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Original Research

The Effect of the Eight-Week FIFA 11+ Injury Prevention Program on Adolescent Footballers' Functional Movement Screen Scores

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ABSTRACT

Sports carry the highest risks of injury and adolescents are more injury-prone than other age groups in this respect. The FIFA 11+ has been thus introduced as an injury prevention program and the Functional Movement Screen (FMS) can be used as a tool to predict injuries. Therefore, this study, with a quasi-experimental research design and experimental/control groups using pretest/posttest, aimed to assess the effect of the eight-week FIFA 11+ injury prevention program on adolescent footballers' FMS scores. For this purpose, 50 adolescent male football players were randomized into experimental or control groups. The experimental group accordingly received the FIFA 11+ training for eight weeks, three sessions per week and 20 min each session, but the control group only performed routine exercises. Before and after the injury prevention program, all the participants completed the FMS tests. The results revealed that the FMS score was lower than 14 for each group at the pretest stage, but this value significantly elevated to over 14 for both groups after implementing the eight weeks of traditional and FIFA 11+ programs ($p<0.05$). However, there was a significant growth in the scores of the group receiving FIFA 11+ as compared with the controls performing the traditional training ($p<0.05$). These results demonstrated that both traditional and FIFA 11+ training programs could reduce the risks of injuries in adolescent footballers, but FIFA 11+ had more effects on injury prevention, which could be explained by stabilization, muscle strength, and proprioceptive and postural alignment during the FIFA 11+ program, making it a better exercise to prevent injury.

Keywords: FIFA 11+, Functional Movement Screen, Adolescent, Sport Injury, Football

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INTRODUCTION

Sports carry the highest risks of injury, so particular injury profiles have been thus far developed for each sport (1). In this sense, football is the world's most popular sport, especially in Iran (1-3), which has a high risk of injury for players, like other sports, both at professional and amateur levels and in all age groups (2, 4). The ascending trend in injuries in sports leads to some public health concerns in terms of the burden on health care systems, financial losses, as well as time lost for education and productivity (1, 2, 5). Accordingly, the effective movement proficiency for safe and effective long-term exercise in adolescent players is of utmost importance (6-9).

One such structured program is the FIFA 11+ injury prevention program, developed in collaboration with national and international experts under the leadership of the FIFA Medical and Research Centre (F-MARC), to reduce the incidence rate of common football-related injuries (2, 10-15). FIFA 11+, as a simple and easy to implement injury prevention warm-up program in sports, is comprised of 10 structured exercises, supported by print and online materials. FIFA 11+ is the replacement of FIFA 11 with a different focus and a number of additions. This training program includes exercises, which mainly concentrate on core stabilization, eccentric training of thigh muscles, proprioceptive training, dynamic stabilization, and plyometric drills performed with good postural alignment. Of note, the program requires no technical equipment other than a ball, and it can be completed in 10-15 min after familiarization (2, 10-14).

In this regard, Barnego et al. (2014) had assessed the impact of FIFA 11+ on injury prevention in football players in a review article (2), and reported considerable reductions in the number of injured players, ranging between 30% and 70%, among the teams that had implemented this program. In addition, players with high compliance with FIFA 11+ had shown an estimated risk reduction in all injuries by 35% and even significant improvements in the components of the neuromuscular and motor performance when participating in structured warm-up sessions at least 1.5 times/week. As well, Silver et al. (2014) had evaluated the efficacy of FIFA 11+ in the male collegiate footballers (13) and reported that the given program had significantly minimized injury rates and time losses in the players recruited in this study in a statistically significant manner. Besides, a significant decline had been observed in the anterior cruciate ligament (ACL) injuries, hamstring injuries, and ankle sprains in the intervention group compared with the controls.

Numerous methods have so far developed for assessing movement proficiency, including Functional Movement Screen (FMS), which has been examined in previous literature. The FMS was originally designed to assess muscle flexibility, strength imbalance, and general movement proficiency in a range of performance tests, identify functional deficits related to proprioception, mobilization, and stabilization, and determine the existence of pain during any of the prescribed movement patterns (6, 16-22).

Shojaedin et al. (2014), in a survey, had further reflected on the relationship between the FMS score and the history of injury, and had thus identified the predictive value of the FMS for injuries (18). They had correspondingly reported that a player could have an approximately 4.7 times greater chance of suffering lower extremity injury during a regular competitive season if they had scored lower than 17 on the FMS. They had also recruited football, basketball, and handball players, and had provided the FMS reference value of university-level ones. In another study, Lee et al. (2018) had exploited the FMS to compare the preparatory and comparative periods in high school baseball players (16), and had found that the FMS individual task and total composite scores differed significantly between the preparatory and competitive periods. Nevertheless, the low sensitivity and negative predictive value as well as the area under the curve (AUC) scores had indicated that the FMS had not accurately predicted the risk of injury. Therefore, the FMS could be used as a tool to identify physical deficiencies between distinct training seasons; however, utilizing it as a screening tool for injury prediction in particular during the competitive period in this population would not be recommended.

Despite the growing interest in the use of the FMS within athletic development programs, no published reports have thus far examined the effect of the FIFA 11+ injury prevention program on the FMS scores of adolescent footballers, to the best of the authors' knowledge. Therefore, the present study was to investigate the effect of the eight-week FIFA 11+ on the FMS scores of adolescent football players.

METHODOLOGY

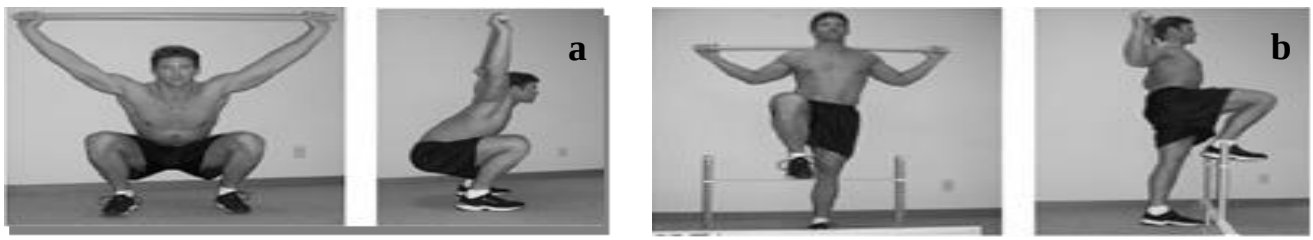
Participants

In total, 50 adolescent male footballers (age: 12.17±1.32; height: 136.13±8.2 cm; weight: 36.2±6.3 kg), as the convenient samples in a football school, voluntarily participated in this study. A-priori power two-way analysis of variance (ANOVA) software (G*3 Power) also revealed that a sample size of at least 24 participants were required for a statistical power of 0.80 at an effect size of 0.80 and an alpha level of 0.05 (23, 24). Moreover, the inclusion and exclusion criteria were having 3-5 years of football training, no lower extremity injury in the previous six months, no history of surgery on lower extremities, neuromuscular injuries, no head or spinal injury or visual, vestibular, or balance disorders, no pain and abnormality in extremities, and missing no two consecutive or three non-consecutive training sessions. The participants with previous FIFA 11+ training or the FMS experience were also excluded to avoid the possibility of bias caused by familiarization (24). The participants and their parents were further informed about the research objective and procedures, and each one voluntarily provided written informed consent before participation. The participants were also free to withdraw from the study if they did not want to do so or felt dissatisfied. As well, they were randomly divided into two groups: intervention and control (n=25 per group). The intervention group performed the FIFA 11+ program for eight weeks, three sessions per week and 20 min each session (10, 25).

FIFA 11+ is a comprehensive warm-up program with six running exercises at the beginning, three exercises to activate the cardiovascular system at the end, and six specific preventive exercises focusing on core and leg strength, balance, and agility with three progressive levels for each exercise, as well as lower extremity and trunk alignment cues. It takes about 20-25 min to be completed, and requires a minimum of equipment (namely, a set of cones and balls) (12). During this period, the control group performed only their traditional warm-up program that included 20-min running, stretching, and flexibility training.

Procedure

An applied quasi-experimental research design with experimental/control groups using pretest/posttest was adopted in this study. For both pretest and posttest, the participants completed a 10-min dynamic warm-up, including 3 min of sub-maximal multidirectional running and 7 min of light dynamic mobilization and activation exercises targeting the main muscle groups of upper and lower extremities. Following the warm-up and given the opportunity to familiarize with the test protocols, all the participants completed the FMS, developed by Cook and Burton, which was comprised of seven fundamental movement tasks and three clearance tests. Each FMS was further scored using an ordinal scale (0-3) to obtain a composite value (0-21). The score of 3 was thus given for performing the specific movement perfectly, the score of 2 was assigned when the movement was completed with some compensatory movements observed, the score of 1 was assumed when the subject could not complete the movement, and the score of 0 was associated with pain being present during the movement. The FMS also included deep squat, hurdle step, in-line lunge, shoulder mobility test, active straight leg raise, trunk stability pushup, and rotary stability test (16).



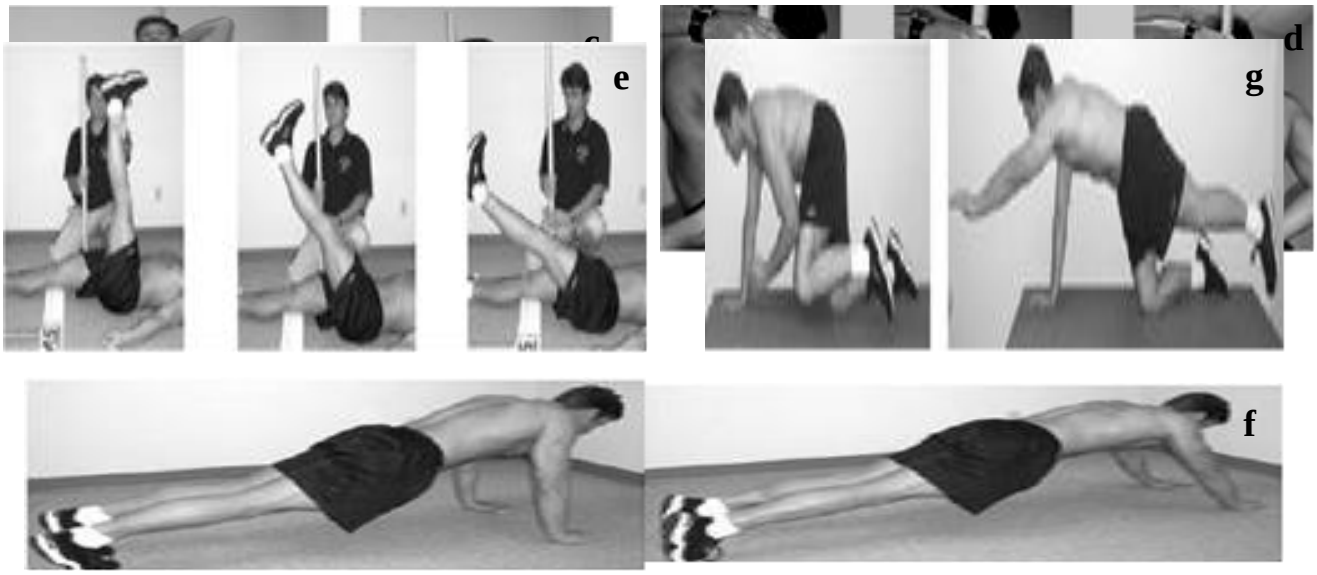


Fig. 1. The FMS tests, including deep squat (a), hurdle step (b), in-line lunge (c), shoulder mobility test (d), active straight leg raise (e), trunk stability pushup (f), and rotary stability (g)

Statistical Analysis

The raw data were summarized into the Excel software, and then analyzed using the SPSS (ver. 26) software package. The distribution of the raw data sets was also checked using the Kolmogorov-Smirnov test, demonstrating that all the data had a normal distribution ($p>0.55$). Therefore, the parametric independent-samples t-test (viz. the comparisons between groups at the pretest stage and the amount of pretest-posttest changes between the groups) and the paired-samples t-test (i.e., the intergroup comparison) was used to analyze the FMS total scores.

RESULTS

The participants' demographic characteristics are presented in Table 1. There was no significant difference between both groups for height, weight, and age ($p>0.05$).

Table 1. Demographic characteristics (mean±standard deviation [SD])

Group	Height	Weight	Age
Control	138 ± 13.1	36.95 ± 8.47	12.5 ± 1.18
Training	133 ± 13.3	35.46 ± 7.1	11.9 ± 1.5

The mean (±SD) values of the FMS scores are illustrated in Table 2. This score is the sum of seven test values, wherein each test has 0-3 scores.

Table 2. Descriptive pretest and posttest statistics (mean±SD) of the FMS score

Group	Pretest	Posttest	Differences
Control	12.91 ± 2.13	14.4 ± 1.94	1.5 ± 1.26
Training	13 ± 2.11	15.86 ± 2.31	2.24 ± 1.4

The independent-samples t-test results showed no significant differences between the groups at the pretest stage ($p=0.78$). Then, the differences between the posttest and pretest were calculated for each group to remove the slight pretest difference (viz. difference=posttest-pretest), and then compared between the groups. Finally,

a significant difference was observed between the groups at the pretest/posttest stage ($p \leq 0.05$) (Table 3, Fig. 2).

Table 3. Baseline (pretest) and post-intervention (FIFA 11+ and control) results (mean±SD) for the FMS score (*: significant differences)

Group	DF	T	Sig
pretest	45	-0.499	0.62
Posttest	45	1.875	0.045 *

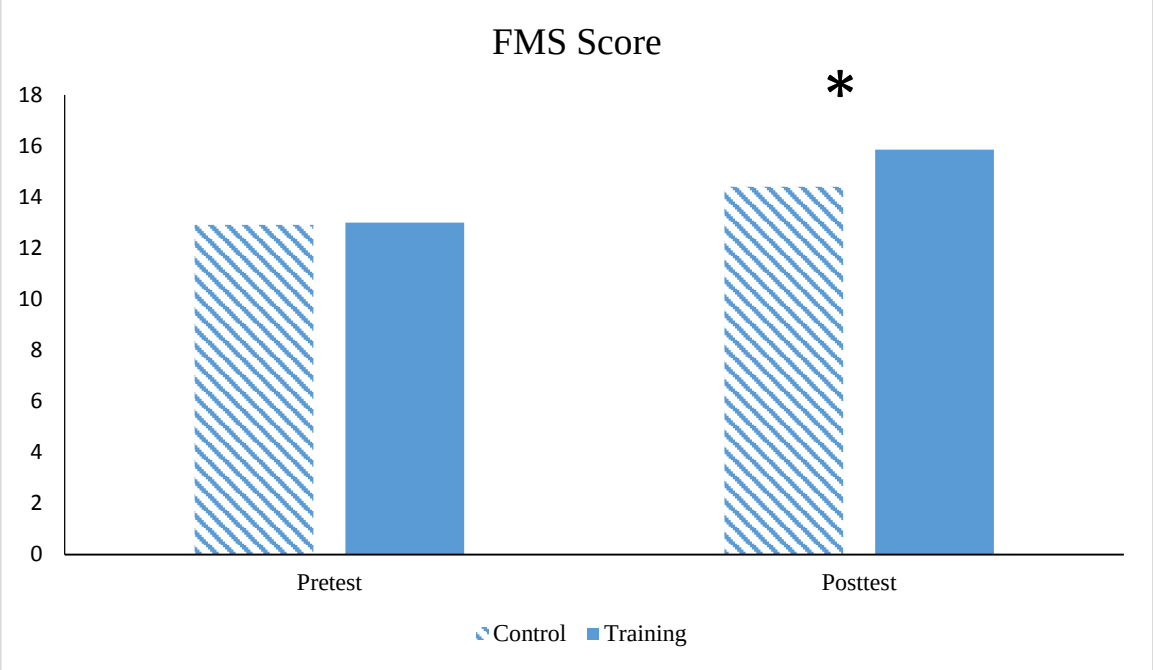


Fig. 2. The FMS score at the pretest/posttest stages for both groups (*: significant differences)

DISCUSSION

This study was to determine the effect of the eight-week FIFA 11+ injury prevention program on adolescent footballers' FMS scores. The results showed that the eight-week FIFA 11+ program had a significant effect on the FMS value, which was lower than 14 for each group at the pretest stage. After eight weeks of traditional and FIFA 11+ training, the FMS score in both groups expanded to over 14.

The FMS can be thus used as a tool to predict injuries. Of note, the ability to predict injuries is equally as important as that to evaluate and treat them. According to the study results, the FMS score was lower than 14 for each group at the pretest stage. Previous studies had further demonstrated that the given score had indicated the high probability of injury incidence (21, 26, 27). In this respect, Krumrei et al. (2014), Zandi et al. (2017), and many others had reported that individuals scoring less than 14 had a higher likelihood of injury (21, 26-30). Preventing injury is also one of the main responsibilities of sports medicine teams at all levels of athletics (XXX). Poor functional movement capability resulting from strength and range-of-motion (ROM) as well as biomechanical abnormalities might be accordingly expected following athletic injury (31). After training, the FMS score in both groups increased to over 14, denoting a reduced risk of injury. However, the FMS score following the FIFA 11+ warm-up program boosted significantly more than that in the traditional training, which showed more impact ($p<0.05$).

To the best of the authors' knowledge, there were no studies assessing the effect of the FIFA 11+ injury prevention program on the FMS score, but there is much research, reflecting on football-related injuries and

the effects of FIFA 11+. The majority of such studies have merely reported that FIFA 11+ has reduced football injuries that were consistent with the findings of the present research (1, 2, 13, 14, 24, 32, 33). They have further reported considerable drop in the number of injured players among the teams implementing FIFA 11+. As well, there are reports on no significant effect of the FIFA 11+ training program. In this sense, Steffen et al. had shed light on injury prevention in female youth footballers but failed to show risk reduction upon training with FIFA 11+ warm-up program, maybe due to low compliance by the intervention group (34). As well, Hammes et al. had reported no preventive effects in their study (35), which was due to some differences in population characteristics between the studies. Walden et al. had also assessed another neuromuscular warm-up program, reporting the significantly reduced incidence rate of the ACL injury in female adolescent football players (36). This was in line with the findings of the present study, suggesting that the traditional warm-up program had decreased the possibility of injuries. A number of other studies had similarly demonstrated that prevention programs could minimize the incidence of injuries in footballers (1, 37-39).

The FMS score was accordingly comprised of seven fundamental movement task scores and each test could be affected by training and screening body mobility and stability movement control in players. On the other hand, the FIFA 11+ injury prevention program included several exercises, focused on core stabilization, eccentric training of thigh muscles, proprioceptive training, dynamic stabilization, and plyometric drills performed with good postural alignment. The significant difference in the FMS scores between the traditional and FIFA 11+ training programs was probably attributed to the similarity of the FIFA 11+ program items to the FMS tests. Anyway, these tests could serve to pinpoint functional deficits related to proprioceptive, mobility, and stability weaknesses; therefore, FIFA 11+ rather than traditional training can be more effective in reducing injuries.

CONCLUSION

The results of the present study showed that the traditional and FIFA 11+ injury prevention programs augmented the FMS scores, indicating the reduced risk of injury. However, FIFA 11+ was more effective in terms of injury prevention, explained by the effects of the program on stabilization, muscle strength, as well as proprioceptive and postural alignment, which could make it a better exercise to prevent injuries.

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چکیده فارسی

اثر ۸ هفته تمرینات فیفا +۱۱ بر نمرات غربالگری حرکات عملکری فوتبالیست های نوجوان

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ورزش همیشه با آسیب های ورزشی همراه است و نوجوانان حساسیت بیشتری نسبت به آسیب ها دارند. برنامه گرم کردن فیفا +۱۱ یکی از روش های تمرینی جلوگیری از آسیب بوده و غربالگری حرکات عملکردی یکی از روش های پیش بینی احتمال آسیب است. از همین رو، هدف از پژوهش حاضر بررسی تاثیر ۸ هفته تمرینات فیفا +۱۱ بر نمرات غربالگری حرکات عملکردی فوتبالیست های نوجوان بود. مطالعه حاضر یک مطالعه نیمه تجربی با گروه کنترل، و طراحی پیش آزمون و پس آزمون می باشد. ۵۰ فوتبالیست مرد جوان به صورت تصادفی در دو گروه کنترل و تجربی قرار گرفتند. گروه تجربی تمرینات فیفا +۱۱ را به مدت ۸ هفته، سه جلسه در هفته و ۲۰ دقیقه در هر جلسه انجام دادند. در طی این مدت، گروه کنترل تمرینات روزمره خود را انجام می دادند. قبل و پس از تمرینات همه آزمودنی ها تست های غربالگری حرکات عملکردی را تکمیل کردند. نتایج نشان داد که نمره غربالگری حرکات عملکردی برای هر دو گروه پیش از تمرینات زیر ۱۴ بوده است و بعد از ۱۴ هفته تمرینات فیفا +۱۱ و سنتی، این نمرات به بالای ۱۴ افزایش یافتند ($P<0.05$)، با این حال گروه تمرینات فیفا +۱۱ نسبت به گروه تمرینات معمولی افزایش معناداری در این نمره داشتند ($P<0.05$). نتایج نشان داد که هر دو تمرینات روزمره سنی و فیفا +۱۱ می توانند ریسک آسیب را در نوجوانان فوتبالیست کاهش دهند، اما تمرینات فیفا +۱۱ اثر بیشتری بر پیشگیری از آسیب دارند، که می تواند به وسیله تاثیر این تمرینات بر ثبات، قدرت عضلانی، حس عمقی و چیدمان وضعیتی توجیه شود و که این تمرینات را به تمرین بهتری برای پیشگیری از آسیب تبدیل می کند.