip-knee-ankle mechanics. The two athletes who scored 1 point likely lacked sufficient strength or coordination in their stepping leg. In the in-line lunge test, the majority—ten participants—scored 1 point, indicating weak performance. This test requires balanced muscle strength in both legs, trunk stability, and adequate flexibility. Observed issues such as forward leaning and upper-body

wobbling suggest instability in trunk or lower limb joints, inadequate strength transfer, or possible spinal mobility limitations.

The shoulder flexibility test showed that 95% of the athletes had normal shoulder mobility, which aligns with the frequent use of the shoulder joint in football-related activities. However, the active straight leg raise results were unsatisfactory, with most athletes scoring only 1 point, indicating weak hip joint flexibility and limited posterior chain mobility. This may be because football movements such as kicking emphasize hip flexion and knee extension, which differ from the muscle groups tested in the straight leg raise. Similarly, the trunk stability push-up results were poor, reflecting inadequate core stability, a crucial factor in improving overall athletic performance. The trunk rotational stability test also showed low performance across the board due to its high difficulty level. This movement requires strong neuromuscular control and trunk strength transfer, which are difficult to achieve without specific training. The overall results suggest that the team needs to improve coordination between upper and lower limbs and enhance neuromuscular control, potentially through training tools where possible.

The relationship between FMS test scores and injury prevention shows that the team's average FMS score was 12, lower than the 14-point injury-risk threshold identified by Kiesel. This suggests a high risk of sports injuries among Lvliang University football athletes. The FMS assesses muscle strength, trunk stability, flexibility, coordination, kinetic chain performance, and lower limb functionality—making it an effective tool for predicting injury risk. Thus, athletes with low scores should undergo targeted corrective training. Such training should focus on strengthening lower limb anterior muscles, ankle stabilizers, and core musculature; increasing flexibility through stretching; improving stability through core and movement-control exercises; and reshaping movement patterns through functional training. While this study did not implement corrective interventions, it provides meaningful guidance for coaches seeking to reduce injuries.

There is also a positive correlation between FMS scores and athletic performance. Among the FMS indicators, stability is assessed through the overhead squat, hurdle step, and in-line lunge; flexibility is evaluated using the active straight leg raise and shoulder mobility tests; and fundamental movement patterns are reflected in the trunk stability assessments. Football performance relies heavily on strength, stability, flexibility, and coordination of the lower limbs and core. Given that football movements primarily involve the hip, knee, and ankle joints as well as lower limb muscle groups, FMS provides an effective reflection of athletic capability. Findings from this study show that athletes with higher FMS scores also performed better in football-specific tasks, indicating a clear positive relationship between functional movement quality and athletic performance.

#### **D. Conclusion**

The findings of this study indicate that the overall functional movement quality of football-specific athletes at Lvliang University is relatively low, as reflected in their FMS scores. This condition suggests a heightened likelihood of sports injuries among team members. The detailed analysis of sub-test scores further reveals specific deficiencies in trunk stability, joint flexibility, and overall movement coordination. These shortcomings not only hinder optimal athletic performance but also significantly increase the vulnerability of athletes to both acute and chronic injuries. The results underline the need for improved functional capacity and balanced physical development to support safe and effective participation in high-intensity football activities.

To address the identified limitations, it is recommended that the football team implement targeted corrective training focusing on core stability, flexibility, and coordinated movement

patterns. Such interventions can help reduce the risk of injury and enhance functional performance. Additionally, the integration of Functional Movement Screening into routine training is strongly advised. Regular FMS assessments will enable continuous monitoring of athletes' movement quality, early identification of potential injury risks, and timely adjustments to training programs, thereby supporting long-term athletic development and improved performance outcomes.

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