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The Effect of FIFA +11 Program on Functional Movement Screen Scores of Junior Soccer Players

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ABSTRACT

Background. Insufficient movement patterns may expose athletes to injury, so it is vital to recognize and rectify these movement patterns. **Objectives.** The purpose of this study was to assess the fundamental movement patterns and determine the effect of a four-week FIFA+11 program on functional movement screen (FMS) scores of junior soccer players. **Methods.** A pre-test post-test quasi-experimental design with an intervention and control group was chosen for the present study. The sample consisted of 28 players at the Rasht education system soccer academy. The players first completed the FMS tasks and then were randomly divided into intervention (n=14) and control (n=14) groups. The intervention group then participated in FIFA+11 for four weeks (three times a week) while control group followed their ordinary warm-up program during this period. After four weeks, both groups completed the FMS tasks and the pre-test and post-test results were compared. **Results.** The results indicated a significant difference in FMS scores in the intervention group between baseline and post-intervention scores ($p = 0.001$). No significant difference was found in these scores for the control group ($p = 0.082$). It is showed a significant difference in FMS scores between the intervention and control groups after intervention ($p = 0.001$). A 57% increase was observed in the number of intervention group players who achieved a score above the injury threshold (14) after four weeks of intervention. A 36% decrease in asymmetry was also observed in the intervention group. **Conclusion.** It appears that the FIFA+11 program improved the fundamental movement patterns of the junior soccer players. It is suggested that coaches use FIFA+11 to improve the quality of movement of players and encourage them to exercise using correct movement patterns to avert injury.

KEY WORDS: ***FIFA+11, Functional Movement Screen Test, Soccer, Fundamental Movement Patterns.***

INTRODUCTION

Soccer is one of the most popular sports in the world. The popularity of this sport increases day-by-day and the rapid increase in the number of participants, particularly teenagers and young adults, has increased the rate of injury in these players (1, 2). The rate of injury among male soccer players has been estimated to be 10 to 35 per 1000 hours of competition (3). The increase in sports-related injury has prompted pre-season screening of athletes in competitive and professional sports (4, 5) to prevent injury and promote performance strategies (4, 5).

Cook *et al*. (2006) introduced the functional movement screen (FMS) (4, 5) after considering pre-season screening and factors relating to its implementation. FMS includes seven movement tests which can identify limitations, asymmetry and changes in fundamental movement patterns.

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These tests have been designed to investigate the interaction between movement chain mobility and the stability required to implement functional movement patterns (4,5). Studies which have investigated the relationship between FMS and injuries have found that FMS scores can be used to predict injury (6-8).

It has been reported that athletes who score 14 or less (injury threshold) on the FMS were four times more likely to be injured (9). Another study revealed that, when their past history of injury was considered, athletes with an FMS composite score of 14 or less had a 15-fold increased risk of future injury (10). It has been observed that players with asymmetric FMS scores, regardless of total score, had a 2.3-fold increased risk of injury (11). It is necessary to identify soccer players who use compensatory movement by assessing their movement patterns, which are the foundation of individual movement skills and performance. It is also vital to improve individual movement quality by implementing intervention programs.

Kiesel *et al*. (2011) examined whether or not players with FMS scores below 14 could improve after implementing an intervention program. After intervention, it was shown that the program significantly increased player scores to above the injury threshold and decreased movement asymmetry (12). It should be noted that the lack of a control group made it difficult to determine the effectiveness of the program. Cowen *et al*. (2010) considered firefighter FMS scores after implementing an intervention program and reported that individual scores increased significantly (13). Nonetheless, there was also no control group in this study and the participants performed extra-program physical activity, which might have affected the results.

Contrary to the above results, after implementing an intervention program, Frost *et al*. (2012) observed no significant increase in FMS scores of the intervention group in comparison with those of the control group (14). The researchers cited several factors which could have effected the results. For instance, the corrective programs were designed by researchers after taking into account the primary scores of the individuals in the FMS test. The participants were trained on how to perform the movements by their club trainers, who were not informed about their trainees' FMS scores. In addition, it was not stated whether or not these club trainers had the necessary experience or qualifications for implementing or monitoring the corrective movements.

One injury prevention program presented by FIFA Medical Assessment and Research Center (F-MARC) is the comprehensive warm-up program called FIFA+11. This program includes running, strengthening and balance exercises along with jumping, sprinting, and special soccer movements (15). Soligard *et al*. (2008) studied the effect of this program and showed that overall, the occurrence of injury in the intervention group was 32% lower than that in the control group. Moreover, severe injuries decreased by 45% after implementation of this program (15). Brito *et al*. (2010) implemented FIFA +11 for 10 weeks (3 times a week) on young male soccer players and reported that muscle strength and balance increased in their knee extensors and flexors (16). It has been reported that FIFA +11 improved soccer player strength, balance and proprioception (17-20). Nevertheless, the effect of FIFA +11 as a comprehensive warm-up program on FMS test results for assessing the quality of fundamental movement patterns and identifying inefficient movements in individuals has not yet been investigated. It is not known whether FIFA +11 is simply an exclusive warm-up program or if it can improve the quality of individual movement patterns. The present study evaluated the movement quality of junior soccer players using the FMS test and determined the effect of the four-week FIFA +11 program on improving FMS scores.

MATERIALS AND METHODS

Participants. A convenience sample of 28 players were recruited from Rasht education system soccer academy and randomly divided into control and intervention groups. The control group (n = 14) had a mean age of 14.46 ± 0.24 years, height of 1.58 ± 0.07 m, weight of 53.71 ± 6.37 kg and body mass index (BMI) of 21.24 ± 1.19 kg/m^2. The intervention group (n = 14) had a mean age of 14.35 ± 0.26 years, height of 1.58 ± 0.06 m, weight of 50.71 ± 6.47 kg and BMI of 20.20 ± 1.84 kg/m^2. A subject was included if he had a composite score below the injury threshold

of 14. Exclusion criteria were a recent (within the previous 8 weeks) musculoskeletal injury that was likely to affect motor performance on the FMS (21). Subjects with physical impairments were also excluded. The subjects and their families were required to read and sign consent forms approved by Guilan University Review Board.

Functional Movement Screen. The FMS is comprehensive screening program that assesses the quality of fundamental movement patterns to identify an individual's limitations or asymmetries (4,5). The FMS includes seven tests which are scored on a 0-3 ordinal scale. The seven tests are the squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, push-ups and rotary stability. A score of 3 denotes perfect performance of the movement, 2 denotes some compensatory movements observed during completion of the movement, 1 indicates that the movement was not completed and 0 denotes pain present during the movement. Each test is done 3 times and the best performance is recorded. The total score out of 21 is considered.

The reliability of the FMS has been established in a study which reported kappa values from 0.80 to 1.00 (22). All seven tests are performed and scored. Five of the tests (hurdle step, in-line lunge, shoulder mobility, active straight leg raise and rotary stability) are scored separately for the right and left sides of the body. Because there is an established relationship between neuromuscular asymmetry (right versus left) and injury risk, it is a common practice to track right- versus left-sided differences. The instruments used in the FMS kit are a measuring device, hurdle step, stretch bands and measuring stick.

Intervention. The FIFA +11 warm-up exercises were obtained from the FIFA website (http://f-marc.com/11plus/). The warm-up program was developed by a group of experts convened by FIFA with representatives from the Oslo Sports Trauma Research Center, Santa Monica Orthopedic and Sport Medicine Research Foundation and FIFA Medical Assessment and Research Centre. The first part of the program comprised running at a low speed, active stretching and controlled contact with a partner. The running course included 6 to 10 pairs of cones. The second part consisted of strength, balance, jumping and Nordic hamstring exercises. The final part was speed running combined with soccer-specific movements with sudden changes in direction (15).

Data collection. In the first meeting, the subjects were given necessary information about the FMS test and research procedure and those who were willing to take part signed the consent letter. All the individuals participated in FMS testing and their demographic information (age, height, weight, and BMI) was recorded. These individuals were divided into intervention and control groups. Both groups underwent four-weeks of soccer training (3 times a week; 1.5 hours a session). All training stages, except the warm-up stage, were similar for both groups. In the warm-up section, the intervention group carried out the FIFA +11 program for 20 to 25 minutes. The control group followed its normal warm-up program of 10 to 12 minutes of slow running and 10 to 15 minutes of dynamic and static stretching. At the end of the fourth week, both groups again completed FMS testing and the composite pre-test and post-test scores were compared. The data was collected by a certified athletic trainer. The composite score for all seven movements of the FMS in the pre-test was recorded and then compared with the post-test composite scores.

Statistical Analysis. The Shapiro-Wilk test was performed initially to determine normality in the data. All data are presented as mean ± standard deviation and statistical significance was set at $p<0.05$. Dependent and independent t-tests were performed using SPSS (version 22).

RESULTS

Table 1 shows the individual characteristics of the control and intervention groups. The two groups showed no significant difference in terms of these variables.

The results showed that after implementing FIFA +11 program, 57% of individuals in the intervention group scored above 14. No change was observed in the control group. The number of individuals in the intervention group with movement asymmetry decreased from 11 to 6 after completion of FIFA +11. No change was observed in the control group (Table 2).

Table 1. The participants' descriptive information and characteristics (mean ± standard deviation)

Variable	Control Group (n=14)	Intervention Group (n=14)	t
Age (Year)	0.24± 14.46	0.26 ±14.35	0.246
Height (Meter)	0.07 ± 1.58	0.06 ± 1.58	0.873
Weight (Kg)	6.37 ± 53.71	6.47 ± 50.71	0.228
Body Mass Index (kg/m^2)	1.19 ± 21.24	1.84 ± 20.20	0.088

Table 2. Number and percentage of those participants who had asymmetry and a score of 14 or less before and after the implementation of FIFA +11 program

Variable	Group	Time	14 or less (n)	14 or less (%)	More than 14 (n)	More than 14 (%)	Asymmetry (n)	Asymmetry relative to the total (%)
FMS total score	Control (n=14)	Pre-test	14	100%	0	0%	7	50%
		Post-test	14	100%	0	0%	7	50%
	Intervention (n=14)	Pre-test	14	100%	0	0%	11	78%
		Post-test	6	43%	8	57%	6	42%

The results indicate that after 4 weeks of implementing FIFA +11, there was a significant change in intervention group scores post-intervention in comparison with at baseline; however, this change was not observed in the control group (Table 3).

Table 3. Paired t-test results of control and intervention groups before and after implementation of FIFA+11 in FMS

Variable	Group	Time	Mean±SD	t	df	p
FMS total score	Control	Pre-test	12.50±0.94	-1.883	13	0.082
		Post-test	12.71±0.99			
	intervention	Pre-test	12.36±1.00	-4.627	13	0.001*
		Post-test	14.36±2.37			

* significant at p<0.05

Table 4 shows that there was a significant difference in total FMS scores between groups after intervention. Individuals in the intervention group had higher composite scores.

Table 4. Independent t-test results of control and intervention groups with or without implementation of FIFA+11 in FMS

Variable	Group	Mean±SD	Means Difference	t	df	p
FMS total score	Control	0.21±0.42	1.78	3.995	26	0.001*
	Intervention	2.00±1.61				

* significant at p<0.05

DISCUSSION

The results of the present study showed that FIFA +11 significantly increased the FMS scores of the intervention group when compared to the control group. FMS examines the fundamental movement patterns of individuals and their movement quality by testing a set of movements which require balance and coordination between body movement chains (4, 5). If an individual does

not have the necessary stability and mobility to perform a movement, he cannot properly complete the movement and will use compensatory movements to complete the task. If these compensatory movements are not corrected, they will become entrenched in the individual as movement patterns which will be used unconsciously during training and can increase the likelihood of injury (4, 5).

The results show that FIFA +11 is a soccer-specific warm-up program which can improve power, balance, core stability and proprioception (17-20). It can improve the movement patterns and quality of junior soccer players. It will train individuals to perform sports movements more efficiently. It appears that the positive change in movement patterns originates from FIFA +11 training and attitude. It is necessary, for instance, to maintain the knee and leg position while landing or leaping. This should be done in order to prevent knee valgus, which can cause anterior cruciate ligament (ACL) injury (23-25). This has been considered in FMS for the squat movement; if an individual has knee valgus, they will not obtain a complete score and their movement will register as compensatory.

The exercises and movements in FIFA +11 resulted in significant improvement of movement quality in the intervention group in comparison with the control group, who followed the normal warm-up program. Squat exercises in FIFA +11 are examined as a deep squat in the FMS. Lunge exercises are evaluated in FMS with an in-line lunge movement. Bench item movement and single-leg standing balance are required for FMS trunk stability push-ups and the hurdle step. Neuromuscular coordination exercises are used in the FMS rotary stability movement. Sideways bench item exercises and bench items to strengthen thigh muscles, which can help the participant to properly perform the FMS active straight leg raise movement (26, 27).

Studies on American football players (12), firefighters (14) and martial artists (28) show improvement in the FMS scores after implementation of intervention programs. In Kiesel (2011) and Cowen (2010), the lack of a control group made it difficult to interpret the results. A study on martial artists by Bodden *et al*. (2015) showed significant improvement in FMS scores after four weeks, but no significant change after eight weeks (28). The researchers concluded that a four-week intervention program is sufficient to improve movement quality. Frost *et al*. (2012) found no significant improvement in their intervention group in comparison with the control group after implementing the intervention program (14). Participant occupation and age and the research methodology used could have affected the results of their research.

In the present study, after implementing FIFA +11, 57% of individuals in the intervention group obtained scores greater than 14, while no change was observed in the control group. These results can be compared with the observations made by Bodden *et al*. and Kiesel *et al*. who reported a 66% and 52% increase, respectively, in the number of individuals who score higher than 14 (12, 28). The results of the present study showed a 36% decrease in the number of asymmetries in the intervention group after intervention; however, no change was observed in the control group. Of the asymmetries (n=18) observed in the pre-test stage of both groups, 55% (n=10) were for shoulder mobility movement. One reason for this result is that the upper limbs are used less often than the lower limbs in soccer, which is why individuals give less attention to strengthening and mobility exercises of this part of the body. Moreover, individuals are more willing to strengthen anterior muscles, such as pectorals and abdominals, rather than back muscles, which could result in muscle imbalance. These imbalances might lead to kyphosis and rounded shoulders (29-32). This condition decreases shoulder girdle mobility, which is a required element for optimal implementation of the FMS shoulder mobility movement.

CONCLUSION

Functional movement screening (FMS), along with pre-season evaluations or alongside exercises designed to determine

player movement quantity can be used to determine player movement quality. Having realized that FMS test can identify movement inefficiency, implementing a program like FIFA +11 which has been shown to prevent injury, improve the physiological variables required in soccer and improve individual movement quality, appears necessary. Implementation of FIFA +11 gives trainers the opportunity to teach their players to perform the exercises with the proper movement patterns to avert future injury.

APPLICABLE REMARKS

- Soccer coaches can implement FIFA+11 as a comprehensive warm-up to decrease injuries and to improve movement quality of players by allowing them to exercise more efficiently.
- It is recommended that soccer coaches use screening tests like FMS besides physical fitness tests to recognize individuals who are disposed to injury.

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