



P-ISSN: 2394-1685  
E-ISSN: 2394-1693  
Impact Factor (ISRA): 5.38  
IJPESH 2017; 4(2): 200-203  
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www.kheljournal.com  
Received: 09-01-2017  
Accepted: 10-02-2017

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# International Journal of Physical Education, Sports and Health

## The effect of short period FIFA 11+ training as an injury prevention program in youth futsal players

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### Abstract

The purpose of this study is to determine the effectiveness of short period *FIFA 11+* training in improving physical fitness components affecting injury risks among youth futsal players. This experimental study recruited two groups of youth futsal players by doing purposive/judgmental sampling to two high school futsal teams in Yogyakarta, Indonesia. The subjects were high school students participating in the school futsal team. From the total of 28 subjects (15 subjects in the experiment group and 13 in control group), 8 subjects dropped out, leaving 9 subjects in the experiment group and 11 in the control group for the final analysis. The experiment (EXP) group underwent *FIFA 11+* training twice per week for four weeks while the control (CON) group underwent routine futsal training. Both groups performed physical fitness tests before and after the intervention. Changes in performance (pre- vs. post-intervention) for each group were analyzed using dependent t-test ( $p < .05$ ). Changes in performance between the two groups were compared using independent t-test ( $p < .05$ ). Core strength (evaluated using plank test), leg power (vertical jump test) and agility (Illinois agility test) were the fitness components tested. Result of the study showed that core strength ( $p = .007$ ) and agility ( $p = .01$ ) of the EXP group increased significantly, while no change were observed in the CON group. The increase of agility in EXP group was found to be significantly different compared to the one in CON group ( $p = .039$ ). A 4-week *FIFA 11+* training can improve certain physical fitness components that contribute in preventing injury. Thus it is recommended to add *FIFA 11+* to the routine futsal training as an injury prevention program.

**Keywords:** FIFA 11+, futsal, injury, physical fitness, prevention

### 1. Introduction

Futsal or *futbol de salon* (five a-side indoor soccer) is a popular sport in Indonesia. Furthermore, it is not just a sport, but also a trend and lifestyle, particularly among high school and college students<sup>[1]</sup>. Rapid growth of this sport becomes a concern because several studies have shown that futsal is categorized as a high risk sport especially in young players<sup>[2-4]</sup>. High intensity game with multiple sprints were thought to be the cause of high injury incidences in this sport. Majority of futsal injuries occur in the lower extremities, particularly in ankles, knees and leg muscles<sup>[2, 4-8]</sup>.

Increasing physical fitness components can reduce risk of the injury<sup>[9-12]</sup>. Herman *et al.* showed that injury prevention program includes stretching, strengthening, balance and agility drill can reduce injury incidence in young, amateur, male and female athlete<sup>[13]</sup>.

The Fédération Internationale de Football Association Medical Assessment and Research Centre (F-MARC) has developed a football injury prevention program, FIFA 11+. The program consists of 15 forms of exercise to improve physical fitness components that contribute to the prevention of injury. Application of these exercises properly and regularly has proven to reduce the incidence of injuries among football players<sup>[14-16]</sup>.

In contrast to the professional teams, amateur school futsal teams do not have a regular training session. Most of them have a very limited time to prepare for a competition, which is approximately 4-5 weeks. The limited preparation time will make them difficult to optimize their physical fitness, risking to injuries. The injury risk will be higher during the competitive situation.

Seeing the similarities between the characteristics of futsal and football, the FIFA 11+ is considered appropriate for futsal as a useful exercise program on physical fitness of young futsal players who have limited preparation before an event.

Reis *et al.* [17] reported that implementing the FIFA 11+ exercise twice a week for 12 weeks can improve physical fitness component, but research on FIFA 11+ implementation among futsal player in limited time is still lacking.

The objective of this study is to determine the effectiveness of the FIFA 11+ application in improving physical fitness components affecting injury i.e. core strength, power and agility risks among young futsal player within a short period of time.

## 2. Materials and Methods

### 2.1. Participants

This study recruited two groups of youth futsal players by doing purposive/judgmental sampling to the high school futsal teams in Yogyakarta, Indonesia. Two public high schools that met the selection criterias were participated in this research. The selection criterias were (1) offering futsal extra-curricular program (2) have a permanent and adequate futsal training facilities (3) have a futsal coach or a physical education teacher in every routine futsal training (4) have a regular training schedule at least twice a week. Randomization was performed to determine which schools were selected as the experiment (EXP) and control (CON) groups.

All subjects from both groups were members of the school futsal team. Total 28 futsal players who met the criteria were participated in this research. The inclusion criteria were (1) member of school futsal team; (2) only performing routine exercise according to futsal extracurricular schedule at school; (3) have passed medical check-up; (4) obtained the consent of parents/guardians (by signing an informed consent research sheet); (5) committed to attend the complete series of studies. This study was approved and accepted for ethical clearance from the Faculty of Medicine, Universitas Indonesia.

### 2.2. FIFA 11+ Intervention

The EXP group underwent the FIFA 11+ training twice per week for four weeks, while the CON group underwent routine futsal training. The FIFA 11+ has three parts with a total of 15 exercises, which was performed as a warm-up in each training session. The coach of EXP group were trained for the FIFA 11+ program in two sessions with a duration of approximately 60-90 minutes as an anticipation for the FIFA 11+ program to be properly conducted before the research was applied.

Both groups performed a physical fitness tests twice, before and after 4 weeks of intervention. The test was conducted at the same time (16:00 local time  $\pm$  1 hour), in the same futsal field and condition. The followings were the measurement of physical fitness conducted in this study: (a) *Plank Test* to measure the core muscle strength; (b) *Vertical Jump Test* using Jump MD® to measure the explosive power of the leg muscle; and (c) *Illinois Agility Test* to measure the agility.

Each test was performed twice per session and the best test result was taken for data analysis. Subjects were allowed to do a trial on each type of test.

### 2.3. Data Collection

Both baseline (e.g. name, birthdate, address, age, height, weight) and physical fitness (pre and post-intervention) data was collected by the same trained staff.

### 2.4. Statistical analysis

A paired t-test was used to compare the difference between pre and post intervention result in the EXP and CON groups, and an independent t-test was used to compare the difference of the pre-post result between EXP and CON groups.

Normality test was performed using Shapiro Wilk test (sample < 50). Transformation was performed if the data was not normally distributed. Parametric test was conducted if data transformation was successful. Non-parametric test was performed using the Mann Whitney and Wilcoxon tests for independent and paired t-tests respectively, when the data transformation was not successful. All analyses were conducted with SPSS software (version 17.0, SPSS Inc., Chicago, IL, USA). A score of  $p < 0.05$  was considered statistically significant.

## 3. Results and Discussions

### 3.1. Participants

Total of 28 subjects (15 subjects in the EXP group and 13 in CON group) participated in this research. From the total, 8 subjects dropped out, leaving 9 subjects in the EXP group and 11 in the CON group for the final analysis. The number of participants in each group is shown in Fig. 1.

Based on 20 subjects, 5 players (25%) were 15-year old, 8 players (40%) were 16-year old, 6 players (30%) were 17-year old, and 1 player (5%) was 18-year old. Table 1 presents age mean and body mass index of EXP and CON group.

Table 1: Subjects characteristics

Group	EXP (n = 9)	CON (n=11)
Age (year)	16 (15-16)	17 (15-18)
BMI (kg/m <sup>2</sup> )	19.73 $\pm$ 2.44	21.08 $\pm$ 2.04

### 3.2. Effect of intervention

As shown in table 2, core and agility were increased in both groups. Statistical analysis showed significant increase in core strength ( $p = 0.007$ ) and agility ( $p = 0.011$ ) of the EXP group. No significant increase in the CON group both in core ( $p = 0.552$ ) and agility ( $p = 0.464$ ). Even though there is an increased of power component ( $p = 0.256$ ) in the CON group, however the increment was not significant.

Table 2: Pre and post intervention result for EXP and CON group

Components	EXP group (n = 9)			CON group (n = 11)		
	Pre-test	Post-test	<i>p</i>	Pre-test	Post-test	<i>p</i>
Plank (second)	90,51 $\pm$ 32,77	126,70 $\pm$ 23,60	0,007*	107,44 $\pm$ 47,88	109,52 $\pm$ 39,75	0,552
VJ (cm)	49 $\pm$ 9,03	48 $\pm$ 6,40	0.502	51,73 $\pm$ 7,94	54,09 $\pm$ 6,28	0,256
IAT (second)	18,67 (17,05-18,81)	17,55 (16,68-18,9)	0,011 <sup>a</sup>	19,59 $\pm$ 0,63	19,45 $\pm$ 0,58	0,464

Abbreviations : VJ : Vertical jump; IAT (Illinois agility test)

\*Significant change in performance (pre-post test)  $p < 0.05$ .

<sup>a</sup> Wilcoxon test

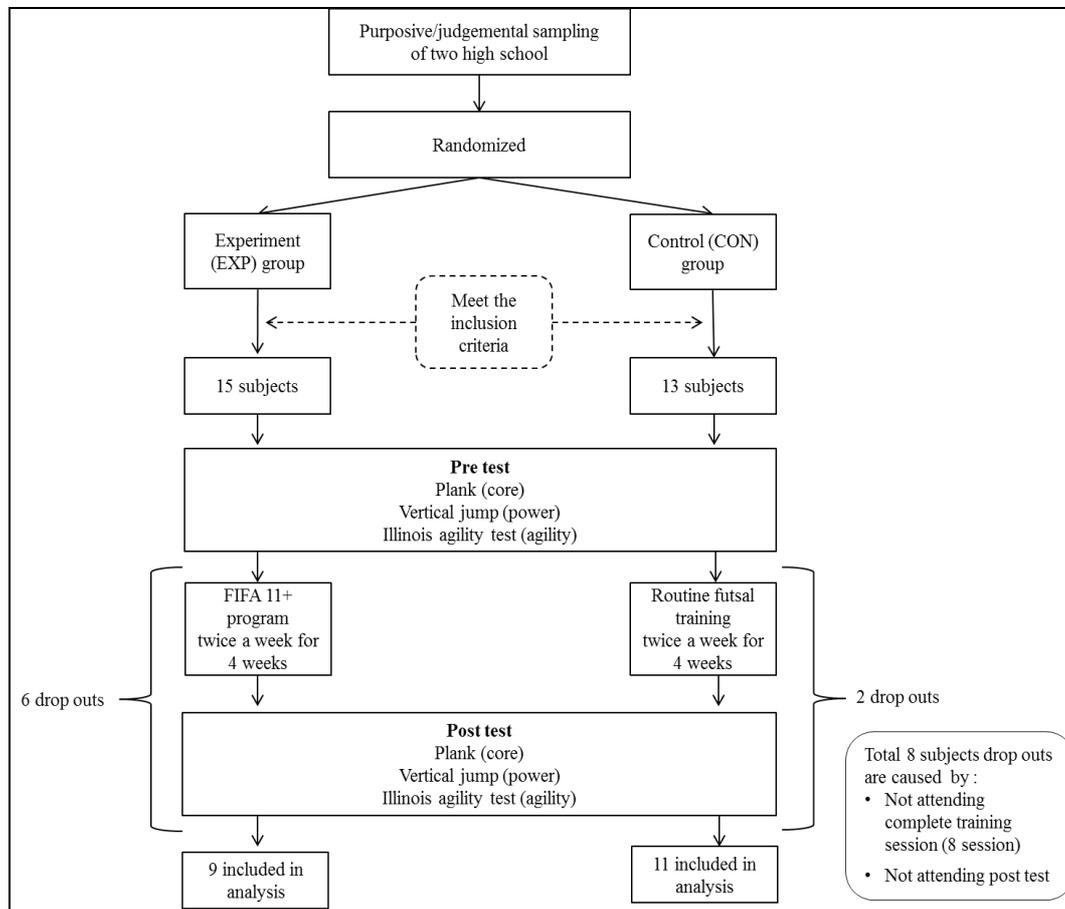
Independent t-test showed that the increased in agility of the EXP group was significantly different than the CON group ( $p = 0.039$ ). Statistically, changes in core strength and power in the EXP and CON groups were not significant ( $p > 0.005$ ).

**Table 3:** Comparison on changes in physical fitness component of EXP and CON groups pre and post intervention.

Components	Group		p
	Δ EXP (n = 9)	Δ CON (n = 11)	
Plank (second)	36.18 ± 30.38 sec	2.08 ± 40.82 sec	0.052
VJ (cm)	-1 ± 3.46 cm	2.36 ± 6.70 cm	0.19
IAT (second)	-0.78 ± 0.61 sec	-0.15 ± 0.64 sec	0.039*

Abbreviations : VJ : Vertical jump; IAT (Illinois agility test)

\*p value shows significant difference between the change score for each group ( $p < 0.05$ )

**Fig 1:** Enrollment, randomization, and drop out of the study participants

### 3.3. Discussion

Research results showed that the CON group did not experience a significant increase in all physical fitness components while the EXP group experienced a significant increase in strength and agility. Between the two groups, the EXP group has a significant improvement in the agility component ( $p < 0.05$ ) as opposed to the CON group.

Increased in core strength experienced by the EXP group ( $\pm 36.18$  seconds) that was assessed using tests plank was clinically significant. The result of the control group showed that the change was considered to be very small ( $\pm 2.08$  seconds), which was not clinically and statistically significant. Plank and side plank exercises are movements which are effective in improving the strength and stability of the core muscles. Unfortunately, these practices are rarely performed by athletes because they are non-functional training and static [18]. Smaller futsal field size than that of football and rapid gameplay characteristics in futsal lead to a very high risks of collision and injury due to body contact. Increasing core strength is very meaningful to support the balance during a collision so that injury can be prevented [19].

Increased in agility which was experienced by the EXP group was supposedly influenced by the increase in core strength. From the point of view of agility, there is a moment of

acceleration-deceleration and change of motion direction that practically occurs at the same time. In this situation, the core muscle has a very important role. It serves as a pivot and a supporting unit when there is a change in point of gravity so that the movement is in accordance with the desired direction [20]. In biomechanics, core also contributes directly to generate power in the lower extremities through a kinetic chain mechanism.

In addition to the increased in the core strength, the other components in the FIFA 11+ exercise also play a role in improving agility. Nordic hamstring movement and squat serves to train leg muscles so as to result in an optimal muscle contraction while running. Plant and cut exercises in Part 3 FIFA 11+ directly train agility in terms of neuromuscular control when changing direction, acceleration, and deceleration. Increase in agility component is considered to be very useful as research shows that repeated sprint with turn is accounted for 37% of the incidence of non-contact injuries in futsal sports [2].

Power of leg muscle was assessed using vertical jump test. In this study, no significant change in the vertical jump was observed in both groups. The EXP group experienced decrease in vertical jump height which was not statistically significant and was considered constant, while the increase

experienced by the CON group also shows no significant difference. Schmidtblecher <sup>[21]</sup> stated that the power is a product of strength and speed. Although any increase in muscle strength will generally increase explosive power of muscle, the increase will not be optimal, unless it is accompanied by speed training to produce the maximal muscle strength. Four-week exercise is not sufficient to provide optimal improvement of the leg power. FIFA 11+ training has strength and plyometrics trainings that are considered to increase the leg power when it is performed in accordance to recommendation (at least 9-12 weeks). Chelly *et al.* study that was conducted on young football players showed that plyometrics exercises which were conducted twice a week for 8-week can increase explosive power of leg muscles <sup>[22]</sup>.

#### 4. Conclusion

This study shows that the implementation of the FIFA 11+ to young futsal players twice per week for 4 weeks can improve physical fitness components (i.e. core strength and agility) better than the control group. It can be an option for young athletes who have a short period of preparation session to reduce injury risks before the competition. Further studies to evaluate the effect of the FIFA 11+ implementation on the decrease of injury incidence is also necessary.

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