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## EFFECTS OF 8 WEEKS OF FIFA 11+ INJURY PREVENTION PROGRAM ON THE PHYSICAL CAPACITY OF YOUNG FUTSAL ATHLETES

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### ABSTRACT

The aim of the study was to verify whether the FIFA 11+ injury prevention protocol can be effective in improving the physical capabilities of young futsal athletes. Thus, 20 athletes between 14 and 15 years old were evaluated before the pre-season and at the beginning of the competitive period. Two groups were randomly formed: Control Group (CG n = 9) and FIFA Group 11+ (G11 + n = 11) which performed an intervention based on the FIFA 11+ program for 8 weeks, twice a week. Variables were evaluated before and after the intervention. Except for a 5m run time, the groups showed no improvement in physical abilities related to the game (30m run time, agility and horizontal Jump). However, for the G11 + there was an increase in core stability whereas for the GC there was a decrease in the values of agility and flexibility, and the 5m run time and core stability were better for the G11 + compared to the GC at the end of the protocol. It is concluded that FIFA 11+ warming protocol can be effective in improving the 5m running time and core stability, in addition to maintaining flexibility and agility in young futsal athletes.

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## INTRODUCTION

In many countries, football is the most popular and most practiced sport, however, the environment becomes less conducive to the practice when in winter, snowing or even by exposure to rain. Thus, over the years, futsal has developed, with the number of players reduced in each team, the size of the ball and the use of a court with another floor, as well as changing the rules and the type of footwear used. International Football Federation (FIFA) regulates Futsal that becomes now more and more popular (Milanovic, Trajkovic e Fiorentini, 2011), being a sport characterized as intermittent and of high intensity which, requires a constant exchange of positions (movement), demanding from the athlete a good development of physical capacities, such as strength, endurance, speed, agility and power (Naser et al. 2017). In this sport, players are exposed to two times of twenty minutes, involving five players on the court of each team, one goalkeeper and four line players, requiring maximum effort to achieve good results. The number of substitutions is unlimited, which causes high intensity of the game on the court, maintaining efforts between 75-90% of the maximum aerobic capacity (VO<sub>2</sub>max) of the athletes. During the match, athletes need to perform momentary actions that involve great muscle power aiming at ball disputes, performing technical gestures, returning to defense to prevent an opponent's counterattack, among other actions (Milanez et al., 2011).

Thus, the movement of players within a match is constant, with Castagna et al. (2009a) showing that every 3.28 seconds the players change direction and that 26% of the actions performed on the court are characterized as high intensity. Thus, physical preparation, involving the main physical capabilities of the sport, is extremely important, since players need to perform powerful movements such as kicking, jumping, turning, running and changing rhythm and directions during the game (Chaouachi et al., 2009; Duncan, Woodfield and al-Nakeeb, 2006) which can increase the risk of injury, just like in soccer. A few years ago, given the scarcity of work on injuries in soccer despite the great popularity of the sport, FIFA, through the FIFA - Medical Assessment and Research Center (F-MARC), showed interest on the subject. In a study carried out in 2013, which investigated the main characteristics of injuries that occurred from 1998 to 2012 in all FIFA tournaments and Olympic games, it was pointed out that 80% of the injuries were due to contact with another player, and that the most injured parts were ankle (19%), thigh (16%) and head / neck (15%), with bruises being the highest prevalence with 55%, followed by sprains with 17% (Junge e Dvorak, 2013). In order to standardize a training or warming method that would prevent possible injuries to the thigh, knees and ankle, the F-MARC started to develop an injury prevention program, initially named "The 11", lasting 15 minutes, consisting of exercises for core stability, neuromuscular control, eccentric strength of the thigh flexors and agility. However, this training protocol did not reduce the

incidence of injuries in the athletes, besides generating difficulties in their adherence (Steffen et al., 2008). Taking these notes into consideration, the F-MARC reformulated some points of the protocol and then "The 11+" emerged, divided into three parts: 1st part - moderate running exercises, displacements and dynamic stretching, 2nd part - 6 exercises on strength, plyometrics and proprioception work, each with three levels (beginner, intermediate and advanced) and 3<sup>rd</sup> part - speed exercises with change of direction (F-MARC, 2005). After such changes, studies pointed out that the FIFA 11+ training protocol could reduce the risk of injury by up to 33% in soccer players, and contribute to an evolution in the body composition of children and promote an increase in lower limb strength. Thus, being able to improve physical performance (Soligard et al., 2008; Brito et al., 2010; Skoradal et al., 2018). However, it is not yet clear whether the FIFA 11+ program can improve fitness in young Futsal players. Thus, the present study aims to verify whether the FIFA 11+ injury prevention protocol can be effective in improving the physical capabilities of young Futsal players.

## MATERIALS AND METHODS

This is a semi-longitudinal quantitative intervention research submitted and approved by the Research Ethics Committee of the Federal University of São Paulo (protocol number 0280/2018) and complied with the Helsinki Declaration and all norms related to research studies with humans. Volunteers were recruited for convenience after a meeting among the researcher, athletes and their guardians. Twenty futsal athletes aged between 14 and 15 years participated in the study. As inclusion criteria, they should not have injuries in the last 3 months and be able to undergo training. As a non-inclusion criterion, participation in training below 75% and participation in other actions or training were considered. The participants were evaluated in two moments: before the pre-season and at the beginning of the competitive period during the preparation for the Paulista Futsal Championship of the year 2018. They were randomly divided into two groups, with athletes from all positions in each group: FIFA 11+ Group (G11+, n = 11) which performed, in addition to technical and tactical training, the FIFA11+ protocol; Control Group (CG, n = 9) which performed only technical and tactical training. The characteristics of the participants can be seen in Table 1.

**Table 1. Anthropometric characteristics of futsal athletes. Data presented as mean ± standard deviation**

Variable/Group	G11+ (n=11)	GC (n=09)
Age (years)	14.19 ± 0.30	14.4 ± 0.53
Body Mass (kg)	61.75 ± 6.75	57.00 ± 7.22
Height (m)	1.67 ± 0.06	1.68 ± 0.09
BMI (Kg/m <sup>2</sup> )	22.12 ± 1.95	20.12 ± 1.59
Fat Mass (%)	16.32 ± 3.40	13.91 ± 3.29
Lean Mass (Kg)	43.30 ± 1.70	45.67 ± 1.72

BMI = Body Mass Index, Kg = kilogram, m = meters, % = percentage.

**Procedures:** The 5m and 30m run time was accessed by an experienced evaluator with a manual chronometer (Speedo®, model - 80621G0EVNP), counting the time from zero to five meters and zero to thirty meters (Little and Williams, 2005). To measure agility, the Illinois test was applied, one of the most used tests for futsal athletes, in which the athlete travels a course with constant displacements with a length of ten meters long and five meters wide (Roozen, 2004). The horizontal jump test was performed as a predictor of lower limb strength, and for flexibility, the sit-and-reach test was used both according to the Proesp-br manual (2016). To measure core stability, a test was applied in an isometric plank position, in prone position with the elbows and toes resting on the floor and the body aligned and the athletes remained in position for as long as possible (Proesp-br, 2016). In all tests, the athletes had three attempts and the best result was considered.

**Training protocol:** During 8 weeks, all participants (20) underwent technical/tactical training twice a week, lasting 70 minutes per

session, which consisted of analytical training, that is, the improvement of the technical gesture isolating the events of the game (pass, kicking the goal, driving the ball) and it was also worked through reduced games, inducing activities with numerical imbalance, such as 3 x 2, 4 x 3. Always at the end of the training a collective game was held in which the activity was of 5 x 5, full length of the court and game with all official rules. The CG athletes participated in the technical and tactical training normally and none of them participated in any other type of exercise related to the FIFA 11+ protocol or any other type of training in an external environment. The G11+ athletes, in addition to technical and tactical training, performed FIFA 11+ protocol actions. The first three weeks of activities began in the beginner stage (the first being for learning the protocol), the subsequent three weeks in the intermediate stage, and in the last two weeks activities of the advanced stage. The FIFA 11+ protocol actions lasted around 20 minutes per session and were performed before technical and tactical training. In this context, 48 hours of rest between sessions were also respected.

**Statistical analysis:** Descriptive statistics were used to describe the data using means and standard deviations. The normality of the data was tested using the Shapiro-Wilk test and to compare groups and moments, according to the study variables, the model of analysis of variance with repeated measures and the method of multiple comparisons of Bonferroni was used. The significance level was 5% (p ≤ 0.05). For this, the GraphPad Prism 7 software was used.

## RESULTS

The results obtained allow the identification of differences in relation to the athletes' physical capacities (Table 3). It was observed that, except for the 5m running time, the groups did not show differences in the physical capacities assessed for the 30m running time and horizontal Jump between moments (pre and post intervention) or between groups. For G11+, there was an increase in core stability while for GC there was a decrease in the values of agility and flexibility when comparing the moments. In addition, the 5m run time and core stability were better for the G11+ when compared to the GC at the end of the protocol.

## DISCUSSION

The results of the present study showed that after 8 weeks of intervention: there was a decrease in the flexibility and agility capabilities for the CG; the groups (G11+ and CG) showed an improvement in the 5m run time, but only the G11+ improved core stability, which was better than the CG at the end of the protocol, as well as the 5m run time. Many studies show the importance of the FIFA11+ training program for the prevention of injuries of amateur and professional soccer players (Brito et al., 2010; Impellizzeri et al., 2013; Sadigursky et al., 2017; Weber-Spickschen et al., 2018). Others, point to an improvement in the physical performance of adolescent and adult soccer and futsal athletes after the application of the program with durations ranging from 4 to 12 weeks, with emphasis on the isokinetic strength of knee extensors and flexors, vertical jump height, agility, balance, and ability to perform sprints (Reis, 2011; Praphawicha Chentanez and Sinphurmsuksakul, 2013; Silva, 2015, Ayala et al., 2017; Pomares-Noguera et al., 2018). However, some publications show that FIFA 11+ did not improve the physical performance of some physical capabilities in soccer (Neto et al., 2017) and futsal athletes (Lopes et al., 2019). Reis (2011) using the FIFA 11+ warm-up protocol before technical and tactical training (twice a week, for 12 weeks) in futsal athletes (average of 17.03 years of age) observed an improvement in the physical capacities imposed in the game, such as acceleration, speed, agility, strength and power of knee flexors and extensors and uni-foot balance in the FIFA11+ group compared to the control group, resulting in an evolution in the ability with the ball. In our study, we did not observe changes for the 30m running times (which can predict running speed), flexibility, agility and horizontal jump in the G11+ after intervention.

Table 2. Periodization of training by the FIFA 11+ group

Stage	Exercises	Series	Repetition	Duration	
Beginner	Running Straight Ahead and Running Circling Partner	---	---	8 minutes	
	The Bench Static	2	---	30 seconds	
	Sideways Bench Static	2	---	20 seconds	
	Hamstrings Beginner	1	5	---	
	Single leg Stange - Hold the Ball	2	---	30 seconds	
	Squats with toe Raise	2	---	30 seconds	
	Jumping - Vertical jumps	2	---	30 seconds	
	Running Across the Pitch	---	---	2 minutes	
	Running Hip Out and Running Shoulder Contact	---	---	8 minutes	
	The Bench Alternate Legs	2	---	30 seconds	
	Sideways Bench Raise & Lower Rip	2	---	20 seconds	
	Intermediate	Hamstrings Intermediate	1	8	---
		Single-Leg Stance Throwing ball with partner	2	---	30 seconds
		Squats Walking lunge	2	---	30 seconds
Jumping - Lateral jumps		2	---	30 seconds	
Running Bounding		---	---	2 minutes	
Running Hip in and Running		---	---	8 minutes	
Quick Forwards & backwards		---	---	---	
Advanced	The Bench One leg lift and hold	2	---	30 seconds	
	Sideways Bench With leg lift	2	---	20 seconds	
	Hamstrings Advanced	1	15	---	
	Single-leg Stance Test your partner	2	---	30 seconds	
	Squats One-leg squats	2	---	30 seconds	
	Jumping - Box jump	2	---	30 seconds	
	Running Plant & cut	---	---	2 minutes	

Table 3. Physical capabilities of futsal athletes before and after intervention

Group	Variable	Pre	Post	p
G11+ (n=11)	RT - 5 m (sec)	1.27 ± 0.12	0.97 ± 0.18 <sup>#</sup>	0.04
	RT - 30 m (sec)	4.21 ± 0.11	4.25 ± 0.11	0.44
	Flexibility (cm)	24.95 ± 3.76	26.14 ± 3.19	0.34
	Agility (sec)	16.45 ± 0.40	16.18 ± 0.53	0.33
	Horizontal Jump (m)	2.02 ± 0.07	1.98 ± 0.13	0.26
	Core Stability (seg)	89.5 ± 26.75	159.9 ± 33.87 <sup>#</sup>	<0.01
CG (n=09)	RT - 5 m (sec)	1.41 ± 0.21	1.15 ± 0.27	0.05
	RT - 30 m (sec)	4.22 ± 0.44	4.35 ± 0.48	0.35
	Flexibility (cm)	31.78 ± 5.38	27.28 ± 2.84	<0.01
	Agility (sec)	14.61 ± 2.42	16.42 ± 1.61	<0.01
	Horizontal Jump (m)	1.89 ± 0.31	1.89 ± 0.26	0.88
	Core Stability (seg)	115.9 ± 27.5	123.44 ± 27.19	0.79

G11+ = FIFA 11+ Training Group, CG = Control Group, RT = Running Time, p = comparing moments (pre x post), <sup>#</sup> = p=0.05 comparing the post moments between groups. Analysis of variance (Interaction) was <0.05 for all variables except TC-30m (0.88) and Horizontal Jump (0.54)

However, we observed that these capacities were maintained, which did not happen for the control group in relation to agility and flexibility. In addition, the 5m run time value was better for the G11 + compared to the CG at the end of the study. These notes do not translate into significant improvement, but they can be considered as maintenance of the results found before and after the intervention, which is still important, since the training and performance improvement process is associated with a season, usually annually. Regarding flexibility, it is worth mentioning that few studies have evaluated it when using the FIFA11 + protocol. However, Ayala et al. (2017) did not observe any improvements from the execution of the program on flexibility, as in this study. However, the maintenance of this capacity by the G11 + can be considered as important to the detriment of the age of our athletes and that the CG did not achieve the same result. It should be noted, however, that the focus of the FIFA 11+ training protocol is not the development of this ability, moreover, it was created for soccer athletes and also for this reason, there are few studies that have evaluated the method with futsal athletes. In a study that assessed the effect of FIFA 11+ on the physical performance of adult amateur futsal athletes, after 10 weeks of intervention (twice a week) and increased intensity every 3 weeks, there were no differences between moments or groups (FIFA 11+ and control) for the assessed physical capacities (flexibility, agility, speed and power of the lower limbs) (Lopes et al., 2019). These results are similar to the present study. Agility is one of the physical abilities that has shown the greatest improvement after the intervention with FIFA 11+. Some studies have pointed this out (Silva, 2015; Pomares-Noguera et al., 2018) including in other sports (Sahin et al., 2018).

However, in this study the G11+ showed maintenance of this condition, whereas the CG did not. These results are similar to those of Nawed et al. (2018), who performed the protocol on 57 college football players (for 12 weeks, 5 times a week) and did not observe differences when assessing agility. Ayala et al. (2017) found similar results when applying FIFA 11+ and Harmoknee to amateur soccer athletes (mean age 16.8 years) during a 4-week protocol. On the other hand, Zarei et al. (2018) showed that when applying the protocol to youngsters aged 14 to 16 years, soccer athletes for 30 weeks (twice a week), the effects were significant for agility, the same happened in the study of Rössler et al. (2016), in which, after applying the FIFA 11+ protocol for 10 weeks (twice a week) to children (7 to 12 years old), soccer athletes, obtained improvement in agility. Thus, we can see that there are conditions to be considered such as the proposed parallel training, the age of the athletes and especially in relation to the protocols (number of weeks and sessions during the weeks), as these are very likely to have direct interference in the results. In an attempt to better elucidate these conditions, Neto et al. (2017) carried out a meta-analysis study on the execution of FIFA 11+ and concluded that it was not able to improve speed and jump height in soccer athletes. Although in our study we did not evaluate the jump height, we observed that there were no changes to the horizontal jump distance and 30m running time after the program. However, we observed that the 5m run time value was better for G11 + at the end of the protocol when compared to GC. The study developed by Pomares-Noguera et al., (2018), with children (11.8 years of age) practicing soccer in which the FIFA 11+ protocol was applied (for 4 weeks, twice a week) showed improvement in height and jumping

distance and agility, however, not for speed (20 meters). A similar effect presented the study by Ayala et al. (2017), with 60 young amateur athletes (national youth league in Spain) obtaining an improvement in speed and jump height after 4 weeks of FIFA 11+. Another study that applied FIFA 11+ for 10 weeks (3 times a week) to soccer athletes (18 years of age) showed improvement in all parameters evaluated (jumping height, agility and repeated sprints) (Silva, 2015). On the other hand, the study by Impellizzeri et al. (2013) using FIFA 11+ for 9 weeks (3 times a week) with 83 amateur soccer players (average age 23.7 years), did not improve for the height of jump. These data show once again the importance of developing studies with well-defined criteria, such as, using the measurement of the maturation stage for observations of possible differences in the effects found. In this study, the improvement in core stability by G11+ (comparing moments and groups), in this case the increase in time in the prone position, with the forearms, elbows and feet supported and without leaving the body (core) touching the ground, was an important result, corroborating the study by Zein et al. (2017), who applied the FIFA 11+ protocol (for 4 weeks, twice a week) in Futsal athletes with an average age of 16 years and observed an improvement in core stability. Similarly, Impellizzeri et al. (2013), showed improvement in neuromuscular control in the capacity for balance and evolution in spinal stability after 9 weeks of training with "FIFA11 +" in amateur soccer athletes. Thus, it is believed that the evolution in the core stabilization capacity may be due to the lack of stimulus given to this region in isolation, specifically when the training is only technical and tactical.

Thus, it is worth emphasizing the importance of developing levels of stability of the muscles of the pelvis, lumbar and hip, as they prevent possible injuries, increase the development of muscle power, improve efficiency in body stability and balance, and improve neural adaptations (Handzel, 2003). In our study, we started the first three weeks at the beginner level, followed by three more weeks at the intermediate level and two more weeks at the advanced level, completing the proposed 8 weeks. Even so, we did not obtain significant results in the physical capacities imposed in the game, which also makes it important to reflect on the pre-established time in each level, taking into account that the degree of difficulty increases considerably between the levels and may come to influence the studies in the area. Rössler et al., (2016) cite in their study that "insignificant results" were observed, that is, not significant. However, the warm-up protocol proved to be interesting for the generation of athletes, providing motor development and the possibility of a different training proposal in the future, even for the ease of reproducing it, not requiring greater investments. Finally, it is observed that the proposed use of the FIFA11 + warming protocol in football and futsal athletes for injury prevention has shown important results, whether as an improvement in physical capacities or injury prevention, however, even with the evolution in the physical capacities of athletes in some studies, many of them point to the need for greater stimuli to induce more significant effects in the improvement of physical performance (Steffen et al., 2008, Neto et al., 2017, Lopes et al., 2019). What allows us to affirm, as well as Grooms et al. (2013) that, although more studies are needed to understand the real effects and the mechanisms involved in the improvements presented in the studies with the FIFA 11+ program. This study has as limitations the small sample size, the use of tests with manual chronometer, the absence of effective monitoring of food intake, maturation and sleep quality of athletes.

**Conclusion:** The FIFA 11+ warm-up protocol developed twice a week, for 8 weeks, can be effective in improving the 5m running time and core stability, in addition to maintaining flexibility and agility in young futsal athletes.

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