Appropriateness of FIFA's "The 11" Prevention Training Program for Juvenile Soccer Players-Effects on Physical Performance

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ABSTRACT

Injuries can counter the beneficial effects of sports participation at a young age if a child or adolescent is unable to continue to participate because of residual effects of injury. "The 11" injury prevention programme was developed by FIFA's medical research centre (F-MARC) to help reduce the risk of injury in soccer players aged 14 years and over. The aim of this study was to determine the appropriateness and effectiveness of "The 11" for younger soccer players. Twenty-seven (14 experimental (EXP), 13 control (CON)) young soccer players (age 13.42 ± 1.4 years) participated. The EXP group followed "The 11" training programme 2 days per week, for 6 weeks, completing all of the 11 exercises. Prior to, and after the intervention, the control group performed the usual warm-up training. Both EXP and CON groups performed a battery of football-specific physical tests, including (1) Standing long jump test (explosive leg power), (2) Sargent jump test (vertical leg power), (3) Illinois agility test (agility), (4) Prone hold test (core stability/abdominal muscle endurance), and (5) Running speed test (speed). Changes in performance scores within each group were compared using independent t-tests ($p \leq 0.05$). At the end of the intervention the experimental group showed no changes compared to the control group for explosive leg power (-0.47% vs 0.96%), vertical leg power (2.43% vs 2.50%), agility (0.18% vs -0.64%), muscle endurance (0.30% vs -0.97%) and running speed (0.70% vs 0.47%). There was no difference between the intervention and control groups in the change in performance from the pre to post-test for any of the tests used. In conclusion, no effect was observed on a series of performance tests in a group of juvenile male soccer players using the ''11'' as a structured warm-up program.

Keywords: **FIFA, juvenile, soccer, prevention, players.**

1. Introduction

Soccer is the most popular sport in the world and like common sports is associated with a certain risk of injury for players, both at the competitive and recreational level (Junge and Dvorak, 2004). Unfortunately players get injured during soccer play. Serious knee injuries, such as anterior cruciate ligament injuries, are of particular concern in young soccer players (Myklebust et al., 2003; Olsen et al., 2005).

Consequently, there is every reason to emphasize the prevention of injuries in soccer, and to develop and implement prevention programs for young players as early in their career as possible. Several studies have shown that the incidence of football injuries can be reduced by adopting various injury prevention strategies including: warm-up, with an emphasis on stretching; proper medical attention for injuries; appropriate recovery methods and time; appropriate cool-down; use of protective equipment; good playing field conditions and adherence to existing rules (Caraffa et al., 1996; Dvorak et al., 2000; Hawkins and Fuller, 1999). However, compliance is a concern (Myklebust et al., 2003), and it may be difficult to motivate coaches and players to follow such exercise programs merely to prevent injuries, unless there is a direct effect performance benefit as well.

Exercises used in prevention protocols have also been shown to have performance effects among male football players, such as increased strength (Askling et al., 2003; Mjølsnes et al., 2004). Core stability exercises may improve technical skills and total awareness of the game (Holm et al., 2004; Leetun et al., 2004; Paterno et al., 2004). Comprehensive neuromuscular training programs that combine plyometrics, core strengthening, balance, resistance or speed/agility training may improve several measures of performance concomitantly and at the same time improve biomechanical measures related to lower extremity injury risk (Hewett et al., 2004; Paterno et al., 2004; Myer et al., 2005; Myer et al., 2006).

However, whilst it is clear that sport-specific strength training programmes that include a balance training component are effective in improving physical condition and reducing the risk of injury in mature athletes, little research has considered such strategies in relation to children (preadolescent) and youth (MacKay et al., 2004) Children are skeletally immature and when participating in sport, are susceptible to a range of hard- and soft-tissue injuries (Frank et al., 2007). Indeed, in a recent review (Spinks and McClure, 2007), the significant injury incidence in children participating in football (or soccer) was highlighted. In one study, the injury rate could be as high as 51.2 injuries per 100 player seasons for 11-14 year olds (Yde and Nielsen, 1990).

To address this, Emery et al. (2005) recently highlighted the need to develop suitable injury prevention programmes for children and youths and to determine their effectiveness using a scientific approach. One such predominantly exercise-based, injury prevention programme that may be suitable for young children is “The 11”, which was developed by FMARC, the medical research centre of The Federation Internationale de Football Association (FIFA). “The 11” comprises ten physical exercises and also promotes Fair Play. The exercises focus on core stabilisation, eccentric training of thigh muscles, proprioceptive training, dynamic stabilisation and plyometrics with straight leg alignment.

The programme requires no technical equipment other than a ball, and can be completed in 10-15 minutes (after a short period of familiarisation). The aim of this randomized controlled study was to assess whether the ‘‘11’’ can improve performance in a group of 13 -14 year-old male juvenile soccer players.

2. Methodology

2.1 Participants

The study was conducted during the second half of the 2012-2013 school seasons. With ethical approval, twenty-seven boys (mean ±SD: age 13.42 ± 1.4 yr; body mass: 21.57 ± 1.33 kg/m2; stature: 1.63 ± 1.26 m,) from Libyan secondary school in Malaysia, with 4.3 ± 1.5 years playing experience, participated. To be eligible participants were required to be free from injury. All of the procedures and risks were explained to the players, parents and management of school, with each volunteer providing assent as well as one parent providing written consent to participate. Players were randomly assigned to either an experimental (EXP, n = 14) or a control (CON, n = 13) group.

2.2 The intervention program

The prevention training program the ‘‘11’’ was designed as a warm-up program. The exercises were chosen based on previous research on injury prevention and established principles for rehabilitation of groin, hamstrings, knee and ankle injuries (F-MARC, 2005). The 15-min program includes 10 exercises focusing on core stability, neuromuscular control, eccentric hamstrings strength and agility (Table 1). The 11th component, a focus on fair play, was not emphasized in the present study.

The ‘‘11’’ was introduced to the student in the EXP group by physical education teacher. The intervention program was to be carried out two times a week during soccer training at school. The players in the CON group warmed up as usual, with jogging and ball based exercises. More than 87% of the intervention sessions were supervised by the project coordinator. Player participation in all training sessions, as well as in the ‘‘11’’ for the EXP group in particular, was recorded throughout the study period.

2.3 Physical tests

Before the start of the intervention period and 1 week after the end of the intervention, the players took part in a testing procedure to assess the performance effects of the ‘‘11’’. The testing took place at the Libyan School in Kuala Lumpur-Malaysia. The test battery included five test stations (1) Standing long jump test, (2) Sargent jump test, (3) Illinois agility test, (4) Prone hold test, and (5) Running speed test and was completed within 3-4 h. The tests were conducted in the same order for each player for the pre- and the post-tests. One week before the pre-test, all players participated in a test run to familiarize themselves with the testing procedures. The test run and the pre- and post-tests were led by the same experienced lab personnel. The shoe type used by the players was recorded to ensure that the same equipment was used on both test days.

2.3.1 *Standing long jump test (SLJT)*

The ability to produce explosive leg power may help in the production of a maximum sprinting and jumping effort while playing soccer (Bangsbo, 1993). In this study, the SLJT was used to measure the explosive leg power and followed the procedure as described by Castro-Pinero et al. (2010). The best score from three attempts was recorded as the subject's performance for explosive leg power.

Table 1. The ''11'' Exercises and intensities of the structured warm-up program used (F-MARC, 2005)

Exercises	Intensities
Core stability	
(1) The bench	10 s x 2 repetitions
(2) Sideways bench	10 s x 2 repetitions on each side
Balance	
(3) Cross-country skiing	10 s x one repetitions on each leg
(4) Chest pass in single-leg stance	10 s x 2 repetitions on each leg
(5) Forward bend in single-leg stance	15 s x 2 repetitions on each leg
(6) Figure of eights in single-leg stance	15 s x 2 repetitions on each leg
Plyometrics	
(7) Jumps over a line (sideways, forwards-backwards)	10 jumps of each type
(8) Bounding	2 repetitions in each direction (10 m)
(9) Zigzag shuffle (forwards and backwards)	8-10 jumps x 2 repetitions (10 m)
Strength	
(10) Nordic hamstrings	2 repetitions
Fairplay	N/A

2.3.2 *Sargent jump test (SJT)*

The ability to jump vertically may be required when trying to catch a high ball especially when the opponent is very close to the player, and in which, high short term muscle power is necessary (Chelly et al., 2009). The maximum vertical jump height was measured using the SJT. This involved several steps including warm-up for 10 minutes. The test was conducted according to the procedure as described by De Salles et al. (2012). The players repeated the test for 3 times with 15 rests in between trials. The average value from the 3 trials was used as the score for the vertical leg power.

2.3.3 *Illinois agility test (IAT)*

The ability to produce a quick movement while playing soccer will depend on the player's agility (Robinson & Owens, 2004; Yap & Brown, 2000). In this study, agility was determined using the IAT. The test was performed with the subject positioned in lying down with both hands next to the shoulders. Then, the subject got up and sprinted between and around the cones, back and forth, to touch the finishing line. The total time taken to complete the test was recorded using a stopwatch, and the mean of the best two times was used to assess the subject's performance for agility.

2.3.4 ***Prone hold test (PHT)***

Good core stability is one of the most important components of most high level sports participation. According to Staron et al. (1994), higher core stability performance requires efficient nervous system functions that may lead to better postural control especially during fast dynamic motion. In this study, the PHT was used to assess the core stability or the abdominal muscle endurance. The subject was asked to lie down while supporting the body on the forearms and feet. The elbows were positioned right under the shoulders. Then, the subject lifted the body up (in a straight line) while pulling the stomach in and was instructed to hold the position as long as possible. The time taken to hold this position was recorded using a stopwatch. The score for PHT was based on a single trial only.

2.3.5 ***Running speed test (RST)***

The ability to run at a high speed is necessary when trying to score goal or to stop a ball from being scored. Bangsbo (1993) suggested that by increasing the force of appropriate muscles and training speed, may improve skills for turning, sprinting, and changing pace during soccer. In this study, the running speed was tested based on time for running a single maximum sprint over 20 meters (RST). The test started from a stationary position, with one foot in front of the other and held for at least 2 seconds prior to running. The researcher assistant provided motivation for the subject to continue running hard till the finishing line. The average of two trials was recorded as the score for this test, in which an adequate recovery time (approximately 3 to 5 min) was allowed between the trials.

2.4 Statistical analysis

Means ± SD were calculated for all measures. A statistical software package (SPSS v19, Chicago, US) was used to compare groups. The differences between pre-and post intervention scores, for both EXP and CON, were compared using independent *t*-tests. Significance was set at $p \leq 0.05$.

3. Results & Discussion

There were no changes to body mass or stature during the study in either the EXP or CON group (Table 2). Training diaries revealed that participants completed the training, on average, 3.4 ± 0.7 times per week, resulting in an adherence rate of 78%. The pre- and post-intervention results for both groups are presented in Table 2. Measures of leg power (SL jump and SJ) showed there was not significant [-0.47% ($p > 0.05$) and 0.69% ($p > 0.05$) respectively] in EXP and CON. Similarly, speed over 20 m showed not significant [0.70% ($p > 0.05$) and 0.47% ($p > 0.05$) respectively]. In addition, there was not significant when compared to changes in the EXP and CON group for both agility and core stability [0.18% ($p > 0.05$) and -0.64% ($p > 0.05$) respectively, Table 2] [0.30% ($p > 0.05$) and -0.97% ($p > 0.05$) respectively, Table 2).

Table 2. Pre- and post-intervention data, and percent changes, for all measures in both the experimental and control group. Values are mean (± SD).

Variables	EXP (*n* = 12)			CON (*n* = 12)			*P* value
	Pre	Post	Δ%	Pre	Post	Δ%	
BMI (kg)	20.21±1.47	20.34±1.51	0.63	19.95±1.65	19.98± 1.21	0.15	0.45
Height (m)	1.61±1.03	1.62±1.34	0.61	1.62±1.09	1.63±1.12	0.61	0.54
SLJT (m)	2.12±0.18	2.11±0.14	-0.47	2.08±0.14	2.10±0.13	0.96	0.80
SJT (cm)	.40±0.03	.41±0.11	2.43	.39±0.22	.40±0.18	2.50	0.09
IAT (s)	16.10±0.70	16.13±0.29	0.18	17.07±0.31	16.96±0.25	-0.64	0.61
PHT (s)	45.17±2.37	45.31±1.12	0.30	48.65± 1.27	48.18±1.58	-0.97	0.23
RST (s)	4.23±0.22	4.26±1.09	0.70	4.19±1.16	4.21±0.16	0.47	0.27

The main finding of this investigation was that no significant performance differences were observed in any of the variables tested between an EXP group using the injury prevention program and a CON group warming up as usual. The most likely explanation is that the training volume and intensity for each of the exercises were too low to result in performance improvements. If training protocols were designed to not just prevent injuries but also increase performance, combined performance and prevention training could be instituted with a higher potential for athlete compliance. However, in the present case, no increased performance was detected.

This result is in agreement with the results in the studies by Steffen et al. (2008), Grandstrand et al. (2007) and Vescovi & VanHeest (2010) but in disagreement with the results in the studies by Kilding (2008) and DiStefano (2010). There were, however, great problems with the players' compliance to the programme and the average player only executed the programme 12 times during the 6 week intervention period. The whole team however executed the programme as intended. In the study by Kilding (2008) positive results with improvements ranging between 2 and 6 % were shown in the intervention group for vertical jump height, three step jump and 20 m sprint times.

However, the programme was performed five times per week in comparison with the present programme with only two scheduled training sessions per week. Additionally the study was performed on boys at the age of ten. In the study by DiStefano (2010) improvements were seen in vertical jump height and time-to-stabilization measures. The programme was performed three times per week and on both boys and girls, which differs from the present programme that only studied boys. The study by DiStefano (2010) didn't separate the girls from the boys in the analyses and it cannot be precluded that the boys represented the greatest improvements.

Mandelbaum et al. (2005) suggested in 2005 that all injury prevention programmes were quite similar and despite the years that have passed since then the present programme didn't differ much from the other programmes available, except for the extended possibility to progress the programme and the pair exercises. Hence the exercises included in the programme probably don't distinguish between effective and ineffective programmes. The programmers' duration, frequency and progression may however be of importance.

Three reasons for the lack of results can be hypothesized in the present study: the programme doesn't improve performance in boys when performed two a week, the players didn't perform the exercises correctly or with enough effort to improve performance, the programme improved muscle function and knee alignment however only during the actual exercises and not during testing. The frequency doesn't seem to be the sole factor that distinguishes between effective and ineffective programmes since the study by DiStefano (2010) used the same number of training sessions per week (two-three) as the studies by Vescovi & VanHeest (2010), Steffen et al. (2008) and Grandstrand et al. (2006). The study by Kilding et al. (2008) however involved five training sessions per week. In the present study however the average player only performed the programme two a week, which may be too little to improve performance.

Steffen et al. (2008) meant that the intensity of the programme was too low to affect performance measures. Grandstrand et al. (2006) however reported of players being unable to correctly perform all exercises. In the present study it is the researcher's opinion after having partaken in one of the groups training sessions that all players were able to perform all exercises correctly. It is, however, doubtful that the players performed the programme with enough effort to induce performance gains.

The study by Vescovi and VanHeest (2010) used similar tests for measuring performance as the present study, while Steffen et al (2008) used a variety of tests including isokinetic and isometric strength tests and tests with the ball. The study by Grandstrand et al. (2010) only evaluated landing mechanics after implementing an injury prevention programme. None of these studies showed any improvements, despite quite different ways of evaluating. Vescovi & VanHeest (2010) and Steffen et al. (2010) discussed the lack of specificity of the measurements and that the test battery might not have been appropriate for detecting all improvements. When testing strength parameters one must bear in mind that movement specific neural adaptations are an important part of the strength gains.

Strength gains may therefore not be seen if the muscles are tested in a different way than they usually are used or in other velocity. The slow speed during the execution of the injury prevention programme may affect the possible improvements seen during measurements and during soccer play due to this training specificity, which also have been discussed by Vescovi & VanHeest (2010). The ''11'' did not contain any specific sprint exercises. However, because the thigh musculature, especially hamstrings strength, is of importance in sprint (Reynolds et al., 2001; Askling et al., 2003; Kraemer et al., 2003), increased strength could result in improved sprint times. This was not the case, but perhaps not surprising, considering that no effect on isokinetic or isometric hamstring torque was seen either. One argument against focusing on injury prevention exercises in warm-up programs is that they may conflict with the development of technical skills.

For youth and adolescent teams, who typically practice two to four times a week, asking them to spend a similar amount of time on injury prevention exercises is not realistic, even if the injury prevention program also were shown to improve football performance. In our opinion, to successfully implement injury prevention exercises in the regular training program of youth and adolescent football teams on a consistent basis, the duration of the program should not exceed 20 min per session, and preferably be designed to replace the ordinary warm-up exercises used by the team school.

4. Conclusions

No significant effects were observed on different performance variables among juvenile male soccer players participating in a 6-week injury prevention program, the ‘‘11,’’ compared with players who trained as usual. There may be problems with the implementation of the programme due to low attendance to soccer training sessions resulting in low player compliance with the programme and lower training frequency than intended.

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