

Implementation of the FIFA 11+ referees injury prevention program among soccer referees

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Abstract:

Background and aim: Soccer referees have significant risk of injuries, particularly to the lower limbs. A growing body of research supports the use of injury prevention programs to prevent such injuries, yet participation rates in these programs by soccer referees is still not been investigated. The Fédération International de Football Association (FIFA) 11+ Referees Injury Prevention Program (FIFA 11+ Referees Program) is a structured warm-up program specially designed to prevent injuries in soccer referees. Therefore, this study aimed to assess soccer referees' awareness, implementation, and opinion of the FIFA 11+ Referees Injury Prevention Program's efficacy. Materials and methods: A self-administered questionnaire was used. The questionnaires were provided by a Google spreadsheet. The survey consisted of six questions covering country, gender, type of soccer, awareness of FIFA 11+, implementation of the FIFA 11+ referees' practices, and opinion about participation. Questions that sought awareness of injury prevention programs had answers of either yes/no. Questions that sought implementation of injury prevention programs were answered only by aware participants and answers were yes/no; if the answer was yes, it moves to a question related to which exercise components are used in the field, and the answers were multiple choice. Questions about their opinion of the effectiveness of the program to prevent injuries were only answered by participants who are implementing the FIFA 11+ program and collected on a scale of 0 (ineffective) to 10 (highly effective). The survey was available in Arabic, English, French, German, Italian, Japanese, Portuguese, Russian, Spanish, and Turkish. Results: A total of 727 soccer referees completed the survey. Only 234 (32.2%) of the participants were aware of the FIFA 11+ Referees Program, and 208 (28.6%) were implementing the FIFA 11+ Referees Program in their current practice. Participants who are implementing the FIFA 11+ Referees Program reported a positive opinion about the program efficacy with a score of 7.5 ± 1.3 out of 10. The results suggested that improving awareness of the FIFA 11+ Referees Program could increase the implementation, which could help to reduce injuries. Conclusion: Good levels of implementation were reported among the participants who reported awareness of the FIFA 11+ Referees Injury Prevention Program. In addition, participants who are implementing the program reported a positive opinion about the FIFA 11+ Referees Injury Prevention Program efficacy.

Keywords: Surveys and Questionnaires, Warm-Up Exercise, Athletes, Football

Introduction

The referee and assistant referee always play a vital role in a football (soccer) match and are needed to 'keep up with the play' to ensure optimal positioning in making key decisions (Weston et al., 2012). Referees cover 9–13 km during a match, typically with 900 meters of running at high speed. This demands a high level of physical fitness and is a significant physical challenge (Castagna et al., 2007). Referees are typically 15–20 years older than other players, and this increases their risk of sustaining injuries and often results in different management of the injuries (Castagna et al., 2007). Referees may have considerable risk of both acute and overuse injuries. However, there are limited data available in the extant literature targeting the injury profile of referees. The Fédération International de Football Association (FIFA) World Cup in Germany reported that, during 2006, 14 referees (22%) incurred an injury and over 30% had musculoskeletal problems (Bizzini et al., 2009b). A few months before the 2007 FIFA Women's World Cup, all 81 pre-selected female referees completed a questionnaire on their injuries and musculoskeletal problems during the training camps. All injuries, musculoskeletal problems, and related care of the 36 officiating referees were reported during the final 32 matches of the tournament in China. Approximately 50% of the referees reported having suffered at least one

injury during their career, resulting in game time loss. Then, 13 (16%) of referees reported having suffered an injury in the previous 12 months, and 64 (79%) reported musculoskeletal problems related to refereeing (Bizzini et al., 2009c). In the top divisions of the Swiss Football League, 41 injuries were recorded by 31 of 71 referees (44%), and 90% of the referees reported musculoskeletal problems over the competitive season of 2005–2006 (Bizzini et al., 2009a). In the Iranian Premier Football League, 102 injuries were reported by referees during the season of 2009–2010 (Kordi et al., 2013). The results of these studies show that the most common injuries were hamstring strains, calf strains, and ankle sprains, and the most common overuse injuries were the lower back, hamstring, and gastrocnemius-Achilles tendon complex.

FIFA 11+ is an injury prevention program designed to prevent football injuries. It was developed in 2006 by The FIFA Medical and Research Centre (F-MARC), Santa Monica Orthopedic and Sports Medicine Research Foundation (SMSMF) and the Oslo Sports Trauma Research Centre (OSTRC) (Bizzini et al., 2015). It is used as a warm-up program, which consists of 15 exercises divided into three components, initial running followed by plyometric and balance exercises focused on core strength, eccentric control, and proprioception finishing with high-speed and change-of-direction running. Recent reviews indicated that doing the FIFA 11+ program regularly improves individual's measures of performance, neuromuscular control, and reduces the incidence of injuries (Bizzini et al., 2013; Impellizzeri et al., 2013). Furthermore, several studies have shown the effectiveness of the FIFA 11+ program in several countries (Al Attar et al., 2021; Steffen et al., 2013; Hammes et al., 2015; Owoeye et al., 2014; Soligard et al., 2008; Grooms et al., 2013). A randomized controlled trial was conducted (Al Attar et al., 2021) to investigate the effectiveness of the FIFA 11+ Referees Program in reducing injury rates among soccer referees. A total of 24 injuries were reported among 100 referees in the control group in 16,606 hours of exposure (1.45 injuries/1,000 exposure hours), and nine injuries were reported across 100 referees within the experimental group in 17,834 exposure hours (0.50 injuries/1,000 exposure hours). The Injury Risk Ratio (IRR) was 0.35 (95% CI 0.26 to 0.45). The results indicated that the FIFA 11+ Referees Program effectively reduced injuries in the experimental group by 65% compared to the control group. Moreover, a large randomized controlled trial was conducted (Silvers-Granelli et al., 2015) to examine the effectiveness of the FIFA 11+ program in the men's United States National Collegiate Athletic Association (NCAA) Division I and Division II soccer. They found that the FIFA 11+ program reduced overall injury rates by 46.1% and reduced time lost due to injuries by 28.6%. Furthermore, Sadigursky et al. (2017) conducted a systematic review to evaluate the effectiveness of the FIFA 11+ Injury Prevention Program in soccer players. Based on the results of their study, the FIFA 11+ program reduced injuries in soccer players by 30% with an estimated relative risk of 0.70 (95% confidence interval, 0.52–0.93, $p = 0.01$). Moreover, Al Attar et al. (2017) conducted a meta-analysis to investigate the efficacy of injury prevention programs, which included the Nordic Hamstring Exercise (NHE) on hamstring injury among soccer players. The NHE is an eccentric exercise of the hamstring muscle and one of the most important components of the FIFA 11+ program. The results of their study were reported based on the total injuries per 1,000 hours of exposure, and they found that teams that used injury prevention programs, including the NHE, had a reduction of 51% in hamstring injuries (IRR 0.490, 95% CI: 0.291–0.827, $p = 0.008$) compared with teams that did not use any injury prevention measures. Furthermore, Al Attar et al. (2019) conducted a meta-analysis of meta-analyses to investigate the preventive effect of the FIFA 11+ injury prevention program in soccer; four meta-analyses were included in this review, and the results indicated a reduction of all injuries by 34% [RR= 0.66 (0.60 – 0.73)] and a reduction of 29% [RR= 0.71 (0.63 – 0.81)] of injuries to the lower limb. Another systematic review and meta-analysis of the FIFA 11 and 11+ programs (Thorborg et al., 2017) found that the FIFA 11+ Injury Prevention Program has a considerable effect on reducing football injuries in recreational football players by 39%, whereas the effect of the FIFA 11 Injury Prevention Program alone could not be documented. Moreover, they also concluded that the FIFA 11+ Injury Prevention Program reduces the most prevalent football injuries, including hamstring, knee, hip/groin, and ankle injuries by 60%, 48%, 41%, and 32%, respectively.

Given the high number of injuries for referees, and after the success of the FIFA 11+ program in soccer players, prevention programs for referees are acutely relevant. The FIFA 11+ Referees Injury Prevention Program was developed by the FIFA Medical and Research Centre (F-MARC) in cooperation with the FIFA refereeing department, which was based on the specific injury profile of referees and the FIFA 11+ Injury Prevention Program (Bizzini et al., 2013; FIFA medical network, 2016). The FIFA 11+ Referees Injury Prevention Program consists of 18 exercises divided into three components: initial running followed by plyometric and balance exercises to focus on core strength, eccentric control, and proprioception with finishing with high-speed and change-of-direction running (Bizzini et al., 2013; FIFA medical network, 2016). This program is based on the original FIFA 11+ game, but the difference lies in the type of exercises. This difference may be due to the difference in physical performance and tasks on the field between the referees and the players.

Compliance and awareness in sports injury prevention programs are extremely important, and they can significantly affect study results and can reduce the incidence of soccer injuries (van Reijen et al., 2016; Al Attar et al., 2016). Several studies have indicated that high adherence to the FIFA 11+ and neuromuscular injury prevention programs can significantly improve the functional balance and reduce the risk of injury (Hammes et al., 2015; Owoeye et al., 2014). However, Bahr et al. (2015) examined the adherence and implementation of the NHE program for the top-level men's football leagues of Europe, Union of European Football Associations

(UEFA) Champions League (UCL), and the Norwegian Premier League soccer teams. The results of their study showed that compliance among European male soccer players was too low to expect it to affect acute hamstring injury rates. Furthermore, Al Attar et al. (2018) evaluated implementation of injury prevention programs, especially the FIFA 11+ program used by Australian and Saudi Arabian soccer coaches. The results of their study demonstrated substantial gaps between the recommendations, knowledge, and awareness for using a soccer injury prevention program, the FIFA 11+ program, and the actual practice among Australian and Saudi Arabian soccer coaches.

To date, there is a lack of data published in the extant literature regarding the current use of injury prevention programs, awareness, and implementation strategies for the FIFA 11+ referee exercises among soccer referees and assistant referees worldwide. Therefore, the aim of this study was to investigate awareness, knowledge of injury prevention programs, specifically the FIFA 11+ Referees Program, among worldwide soccer referees and assistant referees.

Materials & Methods

Survey Development

To our knowledge, there are no validated questionnaires addressing the knowledge of injury prevention programs, specifically the FIFA 11+ Referees Injury Prevention Program for referees and assistant referees. Therefore, a survey was distributed to collect information about the knowledge, awareness, and opinions of injury prevention programs, specifically the FIFA 11+ Referees Injury Prevention Program among referees and assistant referees internationally. Question development was guided by several authors with expertise and extensive experience in sport medicine and injury prevention programs. To assess the validity of each question, a pilot testing was performed prior to the beginning of the study. The questionnaires were provided via a Google spreadsheet. The survey was distributed to soccer referees, soccer assistant referees, and soccer referees or soccer assistant referees' coaches who were representative of the final testing cohort due to their varying experience. The survey consisted of six questions covering country, gender, type of soccer, awareness of FIFA 11+, implementation of the FIFA 11+ referees' practices, and the opinion about participation. Questions that sought awareness of injury prevention programs had yes/no answers. Questions that sought implementation of injury prevention programs were answered only by aware participants and answers were yes/no; if the answer was yes, it moves to a question related to which exercise components are used in the field, and the answer was multiple choice. Questions about opinion of the effectiveness of the program to prevent injuries were answered only by participants who are implementing the FIFA 11+ program and collected on a scale of 0 (ineffective) to 10 (highly effective). The survey was available in Arabic, English, French, German, Italian, Japanese, Portuguese, Russian, Spanish, and Turkish. The Biomedical Ethics Committee at Umm Al Qura University reviewed and approved the study; approval number: HAPO02K012202010460.

Survey Dissemination

To gather a convenient sample of soccer referees, soccer assistant referees, and soccer referees or soccer assistant referees' coaches, a survey invitation was distributed through FIFA Member Associations. The invitation provided a brief background of the survey and encouraged soccer referees, soccer assistant referees, and soccer referees or soccer assistant referees' coaches to participate regardless of their level of experience with the FIFA 11+ Referees Injury Prevention Program. Interested respondents clicked on an electronic link that led them to the survey description, and they were able to provide informed consent and access the survey. Once respondents had submitted the survey, they could not respond again. Surveys were completed anonymously via a web-based form. The survey was open for respondents to participate from June 2019 to June 2020.

Sample Size and Statistical Analysis

According to FIFA, there are more than 4,000 soccer referee members worldwide. Considering a 3% margin of error at a 95% confidence level, the minimum target number of participants was 843. Frequencies and percentages of all nominal variables, mean, and standard deviation (SD) for score of opinion were calculated using Microsoft Excel 2010 (Microsoft Corporation, Redmond, WA, USA). A Chi-square test was used to compare different geographical locations with respect to awareness, implementation, and opinion. One-way analysis of variance (ANOVA) was used to compare different geographical locations with respect to opinion. Results were considered significant for p-values below 0.05 ($P < 0.05$). Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 24.0 (SPSS Inc., Chicago, IL, USA).

Results

A total of 727 out of 900 (80.7%) respondents fully participated and completed the questionnaire. The collected data are classified, according to the country of participation in the questionnaire, into six continental football federations: the UEFA 263 (36.2%), the South American Football Confederation (CONMEBOL) 50 (6.9%), the Asian Football Confederation (AFC) 210 (28.9%), the Confederation of African Football (CAF) 119 (16.4%), the Confederation of North, Central American, and Caribbean Association Football (CONCACAF) 57 (7.8%), and the Oceania Football Confederation (OFC) 28 (3.9%). The types of referees were classified into soccer referees at 524 (72.1%), soccer assistant referees at 173 (23.8%), and soccer referees or soccer assistant

referees' coaches at 30 (4.1%). A total of 677 (93.1%) of the respondents were male, and 50 (6.9%) were female. A complete description of the sample's socio-demographic profile is provided in Table 1.

Table 1. Participant characteristics

Variable	n (%)
Continental football federations	
UEFA	263 (36.2%)
CONMEBOL	50 (6.9%)
AFC	210 (28.9%)
CAF	119 (16.4%)
CONCACAF	57 (7.8%)
OFC	28 (3.9%)
Gender	
Male	677 (93.1%)
Female	50 (6.9%)
Type	
Soccer Referee	524 (72.1%)
Soccer Assistant Referee	173 (23.8%)
Soccer Referees or Soccer Assistant Referees Coach	30 (4.1%)

AFC, Asian Football Confederation; CAF, Confederation of African Football; CONCACAF, Confederation of North, Central American, and Caribbean Association Football; CONMEBOL, South American Football Confederation; OFC, Oceania Football Confederation; UEFA, Union of European Football Associations

Level of awareness

There were 234 (32.2%) of the participants aware of the program, while 493 (67.8%) were not aware. The females reported a 38.0% awareness, and males reported 31%. No statistically significant differences were found in the awareness levels between males and females ($p = 0.360$). The soccer referees or soccer assistant referees' coaches reported the greatest percentage of awareness at 33.3%, followed by soccer assistant referees at 32.9% and soccer referees at 31.9%. No statistically significant differences were found in the awareness levels between the different type of referees ($p = 0.957$), as shown in Fig.1 and Table 2.

Table 2. Comparison of the awareness and implementation of the FIFA 11+ Referees Injury Prevention Program.

	Implementation		P-value
	Yes (n = 208)	No (n = 25)	
Aware (yes) (n = 233)	208 (89.3%)	25 (10.7%)	< 0.0001
Gender			
Male (n = 215)	194 (90.2%)	21 (9.8%)	0.111
Female (n = 18)	14 (77.8%)	4 (22.2%)	
Type			
Soccer Referee (n = 166)	148 (89.2%)	18 (10.8%)	0.510
Soccer Assistant Referee (n = 57)	50 (87.7%)	7 (12.3%)	
Soccer Referees or Soccer Assistant Referees' Coaches (n = 10)	10 (100%)	0 (0%)	
Continental football federations			
UEFA (n = 111)	95 (85.6%)	16 (14.4%)	0.188
CONMEBOL (n = 26)	22 (84.6%)	4 (15.4%)	
AFC (n = 46)	45 (97.8%)	1 (2.2%)	
CAF (n = 23)	20 (87%)	3 (13%)	
CONCACAF (n = 11)	11 (100%)	0 (0%)	
OFC (n = 16)	15 (93.8%)	1 (6.3%)	
Awareness			
	Yes (n = 234)	No (n = 493)	P-value
Gender			
Male (n = 677)	215 (31.8%)	462 (68.2%)	0.362
Female (n = 50)	19 (38.0%)	31 (62.0%)	
Type			
Soccer Referee (n = 524)	167 (31.9%)	357 (68.1%)	0.957
Soccer Assistant Referee (n = 173)	57 (32.9%)	116 (67.1%)	
Coach (n = 30)	10 (33.3%)	20 (66.7%)	

Continental football federations

UEFA (n = 263)	112 (42.6%)	151 (57.4%)	
CONMEBOL (n = 50)	26 (52%)	24 (48%)	
AFC (n = 210)	46 (21.9%)	164 (78.1%)	< 0.0001
CAF (n = 119)	23 (19.3%)	96 (80.7%)	
CONCACAF (n = 57)	11 (19.3%)	46 (80.7%)	
OFC(n = 28)	16 (57.1%)	12 (42.9%)	

AFC, Asian Football Confederation; CAF, Confederation of African Football; CONCACAF, Confederation of North, Central American, and Caribbean Association Football; CONMEBOL, South American Football Confederation; OFC, Oceania Football Confederation; UEFA, Union of European Football Associations



Figure 1: Awareness of the FIFA 11+ Referees Injury Prevention Program worldwide.

The OFC reported the greatest percentage of awareness at 57.1%, followed by the CONMEBOL at 52%, the UEFA at 42.6%, the Asian Football Confederation (AFC) at 21.9%, and the CONCACAF and the CAF reported the same percentage at 19.3%. Statistically significant differences were found in the awareness levels between the different continental football federations ($p < 0.0001$); see Table 3.

Table 3. Comparison of the awareness of the Continental Football Federation participants

		Continental football federations					P-value	
		UEFA (n = 263)	CONMEBOL (n = 50)	AFC (n = 210)	CAF (n = 119)	CONCACAF (n = 57)		OFC (n = 28)
Gender	Male	230 (87.5%)	48 (96.0%)	210 (100%)	114 (95.8%)	52 (91.2%)	23 (82.1%)	< 0.0001
	Female	33 (12.5%)	2 (4.0%)	0 (0%)	5 (4.2%)	5 (8.8%)	5 (17.9%)	
Aware	Yes	112 (42.6%)	26 (52.0%)	46 (21.9%)	23 (19.3%)	11 (19.3%)	16 (57.1%)	< 0.0001
	No	151 (57.4%)	24 (48.0%)	164 (78.1%)	96 (80.7%)	46 (80.7%)	12 (42.9%)	
Type	Soccer Referee	198 (75.3%)	35 (70.0%)	146 (69.5%)	83 (69.7%)	43 (75.4%)	19 (67.9%)	0.931
	Soccer Assistant Referee	57 (21.7%)	12 (24.0%)	55 (26.2%)	30 (25.2%)	11 (19.3%)	8 (28.6%)	
	Soccer Referees or Soccer Assistant	8 (3.0%)	3 (6.0%)	9 (4.3%)	6 (5.0%)	3 (5.3%)	1 (3.6%)	
	Referees Coach							

AFC, Asian Football Confederation; CAF, Confederation of African Football; CONCACAF, Confederation of North, Central American, and Caribbean Association Football; CONMEBOL, South American Football Confederation; OFC, Oceania Football Confederation; UEFA, Union of European Football Associations

Rate of implementation

A total of 234 (32.2%) of the participants were aware of the FIFA 11+ Referees Injury Prevention Program, and 208 (28.6%) of the participants implemented the program, while 25 (3.4%) did not implement it. The greatest percentage of aware participants reported implementation at 89.3%. Significant association was found between aware participants and implementation levels ($p < 0.0001$). The males reported 90.2% implementation, and females reported 77.8%. No statistically significant differences were found between males and females in the implementation levels ($p = 0.360$). The soccer referees or soccer assistant referees' coaches reported the greatest percentage of implementation at 100%, followed by soccer referees at 89.2% and soccer assistant referees at 87.7%. No statistically significant differences were found in the implementation levels between the different type of referees ($p = 0.510$), as shown in Table 2.

The CONCACAF reported the greatest percentage of implementation at 100%, followed by the AFC at 97.8%, The OFC was at 93.8%, the CAF was at 87%, the UEFA was at 85.6%, and the CONMEBOL was at 84.6%. No statistically significant differences were found in the implementation levels between the different continental football federations ($p = 188$); see Table 4.

Opinions on the effectiveness

In total, 208 participants who are implementing the program reported a positive opinion about the program efficacy with a score of 7.5 ± 1.3 out of 10. Statistically significant differences were found in the opinion score between the different continental football federations ($p = 0.027$). The differences in opinion are shown in Table 4.

Table 4. The differences in opinion about the FIFA 11+ Referees Injury Prevention Program efficacy

		Continental football federations						P-value
		UEFA (n = 111)	CONMEBOL (n = 26)	AFC (n = 46)	CAF (n = 23)	CONCACAF (n = 11)	OFC (n = 16)	
Implement	Yes	95 (85.6%)	22 (84.6%)	45 (97.8%)	20 (87%)	11 (100%)	15 (93.8%)	0.188
	No	16 (14.4%)	4 (15.4%)	1 (2.2%)	3 (13%)	0 (0%)	1 (6.3%)	
Opinion	1	1 (1.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
	4	9 (9.5%)	0 (0.0%)	6 (13.3%)	1 (5.0%)	2 (18.2%)	0 (0.0%)	
	5	15 (15.8%)	2 (9.1%)	7 (15.6%)	3 (15.0%)	3 (27.3%)	1 (6.7%)	
	6	20 (21.1%)	4 (18.2%)	12 (26.7%)	6 (30.0%)	4 (36.4%)	3 (20.0%)	
	7	26 (27.4%)	8 (36.4%)	9 (20.0%)	6 (30.0%)	1 (9.1%)	6 (40.0%)	
	8	22 (23.2%)	8 (36.4%)	11 (24.4%)	4 (20.0%)	1 (9.1%)	4 (26.7%)	
	9	2 (2.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (6.7%)	
	10							
	Opinion Score		7.42	8.0	7.27	7.45	6.64	8.07
	Mean \pm SD		± 1.365	± 0.976	± 1.355	± 1.146	± 1.206	± 1.033
Min. – Max.		4 – 10	6 – 9	5 – 9	5 – 9	5 – 9	6 – 10	

AFC, Asian Football Confederation; CAF, Confederation of African Football; CONCACAF, Confederation of North, Central American, and Caribbean Association Football; CONMEBOL, South American Football Confederation; OFC, Oceania Football Confederation; UEFA, Union of European Football Associations.

Discussion

This is the first study to concentrate on referees, and the first international study that includes referees from all over the world. The results indicated that most of the worldwide soccer referees, soccer assistant referees, and soccer referees or soccer assistant referees' coaches are unaware of the FIFA 11+ Referees Injury Prevention Program. In addition, the results showed good levels of implementation among the participants who reported awareness of the FIFA 11+ Referees Injury Prevention Program. Because there are no previous studies that have assessed awareness, or knowledge of the FIFA 11+ Referees Injury Prevention Program among soccer referees, it is indispensable to compare the findings of this current study to similar FIFA 11+ Injury Prevention Program studies of players that have been used and applied by coaches.

The number of participants was 234 (32.2%) who were aware of the program at the time of answering the surveys, in contrast to the results of previous studies that focused on coaches. A study by Junge et al. (2011) was conducted in Switzerland to investigate the success of implementation an earlier version of the program, (FIFA 11), and they found an awareness level of 80%, which was higher than in our study. Nevertheless, initial

education was included for all participating coaches, which means that the selected sample of their study might not have been representative of the broader coaching population. Another study conducted by O'Brien et al. (2016) found higher levels of knowledge (61%) than in our study. The reason behind these higher rates in those two studies than in the current study of referees is that their populations included coaches, physiotherapists, referees, and fitness trainers. Furthermore, a limited sample size ($n=18$) of respondents were obtained in the study by O'Brien et al. (2016). In another study of players' knowledge about the program, 20.7% of Nigerian youth players knew about it (Owoeye et al., 2013).

Although a considerable number of referees included in the current study knew about the program, the effectiveness of the existing strategies to promote the program can be improved. One way to achieve greater knowledge is by educating referees. In accordance with the standards set by the UEFA, Germany offers a progressive license system with four main levels (C level, B level, A level, and Pro level) (Deutscher Fussball-Bund, 2015). An analysis of the contents of the educational systems demonstrated some of the issued licenses, e.g., A level and B level, which include topics specifically dedicated to fitness training and prevention. This could explain the reason for the high awareness rate among licensed owners. Thus, there is a need for more expansive distribution of knowledge about injury prevention programs, which might improve awareness about using these programs.

It is recommended to conduct workshops and disseminate brochures among referees to increase the knowledge and improve awareness of the program. In the current study, 208 referees had knowledge of the program and implemented it. This reflects their interest and desire to avoid injuries.

Implementation and use of the program were more evident among coaches than any other category. This was also evident in the study by Al Attar et al. (2018) in which the rate of implementation among Australian coaches was 73%. However, this was not equally distributed among all regions, as clarified in their study. They reported that 40% of participants surveyed in Saudi Arabia used the program. Owoeye et al. (2013) found an even lower percentage at 28% in a Nigerian sample of coaches.

The coaches reported the highest usage of the program among all other categories of football professionals. However, several gaps were identified in the literature among coaches who have good knowledge of the program. It was found that some coaches, who know about the program, did not apply it, and a considerable number applied it less than the recommended twice per week (McKay et al., 2013). The limitation behind this could be non-availability of equipment, limited space, lack of time, and lack of rated program quality (Joy et al., 2013; McKay et al., 2016). For the present study, the reason could be lack of training courses on how to apply the program properly. Neither total practice duration nor the amount of time dedicated to warm-up prior to practice or matches were associated with program usage among referees. However, McKay et al. (2016) found that a lack of time represents a major barrier for program implementation among unaware coaches.

Several aspects connected to the findings of the present study should be explored in future research. First, to increase the adherence to the program or other standardized, sport-specific warm-up programs, a distinction should be made between the goals of raising awareness among unaware referees and facilitating implementation among aware referees. Regarding the former, it is paramount to evaluate the effectiveness of existing communication strategies aimed at promoting injury prevention and warm-up programs. This, for instance, could be achieved by determining how referees heard about the intervention (e.g., brochure, license education, workshops, conference lectures) and which channels of information they rely on to keep them updated with new methods and contents.

For the already aware referees, a potential issue might relate to the comprehensibility and clarity of the currently used communication strategies. Because most referees have limited expertise regarding exercise science and sports medicine, it might be that they a) in fact apply similarly effective contents or b) do not recognize an existing difference from evidence-based programs. In the latter case, the peculiarities and advantages of interventions like this program would have to be explained in more detail or more clearly. In connection with this, another barrier might be the self-perceived inability of referees to implement the program. In a study that assessed the implementation of a method that teaches proper landing technique, half of the interviewed coaches did not feel prepared for the task (Saunders et al., 2010). Moreover, a lack of knowledge about adequate implementation was reported to be a major obstacle to adopting a prevention program for anterior cruciate ligament injury (Joy et al., 2013). Thus, educational strategies should be adjusted based on a coach's educational background.

Some shortcomings should be discussed. The implementation of an injury prevention program may be a complex process; therefore, the variable 'usage', which was assessed in our study, does not represent its only facet. Besides soccer referees, soccer assistant referees, and soccer referees or soccer assistant referees' coaches were invited to participate in this survey, and we did not ask if they are referees in higher or lower leagues or if they are expert or not; these relevant factors may potentially affect the success of awareness and implementation.

Conclusions

The results indicated that most of the worldwide soccer referees, soccer assistant referees, and soccer referees or soccer assistant referees' coaches are unaware of the FIFA 11+ Referees Injury Prevention Program (low level of awareness). Female participants reported higher awareness than males, and the soccer referees or

soccer assistant referees' coaches reported the greatest percentage of awareness. The OFC reported the greatest percentage of awareness followed by CONMEBOL with more than 50% for both. However, there were high levels of implementation among the participants who reported awareness of the FIFA 11+ Referees Injury Prevention Program. In addition, participants who are implementing the program reported a positive opinion about the FIFA 11+ Referees Injury Prevention Program's efficacy.

To increase the awareness and implementation of the FIFA 11+ Referees Injury Prevention Program, football federations and coaching courses should focus on increasing the education of these programs for referees and assistant referees. Furthermore, conducting several seminars, workshops, conferences, and distributed posters will help to raise the awareness levels. Moreover, changing perceptions of the time required to perform these programs needs to be targeted as a goal. Finally, coaching courses that emphasize injury prevention programs should be mandatory for all soccer referees, soccer assistant referees, and soccer referees or soccer assistant referees' coaches.

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Conflicts of interest

The authors have no conflicts of interest to declare.

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