Correlation Between Isometric Hip Muscle Strength, Dynamic Balance and Self-Reported Ankle Instability in Recreational Male Football Players with Chronic Ankle Instability: A Pilot Study

Abhilash P V[1], Mithun Shetty[2], Tanvi Hasnale[3*]

[1] Associate Professor, Laxmi Memorial College of Physiotherapy, Mangaluru, Karnataka, India

[2] Associate Professor, A.J. Institute of Medical Sciences, Mangaluru, Karnataka, India

[3] Postgraduate Student, Laxmi Memorial College of Physiotherapy, Mangaluru, Karnataka, India

tanvihasnale@gmail.com

Abstract: Background: CAI frequently develops following recurrent lateral ankle sprains in recreational football players and is associated with impaired neuromuscular control, balance deficits, and functional limitations. Deficits in proximal hip muscle strength may alter lower extremity biomechanics and compromise dynamic balance, contributing to persistent ankle instability. Self-reported ankle instability reflects the functional impact of CAI and may be linked with proximal muscle performance and postural control. **Objective:** To correlate isometric hip muscle strength, dynamic balance, and self-reported ankle instability in recreational male football players with CAI. **Method:** A pilot study was conducted with 20 male recreational football players with chronic ankle instability. Hip isometric strength was determined using a handheld dynamometer, dynamic balance was evaluated using YBT-LQ, and self-reported ankle instability was evaluated using the CAIT. **Results:** Significant moderate -to- strong positive correlations was seen between outcome measures. **Conclusion:** Greater hip muscle strength is associated with better dynamic balance and improved self-reported ankle stability in recreational male football players with CAI, highlighting the importance of hip strengthening in CAI rehabilitation.

Keywords: CAI, Hip Strength, Dynamic Balance, CAIT, Football Players.

INTRODUCTION

Football (soccer) is among the most globally recognized team sports. Lateral ankle sprains, in particular, show a markedly high recurrence rate in this population; a systematic review of sporting populations reported that recurrent ankle sprain was the most common pattern (61%) among soccer players with previous injuries [1,2].

CAI is marked by recurrent ankle sprain, episodes of “giving way”, or a persistent feeling of instability. Recurrent ankle sprains often result from insufficient rehabilitation or premature return to play, which can lead to CAI. The injury depends on various intrinsic and extrinsic factors, such as age, intensity of training, playing surface, footwear, muscle strength, flexibility, balance, and neuromuscular control [3]. Recreational players face increased vulnerability because they often have less structured training, inadequate warm-up routines, and limited access to professional rehabilitation services. These conditions can contribute to a higher incidence of CAI [4].

Subjects with CAI exhibit altered muscle activation patterns throughout the entire limb; these are evident during functional tasks such as transitioning from double-leg to single-leg stance, during a single-leg rotational squat and responding to sudden ankle inversion [5,6]. The isometric strength in the frontal (abductors, adductors) and transverse (external rotators) planes was evaluated. These muscle groups were chosen because their strength differs significantly between males and females, whereas hip flexion and extension strength show no sex-specific differences [7].

Emerging data indicate that individuals with CAI exhibit reduced isometric peak torque at both the ankle and hip joints, supporting the concept that proximal weakness may contribute to impaired dynamic control and balance during single-limb activities common in football [8]. In football-specific populations, the hip abductor–adductor strength ratio is significantly associated with dynamic balance performance, highlighting the importance of balanced hip strength for postural control during sport-specific tasks [9]. Despite this growing body of evidence, findings across studies are not entirely consistent. The study reported that although subjects with CAI exhibited deficits in isometric hip strength, these deficits did not significantly influence dynamic stability during a functional landing task [10].

The existing inconsistency in findings limits a clear understanding of the contribution of proximal hip strength to dynamic balance and functional instability. Considering the mixed evidence on the influence of isometric hip strength on dynamic balance, along with the limited focus on recreational male football players. To address this gap, the present study investigates the correlation among parameters in recreational male football players with CAI.

RESEARCH METHODOLOGY

This pilot correlational study was conducted to examine the relationships among isometric hip muscle strength, dynamic balance, and self-reported ankle instability in recreational male football players with CAI. Ethical approval was obtained.

Participants

A total of 20 recreational male football players aged 18–30 years with CAI were recruited using convenience sampling from local football clubs and sports facilities in Mangaluru. Participants must have had a severe ankle sprain (leading to pain, swelling and a period of no activity of at least 24 hours**)** more than 12 months prior to study commencement, at least two episodes of ankle "giving way" during the previous six months and/or recurrent ankle sprains or a persistent feeling of instability, and a CAIT score of ≤24. Participants with a history of lower-limb musculoskeletal surgery, sustained fractures requiring realignment, or experienced an acute lower-limb musculoskeletal injury within the preceding three months that could influence lower-limb function were excluded.

Outcome Measures

Isometric Hip Muscle Strength

Strength of hip abductors, ER and adductors was assessed using a hand-held dynamometer (HHD)11,12].

Dynamic Balance

It was carried out using the YBT-LQ; it has excellent reliability for assessing dynamic postural control [13].

Self-Reported Ankle Instability

It was assessed using the CAIT, a validated patient-reported outcome measure.[14]

Procedure

Participants were screened using the CAIT questionnaire to confirm eligibility. After obtaining written informed consent, demographic information was recorded, and the limb exhibiting the lesser CAIT score was selected. Isometric hip muscle strength was first assessed, followed by the YBT-LQ. The same investigator performed all assessments under standardized testing conditions.

Statistical Analysis

Data were processed using SPSS version 25.0. Mean ± standard deviation were calculated (Table 1). Data normality was verified using the Shapiro–Wilk test. Pearson's correlation was conducted to determine the relationships among outcome measures. Statistical significance was established at $p < 0.05$.

RESULTS

The mean age of the subjects was 24.90 ± 2.40 years, and the mean BMI was 23.05 ± 0.92 kg/m². The mean YBT-LQ Composite Score was 96.15 ± 2.50%, while the mean CAIT score was 20.20 ± 1.24.

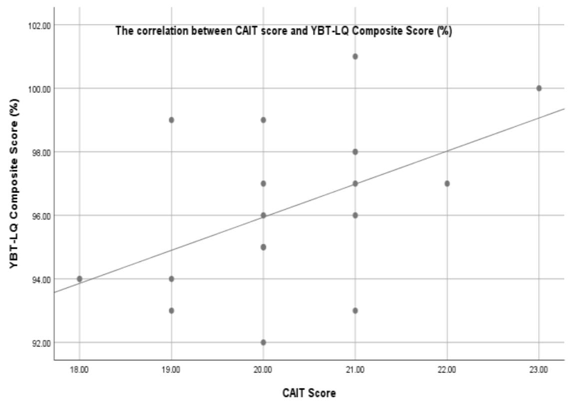
Table 1: Descriptive characteristics of recreational male football players with CAI.

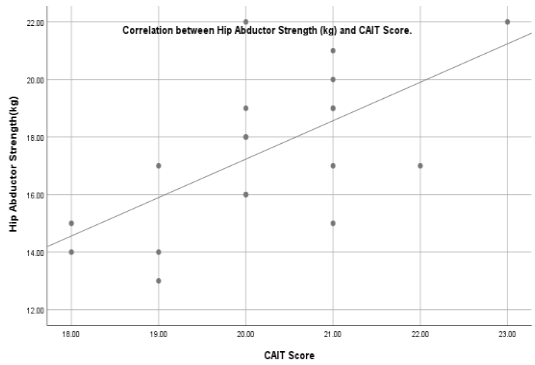
Variable	Mean ± SD	Minimum	Maximum
Age (years)	24.90 ± 2.40	20.00	29.00
BMI (kg/m²)	23.05 ± 0.92	21.60	24.50
Hip Abductor Strength (kg)	18.65 ± 2.16	15.00	23.00
Hip Adductor Strength (kg)	17.50 ± 2.61	13.00	22.00
Hip External Rotator Strength (kg)	15.30 ± 2.05	12.00	19.00
CAIT Score	20.20 ± 1.24	18.00	23.00
YBT-LQ Composite Score	96.15 ± 2.50	92.00	101.00

Table 2. Pearson's correlation analysis of the study variables

Parameters	Correlated Parameter	r	p-value
CAIT Score	YBT-LQ Composite Score	0.517	0.020
CAIT Score	Hip Abductor Strength	0.578	0.008
CAIT Score	Hip Adductor Strength	0.635	0.003
CAIT Score	Hip External Rotator Strength	0.678	0.001
YBT-LQ Composite Score	Hip Abductor Strength	0.684	0.001
YBT-LQ Composite Score	Hip Adductor Strength	0.667	0.001
YBT-LQ Composite Score	Hip External Rotator Strength	0.801	<0.001

Pearson's correlation analysis demonstrated statistically significant positive correlations among the study variables (Table 3). A moderate positive correlation was observed between the CAIT score and the YBT-LQ Composite Score ($r = 0.517$, $p = 0.020$). The YBT-LQ Composite Score was significantly correlated with hip abductor strength ($r = 0.684$, $p = 0.001$), hip adductor strength ($r = 0.667$, $p = 0.001$), and hip external rotator strength ($r = 0.801$, $p < 0.001$). The CAIT score demonstrated significant positive correlations with hip abductor strength ($r = 0.578$, $p = 0.008$), hip adductor strength ($r = 0.635$, $p = 0.003$), and hip ER strength ($r = 0.678$, $p = 0.001$).





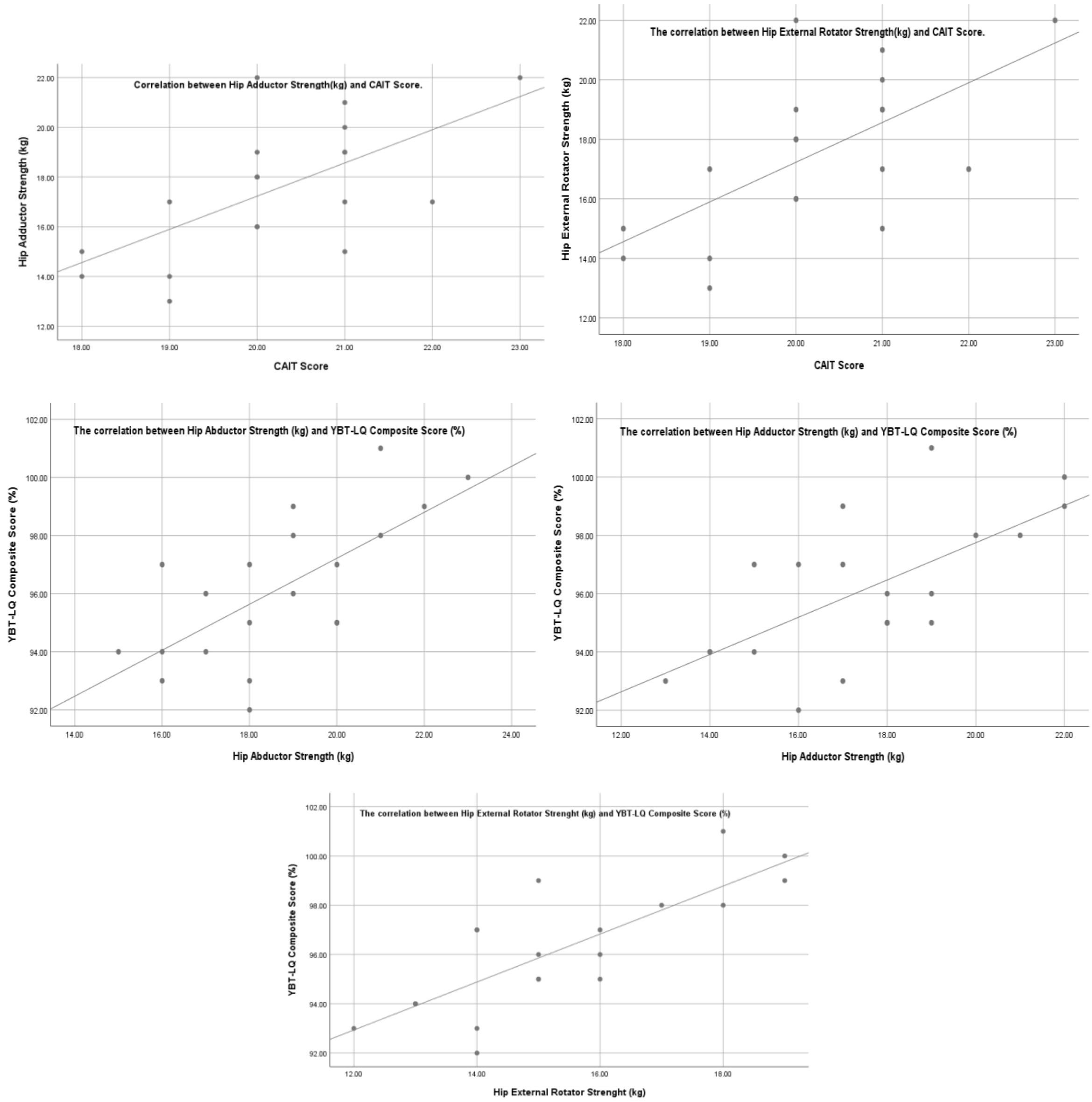


Figure 1. Scatter plots illustrating the relationships between the study variables. (A) CAIT score vs YBT-LQ Composite Score; (B) CAIT score vs Hip Abductor Strength; (C) CAIT score vs Hip Adductor Strength; (D) CAIT score vs Hip External Rotator Strength; (E) YBT-LQ Composite Score vs Hip Abductor Strength; (F) YBT-LQ Composite Score vs Hip Adductor Strength; (G) YBT-LQ Composite Score vs Hip External Rotator Strength.

DISCUSSION:

The current study findings revealed significant relationships between proximal hip muscle strength, dynamic postural control and perceived ankle stability. This supports the notion that

CAI is not limited to the ankle joint but may involve neuromuscular deficits affecting the entire lower-limb kinetic chain.

Hip abductor strength and the YBT-LQ composite score demonstrate a moderate association. Similarly, a higher hip abductor–adductor strength ratio was related to better dynamic balance performance in football players [9]. Evidence from Olszewski et al. indicated that stronger isometric hip abductors contributed to better dynamic balance in males with CAI. Those with CAI may adopt a hip-dominant postural control strategy to compensate for distal ankle deficits during balance tasks [13]. However, Mulligan and DeVahl reported that hip abductor strength demonstrated little relationship with modified SEBT performance in subjects with ankle instability. The authors further stated that static hip strength measures could not differentiate those with CAI from healthy controls [15]. A possible explanation for the difference in findings may be related to variations in participant characteristics, balance assessment procedures and hip strength testing methods. Hip external rotators and YBT-LQ composite score have shown strong correlation, indicating stronger hip external rotators may compensate for distal instability and contribute to superior dynamic balance performance. These findings are supported by Olszewski et al. [13].

Isometric hip strength was associated with CAIT score. Consistent with this finding, Lu et al. documented reduced hip abductor strength and lower CAIT scores in a female cohort study [16]. The study reported that individuals with more severe CAI demonstrated lower isometric hip abductor strength, emphasizing the role of proximal musculature in maintaining functional ankle stability [18]. Evidence from meta-analyses indicates that strengthening the hip abductors, ER, and extensors can enhance patient-reported outcomes in musculoskeletal conditions such as patellofemoral pain syndrome (PFPS), highlighting the functional importance of proximal hip musculature during lower-extremity rehabilitation [17,18].

Supporting the correlation between the CAIT score and YBT-LQ composite score, the authors suggested that lower CAIT scores were associated with impaired balance performance and reduced neuromuscular control during dynamic activities [19]. Similarly, Peng et al. reported that CAIT showed significant limitation in dynamic balance and proprioceptive function in subjects with CAI [20]. Overall, this supports the notion that proximal hip musculature contributes to the functional management and rehabilitation of CAI.

CONCLUSION

The present study demonstrated significant positive relationships among the evaluated parameters. Clinically, these results emphasize the need for incorporating proximal hip strengthening and dynamic balance training into rehabilitation and injury prevention programs. Improving proximal neuromuscular control and lower limb stability to enhance functional performance during football activities.

Limitations

limitations due to the small sample size from a specific group of participants, namely recreational male football players with CAI. Experimental studies are required to further test assumptions.

Acknowledgements

The authors thank all athletes who voluntarily enrolled in this research.

Funding Source

Nil.

Competing Interests

There are no financial or charitable organization to carry out this research.

Ethical Approval

Institutional Ethics Committee, A. J. Institute of Medical Sciences & Research Centre, Mangalore, Karnataka, India, with Ref ID: AIEC/REV/195/2025 dated 24th June 2025.

Informed Consent

All subjects give consent prior to the study.

References

1. Hoveidaei AH, Moradi AR, Nakhostin-Ansari A, Mousavi Nasab MM, Taghavi SP, Eghdami S, Forogh B, Bagherzadeh Cham M, Murdock CJ. Risk factors of ankle sprain in soccer players: a systematic review and meta-analysis. Sports. 2025 Mar 28;13(4):105.

2. Lin CI, Houtenbos S, Lu YH, Mayer F, Wippert PM. The epidemiology of chronic ankle instability with perceived ankle instability-a systematic review. Journal of foot and ankle research. 2021 May 28;14(1):41.

3. Delahunt E, Remus A. Risk factors for lateral ankle sprains and chronic ankle instability. J Athl Train. 2019 Jun 1;54(6):611-6.

4. Hertel J, Corbett RO. An updated model of chronic ankle instability. J Athl Train. 2019 Jun 1;54(6):572-88.

5. Koshino Y, Ishida T, Yamanaka M, Ezawa Y, Okunuki T, Kobayashi T, Samukawa M, Saito H, Tohyama H. Kinematics and muscle activities of the lower limb during a side cutting task in subjects with chronic ankle instability. Knee Surg Sports Traumatol Arthrosc. 2016 Apr;24(4):1071-80.

6. Tamura A, Shimura K, Inoue Y. Biomechanical characteristics of the support leg during side-foot kicking in soccer players with chronic ankle instability. Orthop J Sports Med. 2022 Jul 28;10(7):23259671221112966.

7. Holmes SC, Montgomery MM, Lynn SK, Pamukoff DN. Sex-Specific associations between hip muscle strength and foot progression angle. J Electromyogr Kinesiol. 2023 Feb;68:102723. doi: 10.1016/j.jelekin.2022.102723. Epub 2022 Nov 13. PMID: 36402073.

8. Kosik KB, Johnson NF, Terada M, Thomas AC, Mattacola CG, Gribble PA. Decreased ankle and hip isometric peak torque in young and middle-aged adults with chronic ankle instability. Phys Ther Sport. 2020 May;43:127-133.

9. Doğan FE, Korkmaz N, Güzel NA. The relationship of hip adductor and abductor muscle isometric strength ratio with dynamic balance in football players. Spor Hekimligi Dergisi/Turkish Journal of Sports Medicine. 2021 Dec 1;56(4).

10. McCann RS, Bolding BA, Terada M, Kosik KB, Crossett ID, Gribble PA. Isometric hip strength and dynamic stability of individuals with chronic ankle instability. J Athl Train. 2018 Jul 1;53(7):672-8.

11. Thorborg K, Petersen J, Magnusson SP, Hölmich P. Clinical assessment of hip strength using a hand-held dynamometer is reliable. Scand J Med Sci Sports. 2010 Jun;20(3):493 501.

12. Willy RW, Davis IS. The effect of a hip-strengthening program on mechanics during running and during a single-leg squat. J Orthop Sports Phys Ther. 2011 Sep;41(9):625-32. doi: 10.2519/jospt.2011.3470. Epub 2011 Jul 12. PMID: 21765220.

13. Olszewski M, Golec J, Zając B, Krężałek P. Isometric and isokinetic hip strength in males with chronic ankle instability and its relationship with dynamic balance and self-reported instability. Phys Ther Sport. 2025 Mar;72:9-17. doi: 10.1016/j.ptsp.2024.12.007. Epub 2024 Dec 31. PMID: 39764894.

14. Hiller CE, Refshauge KM, Bundy AC, Herbert RD, Kilbreath SL. The Cumberland ankle instability tool: a report of validity and reliability testing. Arch Phys Med Rehabil. 2006 Sep;87(9):1235-41

15. Mulligan EP, DeVahl J. can proximal hip strength and dynamic control differentiate functional ankle stability classifications? Int J Sports Phys Ther. 2020 Dec;15(6):1061-1072

16. Lu J, Wu Z, Adams R, Han J, Cai B. Sex differences in the relationship of hip strength and functional performance to chronic ankle instability scores. J Orthop Surg Res. 2022 Mar 21;17(1):173. doi: 10.1186/s13018-022-03061-0. PMID: 35313904; PMCID: PMC8935730.

17. Na Y, Han C, Shi Y, Zhu Y, Ren Y, Liu W. Is Isolated Hip Strengthening or Traditional Knee-Based Strengthening More Effective in Patients With Patellofemoral Pain Syndrome? A Systematic Review With Meta-analysis. Orthop J Sports Med. 2021 Jul 29;9(7):23259671211017503. doi: 10.1177/23259671211017503. PMID: 34377715; PMCID: PMC8330492.

18. Alammari A, Spence N, Narayan A, Karnad SD, Ottayil ZC. Effect of hip abductors and lateral rotators' muscle strengthening on pain and functional outcome in adult patients with patellofemoral pain: A systematic review and meta-analysis. J Back Musculoskelet Rehabil. 2023;36(1):35-60. doi: 10.3233/BMR-220017. PMID: 35988215.

19.) Kunugi S, Masunari A, Yoshida N, Miyakawa S. Association between Cumberland Ankle Instability Tool score and postural stability in collegiate soccer players with and without functional ankle instability. Phys Ther Sport. 2018 Jul;32:29-33.

20. Peng D, Tang H, Mao M, Song Q, Mao D, Wang J, Sun W. Correlations of strength, proprioception, and dynamic balance to the Cumberland Ankle Instability Tool Score among patients with chronic ankle instability: a cross-sectional study. BMC Musculoskelet Disord. 2024 Nov 28;25(1):970.