Impact Of Tailored Preventive Exercise Program For Reducing Risk Of Hip Adductors Injury

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ABSTRACT

Background: Football players often have groin injuries due to weak adductor muscles. However, an important factor that is often underestimated is the asymmetry between the adductors and abductors muscle complex. Sports medicine and physiotherapy research has long ignored the mechanical complexity of the hip joint and the effects of preseason preventative protocols in favour of an emphasis on isolated adductor strength as a means to lessen the likelihood of adductor injuries in football players. Adductor injuries, which cause groin discomfort and a decline in game performance and longevity, are common among football players due to the sport's strong physical demands, which include kicking, high velocity, speed, and quick changes of direction.

Objective: The goal of this study is to determine if football players may reduce their risk of hip adductor injuries by participating in a specialized preventative exercise program.

Methods: Forty football players (ranging in age from 18 to 35) from Cairo's Stars of Egypt and Gezira Club participated in this randomized controlled experiment. Twenty participants made up each of the two groups: group A, which received the intervention, and group B, which served as a control. Injured or herniated players were not allowed to participate. As part of their usual team training, members of the intervention group exercised twice or three times weekly for eight weeks, while members of the control group continued to use the conventional FIFA 11+ regimen. Before and after the preventive protocol's intervention, players had their isometric strength tested for adductors and abductors on both the dominant and non-dominant limbs using a handheld dynamometer (HHD) in neutral and functional positions (15-30 degrees of abduction). Their groin health was documented using the Copenhagen HAGOS Questionnaire pre and post the intervention.

Results: Both the neutral position (p = 0.008) and the functional position (p = 0.004) of the dominant limb's ADD:ABD strength asymmetry ratio decreased significantly in group A compared to group B after treatment. Furthermore, after treatment, group A had a significantly lower ADD:ABD strength asymmetry ratio for the non-dominant limb in both the neutral position (p = 0.001) and the functional position (p = 0.009) when compared to group B. In the neutral position, there was no significant difference between groups A and B in terms of limb symmetry index (LSI) or inter limb symmetry of non-dominant to dominant adductors (p = 0.62). However, in the functional position, there was a significant increase in LSI for group A compared to group B (p = 0.002). Additionally, after therapy, group A's Copenhagen HAGOS questionnaire score was significantly higher than group B's (p = 0.001).

Conclusion: Potentially lowering the incidence of hip adductor injuries and GPS (groin pain syndrome), the preseason preventative exercise program helped football players improve stability across hip muscle groups and decrease asymmetry. In this study, we found that the ADD:ABD ratio is a better predictor of functional hip stability and potential adductor injuries than isolating adductor strengthening regimens. In order to safeguard athletes, it is recommended to keep the ADD:ABD ratio near to 1.0. One significant diagnostic technique for diagnosing asymmetries and directing preventative treatments for football players is measuring the LSI between the dominant and nondominant limbs.

Keywords: Preseason preventive program, adductor to abductor strength ratio, LSI, adductor injury, groin pain syndrome (GPS), HAGOS, football players.

INTRODUCTION

Sports like football, hockey, and rugby, which require quick accelerations and decelerations, abrupt direction changes, and running, are prone to hip and groin injuries [1-2-3-4-5]. Inguinal sensitivity and discomfort that travels down the inside of the thigh, particularly to the point where the adductor muscle begins and ends, is known as groin pain syndrome (GPS) [6]. The adductor muscles of the hip are involved in a lot more motions than only adduction. Running, cutting, kicking, rapid directional changes, and controlling limb alignment under load are all facilitated by these multiplanar taskers, which also serve as dynamic pelvic stabilisers. The adductor muscles of the hip are involved in a lot more motions than only adduction. When moving over many planes, such when sprinting, cutting, kicking, making rapid pivots, or changing directions, they dynamically stabilise the pelvis

and lower limbs. Sports medicine and physiotherapy experts now prioritise the management of football player injuries due to the tremendous biomechanical stress that these athletes experience [7] . All three adductor muscles—the adductor longus, the adductor brevis, and the adductor magnus—contribute differently to internal and external rotation of the hips, depending on the hip angle [8, 9]. The importance of the adductors' participation in football players' mobility is shown by all of these factors [10,11]. With a reported weekly incidence of 11.7% [12,13, 14, 15], adductor injuries are among the most prevalent football injuries. These injuries may account for as much as 23% of all muscle injuries among football players. A lack of hip mobility, diminished flexibility, and an imbalance in muscular power between the adductors and abductors are risk factors for GPS. Although groin discomfort may occur in a variety of sports, some are more likely to cause it than others because of the unique physical demands of those activities [6, 16, 17]. Some examples of these types of sports are football and others that include fast acceleration or deceleration as well as repeated motions, such as kicking [18, 19]. There is a considerable probability of injuries and GPS during football games; in extreme cases, the wounded player may become permanently disabled, which may shorten their career longevity and a career ending injury [20, 21, 22]. Injury prevention and prediction methods using GPS and adductors have been the subject of little study. Prevention has received less attention in prior research than therapy and management of groin pain [6, 23 24, 25]**.** The Copenhagen adduction (CA) exercise is a typical intervention for injury prevention, and past research has mostly focused on enhancing absolute eccentric hip adduction (EHAD) strength [26, 27, 28]. Research has looked at the correlation between football players' injury rates and the ratio of strength in their hip adductors to abductors [26, 29, 30, 31,32]. Consequently, finding the true risk factor of adductor injuries in football—which seems to be the asymmetry between the hip muscle complex, specifically the ADD:ABD ratio [29, 33, 34, 35**]** should be the primary clinical goal, rather than pursuing isolated peak force values of the adductor muscle to prevent injury. In order to establish tailored strategies to avoid reinjuries, it is necessary to first identify athletes at risk for secondary prevention, which may be achieved by investigating these characteristics [36]. When evaluating football players for groin injuries, the Copenhagen Hip and Groin Outcome Score (HAGOS) is often used. The data for injury prediction and follow-up, however, is limited evidence [37, 38, 39]. Insufficient research has shown the value of a specialised preventative exercise program for football players' adductors injuries or for sportsmen generally. Thus, these methods reduce the occurrence of groin pain syndrome and groin injuries, which in turn improves team performance and the duration of football players' careers. Therefore, this research set out to identify the true risk factors for hip adductor injuries in football players and then design a preventative program to lower that risk.

Materials and Methods

Design

A pre-post randomized controlled trial design was used for this study

Ethical considerations and registration

Ethical approval for this research came from the Faculty of Physical Therapy at Cairo University's P.T.REC/012/005100 committee, and it was recorded at Clinical Trial under the reference number NCT06694220. In addition, prior to the publication of any personal information, all participants were asked to offer their informed permission. The location of the research was Gezira, Cairo, Egypt's Stars of Egypt. throughout the months of July to august in the year 2025.

Participants

With the use of the G*Power program (version 3.0.10), forty players were chosen at random from Stars of Egypt, Gezira, Cairo governorate, and divided into two groups (A-B), with group A serving as the intervention group and group B as the control group. Ref. 1

This research was conducted during the preseason of the 2025 Egyptian football season and included two groups A and B. The participants were randomly picked from the Stars of Egypt team in Gezira, Cairo governorate. Forty male football players in good health were included in the sample. Their average age was 19.60 ± 1.64 years, their weight was 71.85 ± 4.75 kg, their height was 175.50 ± 5.55 cm, and their body mass index (BMI) was 23.35 ± 1.46 kg/m². And as eligibility criteria, only 40 players recruited out of total 50 who were healthy and injury-free and met inclusion criteria before preseason started and who played regular matches **[**11, 40].Ten players were excluded for not meeting inclusion criteria, acute adductor strain n=4, General groin pain n=3 and low back pain n=3. During the injury history screening, we asked the participants to sign a permission form and to indicate if

they had ever had hip or groin discomfort. The participants were asked to indicate their dominant limb that they preferred to kick a ball. Hip and groin pain was classified as discomfort in the anterior hip, pubic area, inguinal region, and adductor origin and insertion. There was a one-week pre-test, an eight-week primary training program, and a final week of testing that made up the ten-week study. The purpose of the pre- and post-tests was to compare the 8-week preventative program to group B, the control group, which primarily consisted of athletes who followed the regular warm-up and exercise regimen, in terms of the program's influence on the athletes' hip muscles' strength and asymmetry.

Inclusion and Exclusion Criteria

Inclusion Criteria

- Football players before the season
- Determining the ratio of hip abductor to adductor strength
- Documentation of healthy groin HAGOS (Arabic version available)

Exclusion criteria:

Injuries to the hip or surrounding area were detected during the first evaluation [6]. This includes athletes who have recently had hip issues, inguinal hernias, acute adductor strains, acute groin injuries, back pain, knee pain and players who have already ceased training or (playing) matches.

Procedures

Strength testing:

Using a handheld dynamometer (HHD), we can determine the isometric strength of the adductors and abductors in both the dominant (kicking) and non-dominant (non- kicking) limbs in both neutral and functional positions (15-30 degrees of abduction) for both limbs of the athletes. The tester used was a Lafayette model 01165 manual muscle tester with a 7 cm×3.5 cm pad. When testing a subject's isometric strength and limb asymmetry strength ratio, the tester applied force on them while measuring the peak force of their muscles that were necessary to break an isometric contraction. This was done on both the dominant and non-dominant sides of the subject's hips. Large, pre-participation screens or field tests are perfect fits for the Lafayette MMT, which is ideal for situations, where bulkier and more costly systems would not work. You can hold the Lafayette MMT in one hand and read it simply [41]. The examiner was able to maintain consistency in processes and break test methodologies because of the MMT's size and weight. Assuming a neutral posture with their legs extended at the hip and knee, players lay supine and had resistance placed 5 centimeters from the malleolus (Figures 2 and 3). Functional position of 15 to 30 degrees of hip abduction, isometric strength was measured. As a stabilizing measure, players were allowed to stabilize their chests with both hands. Before the hip adductors and abductors tests, participants warmed up by doing two sets of five isometric repetitions against the HHD, with a ten second break in between each set. After 5 seconds of pressing their distal shanks against the pads, players were asked to accomplish a maximum repetition for both their dominant and non-dominant limbs, producing a force measurement in kilograms. There was a 45-second interval between each of the three repetitions of the isometric hip adductor and abductor strength test **[**11].The subjects warmed up before the strength assessments by HHD for 10 minutes included core, hip adductor, and abductors exercises. Arabic translation of the HAGOS questionnaire documentation that make up the six subscales of the 37 items. Pain, symptoms, ADLs, sports and recreational activities, physical activity engagement, quality of life and performance. We may rate them from 0 to 4. A higher score indicates greater hip and groin function [6, 29]. The total may be rated from 0 to 100. The quoted torque values were in kilograms. The strength ratio of the hip's dominant and non-dominant agonist/antagonist muscles was also determined using the ADD/ABD ratio.

Training protocol

The first group, designated as (A), participated in a tailored preventative program warmed up with the FIFA 11+ warming up protocol including exercises such as a light in-place jogging and jumping exercises and adding the main preventative program warming up which included flexibility exercises (such as butterfly adductor muscle stretching, frog stretch, and kneeling pelvic tilts) for ten minutes. Continued with lower-body strengthening exercises, core global stabilizers, balance exercises and drills. Every exercise should be performed for 1-4 sets of 10–20 repetitions, for an hour or more three times per week for eight weeks prior to the season with a 10-minute cooling down consisting of stretches. Fig. (4-5-6-8-9-10) [6 ,41]. In control group (B), participants warmed up for 8 minutes in pairs, following the FIFA 11+ warming up program only as regular. Proper technique execution under

the watchful eye of the physiotherapist and the coach is essential, as is the maintenance of proper body position. The athletes need to do this routine no less than twice weekly [42]. Both the intervention and control groups typically warmed up and trained using the FIFA 11+ application. Coaches from each team recorded the amount of training sessions, hours, and matches that comprised this exercise program. The physiotherapist was not informed of any injuries. The physiotherapist made a note of the problem after assessing it to see whether it was a groin injury.

Fig. 1

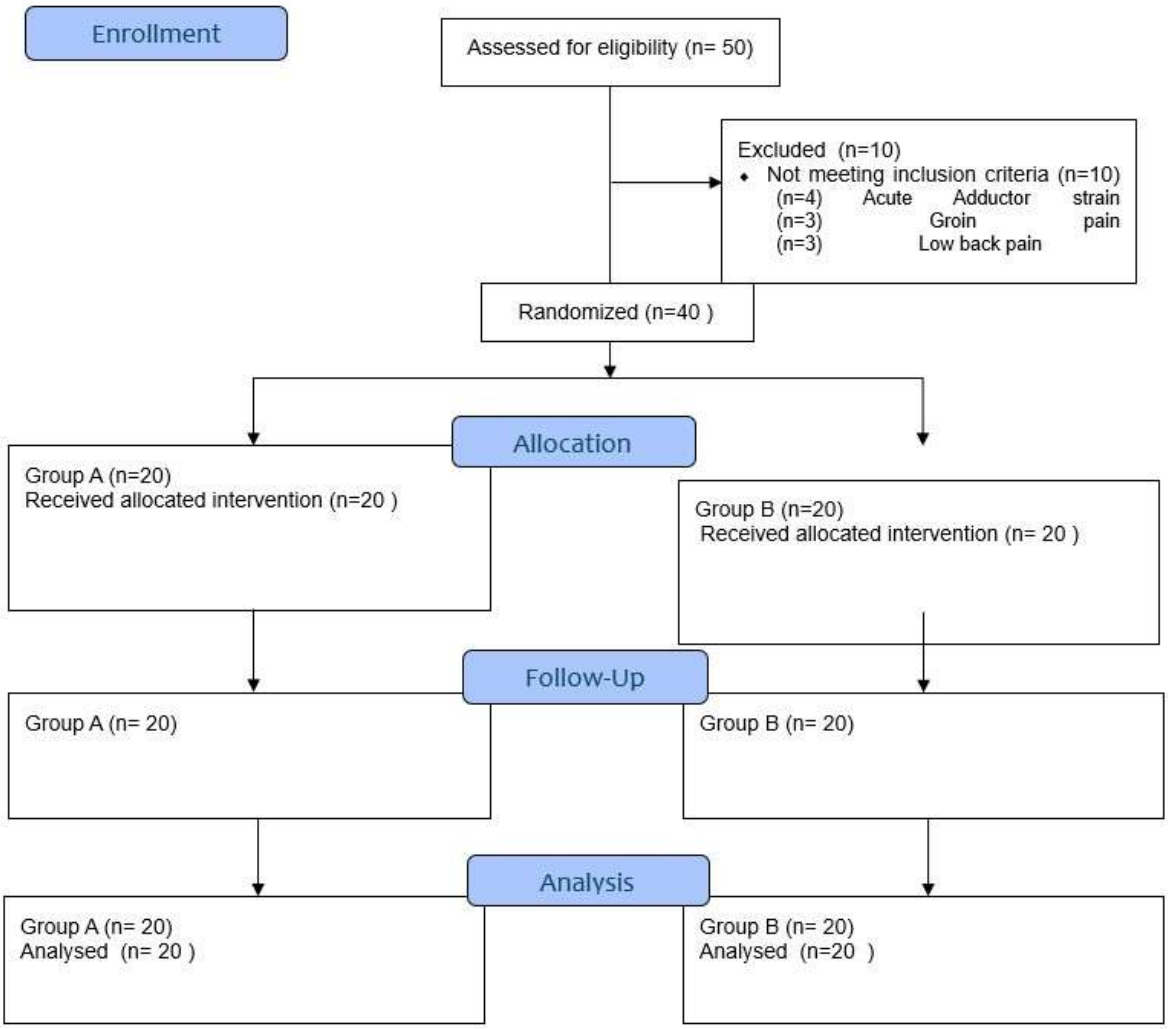

Fig 2&3. Abductor and adductor hip muscle strength testing positions. A hand-held dynamometer was used for testing and placed 5 cm proximally to the lateral malleolus.

Fig. 4 roller squeezes with internal rotated hips

Fig. 5 Unilateral lunges with weights

Fig. 6 Copenhagen lever arm exercise

Fig. 7 core exercises

Fig. 8 drills

Fig. 9 Forward bend in single-leg stance

Fig. 9 Skaters exercises

Randomization

The Priori used folded index cards with various numbers to randomly divide 40 male players into two groups.

Statistical analysis

Unpaired t-test was conducted for comparison of subject characteristics between groups. Chi- squared test was used for comparison of dominant side distribution between groups. Normal distribution of data was checked using the Shapiro-Wilk test. Levene's test for homogeneity of variances was conducted to test the homogeneity between groups. Two-way mixed MANOVA was performed to compare within and between groups effects on adductor/abductor strength asymmetry ratio, adductors strength limbs asymmetry ratio, and HAGOS. Post-hoc tests using the Bonferroni correction were carried out for subsequent multiple comparisons. The level of significance for all statistical tests was set at $p < 0.05$. All statistical analysis was conducted through the Statistical Package for Social Studies (SPSS) version 27 for windows (IBM SPSS, Chicago, IL, USA).

RESULTS

- Subject characteristics:
Table (1) shows the subject characteristics of group A and B. There was no significant difference between groups in age, weight, height, BMI, and dominant leg distribution ($p > 0.05$).

Table 1. Subject characteristics of group A and B:

	Group A	Group B		
	Mean ±SD	Mean ±SD	t- value	p-value
Age (years)	19.60 ± 1.64	19.75 ± 1.16	-0.33	0.74
Weight (kg)	71.85 ± 4.75	72.90 ± 6.77	-0.56	0.57
Height (cm)	175.50 ± 5.55	176.95 ± 5.65	-0.82	0.42
BMI (kg/m²)	23.35 ± 1.46	23.24 ± 1.20	0.25	0.80
Dominant leg distribution, n (%)				
Right	17 (85%)	18 (90%)	($\chi2$ = 0.23)	0.63
Left	3 (15%)	2 (10%)		

SD, Standard deviation; χ2, Chi squared value; p value, Probability value

Effect of treatment on adductor/abductor strength asymmetry ratio, LSI, and HAGOS:
Two-way mixed MANOVA revealed that there was a significant interaction of treatment and time ($F = 23.87$, $p = 0.001$, $\eta p^2 = 0.84$). There was a significant main effect of time ($F = 43.70$, $p = 0.001$, $\eta p^2 = 0.91$). There was a significant main effect of treatment ($F = 2.83$, $p = 0.02$, $\eta p^2 = 0.38$).

Comparison within group
There was a significant decrease in the adductor/abductor strength asymmetry ratio of the dominant and non-dominant limbs in both the neutral and functional positions post treatment compared with pretreatment in group A ($p < 0.05$), whereas no significant within-group changes were observed in group B ($p > 0.05$). (Table 2). In addition, there was a significant decrease in the non-dominant/dominant adductor strength asymmetry ratio in the functional position and a significant increase in HAGOS score post treatment compared with pretreatment in group A ($p < 0.001$), while group B showed no significant changes ($p > 0.05$) (Table 3).

Comparison between groups
Comparison between groups post treatment revealed a significant reduction in the adductor/abductor strength asymmetry ratio of the dominant limb in both the neutral position (ES = 0.88, p = 0.008) and the functional position (ES = 0.97, p = 0.004), in group A compared with group B. Similarly, a significant decrease in the asymmetry ratio of the non-dominant limb was observed in group A compared with group B in the neutral position (ES = 1.37, p = 0.001) and the functional position (ES = 0.87, p = 0.009). (Table 2).

In addition, comparison between groups post treatment demonstrated a significant increase in the non-dominant/dominant adductor strength asymmetry ratio in the functional position in group A compared with group B (ES = 1.04, p = 0.002), whereas no significant between-group difference was found in the neutral position (p = 0.61). Furthermore, a significant increase in HAGOS score was observed post treatment in group A compared with group B (ES = 2.53, p = 0.001). (Table 3).

Table 2. Mean adductor/abductor strength asymmetry ratio of the dominant and non-dominant limbs in the neutral and functional positions position pre and post treatment of group A and B:

	Group A	**Group B**			
	Mean ± SD	**Mean ± SD**	**MD (95% CI)**	**p value**	**ES**
Dominant limb					
Neutral position					
Pre treatment	1.26 ± 0.23	1.22 ± 0.25	0.04 (-0.12: 0.19)	0.63	

Post treatment	1.04 ± 0.12	1.21 ± 0.23	-0.17 (-0.28: -0.04)	0.008	0.88
MD (95% CI)	0.22 (0.11: 0.32)	0.01 (-0.09: 0.12)			
	p = 0.001	**p = 0.72**			
Functional position					
Pre treatment	1.36 ± 0.52	1.34 ± 0.28	0.02 (-0.25: 0.28)	0.88	
Post treatment	1.11 ± 0.18	1.30 ± 0.21	-0.19 (-0.31: -0.07)	0.004	0.97
MD (95% CI)	0.25 (0.11: 0.38)	0.04 (-0.10: 0.17)			
	p = 0.001	**p = 0.61**			
Non-dominant					
Neutral position					
Pre treatment	1.33 ± 0.55	1.32 ± 0.30	0.01 (-0.27: 0.30)	0.93	
Post treatment	1.05 ± 0.17	1.30 ± 0.19	-0.25 (-0.36: -0.13)	0.001	1.37
MD (95% CI)	0.28 (0.10: 0.46)	0.02 (-0.16: 0.20)			
	p = 0.003	**p = 0.79**			
Functional position					
Pre treatment	1.29 ± 0.52	1.30 ± 0.42	-0.01 (-0.31: 0.29)	0.96	
Post treatment	1.07 ± 0.21	1.28 ± 0.26	-0.21 (-0.36: -0.05)	0.009	0.87
MD (95% CI)	0.22 (0.03: 0.42)	0.02 (-0.17: 0.22)			
	p = 0.02	**p = 0.79**			

SD, Standard deviation; MD, Mean difference; CI, Confidence interval; p-value, probability value; Cohen effect size ES

Table 3. Mean LSI in the neutral and functional positions position and HAGOS pre and post treatment of group A and B:

	Group A	**Group B**			
	Mean ± SD	**Mean ± SD**	**MD (95% CI)**	**p value**	**ES**
Neutral position					
Pre treatment	96.90 ± 26.97	96.00 ± 14.03	0.90 (-0.13: 0.15)	0.89	
Post treatment	99.00 ± 14.70	95.75 ± 25.17	3.25 (-0.10: 0.17)	0.62	0.16
MD (95% CI)	-2.10 (-0.11: 0.06)	0.25 (-0.08: 0.09)			
	p = 0.62	**p = 0.95**			
Functional position					
Pre treatment	85.50 ± 16.49	88.55 ± 13.94	-3.05 (-0.13: 0.07)	0.53	
Post treatment	99.65 ± 13.42	86.35 ± 12.00	13.30 (0.05: 0.21)	0.002	1.04
MD (95% CI)	-14.15 (-0.21: -0.07)	2.20 (-0.05: 0.09)			
	p = 0.001	**p = 0.55**			
HAGOS					
Pre-treatment	63.76 ± 13.54	60.21 ± 11.37	3.55 (-4.46: 11.55)	0.38	
Post-treatment	90.97 ± 9.94	64.02 ± 11.30	26.95 (20.13 33.76)	0.001	2.53
MD (95% CI)	-27.21 (-29.76: -24.66)	-3.81 (-6.36: -1.26)			
	p = 0.001	**p = 0.004**			

Mean; SD, Standard deviation; MD, Mean difference; CI, Confidence interval; p-value, probability value; Cohen effect size ES

DISCUSSION

The main aim of this study was to determine the impact of 8 week tailored preventive exercise program for reducing risk of hip adductors injury and to investigate the impact of tailored preventive exercise program in reducing hip adductors to abductors strength asymmetry ratio (ADD/ABD) between dominant and non-dominant limbs in neutral and functional position and to investigate limb symmetry index (LSI). Additionally, to determine the impact of this program on groin health, physical activity and quality of life by using HAGOS in Egyptian football players. More than 40% of all injuries in sports including athletics, hockey, soccer, and basketball were found to have muscle injuries (Pérez-Gómez et al., 2020). So, football players must need injury prevention programs to lessen the likelihood of groin injuries. However, most of these programs only work to increase the strength of the adductors and not the abductors, which leads to an imbalance and ultimately more injuries. The results of this research show how effective a program is for preventing future adductor injuries in football players by improving their imbalances.

Impact of the preventive program on hip ADD/ABD strength asymmetry ratio:

Rodríguez-Sanz et al.29 emphasized the importance of symmetrical muscles, drawing the conclusion that the ADD/ABD strength ratio is the best predictor of adductor injuries and the main risk factor [43]. They noted that injuries are ultimately driven by an imbalance between the opposing muscle groups, adductors and abductors, not simply by absolute strength. There are still limits to studies. Our results showed that the dominant limb's ADD/ABD strength asymmetry ratio in the neutral position of the intervention group (A) decreased significantly after treatment compared to pretreatment, with a percentage change of 17.46% and an 18.38% drop in the functional position, respectively. After the program, the intervention group's ADD/ABD asymmetry ratio in the non-dominant limb was 21.05% lower than it had been before treatment in the neutral position, and it was 17.05% lower in the functional position. The only change from pre- to post-treatment for the control group (B) was a 0.82% percentage change.

The ADD/ABD strength asymmetry ratio of the dominant leg in both the neutral position ($p = 0.008$) and the functional position ($p = 0.004$) decreased significantly when comparing the two groups after treatment. After treatment, group A had a significantly lower ADD/ABD asymmetry ratio for the non-dominant limb in both neutral and functional positions compared to group B ($p = 0.001$ and $p = 0.009$, respectively).

Consistent with Wang et al.44, who found that the intervention group had a 15% lower risk of reporting hip groin problems compared to the control group in an 8-week preseason exercise protocol, our study found that the Eccentric hip adductors/ Eccentric hip abductors (EHADS/EHABS) ratio improved. Polglass et al.45 found similar results, showing that after 8 weeks of training, the EHAD:EHAB ratio improved by 10% and 12% on average, respectively. Kekelekis et al.46 found that the likelihood of groin injuries was 76% lower in athletes whose non-dominant limbs had a lower ADD/ABD isometric strength ratio. They also noted that changes in pelvic stability and muscle coordination can increase mechanical stress on the adductor muscle-tendon units, which can result in injuries. Hip abductor capacity deficiencies may increase groin susceptibility due to impaired movement patterns, instability of the hip joints, and overuse injuries to the adductor muscles **[**47]. Therefore, these were significant indicators of adductor issues. An effective strategy for avoiding adductor injuries is to create an individual training regimen that targets both the agonist and antagonist hip muscles to bring them back into proper balance [48]. On the other hand, Quintana-Cepedal et al. 35 found no correlation between groin discomfort and abductor strength or the ratio of adductor to abductor strength; our findings contradict this.

Moreno-Pérez et al.49 found that abductor strength fluctuated, reaching a peak of 17.1% in mid-season before declining dramatically by the end of the season, whereas adductor strength was consistent, highlighting the requirement of a balance between the two. Building on this idea, a significant drop may open up between adductors and abductors if the abductor's weaknesses are not addressed. This contradicts the results of Markovic et al. [11], who found that weakening of the adductor muscles was the main sign of groin pain. As a result, we initially argued that, unlike numerous studies that have used Copenhagen Adductor exercise to increase eccentric hip adduction (EHAD) strength [26,27,28,50], concentrating only on adductor strength is inadequate for sustaining a healthy athlete or football player [47,51] during high-speed sprinting and multi-directional movements. Because it puts an abnormally high amount of stress on the pubic symphysis, eccentric adduction strength is thus a major risk factor for groin injuries [16]. To avoid injuring the adductors, which act as the engine, it's important to overlook the role of the abductors' counter complex, which acts as the brakes. Based on our findings, a healthy ADD/ABD ratio for football players is about 1.05. A healthy ratio for athletes has been

shown to range from 1.2 to 1.6 in various studies [16]. Additionally, some research have only examined the possibility of adductor injury in cases when the ratio is less than 0.8 [33, 34- 35- 52]. A ratio of 0.92 was shown to be a particular marker that increases the risk of adductor strains, according to another research [38,43]. Here is an imbalance that benefits the primary engine (adductors) over the counter system (abductors). A ratio below 0.8 or 0.9 clearly indicated a significant injury risk, while a ratio beyond 1.2 also reflected a distinct sort of danger. In line with our results, Thorborg [39, 53] found that among healthy football players, the typical ADD:ABD ratio was 1.04. Additionally, it has been proposed that football players may regain their hip adduction strength with an ipsilateral hip ADD:ABD ratio greater than 90%.

Impact of the preventive program on Adductor Limb symmetry Index LSI (Inter-limb symmetry):
Our results showed that after treatment, there was no statistically significant difference in neutral-position LSI between groups A and B ($p = 0.62$). On the other hand, after therapy, there was a statistically significant difference between groups A and B in LSI functional position ($p = 0.002$).

With an LSI of 85.5% for both adductors at baseline, the intervention group fell below the 90% target. Symmetry improved dramatically and LSI reached 99.6% after the preventative intervention. In comparison, there was no statistically significant change (2.48% post-treatment) in the control group. Compared to control group B, intervention group A had a statistically significant rise in LSI after the preventive program.
The fact that the functional state becomes balanced after a substantial change from an unbalanced one, while the neutral state remains unaffected, implies that the adductors may be more visibly restored to symmetry when subjected to higher mechanical demands. Adductors undergo significant loading while in functional postures, the primary kicking positions. When the muscle is at an angle of about 15 to 30 degrees of abduction, the pull is perpendicular, enabling it to generate more internal tension and, in turn, external forces [26, 54]. Since a greater force is produced by abducted hips when the maximal adduction squeeze strength is applied, this might also be explained by the length tension connection. Unlike the agnostic stance [39,53,55]. Due of its relative ease compared to functional kicking positions, the neutral position may not be sensitive enough to identify athletes' strength deficiencies.
Hip adduction strength criteria state that a person has recovered their hip adduction strength when one side is equivalent to the contralateral side, and that the nondominant and dominant sides should be roughly equal for the individual [39,53]. A unique indicator that increases the likelihood of adductor strains is a between-leg adductor asymmetry more than 10% (LSI <90%), according to some research [38,43].
Although symmetry was the aim of the study, previous research backs this up as well, showing that injury risk is substantially increased with adductor-to-adductor asymmetry larger than 10% [56].
Bilateral strength deficits ranging from 10% to 15% have been linked to an increased risk of injury across muscle complexes [57, 58], and a 10% strength gap has also been suggested as a main screening indicator for identifying athletes at risk of injury [11].
One of the main risk factors for lower limb disease, according to Kekelekis et al. [46], is an imbalance in the strength of the non-dominant limb. This provides credence to the hypothesis that, instead of mindlessly strengthening the adductors on one side, the intervention should focus on re-establishing reciprocity between the dominant and nondominant muscles. This is supported by our research, since it focuses on the relationship between the weaker and stronger side rather than just adding strength to the adductor muscles. In order to lessen the likelihood of adductor injuries in the future, it may be necessary to restore symmetry between the limbs.
On the other hand, there are studies that have shown no correlation between inter-limb asymmetry and an increased incidence of groin injuries [11, 16 ,38].
In spite of this discordance, the writers insisted on unilateral procedures for focused adductor strengthening in football training. The goal of our preventative regimen was not to reach an absolute adductor strength value only, but it used a functional approach that targeted also the abductor group and global stabilizers in an effort to achieve hip complex stability and symmetry restoration.

Copenhagen Hip and Groin Outcome Score (HAGOS) subscale:
After therapy, the intervention group reported a 42.68 % improvement on the HAGOS subscale, compared to a 6.33 % improvement in the control group. Additionally, there was a statistically significant difference between the groups after treatment, with the intervention group showing improved results (mean difference 25.95).The results align with those of Harøy et al. [37], who discovered that football players' preseason HAGOS scores were

connected to the severity of their symptoms later on, and that high preseason scores were associated with a reduced likelihood of groin injuries [38, 59].
Nevertheless, a number of investigations failed to find a correlation between the HAGOS subscales and groin issues [60]. Youth football players' hip and groin discomfort throughout the season was not predicted by HAGOS, according to Schoffl et al. [32].
Our findings indicate that the HAGOS subscale may be a valuable tool for keeping tabs on football players' health, symptoms, activity levels, and overall well-being. Additionally, these subscales show promise as potential indicators of future outcomes.

Limitations

Our research may have limitations due to its small sample size and the fact that we did not track asymmetry changes or injuries associated with match exposure over the whole season. If we want to lessen the impact of this factor, we should stick to the preventative protocols and monitor any changes in muscle group asymmetry until the next season.

CONCLUSIONS

Our research shows that football players may greatly reduce their risk of adductor injuries by participating in a tailored preventative exercise program for 8 weeks. By constantly evaluating the ADD:ABD strength asymmetry ratio and (LSI) of adductors in both limbs, the therapeutic emphasis may be shifted from isolated adductor strength programs to prioritizing the mechanical symmetry between the dominant and non-dominant limbs' adductors and abductors. When it comes to football players' health and productivity, this strategy is a must-have.

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