International Journal of Healthcare Education & Medical Informatics
Volume 11, Issue 1&2 - 2024, Pg. No. 23-28
Peer Reviewed & Open Access Journal

Research Article

A Study to Find the Effect of Aerobic Exercise and Core Strengthening on Adductor Muscle Strength and Performance in Female Football Players

S Malini[1], Senthil Purushothaman[2], Sivabackiya Chithiravelu[3]

[1]Student, [2]Professor, Chettinad School of Physiotherapy, Chettinad Hospital and Research Institute, Chettinad academy of Research and Education, Kelambakkam, Tamil Nadu, India.
[3]Assistant Professor, Department of Psychiatry, SRM Medical College Hospital and Research Centre, SRMIST, Tamil Nadu, India.
DOI: https://doi.org/10.24321/2455.9199.202405

I N F O

Corresponding Author:
Senthil Purushothaman, Chettinad School of Physiotherapy, Chettinad Hospital and Research Institute, Chettinad academy of Research and Education, Kelambakkam, Tamil Nadu, India.
E-mail Id:
senthilp101010@gmail.com
Orcid Id:
https://orcid.org/0000-0002-0472-0043
How to cite this article:
S Malini, Purushothaman S, Chithiravelu S. A Study to Find the Effect of Aerobic Exercise and Core Strengthening on Adductor Muscle Strength and Performance in Female Football Players. J. HealthCare Edu. & Med. Inform. 2024;11(1&2):23-28.

Date of Submission: 2024-04-04
Date of Acceptance: 2024-05-22

A B S T R A C T

Background of the study: The increasing interest in female soccer has driven a notable shift in its appeal and audience engagement, underscoring the importance of understanding factors that influence player performance and injury prevention. Physical fitness, identified as a crucial determinant of soccer performance, often surpasses other factors such as technical skills and tactical awareness. Effective interventions, such as dietary supplements and core stabilisation exercises, play a vital role in enhancing performance and reducing injuries. Additionally, the Adductor Strengthening Programme (ASP) has shown promise in mitigating groin problems. Despite the benefits of aerobic exercise for cardiovascular health and muscle function, the specific impact of core-targeted exercises on competitive soccer performance remains unclear, highlighting the need for further research to optimise training protocols for female athletes.

Methodology: A total of 40 subjects were selected for the study obtaining informed consent. Subject who fulfilled the following inclusion and exclusion criteria were randomly to one of the two groups. Each group comprised of 20 subjects between the age group 18-23 years. The experimental group was given aerobic exercise and core strengthening on adductor muscle strength for 8– week treatment course. The study parameters include VAS (Visual analog scale), MMT (Manual Muscle Testing), six minute run test and SPEED score used for the pre-test and post-test comparison done between the experimental and control group.

Result: The experimental group showed slightly higher enhancements in physical performance measures butthere is no significant differences between the groups in VAS (pain) and MMT (muscle strength) improvements ($p > 0.05$), the experimental group exhibited significantly greater improvements in the Six-Minute Run (median improvement of 390.00 meters, $Z = -5.060$, $p = 0.000$) and SPEED scores (median reduction of -4.68, $Z = -5.344$, $p = 0.000$).

Conclusion: Overall, the aerobic intervention was found to be more effective in enhancing physical performance.

Keywords: Female Football Players, GPS, Core Strengthening, Aerobic Strength, Performance

Introduction

The popularity and competitive landscape of female soccer have experienced exponential growth in recent years, marking a significant shift in its appeal and audience engagement. This surge is underpinned by multifaceted factors influencing player performance, injury dynamics, and strategies aimed at enhancing athletic longevity and success.[1,2] Soccer, renowned for its demanding technical skills, tactical intricacies, and physical rigours, places paramount importance on player fitness and physiological resilience.[3] Studies underscore physical fitness as a cornerstone determinant of soccer performance, encompassing agility, endurance, and strength, alongside mental fortitude and strategic acumen.[4] Despite advancements, injuries remain a prevailing concern in soccer, with Groin Pain Syndrome (GPS) emerging as a prominent issue among both amateur and professional athletes.[5] Defined by symptoms in the inguinal-pubic-adductor region, GPS significantly impacts player availability and performance. Traditional injury surveillance methods reliant on "time loss" definitions often underestimate the true prevalence and impact of GPS, which can result from both acute trauma and chronic overuse.[6] Core stability has emerged as a pivotal component in mitigating injury risks in soccer.[7] Effective trunk and hip control not only enhances biomechanical efficiency during dynamic movements but also reduces the likelihood of injuries such as GPS. Exercises targeting core muscles, including deep stabilisers like Transversus Abdominis and Lumbar Multifidus, play a crucial role in improving spinal stability and minimising adduction moments that contribute to injury.[8] Moreover, comprehensive training strategies integrating aerobic exercise, strength training, and flexibility regimens are essential in optimising physical performance and reducing injury susceptibility.[9] Dietary supplements also play a significant role in supporting player health and recovery, underscoring the holistic approach necessary for sustainable athletic success.[10] This review aims to synthesise current literature on the multifaceted influences of physical fitness, injury dynamics, and core stability in female soccer.[11] By examining these interconnected factors, we seek to highlight critical insights and propose future research directions to enhance player welfare and performance in this rapidly evolving sport.[12]

Objectives

- To determine the efficacy of aerobic exercise on performance in female soccer players among the GPS population
- To determine the efficacy of core strengthening on performance in female football players among the groin pain syndrome population
- To determine the efficacy of adductor muscle strengthening on muscle power in female soccer players among the GPS population

Materials and Methods

This study was an experimental study design with pre- and post-test results. The study was conducted in Chettinad Academy of Research and Education in Kelambakkam. Aerobic exercise, core and adductor strengthening are compared with the conventional intervention for muscle weakness in female groin pain syndrome. The participants' informed permission was acquired before the group assignment. The time frame for conducting this investigation was March 2024–May 2024 and the study was ethically approved by the Institutional Human Ethics Committee for Student Research (CARE IHEC-I/2409/24). The target population was academic football players with groin pain syndrome. Convenient sampling was used in the study. A total of 40 participants 18 – 23 years of female gendered football players having groin pain are included and any recent surgery, other musculoskeletal problems like inguinal pain, chronic fatigue syndrome are excluded are excluded in our study.chosen based on the inclusion and exclusion criteria. The subjects were initially assessed and divided into two groups, with 20 individuals each: the experimental and the control group. Pre-test values were obtained for groin pain using the Visual Analague scale (VAS) , muscle weakness (muscle power) using the Manual Muscle Testing (MMT) and performance using the 6-min run test and speed test; these were all based on the outcome measurements. It was considered as the baseline reading, and during the fourth week of post-therapeutic intervention, the post-test readings were obtained. Based on the 6-min run test and speed test, a comparison of the pre-test and post-test interventions was carried out for performance, and similar comparisons for muscle power and groin pain were conducted using the MMT device and the VAS scale, respectively.

Results

The data are collected and interpretation of data are analysed using IBM SPSS version 26 analysis software. Normative test for each variables were analysed using Shapiro-Wilk test (Table 2). Both the experimental and control groups exhibited significant improvements in all measured outcomes based on intra-group and inter-group analysis (Table 1,3 and 4). However, the experimental group demonstrated slightly higher improvements in physical performance measures.

VAS (Pain) and MMT (Muscle Strength) Measurements

- There were no significant differences between the experimental and control groups in terms of VAS (pain) and MMT (muscle strength) improvements.

ISSN: 2455-9199
DOI: https://doi.org/10.24321/2455.9199.202405

Physical Performance Measures

- **Six-Minute Run:** The experimental group showed significantly greater improvements compared to the control group, with a median improvement of 390.00 meters (Z = -5.060, p = 0.000).
- **Speed Scores:** The experimental group also exhibited significantly greater reductions in SPEED scores, with a median reduction of -4.68 (Z = -5.344, p = 0.000).

These findings suggest that the experimental intervention was more effective in enhancing physical performance compared to the control intervention.

Table 1.Descriptive Statistics for all Variables in the Experimental and Control Groups

Descriptive Statistics					
Experimental group	**N**	**Minimum**	**Maximum**	**Mean**	**SD**
VAS_PRE	20	5.00	7.00	5.85	0.75
VAS_POST	20	1.00	2.00	1.35	0.49
MMT_PRE	20	3.00	4.00	3.45	0.51
MMT_POST	20	4.00	5.00	4.85	0.37
SixMins_RUN_PRE	20	650.00	1150.00	898.50	153.63
SixMins_RUN_POST	20	1130.00	1450.00	1279.50	99.02
SPEED_PRE	20	14.22	22.15	17.99	2.42
SPEED_POST	20	10.70	16.70	13.16	1.75
Control group	**N**	**Minimum**	**Maximum**	**Mean**	**SD**
VAS_PRE	20	5.00	7.00	5.90	0.79
VAS_POST	20	1.00	2.00	1.45	0.51
MMT_PRE	20	3.00	4.00	3.35	0.49
MMT_POST	20	4.00	5.00	4.80	0.41
SixMins_RUN_PRE	20	680.00	1260.00	974.00	188.50
SixMins_RUN_POST	20	820.00	1390.00	1116.00	178.34
SPEED_PRE	20	14.29	22.06	17.62	2.19
SPEED_POST	20	12.66	20.55	15.84	2.04

Table 2.Test for Normality

Tests of Normality				
	Group	**Shapiro-Wilk**		
		Statistic	**df**	**p Value**
VAS_PRE	Experimental group	0.809	20	0.001
	Control group	0.809	20	0.001
VAS_POST	Experimental group	0.608	20	0.000
	Control group	0.637	20	0.000
MMT_PRE	Experimental group	0.637	20	0.000
	Control group	0.608	20	0.000
MMT_POST	Experimental group	0.433	20	0.000
	Control group	0.495	20	0.000
SixMins_RUN_PRE	Experimental group	0.954	20	0.425
	Control group	0.930	20	0.153
SixMins_RUN_POST	Experimental group	0.955	20	0.451
	Control group	0.950	20	0.366
SPEED_PRE	Experimental group	0.945	20	0.295
	Control group	0.959	20	0.532
SPEED_POST	Experimental group	0.954	20	0.428
	Control group	0.961	20	0.560

ISSN: 2455-9199
DOI: https://doi.org/10.24321/2455.9199.202405

Table 3.Paired Samples Test

Descriptive Statistics						
Experimental group	**N**	**Mean**	**SD**	**Minimum**	**Maximum**	**Median**
VAS_PRE	20	5.85	0.75	5.00	7.00	6.00
MMT_PRE	20	3.45	0.51	3.00	4.00	3.00
6Mins_RUN_PRE	20	898.50	153.63	650.00	1150.00	925.00
SPEED_PRE	20	17.99	2.42	14.22	22.15	18.31
VAS_POST	20	1.35	0.49	1.00	2.00	1.00
MMT_POST	20	4.85	0.37	4.00	5.00	5.00
6Mins_RUN_POST	20	1279.50	99.02	1130.00	1450.00	1290.00
Control group	**N**	**Mean**	**SD**	**Minimum**	**Maximum**	**Median**
SPEED_POST	20	13.16	1.75	10.70	16.70	13.34
VAS_PRE	20	5.90	0.79	5.00	7.00	6.00
MMT_PRE	20	3.35	0.49	3.00	4.00	3.00
6Mins_RUN_PRE	20	974.00	188.50	680.00	1260.00	955.00
SPEED_PRE	20	17.62	2.19	14.29	22.06	17.32
VAS_POST	20	1.45	0.51	1.00	2.00	1.00
MMT_POST	20	4.80	0.41	4.00	5.00	5.00
6Mins_RUN_POST	20	1116.00	178.34	820.00	1390.00	1090.00
SPEED_POST	20	15.84	2.04	12.66	20.55	15.34

Test Statistics				
	Experimental Group		**Control Group**	
	Z	**p Value**	**Z**	**p Value**
VAS_POST - VAS_PRE	-3.98	0.000	-3.96	0.000
MMT_POST - MMT_PRE	-4.05	0.000	-3.94	0.000
6Mins_RUN_POST - 6Mins_RUN_PRE	-3.93	0.000	-3.93	0.000
SPEED_POST - SPEED_PRE	-3.92	0.000	-3.92	0.000

Table 4.Inter-Group Analysis (i.e., Between-Group Analysis)

Descriptive Statistics						
Experimental group	**N**	**Mean**	**SD**	**Minimum**	**Maximum**	**Median**
VAS_DIFF	20	-4.50	0.89	-6.00	-3.00	-4.00
MMT_DIFF	20	1.40	0.50	1.00	2.00	1.00
SixMinsRUN_DIFF	20	381.00	95.42	130.00	600.00	390.00
SPEED_DIFF	20	-4.83	1.35	-7.15	-2.28	-4.68
Group	20	1.00	0.00	1.00	1.00	1.00
Control group	**N**	**Mean**	**SD**	**Minimum**	**Maximum**	**Median**
VAS_DIFF	20	-4.45	1.00	-6.00	-3.00	-4.50

ISSN: 2455-9199
DOI: https://doi.org/10.24321/2455.9199.202405

MMT_DIFF	20	1.45	0.60	0.00	2.00	1.50
SixMinsRUN_DIFF	20	142.00	29.84	100.00	240.00	140.00
SPEED_DIFF	20	-1.78	0.40	-2.65	-1.23	-1.74

Test Statistics				
	VAS_DIFF	**MMT_DIFF**	**SixMinsRUN_DIFF**	**SPEED_DIFF**
Mann-Whitney U	196.500	186.000	13.500	2.500
Wilcoxon W	406.500	396.000	223.500	212.500
Z	-0.099	-0.433	-5.060	-5.344
p value	0.921	0.665	0.000	0.000

Paired Samples Test

This test was conducted to test whether there is any significant change in VAS, MMT, 6-min run test, and speed test scores from pre-test to post-test.

Discussion

In football, hip and groin injuries are prevalent, constituting approximately 10% to 19% of all injuries that result in time lost from play.[13] During any given season, up to 53% of sub-elite players may experience hip or groin pain, with those suffering from symptoms lasting over six weeks reporting a more severe burden than those with shorter durations of discomfort.[14] As football progresses, players are challenged by rising match intensity, necessitating enhanced capabilities to handle both on-ball and off-ball situations. In today's football landscape, coaches are continuously on the lookout for swift and skilful players who boast exceptional physical fitness. These athletes should be capable of executing repetitive high-intensity exercises and managing rigorous training and match schedules week after week.[15] By integrating aerobic high-intensity training sessions into the regimen once or twice a week, athletes can enhance their aerobic energy system capacity. This approach also raises the threshold at which ionic and metabolic disturbances occur, thereby delaying the onset of fatigue during exertion. Consequently, there is usually a substantial reduction in the training volume allocated to low-to-moderate intensity activities during intensified training phases.[16] A scoping review suggests that the utilisation of strengthening exercises may offer potential advantages in enhancing motor control and the performance of functional and specific movements in individuals recovering from ankle sprains and soft tissue injuries.[17]

Various types of strengthening exercises, including bodyweight exercises, machine-based routines, multi-axial strengthening exercises, specific resistance training, and combinations of strength training with motor control or visual motor training, were utilised. These exercises incorporated different resistance types, repetition maximal techniques, and surface variations, offering a diverse regimen aimed at improving rehabilitation and performance outcomes.[18] Strengthening exercises were identified as effective in enhancing motor control and performance in individuals with ankle sprains. Three studies highlighted a noteworthy distinction in motor control and performance outcomes when comparing the effects of strengthening exercises to those of conservative physical therapy treatment for ankle sprain or instability.[19,20] The current study sought how well individuals with GPS responded to the experimental group and control group treatments for performance management, pain management and muscle power enhancement.[21] The results of this investigation contribute to the body of knowledge on physiotherapy therapies for GPS and offer insightful information about the possible advantages of these methods. It has been shown that aerobic, core and adductor muscle strength and stretching and strengthening techniques effectively reduce groin pain and increase muscle power and performance. Still, not much study has been done on using these techniques, especially for GPS. As a result, this research would help determine how beneficial these methods are for people with GPS.

Conclusion

The results of both intra-group and inter-group analyses revealed significant enhancements in all measured outcomes for both the experimental and control groups. The participants who received aerobic exercises exhibited slightly greater improvements in physical performance metrics compared to the control group. These findings indicate that the aerobic intervention was more efficacious in augmenting physical performance.

Conflict of Interest: None

Source of Funding: None

References

1. Bangsbo J. The physiology of soccer--with special reference to intense intermittent exercise. Acta Physiol Scand Suppl. 1994 Jan 1;619:1-55. [PubMed] [Google Scholar]
2. Stølen T, Chamari K, Castagna C, Wisløff U. Physiology of soccer: an update. Sports Med. 2005;35(6):501-36. [PubMed] [Google Scholar]
3. Hoff J, Helgerud J. Endurance and strength training for soccer players: physiological considerations. Sports Med. 2004 Mar;34(3):165-80. [PubMed] [Google Scholar]
4. Gabbett T, Kelly J, Pezet T. Relationship between physical fitness and playing ability in rugby league players. J Strength Cond Res. 2007 Nov;21(4):1126-33. [PubMed] [Google Scholar]
5. Leetun DT, Ireland ML, Willson JD, Ballantyne BT, Davis IM. Core stability measures as risk factors for lower extremity injury in athletes. Med Sci Sports Exerc. 2004 Jun;36(6):926-34. [PubMed] [Google Scholar]
6. Yoon SD, Sung DH, Park GD. The effect of active core exercise on fitness and foot pressure in Taekwondo club students. J Phys Ther Sci. 2015;27(2):509-11. [PubMed] [Google Scholar]
7. Collins J, Maughan RJ, Gleeson M, Bilsborough J, Jeukendrup A, Morton JP, Phillips SM, Armstrong L, Burke LM, Close GL, Duffield R, Larson-Meyer E, Louis J, Medina D, Meyer F, Rollo I, Sundgot-Borgen J, Wall BT, Boullosa B, Dupont G, Lizarraga A, Res P, Bizzini M, Castagna C, Cowie CM, D'Hooghe M, Geyer H, Meyer T, Papadimitriou N, Vouillamoz M, McCall A. UEFA expert group statement on nutrition in elite football. Current evidence to inform practical recommendations and guide future research. Br J Sports Med. 2021;55(8):416. [PubMed] [Google Scholar]
8. Pedrinelli A, Ejnisman L, Fagotti L, Dvorak J, Tscholl PM. Medications and nutritional supplements in athletes during the 2000, 2004, 2008, and 2012 FIFA Futsal World Cups. BioMed Res Int. 2015 Oct 20;2015:870308. [Google Scholar]
9. Aljaloud SO, Ibrahim SA. Use of dietary supplements among professional athletes in Saudi Arabia. J Nutr Metab. 2013;2013:245349. [PubMed] [Google Scholar]
10. Günalan E, Çavak BY, Turhan S, Cebioğlu İK, Domínguez R, Sánchez-Oliver AJ. Dietary supplement use of Turkish footballers: differences by sex and competition level. Nutrients. 2022 Sep 18;14(18):3863. [PubMed] [Google Scholar]
11. Crowe A, Matthews PB. The effects of stimulation of static and dynamic fusimotor fibres on the response to stretching of the primary endings of muscle spindles. J Physiol. 1964 Oct;174(1):109. [PubMed] [Google Scholar]
12. Mens J, Inklaar H, Koes BW, Stam HJ. A new view on adduction-related groin pain. Clin J Sport Med. 2006 Jan 1;16(1):15-9. [PubMed] [Google Scholar]
13. Pałac M, Sikora D, Wolny T, Linek P. Relationship between respiratory muscles ultrasound parameters and running tests performance in adolescent football players. A pilot study. PeerJ. 2023 Apr 17;11:e15214. [Google Scholar]
14. Orchard JW. Men at higher risk of groin injuries in elite team sports: a systematic review. Br J Sports Med. 2015;49(12):798-802. [PubMed] [Google Scholar]
15. Whalan M, Lovell R, McCunn R, Sampson JA. The incidence and burden of time loss injury in Australian men's sub-elite football (soccer): a single season prospective cohort study. J Sci Med Sport. 2019 Jan 1;22(1):42-7. [PubMed] [Google Scholar]
16. Thorborg K, Rathleff MS, Petersen P, Branci S, Hölmich P. Prevalence and severity of hip and groin pain in sub-elite male football: a cross-sectional cohort study of 695 players. Scand J Med Sci Sports. 2017 Jan;27(1):107-14. [PubMed] [Google Scholar]
17. Nassis GP, Massey A, Jacobsen P, Brito J, Randers MB, Castagna C, Mohr M, Krustrup P. Elite football of 2030 will not be the same as that of 2020: preparing players, coaches, and support staff for the evolution. Scand J Med Sci Sports. 2020 Jun;30(6):962-4. [PubMed] [Google Scholar]
18. Wallace JL, Norton KI. Evolution of World Cup soccer final games 1966–2010: game structure, speed and play patterns. J Sci Med Sport. 2014 Mar 1;17(2):223-8. [PubMed] [Google Scholar]
19. Smith BI, Docherty CL, Simon J, Klossner J, Schrader J. Ankle strength and force sense after a progressive, 6-week strength-training program in people with functional ankle instability. J Athl Train. 2012;47(3):282-8. [PubMed] [Google Scholar]
20. Bleakley CM, O'Connor SR, Tully MA, Rocke LG, MacAuley DC, Bradbury I, Keegan S, McDonough SM. Effect of accelerated rehabilitation on function after ankle sprain: randomised controlled trial. BMJ. 2010 May 10;340:c1964. [PubMed] [Google Scholar]
21. Flanagan SP, Laubach LL, De Marco Jr GM, Alvarze C, Borchers S, Dressman E, Gorka C, Lauer M, McKelvy A, Metzler M, Poeppelman J, Redmond C, Riggenbach M, Tichar S, Wallis K, Weseli D. Effects of two different strength training modes on motor performance in children. Res Q Exerc Sport. 2002;73(3):340-4. [PubMed] [Google Scholar]

ISSN: 2455-9199
DOI: https://doi.org/10.24321/2455.9199.202405