VOLUME - 15, ISSUE - 11, NOVEMBER - 2026 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper | Physical Medicine & Rehabilitation

COMPARISON OF PLYOMETRIC AND ADVANCED FUNCTIONAL REHABILITATION IN FOOTBALL PLAYERS WITH FUNCTIONAL ANKLE INSTABILITY

Sakshi R Bhadre	MPT Sports Physiotherapy
Dr B Yugandhar Reddy	Professor, Rami Reddy College of Physiotherapy, Kadapa, Florence College of Physiotherapy
Dr C Navabharatha Reddy	(PT), Professor, Florence College of Physiotherapy

KEYWORDS :

INTRODUCTION

Lateral ankle sprains represent one of the most prevalent lower-limb injuries, accounting for up to 17 per cent of all time-loss incidents and frequently progressing to chronic functional ankle instability (FAI) if inadequately managed [1,2] Functional ankle instability is characterized by recurrent "giving way", persistent pain and swelling, reduced proprioception and neuromuscular control, and a heightened risk of re-injury during high-velocity directional changes [3,4].

Given the dynamic demands of football rapid acceleration, deceleration, pivoting and single-leg landings rehabilitation strategies that restore sensorimotor function and mechanical stability are essential to return athletes safely to play and to reduce longterm sequel such as osteoarthritis [5]

Plyometric training, which emphasises rapid stretch–shortening cycles and highvelocity muscle actions, has been proposed to enhance lower-limb power, reactive strength and proprioceptive acuity [6,7] By exposing the neuromuscular system to controlled high-impact stimuli, plyometric protocols aim to accelerate muscle–tendon unit stiffness adaptations and improve feed-forward and feedback control mechanisms during sport-specific tasks [8].

Advanced functional rehabilitation aims to retrain the sensory-motor system and enhance the athlete's confidence in weight-bearing and multidirectional movements.

Although both plyometric training and advanced functional rehabilitation are widely used in the management of functional ankle instability, there is limited evidence.

Functional ankle instability frequently develops following inadequately rehabilitated lateral ankle sprains, a condition that affects up to one in five footballers and predisposes them to recurrent injury, persistent pain, proprioceptive deficits and long-term joint degeneration. Although plyometric training and multimodal functional rehabilitation are each advocated within clinical practice, direct head-to-head comparisons—especially within a football-specific context—remain scarce.

Football's rapid changes of direction, high-velocity landings and unipedal support may differentially influence the adaptations elicited by these two rehabilitation strategies. Repeated landing could cause high risk injury in football players and for this dynamic ankle instability, repeated concentric and eccentric contractions along with high intensity exercise can be affective, hence plyometric will be helpful for FAI there is very limited evidence for comparing plyometric technique of high velocity and rapid stretch –shortening muscle exercises compared with neuromuscular exercises of advance functional rehabilitation in FAI.

Objectives

- To find the comparison of plyometrics and advanced functional rehabilitation in football players with functional ankle instability.
- To find the effectiveness of advanced functional rehabilitation in football players with functional ankle instability.
- To compare the effectiveness of plyometrics in football players with functional ankle instability.

METHODOLOGY

Study Design: Pre and post comparative study
Study Subject: Recreational Football players with functional Ankle Instability
Source of Data: Rohan Bopanna Academy
Sampling Method: convenience sampling method Study
Duration: 4-8 MONTHS
Sample Size
Thus n = 0.075264 divided by 0.0025 = 30.10 (round off to 30)

So, it is approximately 30 participants required to estimate the proportion with a margin of error of 0.05 and a 95% confidence level with 10% drop out the required sample size – 27, With 20% drop out the required sample size – 24

Sample Selection

Inclusion Criteria

- Age between 18 and 35 years.
- Male
- History of FAI wen ≥2 ankle sprain in the past 12 months, at least one episode of "giving way" in the past six months [1]
- Willingness to participate and provide informed consent.
- Grade 1 –mild injuries.

Exclusion Criteria

- Neuromuscular injury involving of lower limb[2]
- Musculoskeletal disorder of lower limb
- History of lower limb fracture or surgery[1,2]
- Current ankle injury (<3 months)

Procedure

The study obtained ethical approval (ANNEXURE -I) from the institutional ethical committee, and patients provided written consent (ANNEXURE-II) by signing a form. Demographic data and physical examination were recorded for 52 participants. The simple random sampling method was used to randomly assign participants into two groups: 26 participants in Intervention Group A plyometrics and 26 participants in Group B – advanced functional rehabilitation using a computer-generated block randomisation schedule. After grouping, the participants' medical history, assessment, and baseline data were collected before and after the treatment.

After baseline assessments, participants were randomised to Plyometric Exercise (PE) Group – 3 sessions per week ,Warm-up (10 min): light jogging, dynamic stretches. Eight-week plyometric protocol [22], incorporating single- and double-leg hops, squat jumps, box jumps, zig-zag hops and depth

drops.The following exercises were repeated (three sets of eight repetitions; Borg RPE (Rate of Perceived Exertion) 5–7).Cool-down (10 min): static stretching.

Statistical Analysis

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using statistical package for social science (SPSS) version 24, with a significance level of p value less than 0.05 and a 95% confidence interval set for all analysis.

Table- 3 Comparison of Y-Balance Test Score within Group – A and Group - B Between Pre Test and Post Test

Groups	Pre Test		Post Test		T - Test	Significance
	Mean	S.D	Mean	S.D		
Group- A	54.86	2.82	80.26	3.36	-23.48	.001**
Group- B	56.73	4.02	83.80	2.17	-23.40	.001**

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – A & Group – B.

There is a statistically significant difference between the pre test and post test values within Group A and Group B at $P \leq 0.05$.

Table – 4 Comparison of Faam Score within Group – A and Group - B Between Pre Test and Post Test

Groups	Pre Test		Post Test		T - Test	Significance
	Mean	S.D	Mean	S.D		
Group- A	59.93	5.72	69.93	7.60	-5.93	.001**
Group- B	59.53	5.81	80.66	3.71	-12.01	.001**

(**- $P \leq 0.05$ - Significant).

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – A & Group – B.

There is a statistically significant difference between the pre test and post test values within Group A and Group B at $P \leq 0.05$.

RESULTS

On comparing the Mean Values of Group A & Group B on Y – Balance Test Score, it shows a significant increase in the post test mean values in both groups, but (Group B - Plyometric) shows 83.80 ± 2.17 which has the higher mean value is more effective than (Group A – Advanced Functional Rehabilitation) 80.26 ± 3.36 at $P \leq 0.05$. Hence the null hypothesis is rejected.

On comparing the Mean Values of Group A & Group B on FAAM Score, it shows a significant increase in the post test mean values in both groups, but (Group B - Plyometric) shows 80.66 ± 3.71 which has the higher mean value is more effective than (Group A – Advanced Functional Rehabilitation) 69.93 ± 7.60 at $P \leq 0.05$. Hence the null hypothesis is rejected.

On comparing Pre test and Post test within Group A & Group B on Y – Balance Test Score & FAAM Score shows significant difference in the mean values at $P \leq 0.05$.

DISCUSSION

The present study was conducted to compare the effectiveness of plyometric training and advanced functional rehabilitation in football players with functional ankle instability (FAI). The outcome measures used in this study were the YBalance Test (YBT) and Foot and Ankle Ability Measure (FAAM). The findings of the present study demonstrated that both intervention groups showed significant improvement in dynamic balance and functional ability following the intervention period. However, the plyometric training group demonstrated greater improvement compared to the advanced functional rehabilitation group.

The findings of the present study are consistent with the study conducted by Huang Pi-Yin, who reported significant improvements in joint position sense, dynamic balance, and neuromuscular control following plyometric and balance training in recreational athletes with FAI. Their study concluded that plyometricbased rehabilitation enhances postural control and landing mechanics in individuals with ankle instability.[36]

Similarly, the findings correlate with the study by Ismail MM, which demonstrated that plyometric exercises were more effective than resistive exercises in improving dynamic stability, proprioception, and functional performance after lateral ankle sprain rehabilitation.

The present study also demonstrated significant improvement in FAAM scores in both groups following intervention. However, the plyometric group exhibited greater improvement in functional ability compared to the advanced functional rehabilitation group. The post-test FAAM mean score in Group B was 80.66 ± 3.71, whereas Group A demonstrated 69.93 ± 7.60. These findings suggest that plyometric exercises may provide greater carryover into sport-specific functional activities such as running, jumping, cutting, and landing, which are essential components of football performance.

Football players with FAI commonly demonstrate impaired proprioception, delayed peroneal muscle activation, altered landing mechanics, and decreased postural stability. Plyometric exercises involve repeated rapid eccentric and concentric muscle contractions that enhance muscle spindle sensitivity and improve sensorimotor integration. These adaptations may contribute to improved ankle joint stability and reduced episodes of "giving way."

The greater effectiveness of plyometric exercises may also be explained by the sport-specific nature of football, which involves repeated sprinting, jumping, rapid acceleration-deceleration, cutting, and landing activities. Plyometric exercises closely mimic these movement patterns and therefore may better prepare athletes for return to play.

Overall, the findings of the present study suggest that plyometric training can be considered an effective rehabilitation strategy for improving dynamic balance and functional outcomes in football players with functional ankle instability. However, advanced functional rehabilitation also remains an important intervention for restoring proprioception and neuromuscular control.

REFERENCES

1. Waterman BR, Owens BD, Davey S, Zacchilli MA, Belmont PJ Jr. The epidemiology of ankle sprains in the United States. J Bone Joint Surg Am. 2010;92(13):2279–84.
2. Gerber JP, Williams GN, Scoville CR, Arciero RA, Taylor DC. Persistent disability associated with ankle sprains: a prospective examination of an athletic population. Foot Ankle Int. 1998;19(10):653–60.
3. Hertel J. Functional anatomy, pathomechanics, and pathophysiology of lateral ankle instability. J Athl Train. 2002;37(4):364–75.
4. Wikstrom EA, Naik S, Lodha N, Cauraugh JH. Balance capabilities after lateral ankle trauma and intervention: a meta-analysis. Med Sci Sports Exerc. 2010;42(3):399–410.
5. Delahunt E, Monaghan K, Caulfield B. Altered neuromuscular control and ankle joint kinematics during walking in subjects with functional ankle instability. Am J Sports Med. 2006;34(12):1970–6.
6. Hubbard TJ, Kramer LC, Denegar CR, Hertel J. Contributing factors to chronic ankle instability. Foot Ankle Spec. 2007;2(4):186–91. Ross SE, Guskiewicz KM, Gross MT, Shultz SJ. Balance measures for discriminating between functional and mechanical ankle instability. J Athl Train. 2005;40(1):21–6.
7. Chimera NJ, Smith CA, Warren M. Effects of plyometric training on muscle–tendon efficiency in women. J Strength Cond Res. 2004;18(2):228–36.
8. Eils E, Rosenbaum D. A multi-station proprioceptive exercise programme in patients with ankle instability. Med Sci Sports Exerc. 2001;33(12):1991–8.
9. McKeon PO, Hertel J. Systematic review of postural control and lateral ankle instability, part II: is balance training clinically effective? J Athl Train. 2008;43(3):305–15.
10. Fong DT, Hong Y, Chan LK, Yung PS, Chan KM. A systematic review on ankle injury and ankle sprain in sports. Sports Med. 2007;37(1):73–94.
11. Verhagen EA, Bay K. Optimising ankle sprain prevention: a critical review and practical appraisal of the literature. Br J Sports Med. 2010;44(15):1082–8.

12. Hubbard TJ, Kramer LC, Denegar CR, Hertel J. Contributing factors to chronic ankle instability. Foot Ankle Spec. 2007;2(4):186–91.
13. Wilkerson GB, Mason MA. Effectiveness of a balance training programme on ankle proprioception, balance, and functional performance. Int J Sports Phys Ther. 2010;5(1):46–54.
14. Hertel J, Olmsted-Kramer LC, Denegar CR. Efficacy of proprioceptive modalities in ameliorating self-reported ankle instability: a meta-analysis of randomized controlled trials. J Orthop Sports Phys Ther. 2011;41(1):A1–A22.
15. Bleakley CM, O'Connor SR, Tully MA, et al. Optimal loading and neuromuscular training for chronic ankle instability: a randomised controlled trial. J Orthop Sports Phys Ther. 2013;43(11):848–57.
16. Lee HM, Oh S, Kwon JW. Effect of Plyometric versus Ankle Stability Exercises on Lower Limb Biomechanics in Taekwondo Demonstration Athletes with Functional Ankle Instability. Int J Environ Res Public Health. 2020;17(10):3665.
17. Huang PY, Chen WL, Lin CF, Lee HJ. Lower extremity biomechanics in athletes with ankle instability after a 6-week integrated training program. J Athl Train. 2014;49(2):163–172.