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EFECTO DEL "FIFA 11+" EN EL PATRÓN DE MOVIMIENTOS FUNDAMENTALES EN FUTBOLISTAS SUB-14

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ABSTRACT

Introduction: Increasing youth participation in soccer has several benefits, but it also brings risks of injury. The use of neuromuscular techniques is effective in preventing injuries, especially in periods of growth as occurs in puberty, which coincides with the development of fundamental basic movements. Therefore, it is important to implement and evaluate prevention programs that focus on neuromuscular control during this stage. Objective: To determine the effect of the FIFA 11+ over a six-week training period in order to quickly improve fundamental movement patterns in under-14 soccer players. Method: A quasi-experimental study that evaluated the fundamental movement patterns through the Functional Movement Screen (FMS) in 22 athletes who were divided into a control group (CG; N=11) and an experimental group (EG; N=11), submitted to the program FIFA 11+ for six weeks. The SPSS 20.0 program was used to analyze the data. Results: Statistically significant improvements were found in the in-line lunge (IL) and in the post-intervention FMS total scores in EG, as well as intergroup improvements when testing the deep squat (DS) in the EG, but not in both groups. Conclusions: The six week FIFA 11+ program did not produce significant improvements in players' fundamental movements.

Keywords: *risk factors; soccer; athletic injuries/prevention & control.*

RESUMO

Introdução: O aumento da participação de jovens no futebol apresenta vários benefícios, mas também traz riscos de lesões. A intervenção de técnicas neuromusculares parece ser eficaz na prevenção de lesões, especialmente nos períodos de crescimento, como ocorre na puberdade, que coincide com o desenvolvimento de movimentos básicos fundamentais. Por isso, é importante implementar e avaliar programas de prevenção que se concentrem no controle neuromuscular nessa fase. Objetivo: Determinar o efeito do programa FIFA 11+, durante seis semanas de treinamento para melhorar - de forma aguda – os padrões de movimentos fundamentais em jogadores de futebol sub-14. Método: Estudo quase-experimental que avaliou os padrões de movimentos fundamentais através do Functional Movement Screen (FMS) em 22 atletas que foram divididos em grupo controle (CG, N = 11) e grupo experimental (EG; N = 11), submetido ao programa FIFA 11+ durante seis semanas. Para a análise de dados, utilizou-se o programa SPSS 20.0. Resultados: Foram encontradas melhoras estatisticamente significantes em in-line lunge (IL) e no escore total do FMS no EG pós-intervenção, assim como melhoras intergrupo no teste de deep squat (DS) do EG, mas não entre ambos os grupos. Conclusões: As seis semanas de intervenção do programa FIFA 11+ não produziram melhoras significativas nos movimentos fundamentais dos jogadores.

Descritores: *fatores de risco; futebol; traumatismos em atletas/prevenção & controle.*

RESUMEN

Introducción: El aumento en la participación de los jóvenes en el fútbol, si bien lleva consigo beneficios, se asocia a la presencia de factores de riesgo de lesión. La intervención de las técnicas neuromusculares parece ser efectiva en la prevención, principalmente en periodos de crecimiento como ocurre en la pubertad, que coincide con el desarrollo de los movimientos básicos fundamentales. Debido a esto, es importante implementar y evaluar programas de prevención que se enfoquen en el control neuromuscular en ésta etapa. Objetivo: Determinar el efecto del FIFA 11+ en seis semanas de entrenamiento para mejorar – de forma aguda – los patrones de movimientos fundamentales, en futbolistas varones sub-14. Método: Estudio cuasi-experimental, que evaluó patrones de movimientos fundamentales a través del Functional Movement Screen (FMS) de 22 deportistas, conformándose el grupo control (CG; N=11) y grupo experimental (EG; N=11) sometido al programa FIFA 11+ durante seis semanas. Para el análisis de datos se utilizó el programa SPSS 20.0. Resultados: Se encontraron mejoras estadísticamente significativas, en in-line lunge (IL) y puntaje total del FMS en el EG post-intervención, y mejoras inter-grupo en la prueba de deep squat (DS) del EG, pero no entre ambos grupos. Conclusiones: El FIFA 11+ en seis semanas de intervención, no logra mejorar los movimientos fundamentales de forma aguda.

Descriptores: *factores de riesgo; fútbol; traumatismos en atletas/prevención & control.*

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INTRODUCTION

Football is an extremely popular sport worldwide, with over 265 million players, the majority of which are young people. There are benefits to this high participation number but it also brings an increased possibility of injury. The prevention of these injuries is closely related to the presence of modifiable risk factors, underlining the importance of neuromuscular control as an effective way of preventing injury[1-4]. Fort-Vanmeerhaeghe and Romero-Rodriguez[3] define neuromuscular control as the precise muscular activation which enables compound and efficient development of a motor action or task, therefore, correct execution of these actions is linked to reduced occurrence of injuries since it is associated with improved articular movements, muscular activation patterns, strength and balance. If these are not developed correctly and appropriately the quality of the athlete's movements are affected, causing a series of biomechanical changes, imbalances between muscle groups, proprioceptive changes and muscular fatigue[4].

It has been proven that neuromuscular training programs can have a great effect during the prepubescent stage of development, as long as it coincides with the development of fundamental motor skills which are defined as "an organised series of basic movements which affect the combination of movement patterns of two or more parts of the body" which are also important to the development of an individual's motor skills[3-6]. Many authors suggest that the use of precautionary training based on neuromuscular control during crucial stages of growth, such as infancy and adolescence, improves different abilities such as the feeling of a specific position and joint movement, strength and balance[4,7,8].

One of these programs which is renowned for its effectiveness at preventing injury is the FIFA 11+[9]. Those football teams that use the program generally reduce the risk of injury by 30% to 70% compared to those that do not use it[10,11], when applied this program also significantly improves the players' functional capacity in neuromuscular control, strength, static/dynamic balance and agility skills over an 8 week period[12].

There are some tools available which enable the assessment of movements such as the Functional Movement Screen (FMS)[TM 13,14]. This main focus of this series of tests is to emphasise quality (of neuromuscular control) over quantity, since it has the ability to detect when an individual is at risk of obtaining an injury[15].

So far researchers have not discovered any evidence indicating that fundamental movement patterns change when pre-adolescent subjects take part in the FIFA 11+ program. For this reason, the aim of this study was to investigate the effect of the FIFA 11+ program when used over a 6 week period to acutely improve fundamental movement patterns among football players under the age of 14.

The theory suggests that the FIFA 11+ 6 week training program is an effective way of acutely improving fundamental movement patterns among footballers under the age of 14.

MATERIALS AND METHODS

This is a quasi-experimental, longitudinal study. For this reason the study was conducted following the guidelines established by CONSORT.

In the interest of convenience, the subjects analysed were from 2 male football teams under the age of 14. The youngsters were selected without being questioned about their pre-existing fitness levels, were all male, born between 2001 and 2002 and with the agreement that they would complete a minimum of 60% of the training programme. All those who had suffered musculoskeletal injuries during the 6 months leading up to the study, injuries which affected regular participation in training and involved the use of orthopaedic insoles or support of any type which could affect the use of assessment equipment, were excluded from the study. The subjects took part voluntarily, thus before taking part in any evaluation both the parents and youngsters had the right to read a consent form, respecting Helsinki's ethical principles (to benefit, not to harm, fairness and freedom), which had previously been approved by the University Ethics Committee.

The groups were randomly organised in the simplest way possible. The evaluators were a group of physiotherapy students who specialized in this evaluation system; however, they did not know which subjects they were evaluating.

Interventions

All subjects were required to complete a form with their name, age, height, weight, weekly training volume and record of any previous injuries. The Functional Movement Screen (FMS) was used to evaluate appropriate fundamental movements, where each test was recorded on video, using front and sagittal side cameras. The tests were explained to subjects prior to taking part and they all used a standardised shirt every time they were evaluated for the study. This study was conducted one week prior to the start of the training program and one week following its completion. This method was developed by physiotherapy students who were previously trained in this area. Immediately following the re-evaluation of both groups, they proceeded to edit the videos, which were delivered to the evaluators along with the information corresponding to each participant but without revealing their identity or to which group they belonged, using the "Movie Studio Platinum 12.0" program. They were then required to categorize the results using the FMS. The videos were analysed by an expert physiotherapist, who recorded the scores in an Excel ® spreadsheet.

Therefore, the normal warm-up routine for the Experimental Group (EG) was modified for the FIFA 11+ prevention program, and the warm-up routine for the Control Group (CG) remained as normal.

Experimental Group (EG) FIFA 11 +

The test group's warm-up routine was modified for the FIFA 11+ prevention program, commencing the week prior to the initial assessment. This routine lasted 20 minutes, 3 times a week, for 6 weeks, equalling their normal training. The program is made up of 15 exercises, divided into three parts (race: 6 exercises; strength, plyometrics and balance: 6 exercises which can progress in difficulty; and 3 more races) **h**ttp://www.f-marc.com/downloads/workbook/11plus_workbook_s.pdf. It should also be mentioned that the exercise called "nordic hamstring" was removed from the program to avoid possible risks to those taking part due to the tension this exercise puts on the bones and, taking into account the maturing stage of the participants' bones.

Control Group (CG)

The Control Group used the original warm-up routine during training, which lasted 20 minutes, 3 times a week, for 6 weeks, equalling their normal training. This warm-up consisted of running exercises, stretching and joint movement.

Key outcome

The Functional Movement Screen (FMS) [TM] is a series of tests created by the physiotherapist Gray Cook in collaboration with coach Lee Burton in the United States, and gathers information from 7 tests that require balance, mobility and stability[13,14] to identify any weaknesses or limitations in movements, by placing the individual in extreme positions which highlights weaknesses and imbalances if stability and mobility are not appropriately executed. The FMS analyses 7 fundamental movement patterns, which are: Deep Squat, Hurdle Step, In-Line Lunge, Shoulder Mobility, Active Straight Leg Raise, Trunk Stability Push-Up and Rotary Stability. A "0 to 3" score system was used to evaluate the tests, where "0"

indicates that the subject was in pain whilst carrying out the exercise, "1 and 2" indicate failure or compensation to complete the movement at different levels, and "3" that the movement was completed perfectly and without pain. If at any point an individual was in pain whilst performing a test the evaluators would show a red flag which could be seen in the video which indicated to the expert-evaluator, who was in charge of scoring the individuals, to take into consideration that this could have affected the individual's performance. The Functional Movement Screen Test Kit was used for this test.

The number of protocol is 15.09.2015 of Ethics Committee of Medicine Faculty of Universidad Austral de Chile, Valdivia, Chile. All participants and their parents signed a declaration and consent form before taking part.

Statistical analysis

The data was analysed using the SPSS Statistics ® 20 program. A $p<0.05$ and a dominant value of 95% were considered statistically significant. The quantitative variables used are shown using the central measurement of the average, known as the mean, and measurements of variations, known as the standard deviation. The Shapiro Wilk (>0.05) test was carried out to determine whether there variables were distributed normally. The T Student test was used in parallel to determine if significant statistical differences existed between the FMS values before and after intervention.

RESULTS

A total number of 42 footballers under the age of 14 were eligible to take part in the study of which 27 were designated to the Experimental Group (EG) and 15 to the Control Group (CG). Of the EG 2 subjects were excluded due to injury, 9 due to absence from training and 5 for not taking part in the final evaluations. Of the CG 2 subjects were excluded due to injury and 2 due to absence from training. The study was performed with 22 subjects, 11 in the EG and 11 in the CG, and all data from these subjects was analysed (Figure 1). In regards to training frequency, both groups trained 3 days a week, accumulating 4.5 hours of weekly training. The subjects' demographic distribution is shown in Table 1.

The results from the fundamental movement tests gathered using the FMS are shown in Table 2. A significant difference was found between the results of the EG pre and post FMS intervention. There was no significant difference between the post-intervention results of the EG and the CG.

Table 1. Demographic data of study participants in each group.

	Control (Classic warm up) (n=11)	FIFA 11+ Program (n=11)
Age (years)	13.36 (0.67)	13.45 (0.52)
Weight (kg)	57.09 (5.46)	53.18 (5.92)
Size (m)	1.61 (0.05)	1.60 (0.07)
Training assistance (%)	72.71 (11.71)	75.12 (10.78)

Variables are expressed as mean (SD); kg= kilograms; m= meters; %= percentage.

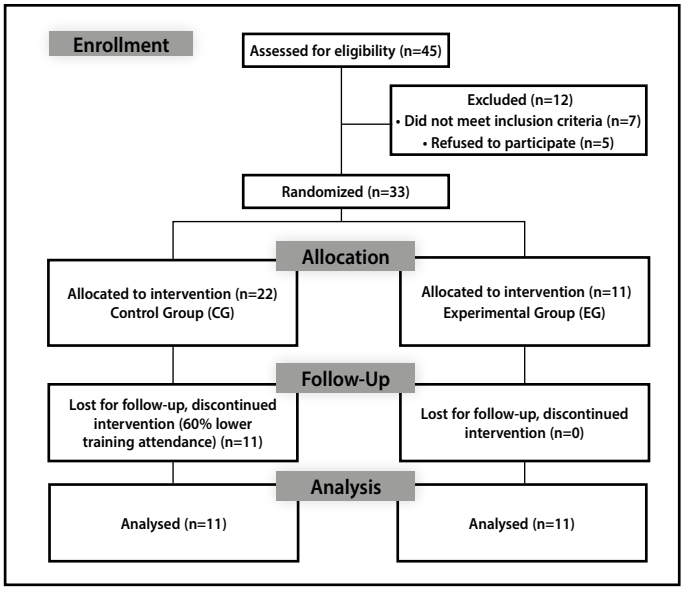

Figure 1. Flowchart of the group randomization of the study.

DISCUSSION

Our study showed that the FIFA 11+ 6 week program is not effective at acutely improving the fundamental movement patterns of male footballers under the age of 14. In regards to the tests used to evaluate fundamental movement patterns, studies suggest that the FMS tests can better detect changes during puberty as shown in a study carried out by Paszkewicz et al.[16] in the year 2013 where they compared the

Table 2. Average scores (SD) for FMS for Control and FIFA 11+ group pre and post intervention.

		Control (Classic warm up) (n=11)	p-value	FIFA 11+ (n=11)	p-value	Total (n=22)
Squatting	Pre	1.63 (0.50)	0.055	1.54 (0.52)	0.235	1.59 (0.50)
	Post	1.18 (0.40)		1.81 (0.40)		1.50 (0.51)
Stepping	Pre	1.36 (0.50)	0.386	1.63 (0.67)	0.386	1.50 (0.59)
	Post	1.54 (0.68)		1.45 (0.52)		1.36 (0.50)
Lunging	Pre	1.81 (0.75)	0.135	1.36 (0.50)	0.002*	1.59 (0.66)
	Post	2.09 (0.70)		2 (0.44)		2.04 (0.57)
Reaching	Pre	2.81 (0.40)	1.000	2.63 (0.67)	0.080	2.72 (0.55)
	Post	2.81 (0.40)		3 (0)		2.90 (0.29)
Leg Raising	Pre	1.90 (0.30)	0.438	2 (0.44)	1.000	1.95 (0.37)
	Post	1.81 (0.40)		2 (0)		1.90 (0.83)
Push-up	Pre	1.54 (0.82)	1.000	1.90 (0.83)	0.379	1.72 (0.82)
	Post	1.54 (0.68)		2.18 (0.87)		1.86 (0.83)
Rotatory Stability	Pre	2 (0)	1.000	2 (0)	1.000	2 (0)
	Post	2 (0)		2 (0)		2 (0)
Total	Pre	13.09 (1.81)	0.766	13.09 (1.30)	0.035*	13.09 (1.54)
	Post	12.90 (2.25)		14.45 (1.29)		13.68 (1.96)

FMS= Functional Movement Screen; *=p<.05.

test´s ability to identify musculoskeletal changes in young players who were going through puberty. The study ranks these test´s abilities above others[16], and endorses the FMS as the tool of choice for assessing fundamental movement patterns associated with puberty, whilst taking into account that a lower injury rate can be associated with a higher standard of execution of movements[13].

Our average sample score, in regards to the FMS' characterisation of the fundamental movement patterns, differs from other areas. This is shown in a study conducted by Abraham A, & colleagues in the year 2015 where 1005 adolescents were tested, where they obtained a higher average than our sample[15].

This could be related to the great variability of influencing factors during puberty which are associated with influential genetic and environmental factors[17].

Various studies have used detection statistics to establish a cut-off score, where the author stated that a score of $\leq$ 14 was favourable in order to predict serious injury[18]. According to earlier studies, and as with the scores gathered by the FMS prior to the implementation of this study's training program, the results which showed a greater probability of suffering musculoskeletal changes were fewer. However, our results show that the EG's results after 6 weeks of training using the FIFA 11+ program improved in 4 out of 7 of the tests when this tool, showing a significant increase in the overall score, obtaining a score of 14.45; decreasing the probability of obtaining an injury, according to a clinical analysis.

The majority of the post intervention intra-group results for the EG showed a tendency to rise, however, only one of them (IL) presented a significant statistic differences of 46% compared to the CG which only increased to 15%, which could be associated with the stability of the dynamic chain (provided by the training program) which could be associated with the requirements for performing this motor movement[10,19].

The post intervention inter-group results suggest that the EG had significantly improved scores in the IL, test with a score of p 0.001, compared to the CG which didn't produce any significant scores in any of its variables. This rise could explain a possible improvement in the stability of the ankle, knee and hip closed Kinetic chains[13] due to similar exercises which were completed as part of the FIFA 11+ program and required for this test. Part of this study's limitations is that the results cannot be compared to those from other studies due to the difference in sample size. Also, the authors expected to find significant changes after a period of only 6 weeks, suggesting that the program would have had a greater effect over a longer period of time.

CONCLUSION

Our study did not prove that the 6 week FIFA 11+ training program is an effective way of acutely improving fundamental movement patterns of male football players under the age of 14. Despite this, a significant clinical improvement was observed for the use of a standard warm-um program. This could reduce the risk of injury among athletes. This study should be repeated with a larger sample timeframe in order to confirm these results.

All authors declare no potential conflict of interest related to this article.

AUTHOR'S CONTRIBUTIONS: Each author made significant individual contributions to this manuscript. GB (0000-0003-0194-6511)* and RG (0000-0002-4515-2492)* were the main contributors in the drafting of the manuscript; GB, GP (0000-0002-2950-4902)* and PV (0000-0002-6144-4436)* collected the data and executed the protocol; MM (0000-0002-8567-827X)* analyzed the data; GB, GP, PV and RG performed the literature search. All authors performed a review of the manuscript and contributed to the intellectual concept of the study. *ORCID (Open Researcher and Contributor ID).

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