

ORIGINAL ARTICLE



The Copenhagen Adduction Exercise is not Applied by the Majority of Professional and Semi-Professional Soccer Players and Coaches

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ABSTRACT

Background. Groin injuries are frequent and commonly seen in soccer. The Copenhagen Adduction Exercise (CAE) increases eccentric hip adduction strength and reduces the groin injury incident. **Objectives.** To assess the professional and semi-professional soccer players and coaches' awareness, implementation, and opinion of the CAE. **Methods.** A cross-sectional study based on a survey consisting of questions covering the awareness, implementation, and opinion of CAE by soccer players and coaches. It was sent to all FIFA continental football federations. Primary outcomes were awareness level, implementation rate, and their view of the CAE's effectiveness in reducing groin injury. **Results.** A total of 1621 male and female professional and semi-professional soccer players (PP and SPP) and coaches (PC and SPC) completed the survey. Most PP (93.5%) and SPP (81.4%) were unaware of the CAE ($p < 0.001$), with high implementation rates ($p = 0.005$). In contrast, the PC had significantly higher awareness about the CAE than the SPC ($p < 0.001$). A moderate association between the level and awareness (Cramér's $V = 0.340$) was found. The highest percentage of awareness was found in the UEFA at 42.6%. Over 67% of those who implemented the CAE reported a positive attitude about the program's efficacy, with a score of >8 out of 10. **Conclusion.** Most PP, SPP, and SPC were unaware of the CAE. Further work needs to be done to educate soccer players and coaches about the importance of implementing the CAE and its effectiveness in reducing groin injuries to enhance the CAE implementation.

KEYWORDS: Athletic Injuries, Hip Injuries, Groin, Physical Conditioning, Rehabilitation, Athletic Performance.

INTRODUCTION

Football, or soccer as it is called in North America, is the most popular sport worldwide, with 275 million interested (1). There are about 200 million players in total, 40 million of whom are women. The increasing number of active players, leading to an increased incidence rate of injuries with elevated treatment costs and loss of

playing time, make an injury prevention program imperative. The Fédération Internationale de Football Association (FIFA) plays an essential role in supporting and developing injury prevention programs and soccer-related researches. In 1994, the FIFA Medical Assessment and Research Center (F-MARC)

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was established to study soccer injuries' aetiology and epidemiology (2). Recent reviews point out that the rate of soccer injuries could be decreased by applying injury prevention programs (3, 4).

Groin injuries are frequently reported in any sport containing sudden direction change, rapid acceleration, deceleration, and kicking. Such movements are predominantly performed in soccer (5, 6), rugby (7), Australian rules football (8), ice hockey (9), Gaelic football, and cricket (9, 10). In soccer, kicking is the most common injury mechanism for acute groin injuries (11). Moreover, players with a previous groin injury are at 2.4 folds higher risk of a groin injury in consecutive soccer seasons than players with no prior history of injury (12). This cycle of injury and re-injury may decrease the overall performance and participation in games, such as missing some training sessions and competitions or the end of the player's career. They may also contribute to future disabilities. Furthermore, soccer players demonstrate increased eccentric strength in the hip abductors but not in the hip adductors than their activity-matched controls. In soccer games, the hip adductor muscle-tendinous complex is stressed substantially, especially in kicking. Therefore, strengthening the hip-adductors is a key factor in preventing adductor-related groin injuries (13).

The Copenhagen Adduction Exercise (CAE) is a suitable exercise for groin injury prevention and rehabilitation. A recent study showed that the CAE activates the hip adductors after examining eight pattern strength exercises using electromyography activation (14). The CAE protocol is a progression of eccentric training regime that strengthens the hip adduction and increases eccentric hip adduction and abduction ratios (15). It is performed in side-lying with elbow support, and a partner holds the top leg. Then, the athlete lifts the body and lowers it using the hip adductors. Further details can be found in the literature (13).

The FIFA 11+ injury prevention program was structured as a complete warm-up program to prevent injuries in youth and amateur soccer players (16, 17). A recent systematic review and meta-analysis indicated that the FIFA 11+ injury prevention program, a revised version of the FIFA 11, may have a preventive effect on hip and groin injuries. The FIFA 11+ injury prevention program reported a 42% injury reduction in soccer players (14). Large randomized controlled trials (RCTs), including

both female and male players, have proven that the program prevents non-contact injuries in soccer (17-19). Of these, two studies reported conflicting results on groin injury prevention. The first study reported no reduction in the rate of groin injury on young females (19), while the second study reported a significant decrease in injuries among male collegiate players (18).

Knowledge and application of coaches and players about injury prevention programs are essential areas that need to be examined. Al Attar et al. (20) surveyed soccer coaches to investigate and compare injury prevention programs' implementation. Their results showed a gap between the coaches' knowledge and their actual practice. Therefore, the purpose of this study is to assess the awareness, implementation, and opinion of worldwide soccer players and coaches about the CAE, which is essential in the prevention of groin injury.

MATERIALS AND METHODS

Survey Development. There is no validated survey addressing soccer players' and coaches' experience with the CAE to the authors' knowledge. Therefore, a survey to collect information on the awareness, implementation and opinion of the CAE's role in preventing groin injury among soccer players and coaches was developed. This survey consisted of seven questions covering the players' and coaches' demographics, level of training, awareness of the CAE, and the CAE implementation. Finally, they were asked about their personal opinion regarding the CAE's effectiveness to prevent groin injury on a scale of 0 to 10 (0 as ineffective and 10 as effective). The survey was developed in English and translated to 10 languages (Arabic, French, German, Italian, Japanese, Portuguese, Russian, Spanish and Turkish).

Survey Validity and Reliability. Face validity and pilot testing were performed before starting the study. The survey was distributed to thirty soccer players and coaches who were a representative sample of the final testing cohort due to their varying soccer playing and coaching experience levels. They were asked to rate the three core questions related to the awareness, implementation and opinion of the CAE for clarity, comprehension, and appropriateness using a scale of 1 to 5 points. Questions scoring an average below 4.0 on any of the parameters were discarded. Next, construct validity was determined using the exploratory factor analysis

(EFA) adequacy, which was conducted using Bartlett's test and the Kaiser-Meyer-Olkin (KMO) measure. Principle component analysis (PCA) with a Varimax rotation was used to explore the structure of the three questions in terms of clarity, comprehension and appropriateness resulting in nine combinations or questions (3 x 3). Lastly, Cronbach's alpha test was utilized to measure the internal consistency.

Survey Distribution and Administration.

Two thousand male and female soccer players and coaches were contacted through FIFA Member Associations. Responses were collected from June 2019 to June 2020. The invitation to participate in the study provided a brief background on the survey and its purpose. 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. Surveys were completed anonymously and voluntarily via Google Forms (Alphabet Inc., Mountain View, California, United States) and were limited to one response.

Statistical Analysis. Descriptive statistics were presented as percentages and compared using the Chi-squared test. Cramér's $V(\phi_c)$ was used to measure the association between categorical variables. The validity and reliability of the questionnaire questions together with the responses were analyzed using the Statistical Package for the Social Sciences (SPSS) version 24.0 (IBM Corp., Armonk, New York, United States). This study was reviewed and approved by the Biomedical Ethics Committee at Umm Al Qura University, Approval No.: HAPO02K012202011488.

RESULTS

Opinions of coaches and players about the questions' clarity, comprehension, and appropriateness showed high scores of above 4.5 (Table 1). Therefore, all questions were considered suitable for this study. For EFA, the KMO result was .665, and Bartlett's test was $P < .001$, indicating the suitability of the questions for factor analysis. The nine questions EFA analysis identified three components (all for the first question), which explained 68.8% of the variance in the data (Table 2). Communalities of the nine components ranged from .526 to .906, indicating that these questions are rated high for clarity, comprehension, and appropriateness (Table 3). Cronbach's alpha value was .805, indicating a high level of internal consistency.

The total number of soccer players and coaches who participated in the study was 1621 from 185 countries, with a response rate of 81%. Most of them were males at 89% ($n = 1442$), and females represented only 11% ($n = 179$). The soccer players and coaches were at different levels. Semi-professional soccer players (SPP) made up most of the respondents at 64.5% ($n = 1045$), followed by semi-professional soccer coaches (SPC) at 17.0% ($n = 276$). Professional soccer coaches (PC) represented the lowest participation rate at 5.9% ($n = 96$). Similarly, the professional soccer players (PP) made up only 12.6% ($n = 204$) of the sample. The results also revealed that most respondents were unaware of the CAE (64%, $n = 1037$). Most of those who were aware of it (83.6%, $n = 488$) reported implementing the CAE. When the participants were asked about their opinion, most of them scored the exercise as 8 or more, indicating its effectiveness in preventing groin injury (67%, $n = 327$). The participants' demographics are shown in Table 1.

Table 1. Participants Demographics

Variable	n (%)
Gender	
Male	1442 (89.0)
Female	179 (11.0)
Category and level	
PP	204 (12.6)
SPP	1045 (64.5)
PC	96 (5.9)
SPC	276 (17.0)
Awareness	
Yes	584 (36.0)
No	1037 (64.0)
Implementation	
Yes	488 (83.6)
No	96 (16.4)
Opinion Score	
5	11 (2.3)
6	41 (8.4)
7	109 (22.3)
8	148 (30.3)
9	162 (33.2)
10	17 (3.5)
Continental football federations	
UEFA	570 (35.2)
CONMEBOL	94 (5.8)
AFC	487 (30.0)
CAF	286 (17.6)
CONCACAF	154 (9.5)
OFC	30 (1.9)

PP, professional soccer player; SPP, semi-professional player; PC, professional coach; SPC, semi-professional coach; AFC, Asian Football Confederation; CAF, Confederation of African Football; CONCACAF, Confederation of North, Central American and Caribbean Association Football; CONMEBOL, The South American Football Confederation; OFC, Oceania Football Confederation; UEFA, Union of European Football Associations.

Comparison between the soccer players and coaches revealed different results. Regarding the

PP and SPP, most of them were unaware of the CAE $X^2(1, N = 1249) = 16.233, P < 0.001$, Cramér's $V = 0.036$. Most of those who were aware of it were already implementing it, $X^2(1, N = 423) = 7.922, P = 0.005$, Cramér's $V = 0.137$, with a higher percentage found for PP

(93.5%) compared to SPP (81.4%). There were no other significant differences or strong associations between the two levels of players regarding gender, opinion score, or continental football federations ($P = 0.615$) (Table 2).

Table 2. Chi-Square Test Results Comparing the Responses of Soccer Players and Based on their Level

	Category and Level		Association	
	PP, n (%)	SPP, n (%)	ϕ_c	P
	204 (12.6%)	1045 (64.5%)		
Gender			0.036	0.207
Male	172 (84.3)	915 (87.6)		
Female	32 (15.7)	130 (12.4)		
Awareness			0.114	< 0.001
Yes	94 (46.1)	329 (31.5)		
No	110 (53.9)	716 (68.5)		
Implementation			0.137	0.005
Yes	86 (93.5)	258 (81.4)		
No	6 (6.5)	59 (18.6)		
Opinion Score			0.102	0.615
5	1 (1.2)	4 (1.5)		
6	6 (7.1)	19 (7.3)		
7	21 (24.7)	56 (21.6)		
8	21 (24.7)	89 (34.4)		
9	34 (40.0)	83 (32.0)		
10	2 (2.4)	8 (3.1)		
Continental football federations			0.087	0.093
UEFA	63 (30.9)	376 (36.0)		
CONMEBOL	14 (6.9)	55 (5.3)		
AFC	72 (35.3)	299 (28.6)		
CAF	35 (17.2)	191 (18.3)		
CONCACAF	20 (9.8)	100 (9.6)		
OFC	0 (0)	24 (2.3)		

PP, professional soccer player; SPP, semi-professional player; ϕ_c , Cramér's V measure of association; AFC, Asian Football Confederation; CAF, Confederation of African Football; CONCACAF, Confederation of North, Central American and Caribbean Association Football; CONMEBOL, The South American Football Confederation; OFC, Oceania Football Confederation; UEFA, Union of European Football Associations.

In comparison, the PC and SPC responses were similar with no statistically significant differences ($p = .903$). The only exception was observed in the awareness level where the PC had significantly higher awareness about the CAE than the SPC, $X^2(1, N = 372) = 43.1, P < 0.001$. It also showed a moderate association between the level of the coach (professional and semi-professional) and awareness (Cramér's $V = 0.340$). Further information is available in Table 3.

Overall, the awareness level differed significantly between the various continental football federations, $X^2(5, N = 1621) = 29.179, P < 0.001$, Cramér's $V = 0.134$. The highest percentage of awareness was found in the Union of European Football Associations (UEFA) at 42.6% ($n = 249$), followed by the Asian Football Confederation (AFC) at 29.5% ($n = 172$). Conversely, the lowest reported awareness level was in the Oceania Football Confederation

(OFC) at 2.2% ($n = 23$). On the contrary, there were no significant differences in the awareness level among those who implement the CAE, genders, and various opinions regarding its effectiveness ($P = 0.633$). The differences between the participants based on the awareness level are shown in Table 4.

Different continental football federations were also compared in terms of the awareness level, implementation of the CAE, and opinion on the CAE's effectiveness in preventing groin injuries (Table 5). The only significant difference among the federations was the awareness level ($P < 0.001$). Members of the OFC showed the highest implementation rate at 100% ($n = 7$), followed by the Confederation of North, Central American and Caribbean Association Football (CONCACAF) at 93% ($n = 40$). In comparison, AFC members showed the lowest implementation rate at 79.7%. However, the membership of the

federation had an insignificant and weak association with the implementation rate, $X^2(5, N = 584) = 6.161$, $P = 0.291$, Cramér's $V = 0.103$. Regarding the opinion score, the highest average

opinion (\pm SD) score was reported from the Confederation of African Football (CAF) at 8.12 (± 1.09), and the lowest was from the OFC at 7.86 (± 1.35) ($P = 0.861$).

Table 3. Chi-Square Test Results Comparing the Responses of Soccer Coaches and Based on their Level

	Category and Level		Association	
	PC, n (%)	SPC, n (%)	ϕ_c	P
Gender	96 (5.9%)	276 (17.0%)		
Male	96 (100.0 %)	259 (93.8 %)	0.129	0.013
Female	0 (0 %)	17 (6.2 %)		
Awareness			0.34	< .001
Yes	69 (71.9 %)	92 (33.3 %)		
No	27 (28.1 %)	184 (66.7 %)		
Implementation			0.148	0.061
Yes	65 (94.2 %)	78 (84.8 %)		
No	4 (5.8 %)	14 (15.2 %)		
Opinion Score			0.195	0.367
5	3 (4.6 %)	1 (1.3 %)		
6	7 (10.8 %)	9 (11.5 %)		
7	16 (24.6 %)	17 (21.8 %)		
8	13 (20.0 %)	25 (32.1 %)		
9	21 (32.3 %)	24 (30.8 %)		
10	5 (7.7 %)	2 (2.6 %)		
Continental football federations			0.065	0.903
UEFA	35 (36.5 %)	96 (34.8 %)		
CONMEBOL	7 (7.3 %)	18 (6.5 %)		
AFC	28 (29.2 %)	88 (31.9 %)		
CAF	18 (18.8 %)	42 (15.2 %)		
CONCACAF	7 (7.3 %)	27 (9.8 %)		
OFC	1 (1.0 %)	6 (1.8 %)		

PC, professional coach; SPC, semi-professional coach; ϕ_c , Cramér's V measure of association; AFC, Asian Football Confederation; CAF, Confederation of African Football; CONCACAF, Confederation of North, Central American and Caribbean Association Football; CONMEBOL, The South American Football Confederation; OFC, Oceania Football Confederation; UEFA, Union of European Football Associations.

Table 4. Chi-Square Test Results Comparing the Responses of Participants Based on their Awareness of the Copenhagen Adduction Exercise

	Awareness		Association	
	Yes, n (%)	No, n (%)	ϕ_c	P
Gender	584 (36.0%)	1037 (64.0%)		
Male	530 (90.8 %)	912 (87.9 %)	0.043	0.083
Female	54 (9.2 %)	125 (12.1 %)		
Implement			NA*	0.27
Yes	486 (85.6 %)	1 (50.0 %)		
No	82 (14.4 %)	1 (50.0 %)		
Opinion			NA*	0.633
5	9 (1.9 %)	0 (0 %)		
6	41 (8.4 %)	0 (0 %)		
7	109 (22.4 %)	1 (100.0 %)		
8	148 (30.5 %)	0 (0 %)		
9	162 (33.3 %)	0 (0 %)		
10	17 (3.5 %)	0 (0 %)		
Continental football federations			0.134	< 0.001
UEFA	249 (42.6 %)	321 (31.0 %)		
CONMEBOL	33 (5.7 %)	61 (5.9 %)		
AFC	172 (29.5 %)	315 (30.4 %)		
CAF	80 (13.7 %)	206 (19.9 %)		
CONCACAF	43 (7.4 %)	111 (10.7 %)		
OFC	7 (1.2 %)	23 (2.2 %)		

ϕ_c , Cramér's V measure of association; *, not measured because it is a constant; AFC, Asian Football Confederation; CAF, Confederation of African Football; CONCACAF, Confederation of North, Central American and Caribbean Association Football; CONMEBOL, The South American Football Confederation; OFC, Oceania Football Confederation; UEFA, Union of European Football Associations.

Table 5. Chi-Square Test Results Comparing the Responses of Participants Based on the Continental Football Federation

	Continental football federations						Association	
	UEFA, n (%)	CONMEBOL, n (%)	AFC, n (%)	CAF, n (%)	CONCACAF, n (%)	OFC, n (%)	ϕ_c	P
	570 (35.2)	94 (5.8)	487 (30.0)	286 (17.6)	154 (9.5)	30 (1.9)		
Gender							0.073	0.128
Male	501 (87.9)	80 (85.1)	427 (87.7)	264 (92.3)	143 (92.9)	27 (90.0)		
Female	69 (12.1)	14 (14.9)	60 (12.3)	22 (7.7)	11 (7.1)	3 (10.0)		
Awareness							0.134	< 0.001
Yes	249 (43.7)	33 (35.1)	172 (35.3)	80 (28.0)	43 (27.9)	7 (23.3)		
No	321 (56.3)	61 (64.9)	315 (64.7)	206 (72.0)	111 (72.1)	23 (76.7)		
Implementation							0.103	0.291
Yes	209 (83.9)	28 (84.8)	137 (79.7)	67 (83.8)	40 (93.0)	7 (100)		
No	40 (16.1)	5 (15.2)	35 (20.3)	13 (16.3)	3 (7.0)	0 (0)		
Opinion Score							0.071	0.985
5	4 (1.9)	1 (3.6)	5 (3.6)	1 (1.5)	0 (0.0)	0 (0.0)		
6	17 (8.1)	2 (7.1)	12 (8.8)	5 (7.5)	5 (7.5)	1 (14.3)		
7	48 (23.0)	6 (21.4)	33 (24.1)	11 (16.4)	11 (16.4)	2 (28.6)		
8	68 (32.5)	8 (28.6)	37 (27.0)	20 (29.9)	20 (29.9)	2 (28.6)		
9	66 (31.6)	10 (35.7)	44 (32.1)	27 (40.3)	27 (40.3)	1 (14.3)		
10	6 (2.9)	1 (3.6)	6 (4.4)	3 (4.5)	3 (4.5)	1 (14.3)		
Opinion Score Average	7.94 ± 1.06	7.96 ± 1.17	7.90 ± 1.17	8.12 ± 1.09	7.93 ± 1.0	7.86 ± 1.35		0.861

ϕ_c , Cramér's V measure of association; AFC, Asian Football Confederation; CAF, Confederation of African Football; CONCACAF, Confederation of North, Central American and Caribbean Association Football; CONMEBOL, The South American Football Confederation; OFC, Oceania Football Confederation; UEFA, Union of European Football Associations. Data in table are presented as No.(%) or Mean ± SD.

DISCUSSION

This study aimed to explore the players' and coaches' awareness and implementation of the CAE and investigate their attitudes towards groin injury preventions. The study's main findings are that PP was more aware of the CAE compared to SPP. Nevertheless, SPP from the UEFA had the highest awareness and implementation levels of the CAE. The highest percentage of respondents were SPP at 64.5%, followed by SPC at 17.0%, while PC represented the lowest participation rate of 5.9%. The current study results also revealed that most respondents (64%) were unaware of the CAE. However, 83.6% of those who were aware of it are already implementing it. Most of the players and coaches agree that the CAE would reduce the prevalence of groin injuries (67.0%). Investigating the awareness and implementation rates of the CAE as a preventive and rehabilitative program is one out of six steps proposed by Donaldson et al. (21), who developed a model for developing sports injury prevention interventions.

Therefore, the question is, why do players and coaches agree that the CAE would reduce the prevalence of groin injuries and still, 16.4% (of those who were aware of it) are not implementing this exercise program during their practice, which is difficult to explain. Our findings align with a randomized controlled trial

conducted to investigate the effects of Nordic Hamstring Exercise (NHE) on hamstring injuries in high-school soccer players. The authors reported a compliance rate with the NHE of 88% (22). However, the implementation rates reported in the current study are still better than those reported by Bahr et al (23). The researchers surveyed athletes to evaluate the compliance and implementation of the NHE in the UEFA Champions League and the Norwegian Premier League soccer teams. Their conclusion points out that the compliance rate of 11% was too low to expect it to affect acute hamstring injury rates among European male soccer players. Thus, a vast disconnection was reported between the available evidence of NHE effectiveness and its adoption in elite athletes. Brukner et al. (24) and Buckthorpe et al. (25) indicated that the present gap between clinician's evidenced-based work and the reality of professional sport allows the introduction of unscientific approaches and interventions. Donaldson et al. (21) also believe that prevention interventions may not include suite or directly connect with real-life contexts. Such behaviour shadows the management of some sports injuries, including groin pain. Therefore, it seems that we have to investigate the reasons for non-compliance between players and coaches among other factors, such as the limited time during their training sessions, limited influence

on coaching practices by the medical team, or limited equipment needed to applied this protocol (the CAE). This needs to be explored in future researches.

The study results also reported that PC showed higher awareness rates of the CAE at 71.9% compared to SPC. Also, the professional level was associated with the awareness rate. The decision to implement a specific prevention or rehabilitation protocol involves several stakeholders such as the coaches, players, health and conditioning specialists (26). Although the physiotherapists and strength and conditioning specialists are the best team members to decide on the most suitable protocols for the team, the head coach also has a say (27). In a study investigating basketball head coaches attitudes toward injury prevention, Wilke et al. (27) reported that less than half (42.2%) of the coaches had no health professional personnel at their disposal. At the same time, about one-third of the coaches apply pre-season injury screenings. Thus, the lack of specialized team members on board may have negatively impacted the rate of applying injury screening and prevention strategies. Surprisingly, the coaches also consider improving sports technique, movement patterns and stretching, which are not backed up with research, to be effective injury prevention measures. Given the fact that 80% of the participating coaches had a coaching license, it is expected that they may have better knowledge in such areas.

The lower implementation rates reported by the SPP and SPC may be due to several barriers. As stated earlier, the absence of supporting health and conditioning team members may be one reason (27). Obrien and Finch (28) identified several barriers to facilitating injury prevention exercise programmes (IPEP) in professional soccer teams. The survey respondents (players, team staff, clubs, and governing bodies) indicated that lack of acceptance, awareness of the benefits, staff numbers, communication, and long-term planning are the main obstacles behind not implementing such programs. Other factors such as the club's stability, medical staff, and playing style are also factors (29).

Coaches and players in the UEFA federation also reported the highest awareness and implementation rates. Elite soccer teams in the UEFA typically contain a medical team consisting of physiotherapists, strength and conditioning specialists, chief medical officer

and other professionals (28, 30). Ekstrand et al. (30) found that high internal communication quality within teams was associated with lower injury rates. Moreover, the proper line of communication between the head coach and the medical team was vital in lowering the injury and higher player availability. Therefore, the authors of this research believe that coaches and players in the UEFA region have superiority over the other regions due to these reasons, resulting in the high implementation rate.

The effect of an adductor strengthening program in injury prevention indicates the importance of focusing on these types of exercises (13, 31). In the study by Al Attar et al. (32), applying the CAE and NHE provided better dynamic balance outcomes with evidence supporting both approaches for injury prevention. Following the intervention, balance performance was significantly improved within all groups. However, the intervention groups showed significantly better outcomes of dynamic balance when compared to the control group. The CAE and NHE combined intervention were superior to the other groups in terms of stability improvements. Therefore, using the CAE combined with other injury prevention programs would provide better outcomes than implementing this exercise alone.

The CAE can be considered a suitable exercise for groin injury prevention and rehabilitation, especially in sports involving high agility, cutting, and sudden change in direction, such as basketball, rugby, and football. Al Attar et al. (33) conducted a meta-analysis of meta-analyses to investigate FIFA injury prevention programs' preventive soccer effects. Four meta-analyses were included in their review, and the results indicated a reduction of all injuries by 34% [RR= 0.66 (0.60 – 0.73)] and a decrease of 29% [RR= 0.71 (0.63 – 0.81)] for injuries to the lower limb. However, an RCT by Harøy et al. (31) found that including the CAE in the FIFA 11+ injury prevention program increases the eccentric hip adduction strength. In contrast, the standard FIFA 11+ injury prevention program alone does not have a similar effect. In their study, analyses between groups showed a more significant increase in eccentric hip adduction strength of 0.29 Nm/kg (8.9%; $P = 0.01$) in the advantage of the group performing the CAE. Conversely, no within-group change was noted in the group that used the standard FIFA 11+ injury prevention program (-0.02 N·m/kg [-

0.7%]; $P = 0.69$). Although the CAE would be more beneficial in increasing the eccentric hip adductor strength and consequently minimising the groin's injury rate, implementing the CAE in combination with other exercise programs would be beneficial than prescribing this exercise alone.

Study Limitations. There are several limitations to consider the methodology of the study. Using convenient sampling resulted in an unequal sampling number between sports levels. Also, the study focused on soccer coaches and players only and did not include other sports. Thus, the generalization of the results can be limited to soccer only. Moreover, the survey could have consisted of more questions to understand better how coaches and players implement the CAE. Such questions may also identify other factors that may have influenced their awareness or implementation, such as a medical team, formal training certification, and players' classification.

CONCLUSIONS

The results of this study demonstrated a significant percentage of implementation of the CAE and awareness. Lack of knowledge about the CAE among soccer players and coaches may increase the injury rate. Moreover, there is a variation in the awareness and implementation levels apparent among the players, coaches and FIFA continental federations. Thus, further work needs to be done to educate them about the importance of implementing the CAE in injury prevention. Such goals can be achieved by educating coaches and players regarding the importance of decreasing injury rates. It is imperative to reach out to soccer players, coaches, sports organizations, and those

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involved in sports programs to encourage CAE inclusion in their training programs.

APPLICABLE REMARKS

- Further work needs to be done to educate soccer players and coaches about the importance of implementing the CAE and its effectiveness in reducing groin injuries to enhance the CAE implementation.
- Courses that emphasize most updated Evidence-Based Injury Prevention Programs and exercises such as the CAE should be mandatory for all soccer players and coaches.

CONFLICT OF INTEREST

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AUTHORS' CONTRIBUTIONS

WSA conceptualized the study. WSA, AQ and NA wrote the study protocol. WSA, MAH, AQ and NA conducted the data-analyses. HSG, MAH and WSA drafted the abstract, introduction, methods, and the result section of the manuscript. MAH edited and revised the results and discussion sections and reviewed the final manuscript. All authors critically revised the draft manuscript and approved the final version of the manuscript.

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