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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 involves the shoulders, torso, and lower limbs of the body. During movement, various parts of the body engage in complex coordination to achieve movements such as footwork, foot frequency, sprinting, turning, and jumping. This sport requires athletes to have highly developed physical fitness and is often accompanied by sports injuries. The seven test movements in Functional Movement Screening (FMS) include the basic movement patterns of the human body. It is a measurement tool used to evaluate the quality of athletes' movements and exercise risks. Based on the results, the training plan can be adjusted accordingly, and corrective training can be carried out to reduce exercise risks and improve athletic performance. At present, the application of this measurement tool in college football special athletes is relatively limited. Therefore, this article selects this group for research, with two research objectives: firstly, to understand the overall and sub scoring characteristics of FMS for male specialized football players in universities through testing, and secondly, to explore the relationship between FMS test results and athletes' sports injuries. This study focuses on 18 male football students majoring in physical education from Lvliang University who participated in the Shanxi Province Campus Football League. Firstly, before the test, the subjects filled in a survey questionnaire about their training time and sports injury history within one year. Then, the functional movement quality of the subjects was tested using a functional movement screening kit. After the test, the distribution characteristics of the overall and sub item scores of the subjects' functional movements were analyzed based on the data, and the relationship between the athlete's FMS test score and sports injury was explored. (1) According to the FMS test results of 18 participants, it was found that the athlete's total score was the highest at 17 points, with only one person; The minimum score is 7 points, and there is only one person, each accounting for 5% of the total sample size. The highest number of people scored between 11-14, with a total of 13 people, accounting for 72.2% of the total sample size. According to the gold standard for FMS scores, subjects with a total score below 14 are prone to sports injuries, with a total of 9 people, accounting for half of the football team. This indicates that the overall testing level of the team is not high, and the quality of the movements completed in FMS is poor, making the possibility of sports injuries very high. (2) After analyzing the scores of each sub item in the test, it was found that the athletes' scores in each event were mainly concentrated in 1 and 2 points. The test with the highest score of 3 points was the over the top squat event, which may be due to the fact that this event can reach the standard testing ability after a short period of training. The athletes who scored 2 points in the shoulder flexibility test were the most, which may be due to the fact that team members often engage in shoulder exercises during regular

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classes, training, and competitions, which improves shoulder flexibility. The test with the highest score of 1 is the trunk rotation stability project, because this test requires particularly high coordination ability, and athletes who have not undergone systematic training find it difficult to maintain limb coordination stability. After investigation, it was found that the functional movement screening scores of male football special athletes from Lvliang College were relatively low. The core stability and control ability of the body, as well as the flexibility of the ankle joint, need to be strengthened. The strength of the quadriceps and rectus femoris muscles needs to be strengthened. Pelvic stability and the flexibility and coordination ability of the lower limb muscles are poor, and the risk of sports injuries is high. In the training after the football team, targeted corrective training should be strengthened, and FMS testing should be used in regular training to reflect the risk of sports injuries and performance of athletes, and to continuously improve the team's sports level based on this indicator level.

Keywords

Campus Football; Football-specific; Functional Movement Screening; FMS Test.

1. Introduction

1.1. Research Background

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 [1]. 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 [2]. 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 [3]. On March 17, 2015, the state released the "Chinese Football Reform and Development 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 [4].

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 [5]. 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 [6]. Ensuring athletes possess good physical conditioning and effectively enhancing sports performance necessitates strengthened efforts in injury prevention and prediction [7]. 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 [8]. The FMS can

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identify individuals at risk of movement dysfunction [9] who do not yet present symptoms or signs of musculoskeletal injury [10]. Consequently, this study employs the FMS to evaluate university football-specialized athletes, aiming to assess their athletic capabilities and improve movement patterns.

1.2. Research Purpose

Current research on football-related sports injuries in China's mainland 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 China's mainland [11]. 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 [12]. 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 [13]. 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.

1.3. Research Significance

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.

2. Research Objects and Methods

2.1. Research Objects

A total of 18 football players from Lvliang University who participated in the 2023 Shanxi Provincial University Campus Football League were selected as subjects. All participants were students majoring in football-specific physical education within the Department of Sports and Health at Lvliang University.

2.2. Research Methods

2.2.1. Literature Review Method

Searches were conducted in databases such as CNKI (China National Knowledge Infrastructure) and Wanfang Data. Types of literature retrieved included journal articles, dissertations, and conference papers. Keywords used in the search included "campus football," "university football players," "football specialization," "Functional Movement Screen (FMS)," among others. Additional relevant references were obtained from the bibliographies of retrieved articles to support the literature foundation of this study.

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2.2.2. Experimental Method

2.2.2.1 Testing Equipment

The equipment used included FMS testing kit components, a tape measure, an electronic weight scale, elastic resistance bands, foam rollers, and a wooden stick.

2.2.2.2 Testing Procedure

Prior to the experiment, the 18 male football-specialized athletes from Lvliang University were required to complete personal information forms, including name, gender, age, height, and years of training. Functional movement screening was conducted individually for each subject according to FMS testing protocols and standards. Scores for each FMS test item were recorded based on established scoring criteria. Testing followed standard procedures using the official FMS kit. Approximately 10 seconds of rest was provided between trials, and one minute of rest was allowed between different tests. All tests except the Deep Squat (DS) and Trunk Stability Push-up (TSP) were assessed bilaterally. The best score from each of the seven tests was used for analysis and composite score calculation. The composite FMS score was derived by summing the scores of the individual tests. Unilateral assessment was considered; for example, if an individual scored 3 on the left leg and 2 on the right leg in the Hurdle Step (HS), the final score for HS was 2. The maximum possible score for each participant was 21 points. The reliability of these assessment criteria has been established, showing moderate to excellent agreement among trained raters.

(1) Testing location: Lvliang University football training field and AQ Fitness Club in Lvliang City.

(2) Testing time: The tests commenced at 2:00 PM on Saturday. No warm-up activities were arranged for the subjects prior to testing. The athletes were divided into three groups for assessment. Researchers demonstrated each test movement to the athletes. Verbal instructions were provided during testing, and correct application of the tests was confirmed. After ensuring the athletes understood the test requirements, three trials were performed, and the best score was recorded. Each athlete completed all seven movements as required. Participants were instructed to wear uniform shorts, short-sleeved shirts, and athletic shoes.

2.2.2.3 Experimental Content

The FMS included seven movement tests: Deep Squat, Hurdle Step, In-Line Lunge, Shoulder Mobility, Active Straight Leg Raise, Trunk Stability Push-up, and Rotary Stability. Additionally, three clearance tests were used to check for pain.

2.2.3. Experimental Method

Valid data obtained from questionnaires and interviews were entered into Excel software for conventional statistical analysis.

3. Results and Analysis

3.1. Overall Situation of the Functional Movement Screen (FMS)

3.1.1. Analysis of Basic Information of the Subjects

3.1.1.1 Basic Physical Characteristics of the Subjects

A comprehensive investigation was conducted on the physical factors of the 18 athletes. Physical fitness and football skills were assessed with reference to the 2024 specialized football entrance examination methods. Physical fitness was measured using a 5×25-meter shuttle run, while football skills were evaluated based on three indicators: passing accuracy, dribbling and shooting, and practical performance. Since none of the athletes had reached the level of a second-grade football player, a subjective 100-point scoring system was adopted. The evaluation yielded the following data:

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

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

3.1.1.2 Sports Background and Training Duration of the Subjects

A survey of the 18 athletes yielded the following data:

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

	Sports Background	Training Duration
Result	General Sports Exam Students	No systematic training undergone

As indicated in Table 2, none of the 18 athletes possessed an athlete (athlete grade certificate). All were general sports exam students and had not undergone systematic training measured in years. Their preparation consisted solely of short-term, unified pre-competition training. The professional training duration was brief, and the training level was low. It is evident that the football-specialized athletes at Lvliang University have a weak sports foundation, and their training capacity is inferior to that of higher-level university teams.

3.1.2. Analysis of FMS Test Results

3.1.2.1 Analysis of Overall Scores

Functional Movement Screen (FMS) includes seven test movements and three clearance tests. The seven test movements are Overhead Squat, Hurdle Step, In-line Lunge, Shoulder Mobility, Active Straight Leg Raise, Trunk Stability Push-up, and Rotary Stability. Among them, the Hurdle Step, In-line Lunge, Shoulder Mobility, Active Straight Leg Raise, and Rotary Stability need to be tested separately on both the left and right sides. Additionally, Shoulder Mobility, Trunk Stability Push-up, and Rotary Stability also require clearance tests. Each test movement is scored out of a maximum of 3 points, with a total possible score of 21 points. If the subject experiences pain during the three clearance tests or at any body part during the testing process, the corresponding test score is 0 points[14]. The overall FMS scores for the football-specific athletes at Lvliang University are shown as follows:

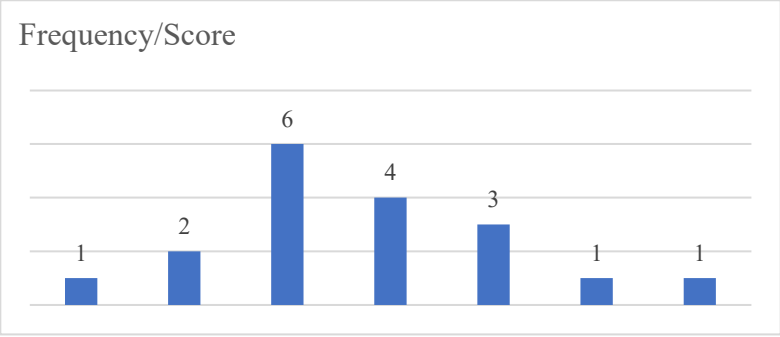

Figure 1. Overall Scores of FMS Testing for Participants

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.

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3.1.2.2 Comparison and Analysis of Scores for Different Test Items

By statistically organizing the scores for each item, the following data were obtained:

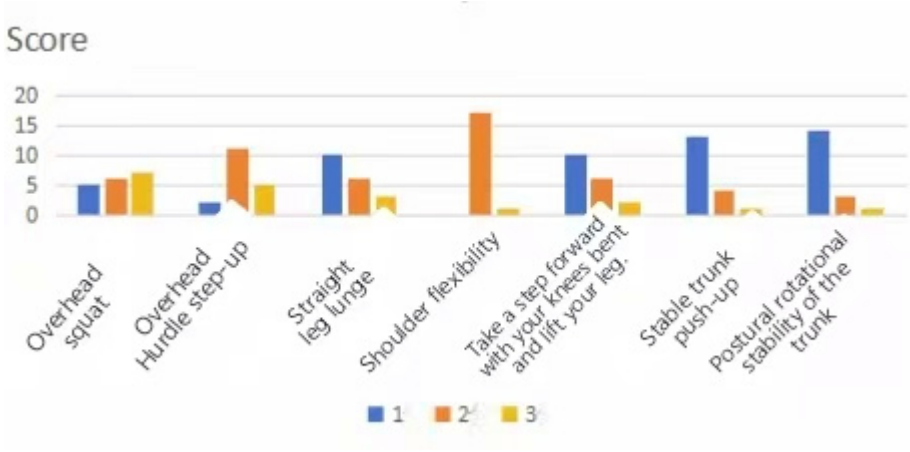

Figure 2. Score Statistics for Different Items of Participants

As can be seen from Figure 2, in each item, the majority of scores are 1 and 2 points. The item with the most 3-point scores is the overhead squat, which may be due to the fact that this item can reach the standard test ability after a short period of training. In the shoulder flexibility item, the most common score is 2 points. This may be because the team members often engage in shoulder movements during regular classes, training, and recreational activities, which enhances their shoulder flexibility. The item with the most 1-point scores is trunk rotational stability. This is because the trunk rotational stability test has particularly high requirements for coordination ability and is very difficult. It is hard to react quickly without systematic training.

3.2. Results and Analysis of Each Test Movement Pattern

3.2.1. Results and Analysis of Overhead Squat Test

According to the test, the most participants scored 3 points in the overhead squat test, indicating the highest level of performance in this indicator. This indicator is used to assess the symmetry of the lower limb joints and the stability of the trunk. It can be seen that the shoulder joints and thoracic spine function well in football players, and the stability of the core body and pelvis is strong. The five participants who scored 1 point may have average lower limb flexibility and need to strengthen the practice of shoulder or thoracic spine joints.

3.2.2. Results and Analysis of Hurdle Step Test

According to the test, the majority of participants scored 2 points, with 11 individuals achieving this score. There were 2 participants who scored 1 point, and 5 who scored 3 points. This indicates that the athletes generally have adequate lower limb strength and body control abilities. The hurdle step movement requires the tester to complete the stepping motion with one leg while maintaining stability with the other leg. The symmetry of the muscles in both legs is crucial for supporting the stability of the movement, while body coordination is the foundation for completing the action. The two participants who scored 1 point may have had insufficient lower limb strength in their hurdle leg and inadequate coordination and flexibility in the hip-knee-ankle joints.

3.2.3. Results and Analysis of the Lunge Walk Test

In the straight-leg lunge test, 10 participants scored 1 point, which constitutes the largest proportion, indicating that the results in this test were not satisfactory. To perform the straight-leg lunge FMS test to the standard, strong muscle strength in both the front and back legs is required. The presence of forward lean and wobbling of the upper body suggests instability in

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leg strength, trunk stability, hip joints, or ankle joints. This test engages the entire body, from the shoulders to the trunk and lower limbs, assessing the strength, coordination, and flexibility of the latissimus dorsi, quadriceps, and rectus femoris muscles. In addition, it is also necessary to consider whether there are any limitations in the spine of these players.

3.2.4. Results and Analysis of Shoulder Flexibility Test

In this test, 95% of the athletes have acceptable shoulder flexibility. As the shoulder joint is frequently used in sports activities, the scores obtained in this test are within a normal and reasonable range.

3.2.5. Results and Analysis of Active Straight Leg Raise Test

According to the survey, the main score for the active straight leg raise indicator is 1 point, followed by 2 points, with only 2 people scoring 3 points. This indicates an unfavorable result. The active straight leg raise tests the ability of the hip joint to actively flex and extend while maintaining trunk stability, as well as the stability of the pelvis and the flexibility of the posterior lower limb muscle groups (hamstrings and calf muscles). Since the characteristics of kicking a football mainly consist of three phases: backswing, forward swing, and forward kick, the primary muscles and joints involved are the iliopsoas for hip flexion, the quadriceps for knee extension, and the anterior calf muscles for foot flexion, which are contradictory to the muscle groups and joints assessed in the test. In addition to the kicking action, athletes mainly run on the field, which does not exercise the muscle groups and joints required for the active straight leg raise. Therefore, the scores in this item are not satisfactory. This also suggests that the risk of sports injuries is relatively high for football teams when training with this type of movement trajectory.

3.2.6. Results and Analysis of Trunk Stability Push-up Test

According to the survey, the results of the trunk stability push-up test are also not satisfactory. This movement primarily tests the core stability of the athletes. This result indicates that the sports team must strengthen core training, as the core is the key to improving athletic performance.

3.2.7. Results and Analysis of Trunk Rotational Stability Test

According to the survey, few players scored highly in the trunk rotational stability test. Given the high difficulty of this test, the overall low scores are understandable. This test can observe the remaining stability and control ability of an athlete’s body when they lift a limb on the same side. Players who score highly in this test need strong neuromuscular control and powerful trunk strength transfer capabilities, which require a high level of natural talent. This also suggests that the team should enhance the coordination between the upper and lower limbs and the control over the body. Where conditions permit, instruments can be used to train the nervous system’s coordination abilities.

3.3. Discussion on the Relationship between FMS Test Results and Performance of Football-Specific Athletes

3.3.1. Relationship between FMS Scores and Injury Prevention

After conducting the FMS test and survey, it was found that the functional movement screen scores of athletes in the specialized football team are generally average. Research revealed that the overall average score of the football team was 12 points, which differs from Kiesel's study, where 14 points were used as the critical value for injury risk. This discrepancy may be due to the relatively ordinary level of professional skill of the athletes in this study, or it may be because the number of studies included in this research was relatively small. In any case, this study found that the risk of sports injuries among football-specific athletes at Lvliang University is relatively high. The functional movement screen assesses the majority of the body's muscle strength, trunk stability, flexibility, and coordination, as well as the kinetic chain and trunk

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strength transfer capabilities, with a particular focus on lower limb flexibility. Currently, it is one of the most powerful guidelines for testing athletic ability and preventing sports injuries. Athletes with low FMS scores should undergo targeted corrective training to reduce the risk of sports injuries. For the athletes in this study, targeted corrective training can focus on three main areas: first, strength training, primarily targeting the anterior lower limb muscle groups, small muscle groups of the ankle, and core strength training; second, flexibility training, mainly focusing on joint and muscle flexibility, as well as improving flexibility through static and dynamic stretching; third, stability training, which includes core stability training and a significant amount of training for movement control. The fourth point is the reshaping of movement patterns, which can be improved through functional training. Due to the limited capabilities of this study, corrective training interventions were not implemented. However, this provides constructive suggestions and improvement strategies for football coaches.

3.3.2. Correlation between FMS Scores and Athletic Performance

Among the seven indicators tested in the FMS, stability is represented by the overhead squat, hurdle step, and lunge walk. Flexibility is represented by the active straight leg raise and shoulder flexibility. Basic movement patterns are represented by the two trunk stability tests. In the process of football, various athletic performances are reflected in muscle strength, trunk stability, flexibility, coordination, and flexibility. The FMS test focuses on the trunk and lower limbs. Football involves offensive dribbling and shooting, defensive techniques, running, and regular full-field running, with the primary movement joints being the hip, knee, and ankle, and the main skeletal muscles being the lower limb muscle groups. The FMS test can effectively reflect the athletic ability in football. According to this study, athletes with higher FMS scores generally perform better in football. This indicates a positive correlation between FMS scores and athletic performance.

4. Conclusion and Recommendations

4.1. Conclusion

(1) The survey found that the functional movement screen scores of football-specific athletes at Lvliang University are low, indicating a high probability of sports injuries.

(2) After conducting various tests in the functional movement screen, it was found that the athletes have poor trunk stability, flexibility, and coordination, which increases the risk of sports injuries.

4.2. Recommendations

(1) In future football team training, targeted corrective exercises should be strengthened to reduce the risk of sports injuries.

(2) The FMS test should be incorporated into regular training to reflect the risk of sports injuries and athletic performance, and to continuously improve the level of sports performance based on this indicator.

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