

Application Research of Functional Movement Screen in Weightlifting Athletes

Qiongxia Chen^{1, a}, Dawei Li^{1, b}, and Bing She^{2, c *}

¹ Hainan Provincial Sports Academy, Haikou, 570203, China;

² Huhhot First Hospital, Huhhot, 010030, China;

^a2831610188@qq.com, ^b470793421@qq.com, ^cshebing2588@163.com*

Abstract. This study aimed to investigate the functional movements and the causes of injuries of weightlifting athletes by Functional Movement Screen test, and improve the physical training approaches for weightlifting athletes. Six weightlifting athletes from Hainan Provincial Sports Academy were screened for the Functional Movement Screen test. The test results were evaluated and analyzed by the researchers. The test items included the shoulder flexibility, the active straight leg raise, the trunk stability push-up, the rotary stability test, the deep squat, the hurdle step and the inline lunge. The average score of weightlifting athletes was 15.5 points. The average score for the inline lunge was 3 points, the hurdle step had an average score of 2.8 points, but the average score for shoulder flexibility was less than 1 point. The trunk strength and lower limb strength of weightlifting athletes were at relatively high levels, but shoulder flexibility was relatively weak.

Keywords: Weightlifting athletes; Flexibility; Stability; Functional Movement Screen

1. Introduction

Functional Movement Screen (FMS testing) was invented and popularized by American fitness trainer and physical therapist Gray Cook[1]. FMS testing consists of 7 fundamental movement patterns. The purpose of FMS is to expose compensations and asymmetries in the body's flexibility and stability through testing, and to improve flexibility and stability through corrective exercises, ultimately aiming to predict injuries[2,3]. FMS has been recognized as a testing method with high reliability and validity. Since the 21st century, FMS has been widely used abroad in sports[4-7], military training[8], and general fitness[9], with its application in the sports field being the most extensive.

Considering the current training status of weightlifting athletes, their training regimen includes not only foundational qualities such as strength, explosiveness, and speed but also specialized training in upper and lower limbs, joint flexibility, coordination, and agility. Due to the high intensity of training, the risk of injury is elevated. Therefore, this study, based on the training characteristics of weightlifting athletes, utilized FMS testing to identify existing movement functional impairments in weightlifting athletes, and proposed recommendations for improving training to reduce the occurrence of sports injuries. This aims to ensure that weightlifting athletes possess both high-quality combat capabilities and good health levels, making a necessary contribution to the vigorous development of sports.

2. Methods

The study focused on six weightlifting athletes from a sports vocational and technical college. FMS consists of the following 7 movements: deep squat, hurdle step, inline lunge, shoulder joint mobility, supine straight leg raise, trunk stability push-up, and rotary stability test. Each movement is scored from 0 to 3 points.

The FMS scoring criteria have four levels, ranging from 0 to 3 points. The subject who is painful detected in any part during the test will get 0 points. The subject who is unable to complete the entire movement or maintain the starting position will get 1 point. The subject who can complete

the entire movement, but the quality of completion is low will get 2 points. The subject who can complete the movement with high quality will get 3 points.

3. Results

3.1 Evaluation System for FMS

The FMS test comprises 7 items, with a maximum score of 3 points for each item, totaling 21 points. The passing score is 13 points. If the score falls below the passing line, it indicates that the tested individual's level of functional movement is relatively low, and there may not be much room for further improvement. The individuals with low scores are more prone to sports injuries during high-intensity activities. When coaches design training plans based on FMS test results, they can develop progressive corrective action sequences according to Table 1.

Table 1. The processing sequences of FMS test

Processing Sequence	FMS Test Score
1	Scores 0 points in any of the tests.
2	The subject is unable to complete the entire movement or maintain the starting position, scores 1 point.
3	The subject can complete the entire movement, but the quality of completion is low, scores 2 points.
4	The subject can complete the movement with high quality, scores 3 points.

We sorted the scores of each movement one by one. Pain issues are prioritized, as any occurrence of pain indicates an urgent need for resolution. Pain suggests a high likelihood that the individual is currently unsuitable for the training. This is an important indication for protecting athletes from injury. Addressing athlete pain and developing suitable training plans are crucial milestones in injury prevention.

3.2 FMS Test Results of Weightlifting Athletes

The FMS test results for weightlifting athletes indicate an average score of 15.5 points, suggesting overall good performance. However, there are deficiencies in shoulder flexibility, as well as in the rotary stability test and deep squat.

The average scores for the hurdle step and inline lunge are better than other movements, with athletes achieving average scores of 3.0 and 2.8, respectively. This indicates relatively good trunk stability and core strength. Shoulder flexibility is the weakest aspect of weightlifting athletes' performance. Therefore, attention should be paid to protecting the shoulders of weightlifting athletes based on individual circumstances, and further medical testing should be conducted to check for the organic damage.

After sorting the likelihood of weightlifting athletes experiencing sports injuries, priority is given to addressing the most likely functional impairments that may cause athlete injury. Coaches typically refer to the ranking of functional impairments in Table 2 when implementing corrective training. The methods and exercise content for corrective training are arranged accordingly.

Table 2. FMS Test Scores for Weightlifting Athletes

Number	Shoulder Flexibility	Active Straight Leg Raise	Trunk Stability	Rotary Stability	Deep Squat	Hurdle Step	Inline Lunge	Total Score
1	0	2	3	2	3	3	3	16
2	0	3	3	2	3	2	3	16
3	0	3	0	0	0	3	3	9
4	1	3	3	2	3	3	3	18

5	3	3	3	2	3	3	3	20
6	1	2	3	2	0	3	3	14
Average Score	0.8	2.7	2.5	1.7	2.0	2.8	3.0	15.5

The test scores of "inline lunge" was better than the results of the other 6 movements. All 6 athletes scored the maximum 3 points, with no movement of the trunk during the test, both feet remaining on the 26 testing board, the front heel and back knee touching the 26 testing board, achieving a 100% test effectiveness.

The "hurdle step" movement ranks second, with test scores significantly better than the results of the remaining 5 movements. 5 athletes scored the maximum 3 points, with an average score of 2.83. Only one athlete had bending of the hip/knee/ankle of the supporting leg, movement of the waist, and the rod and bar rack no longer parallel. The other 5 athletes were able to support the leg on the testing board well, keeping the hip, knee, and ankle straight, with slight movement of the waist, and the rod and bar rack remaining parallel.

Three athletes experienced pain in shoulder flexibility. The "shoulder flexibility" movement ranks seventh, with one athlete scoring the maximum 3 points, having a gap between the two fists less than the length of one palm. The gap between two athletes was significantly greater than 1.5 palm lengths.

4. Discussion

From the results of the FMS test, it can be seen that due to years of specialized training, some weightlifting athletes have experienced varying degrees and types of sports injuries. Among them, the most severely affected area is the shoulder joint. Therefore, it is crucial to promptly strengthen the functional rehabilitation training of the injured area, research and design unique movement pattern training for weightlifting athletes, and improve the efficiency of power transmission in the shoulder joint kinetic chain. These are important pathways to effectively reduce the occurrence of sports injuries and enhance the combat effectiveness of weightlifting athletes.

From the results of the FMS test for weightlifting athletes, it is observed that 50% of the athletes experience shoulder joint pain. Further research reveals that among the 6 weightlifting athletes, the highest score is 20 points, the lowest score is only 9 points, and the average score is 15.5 points. This reflects an extremely high potential injury risk among them, which requires significant attention. Concerningly, out of the 6 athletes, only 2 individuals are able to achieve a safe score of 18 points or higher, highlighting the urgent need for targeted training to address weaknesses and reduce the likelihood of sports injuries, ensuring that weightlifting athletes possess high-quality combat capabilities.

Concerning the causes of sports injuries in the weightlifting athletes, firstly, sports injuries stem from systemic fatigue. After high-intensity training, athletes experience a comprehensive decline in physical function, movement control, etc. If they persist in training loads beyond their capabilities, various sports injuries are more likely to occur[10-12].

Secondly, sports injuries arise from localized fatigue. During training, certain key movement segments or weak areas of the body undergo prolonged stress, resulting in a decrease in muscle strength in these weak areas while overall capacity remains relatively intact. In technical training, local strength may not keep pace with the demands of overall capability, leading to injury.

Thirdly, insufficient warm-up activities and lack of concentration can also lead to sports injuries. Athletes must undergo adequate warm-up activities before engaging in high-load strength and technical training. If warm-up time is insufficient, the number of movements is inadequate, intensity is insufficient, movement speed is not well controlled, muscle sensations are inadequate, or the interval between sets is too long or too short, it fails to meet the requirements of physical preparation, coordination, and adaptation. As a result, entering maximum intensity training and competitions can easily lead to muscle, joint, ligament, and soft tissue injuries due to inadequate adaptation and coordination in various movement segments.

During the training process, improper movement techniques and uncoordinated exertion are also potential risk factors for sports injuries[13]. Reasonable movement techniques not only allow the body to fully exert its maximum physical capacity but also ensure that the bones and muscles in each movement segment form a reasonable structure. The timing, magnitude, and direction of force exertion are all important components of completing a movement. Prevention of excessive force or imbalance during exertion can help prevent sports injuries. Instances of sports injuries due to the existence or occurrence of clearly unreasonable movement techniques have been observed in ample practice[14].

Unreasonable training loads and methods are significant contributors to the widespread occurrence of sports injuries. If training loads are excessive, especially if the intensity is too high without prior adaptation and preparation, injuries are more likely to occur. Improper combinations of load intensity and volume, as well as irrational changes in load intensity and volume, such as simultaneously increasing intensity and volume, can also lead to sports injuries. Furthermore, improper training arrangements are a common major cause of sports injuries. Athletes with low functional levels who fail to receive sufficient adjustment and recovery are particularly vulnerable. Rushing into training loads, especially intensity, after long-term interruptions due to injury or other reasons, can lead to acute injuries and chronic fatigue-related sports injuries upon resuming training.

5. Summary

In summary, the trunk and lower limb strength of weightlifting athletes are at relatively high levels, but their shoulder flexibility, lumbar-sacral joint, and lower limb flexibility are relatively weak. The most common injury sites for weightlifting athletes are the shoulder joint, knee joint, and lumbar vertebrae. Specialized training leads to imbalances in muscle strength on both sides of the spine in weightlifting athletes, and the scapula and humerus on the dominant arm side are prone to abnormal wear, leading to shoulder joint pain. Weightlifting athletes have developed a body training system that conforms to their professional characteristics during long-term training practices, especially in specialized weightlifting skills training, where a unique training model has been established. FMS testing can assist coaches and athletes in evaluating and improving movement techniques, enhancing strength and skills, and proposing recommendations for improving training to reduce the likelihood of sports injuries.

6. References

- [1] COOK G . Athletic Body Balance[M] . Champaign: Human Kinetics, 2001.
- [2] COOK G, L BuRT(N), B HOOGENBOOM . The use of fundamental movements as an assessment of function-part 1[J] . North Am J Sports Phys Ther, 2006, 1: 62-72 .
- [3] COOK G, L BuRT(N), B HOOGENBOOM . The use of fundamental movements as an assesement of function-part 2[J] . North Am J Sports Phys Ther, 2006, 1: 132-139 .
- [4] APPEI B M . The Capability of the Functional Movement Screen to Predict Injury in Division I Male and Female Track and Field Athletes[M] . Utah: Utah State University, 2012 .
- [5] PARCHMANN C , J MCBRIDE . Relationship between functional movement screen and athletic performance[J] . J Strength Cond Res, 2011, 25(12): 3378-3384 .
- [6] FROHM A, A HEIJNE, J KOWAISKI, et al . A nine-test screeningScreen battery for athletes: A reliability study[J] . Scand J Med Sci Sports, 2012, 22(3): 306-315 .
- [7] KIESEL K, P J PLI SKY, P KERSEY . Functional movement test score as a predictor of time-loss during a professional football team's pre-season[J] . Med Sci Sports Exe, 2008, 40(5): S234 .

- [8] OCONNOR F G, P A DEUSTER, J DAVIS, et al .Functional movement screeningScreen: Predicting injuries in officer candidates[J] . Med, 2011, 43(12): 2224-2230 .
- [9] BHK F, M KOEHLE . Normative data for the functional movement screen in middle-aged adults[J] . J Strength Cond Res, 2013, 27(2): 458—462.
- [10] PEATE W F, G BATES, K LUNDA, et al . Core strength: A new model for injury prediction and prevention[J] . J Occupational Med Toxicology, 2007, 2(3): 1-9 .
- [11] KIESEL K, P J PLISKY, M L VOIGHT . Can serious injury in professional football be predicted by a preseason functional movement screen?[J] . North Am J Sports Phys Ther, 2007, 2(3): 147-158 .
- [12] WIECZORKOWSKI M. Functional Movement ScreeningScreen as a Predictor of Injury in High School Basketball Athletes[M]: The University of Toledo, 2010 .
- [13] BROWN M, The Ability of the Functional Movement Screen in Predicting Injury Rates in Division I Female Athletes[M] . University of Toledo, 2011 .
- [14] KIESEL K, P PLISKY, J E BUTLER . Functional movement test scores improve following a standardized off-season intervention program in professional football players[J] . Scand J Med Sci Sports, 2011, 21(2): 287-292 .