

Eldin Jelešković<sup>1</sup>, Haris Alić<sup>1</sup>, Emir Mustafović<sup>1</sup>, Amer Suljić<sup>1</sup>, Munir Talović<sup>1</sup>, Erduan Kafedžić<sup>2</sup> and Nedim Čović<sup>1</sup>

# THE INFLUENCE OF THE FIFA 11+ TRAINING PROGRAMME ON ISOKINETIC PARAMETERS OF KNEE JOINT STABILISERS - THEORETICAL ANALYSIS

<sup>1</sup>Faculty of Sport and Physical Education, University of Sarajevo, Bosnia and Herzegovina

<sup>2</sup>Football club Sarajevo, Bosnia and Herzegovina, Sarajevo

<sup>3</sup>Institute VO<sub>2</sub>max, Bosnia and Herzegovina, Sarajevo

*Systematic review:*

## Summary

FIFA 11+ represents a complete warm-up programme, which had appeared as a result of an F-MARC research and has been characterised as a prevention warm-up programme. The aim of this paper is to analyze what effects the application of FIFA 11+ training programme will yield on isokinetic parameters of knee joint stabilizers. Two independent researchers have analyzed the previous research studies found via a search of different online databases (PubMed, ResearchGate, and Medline). Only those research studies which are directly linked to the subject matter of this paper and which satisfy the inclusive criteria were analyzed. Concerning the analysis of effects of the training programme on the isokinetic parameters, six research studies satisfied the inclusive criteria and were analyzed accordingly. The general conclusion of this paper is that the FIFA 11+ prevention programme might prove to be an extremely useful and applicable programme for the decrease of imbalance between the quadriceps femoris and biceps femoris muscles, as well as that it might help enhance knee joint stabilizers.

**Keywords:** effects, FIFA 11+, isokinetics, training programme, football

## Introduction

Football is an aerobic exercise combined with frequent intermittent short intense actions with a high rate of the anaerobic energy turnover (Boone et al., 2012). It belongs to the group of multi-structural complex sports (Malacko & Rađo, 2004; Milanović, 2013). Each football action taking place over the course of a single match has its own four components: time, place, direction, and speed. It would be almost impossible to have two football actions played with the exact same component values (or characteristics) (Verheijen, 2014). Such situational unpredictability is what makes football a complex sport, but it is also what simultaneously heightens the possibility of injury to sensitive bodily areas in athletes. A great number of the research studies were focused on determining the causes of injury, since it remains a highly significant issue for the success of the collective as a whole. Namely, the highest number of injuries in football affect

the lower extremities (Schneider et al., 2013; Faude et al., 2013; Quisqater et al., 2013; Suzue et al., 2014), while the most sensitive parts of lower extremities are the knee joint and ankle joint (Faude et al., 2013; Quisqater et al., 2013; Suzue et al., 2014). The primary injury prevention programme of the anterior cruciate ligament and ankle joint entails a specific proprioceptive and neuromuscular training (Caraffa et al., 1996; Cimino, 2010).

The basic condition for a successful transformation process is diagnosing the current state of the athlete (Malacko & Rađo, 2004). Kinesiologists, trainers, and others have long been striving to create an accurate measurement of muscular strength, but also of other relevant performances of the muscular and joint system (Kovač et al., 2013). Isokinetic procedures of knee joint testing represent a contemporary method of detecting latency ability in athletes, while simultaneously offering an objective way of measuring

strength of the eccentric and concentric muscular contraction of knee stabilisers in football players (Greco et al., 2012; Ksibi et al., 2015). Since the majority of explosive football actions are primarily activated by the quadriceps, biceps femoris is often neglected during training, which results in an irregular ratio of activity between the two muscles. The majority of football players with a heightened quadriceps strength showed an irregular H:Q ratio, while football players with a lower quadriceps strength showed an H:Q ratio within recommended values (Bogdanis & Kalapotharakos, 2015). An irregular ratio between the hamstring and quadriceps strength might influence the performance of a player during a season, as well as lead to a heightened risk of knee injury (primarily injury to the anterior cruciate ligament, i.e. the ACL) (Rosene et al., 2001; Gregory et al., 2008; Dal Pupo et al., 2014; Ardern et al., 2015; Evangelidis et al., 2015).

The FIFA 11+ training programme was created by the F-MARC as a prevention programme aiming to lower the risk of injury to sensitive body parts, with a special emphasis placed on strengthening knee joint stabilisers. The programme consists of three parts: slow-speed exercises with active stretching (8 minutes), stabilization and proprioception exercises (10 minutes), and moderate- and high-speed and change-of-direction running exercises (4 minutes). Based on the classification of training types, FIFA 11+ falls into the category of prevention programmes. It is recommended that it be used during the introductory training stage, three times a week.

### Subject and Aim

The subject of this paper was to summarise the research collected and determine the influence of the FIFA 11+ training programme on isokinetic parameters of knee joint stabilizers. The aim of this paper was to analyse what effects the application of the FIFA 11+ training programme would yield on isokinetic parameters of knee joint stabilizers, as well as ascertain the extent to which the application of this programme might improve the ratio between the knee joint stabilizers muscles.

### Methods

For the purpose of obtaining relevant scientific studies, the following online databases were

searched: Medline, ResearchGate, PubMed, and Embase. The keywords used were “FIFA 11+”, “prevention programme”, and “football injuries”. Via the databases search, a total of 30 studies dealing with the subject of the FIFA 11+ programme was found. The subjects of research in all of the aforementioned studies were football players.

Having been found, and before undergoing the full analysis, the studies were selected via the following four inclusive criteria: I) the research topic was the FIFA 11+ training programme, II) the research was of a transversal or longitudinal character (theoretical analyses and reviews were not taken into account), III) the FIFA 11+ programme effects were tested on a diagnostic apparatus for testing knee joint stabilizers parameters, IV) the research was conducted on subjects above the age of fourteen. The exclusive criteria based on which the studies were eliminated are as follows: I) a research study represented either a theoretical analysis or a review (i.e. paper not including quantitative data), II) the diagnostics was not run on isokinetic apparatuses. Having been selected via the inclusive criteria, a total of six studies were analyzed.

The methodology used in this paper was PRISMA. Based on the methodological demands of this method, a scheme of research study selection was made, as shown below:

### Results

A total of six studies dealt with the issue of influence of the FIFA 11+ training programme on isokinetic parameters of knee joints stabilizers, as follows: Brito

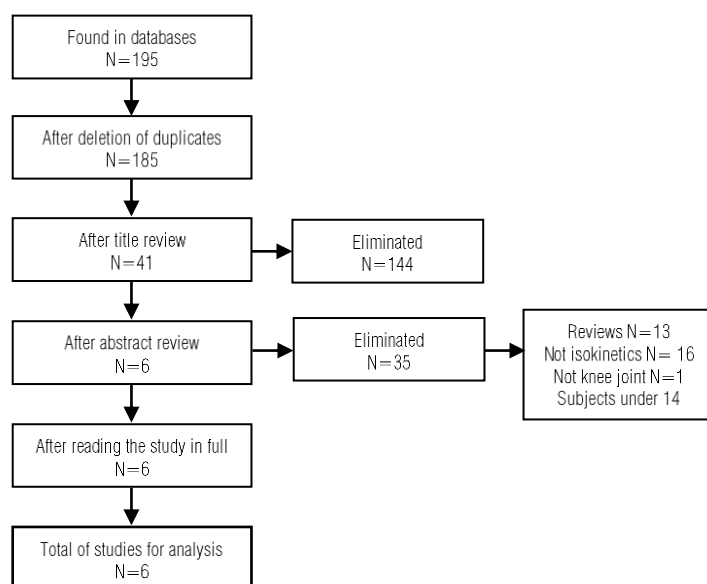


Figure 1 Selection of Research Studies for Analysis

et al. (2010), Reis et al. (2013), Daneshjoo et al. (2012), Daneshjoo et al. (2013a), Daneshjoo et al. (2013b), and Lopes et al. (2019).

## Discussion

Regarding the 30°/s speed test, there has been noted a slight improvement of the non-dominant leg PT Q (16%), whereas no changes regarding the muscle have been noted on the dominant leg. However, at this speed, significantly greater changes have been noted on the hamstring – dominant leg PT H showed a 24.8% improvement, whereas non-dominant leg PT H showed a 28.7% improvement. These results appeared as a consequence of a lack of exercises within FIFA 11+ aiming to strengthen the quadriceps itself. The majority of exercises are focused on developing proprioception and stabilisation. On the other hand, the programme contains an exercise aiming to strengthen the hamstring, which ultimately led to a significant

improvement in PT hamstring parameter in both legs at the 30°/s speed. Regarding the quadriceps and hamstring PT at the speed of 60°/s, different research studies have yielded different results. However, what is most important is that all the changes were positive.

Different research studies showed that, at the speed of 60°/s, dominant leg PT Q had an increase of 6.9% and 19.7%, whereas non-dominant leg PT Q had an increase of 35.3% and 31.3% at the same speed. After calculating the arithmetic mean of the aforementioned results, the following values were obtained: dominant leg PT Q had an increase of 13.3%, whereas non-dominant leg PT Q had an increase of 33.3% at the 60°/s speed. The research has shown that, at the 60°/s speed, dominant leg PT H had an increase of 20.4%, 19.8% and 22%, whereas non-dominant leg PT H had an increase of 14.6%, 13.7% and 31.3%. After calculating the arithmetic mean of the aforementioned results, the following values were obtained: dominant leg PT H had an increase of 20.7%, whereas non-

Table 1: A Review of Research Studies Focused on Analysing the Influence of the FIFA 11+ Programme on Isokinetic Parameters

Research study	Subject pattern	Aim	Variables pattern	Research results
Brito et al., 2010	20 (M) age=22.3	Determining whether FIFA 11+ influences the increase of isokinetic strength of knee extensors and flexors	Bilaterally, CON contraction 60°/s and 180°/s, ECC contraction 30°/s.	Dominant leg: 6.9% (60°) and 8.3% (180°) PT Q increase, 20.4 (60°) PT H increase. Non-dominant leg: 14.6 %, 15 % and 14.3 % PT H at all speeds.
Daneshjoo et al., 2012	36 (M) ECC (11+), n=12 ECC (HK), n=12 CON, n=12 age=21	Analysing the effects of FIFA 11+ and HarmoKnee warm-up programme on proprioception and static and dynamic balance	Bilateral knee flexion at the 30°, 45° and 60° speed, stork stand test and Star Excursion Balance Test (SEBT)	A 2.8% and 1.7% decrease in proprioceptive defect at the 45° and 60° speed. The highest positional joint defect found in non-dominant leg at the speed of 30°.
Daneshjoo et al., 2013 (a)	36 (M) ECC (11+), n=12 ECC (HK), n=12 CON, n=12 age=18.9	Analysing the effects of FIFA 11+ and HarmoKnee warm-up programme on the hamstring (H) and quadriceps (Q) strength development	Bilaterally at the 30°/s, 60°/s and 90°/s.	Dominant leg: Q: 19.7% and 47.8% (60° and 90°). H: 24.8% and 19.8% (30° and 60°). Non-dominant leg: Q: 16%, 35.3% and 78.1% (at all speeds). H: 28.7% and 13.7% (30° and 60°). FIFA 11+ strengthens the hamstring and quadriceps.
Daneshjoo et al., 2013 (b)	36 (M) ECC (11+), n=12 ECC (HK), n=12 CON, n=12 age=17-20	Analysing the effects of FIFA 11+ and HarmoKnee warm-up programme on knee strength	Bilateral, hamstring (H) and quadriceps (Q) at the 60°/s, 180°/s and 300°/s speed.	Dominant leg: PT Q: 27.7% (300°). PT H: 22%, 21.4% and 22.1% (at all speeds). Non-dominant leg: PT H: 31.3%, 31.7% and 20.1% (at all speeds). FIFA 11+ has proved useful for strengthening the hamstring.
Reis et al., 2013	36 (M) ECC, n=18 CON, n=18 age=17.3	Analysing whether FIFA 11+ training programme enhances physical and technical abilities	Isokinetics (H:Q ratio), 5m and 30 m sprint, T-Test of Agility, slalom dribbling, squat jump (SJ), countermovement jump (CMJ), Flamingo Balance Test.	H:Q ratio increase of 6.7%, SJ increase of 13.8%, CMJ increase of 9.9%, 5m sprint increase of 8.9%, 30m sprint increase of 3.3%, agility increase of 4.7% and slalom increase of 4.8%. Balance Test fails decrease of 30% noted. FIFA 11+ may be used effectively for the development of physical and technical abilities.
Lopes et al., 2019	71 (M) ECC=37, 27±5.1 CON=34, 26±5.1 Futsal	Determining short- and long-term effects of FIFA 11+ programme on knee strength and muscle latency parameters	Bilaterally, knee joint at 60°/s and ankle joint at 180°/s speed.	FIFA 11+ programme has not led to short-term effects in knee strength or muscle latency. On the other hand, significant long-term results regarding eccentric strength and H:Q ratio were noted.

dominant leg PT H had an increase of 19.8% at the 60°/s speed.

The 90°/s speed test was included in one research only, and the following results have been obtained: dominant leg PT Q had an increase of 47.8% and non-dominant leg PT Q had an increase of 78.1%, while no significant changes have been noted either in the dominant or non-dominant leg PT H.

At the speed of 180°/s, dominant leg PT Q had an increase of 8.3%, whereas no quantitative changes have been noted in non-dominant leg PT Q. Dominant leg PT H had a quantitative increase of 21.4%, and non-dominant leg PT H had an increase of 15% at this speed.

At the speed of 300°/s, dominant leg PT Q had an increase of 27.7%, whereas no significant quantitative changes have been noted in non-dominant leg PT Q. Dominant leg PT H had an increase of 22.1%, and non-dominant leg PT H had an increase of 20.1%.

Also, it has been shown that the application of the FIFA 11+ programme has led to an improvement regarding the hamstring and quadriceps (H:Q) ratio, i.e. that of a 6.7%.

## Conclusion

The research conducted has proved that the application of the FIFA 11+ prevention programme may have a significant influence on the improvement of isokinetic strength of the knee during flexion and extension at different speed rates (30°/s, 45°/s, 60°/s, 90°/s, 180°/s and 300°/s). In order to achieve the desired effects, it is necessary to use the full programme three times a week at minimum during training, as well as to use the first and third part of the programme before each match. The results should become visible after ten to twelve weeks of constant and regular application of this programme. There has also been noted a positive effect in amateur futsal players. The general conclusion of this paper is that the FIFA 11+ complex warm-up programme is a useful and applicable tool, the usage of which might lead to a decrease of the unilateral and bilateral imbalance of the quadriceps femoris and biceps femoris muscles in football and futsal players, which ultimately might result in a diminished risk of injury. In order to achieve the highest success, it is necessary to provide additional training for coaches, as well as fully involve them into the application of the programme, in the sense of putting emphasis on performing the exercises by using the proper technique.

## References

1. Ardern, CL., Pizzari, T., Wollin, MR & Wevster, KE. (2015). Hamstrings strength imbalance in professional football (soccer) players in Australia. *J Strength Cond Res.*, 29(4), pp. 997-1002.
2. Bogdanis, GC., Kalapotharakos, VI. (2015). Knee Extension Strength and Hamstring-to-Quadriceps Imbalances in Elite Soccer Players. *Int J SportsMed.*, <http://www.ncbi.nlm.nih.gov/pubmed/26509377>.
3. Boone, J., Vaeyens, R., Steyaert, A., Vanden Bossche, L & Bourgois, J. (2012). Physical fitness of elite Belgian soccer players by player position. *Journal of Strength and Conditioning Research*, 26 (8), pp. 2051-2057.
4. Brito, J., Figuerido, P., Fernandes, L., Seabra, A., Soares, J. M., Krstrup, P. & Rebelo, A. (2010). Isokinetic strength effects of FIFA's "The 11+" injury prevention programme. *Isokinetics and Exercise Science*, 18, pp. 211-215.
5. Caraffa, A., Cerulli, G., Progetti, M., Aisa, G. & Rizzo, A. (1996). Prevention of Anterior cruciate ligament injuries in soccer. *Knee Surg. Sport Traumatology, Arthroscopy*, 4, pp. 19 – 21.
6. Cimino, F. (2010). Anterior Cruciate Ligament Injury: Diagnosis, Management and Prevention. *Am Fam Physician*, 82(8), pp. 917-922.
7. Daneshjoo, A., Mokhtar, A.H., Rahnama, N. & Yusof, A. (2012). The effects of injury preventive warm-up programs on knee strength ratio in young male professional soccer players. *PLoS One*, 7(12), e50979.
8. Daneshjoo, A., Mokhtar, AH., Rahnama, N. & Yusof, A. (2013a). The Effects of injury prevention warm-up programs on knee strength in male soccer players. *Biol. Sport*, 30, pp. 281-288.
9. Daneshjoo, A., Rahnama, N., Mokhtar, A.H. & Yusof, A. (2013b). Effectiveness of injury prevention programs on developing quadriceps and hamstring strength of young male professional soccer players. *Journal of Human Kinetics*, 39, pp. 115-125.
10. Del Pupo, J., Detanico, D. & Santos, SG. (2014). The fatigue effect of a simulated futsal match protocol on isokinetic knee torque production. *Sports Biomech.*, 13(4), pp. 332-340.
11. Evangelidis, PE., Pain, MT. & Folland, J (2015). Angle-specific hamstring-to-quadriceps ratio: a comparison of football players and recreationally active males. *J Sports Sci.*, 33(3), pp. 309-319.
12. Faude, O., Rossler, R. & Junge, A. (2013). Football injuries in children and adolescent players: are there clues for prevention? *Sports Medicine*, 43 (9), pp. 819-837.

13. Greco, C., Wendell, Da Silva, W., Camarada, S. & Denadai, B. (2012). Rapid Hamstring/Quadriceps strength capacity in professional soccer players with different conventional isokinetic muscle strength ratios. *Journal of Sport Science & Medicine*, 11, pp. 418 – 422.
14. Kovač, S., Abazović, E., Kovačević, E. & Alić, H. (2013). Izokinetičko testiranje i trening. Sarajevo: Fakultet sporta i tjelesnog odgoja Univerziteta u Sarajevu.
15. Ksibi, I, Kessomtini, W., llehi, Y., Maaoui, R. i Khachlouf, H. (2015). Isokinetic profile of knee muscles in Tunisian competitive footballers. *Tunis Med.*, 93 (5), pp. 322-325.
16. Lopes, M., Rodrigues, J.M., Monteiro, P., Rodrigues, M., Costa, R., Oliveira, J. & Ribeiro, F. (2019). Effects of the FIFA 11+ on ankle evertors latency time and knee muscle strength in amateur futsal players. *Eur J Sport Sci.*, 15(1), (*Epub ahead of printing*).
17. Malacko, J. & Rađo, I. (2004). Tehnologija sporta i sportskog treninga. Sarajevo: Fakultet sporta i tjelesnog odgoja Univerziteta u Sarajevu.
18. McKay, C., Steffen, K., Romiti, M., Finch, C & Emery C. (2014) The effect of coach and player injury knowledge, attitudes and beliefs on adherence to the FIFA 11+ programme in female youth soccer. *British Journal of Sport Medicine*, 48, pp. 1281-1286.
19. Milanović, D. (2013). Teorija treninga. Zagreb: Kineziološki fakultet Sveučilišta u Zagrebu.
20. Myer, G., Ford, K., Barber Foss, K., Liu, C., Nick, T. & Hewett, T. (2009). The Relationship of Hamstring and Quadriceps Strength to Anterior Cruciate Ligament Injury in Female Athletes. *Clinical Journal of Sport Medicine*, 19 (1), pp. 3-8.
21. Quisquater, L., Bollars, P., Vanlommel, L. Claes, S., Corten, K. & Bellemans, J. (2013). The incidence of knee and anterior cruciate ligament injuries over one decade in the Belgian Soccer League. *Acta Orthop Belg.*, 79 (5), pp. 541-546.
22. Reis, I., Rebelo, A., Krstrup, P. & Brito, J. (2013). Performance Enhancement Effects of Federation Internationale de Football Association's "The 11+" Injury Prevention Training Program in Youth Futsal Players. *Clinical Journal of Sport Medicine*, 0 (0), pp. 1-3.
23. Schneider, A.S., Mayer, H.M., Geisser, U., Rumpf, M.C. & Schneider, C. (2013). Injuries in male and female adolescent soccer players. *Sportverletz Sportschaden*, 27 (1), pp. 34-38.
24. Soligard, T., Nilstad, A., Steffen, K., Myklebust, G., Holme, I., Dvorak, J., Bahr, R. & Andersson T.E. (2010). Compliance with a comprehensive warm-up programme to prevent injuries in youth football. *British Journal of Sport Medicine*, 44, pp. 787-793.
25. Steffen, K., Meeuwisse, W.H., Romiti, M., Kang, J., McKay, C., Bizzini, M., Dvorak, J., Finch, C., Myklebust, G. & Emery, C.A. (2013). Evaluation of how different implementation strategies of an injury prevention programme (FIFA 11+) impact team adherence and injury risk in Canadian female youth football players: a cluster-randomised trial. *British Journal Sports Medicine*, 47 (8), pp. 480-487.
26. Suzue, N., Matsuura, T., Iwame, T., Hamada, D., Goto, T., Takata, Y., Iwase, T. & Sairyo, K. (2014). Prevalence of childhood and adolescent soccer-related overuse injuries. *J Med Invest.* 61 (3-4), pp. 369-373.
27. Verheijen, R. (2014). Football periodization – always play with your strongest team – Part 1. Amsterdam: World Football Academy.

Corresponding author:

**Eldin Jelešković**

Faculty of Sport and Physical Education, University of Sarajevo,

Bosnia and Herzegovina

e-mail address: jela\_13@hotmail.com

**Submitted:** 02.09.2019.

**Accepted:** 24.05.2020.