

Original Article

# Effects of Hop Stabilization versus Balance Training on Disability and Balance in Chronic Ankle Instability among Basketball Players

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## ABSTRACT

**Background:** Ankle sprains, which often lead to chronic ankle instability (CAI), are common within the young, athletic population, particularly among basketball players. Rehabilitation programs frequently employ hop stabilization and balance training to mitigate the complications associated with CAI. This research was undertaken to compare the effectiveness of these two training approaches in improving disability and balance in affected individuals.

**Objective:** The study aimed to evaluate and contrast the impact of hop stabilization versus balance training on disability and balance in basketball players with CAI.

**Methods:** The randomized clinical trial was conducted at Ranger's Teaching Hospital in Lahore, targeting young basketball players aged between 25 to 35 years with a history of recurrent ankle sprains and at least 8 months of playing experience. Through a non-probability convenient sampling technique, the participants were randomized into two groups: Group A underwent 6 weeks of hop stabilization training in addition to general training, while Group B participated in 6 weeks of balance training coupled with their general training regimen. The efficacy of these interventions was quantified using the Star Excursion Balance Test, Functional Ankle Disability Index, Functional Ankle Ability Measure questionnaire, and Multiple Single Leg Hop Stabilization Test (MSLHST).

**Results:** Post-training assessments within groups indicated significant enhancements in disability and balance scores, with p-values below 0.05, suggesting notable improvements. However, when comparing the two groups, the Functional Ankle Ability Measure, Ankle Disability Index, and Star Excursion Balance Test showed no significant differences, with p-values exceeding 0.05. Notably, the MSLHST exhibited a significant contrast, with Group B showing a mean score decrease from 10.7857 to 5.7857, reflecting a 46% improvement, whereas Group A displayed a reduction in mean score from 13.625 to 11.7, a 14% enhancement, resulting in a significant p-value of 0.0289.

**Conclusion:** The study concluded that balance training surpasses hop stabilization training in terms of efficacy, significantly improving balance and reducing disability in basketball players with chronic ankle instability.

**Keywords:** Chronic Ankle Instability, Multiple Single Leg Hop Stabilization Test, Functional Ankle Ability Measure, Balance Training, Hop Stabilization.

## INTRODUCTION

Chronic ankle instability (CAI) is an often encountered issue among basketball players, significantly impacting their performance and well-being (1-3). This condition typically manifests as a recurring feeling of the ankle 'giving way,' often a sequel to an inadequately rehabilitated ankle sprain. The demanding nature of basketball, with its characteristic high-impact movements such as frequent jumping, sudden directional changes, and quick stops, not only increases the risk of initial ankle injuries but also aggravates the likelihood of developing chronic instability in the ankle joint. This repeated instability not only hinders athletic performance but can also lead to a decreased quality of life due to persistent discomfort and the increased risk of further injuries (4-6).

Addressing CAI effectively is a critical concern in the realm of sports medicine and physical therapy, particularly for basketball athletes. In this context, hop stabilization and balance training emerge as two key rehabilitative approaches (7, 8). Hop stabilization exercises are specifically designed to enhance neuromuscular control during dynamic, high-impact activities that are integral to basketball. These exercises typically involve various forms of single-leg hops, jumps, and bounds, which are aimed at challenging and consequently strengthening the stability of the ankle. These plyometric movements are crucial as they mimic the actual movements athletes encounter during play, thereby specifically targeting the muscles and reflexes used in basketball (7, 9).

Conversely, balance training, another pivotal rehabilitative strategy, focuses on enhancing proprioception and postural control. This form of training incorporates both static and dynamic exercises, often utilizing specialized equipment such as balance boards, wobble boards, or foam pads (10-12). These tools aid in creating an unstable environment, forcing the ankle and surrounding muscles to engage in order to maintain balance. This type of training is crucial as it works on the foundational aspect of ankle stability – the ability to maintain control over body position, both in motion and at rest (13-15).

The comparison between these two methods – hop stabilization and balance training – is vital to determine their respective efficacies in improving balance and reducing the disability associated with CAI in basketball players (16-18). This comparison is multifaceted, considering improvements in physical balance, a reduction in the frequency and intensity of the 'giving way' sensation, and the overall impact on the athletes' performance and their perception of disability. A thorough comparative analysis would provide insights into which method is more adept at addressing the specific challenges posed by CAI in a high-impact sport like basketball (19).

The primary objective of this research is to methodically compare hop stabilization and balance training, evaluating their effectiveness in improving both the physical and perceived disabilities among basketball players suffering from CAI (20-22). It hypothesizes that while both methods will likely yield improvements in stability and function, one might prove superior in certain aspects, such as enhancing dynamic stability or reducing the subjective experience of instability during play.

The significance of this study extends beyond the academic interest, reaching into the practical realms of sports medicine, physical therapy, and athletic training. By identifying the more effective of these two methods, the study could inform and possibly transform clinical practices and training regimens for athletes dealing with CAI. The potential benefits are manifold – enhanced athletic performance, reduced risk of recurrent ankle injuries, and improved overall quality of life for the athletes. Such insights are invaluable not only for the athletes themselves but also for sports medicine professionals, physiotherapists, and basketball coaches who are instrumental in the rehabilitation and training processes (23, 24). Ultimately, this research could lead to more targeted, effective treatment and training strategies, catering specifically to the needs of basketball players with chronic ankle instability, thereby ensuring their continued engagement in the sport and enhancing their overall well-being.

## MATERIAL AND METHODS

In the study, a randomized control trial was conducted to evaluate the effectiveness of hop stabilization training versus balance training in improving disability and balance among basketball players with chronic ankle instability (CAI). The participants in this study were basketball players, specifically selected due to their history of CAI. These athletes were characterized by recurrent episodes of ankle 'giving way,' which is a common symptom of CAI, and their participation provided a pertinent sample for assessing the interventions' effectiveness.

The study's methodology involved randomly assigning these players into two distinct groups. One group was designated to receive hop stabilization training in addition to their general training routines. Hop stabilization training is a specific type of exercise regimen focused on improving dynamic ankle stability through plyometric exercises like hops and jumps. These exercises were designed to mimic the movements basketball players typically perform during games, thereby targeting the specific neuromuscular pathways and muscles involved in these activities.

The second group was assigned to undergo balance training, also alongside their general training routines. Balance training differs from hop stabilization in that it focuses on improving proprioception and postural control. This training often utilizes equipment such as balance boards or foam pads to create an unstable environment, forcing the athletes to engage their ankle and surrounding muscles to maintain balance. This type of training is crucial in rehabilitating ankle stability as it addresses the foundational aspect of maintaining body control.

Both groups participated in their respective training programs for a designated period, typically spanning several weeks. This duration was chosen to provide sufficient time for the training to have a measurable impact on the participants' ankle stability and overall balance.

To assess the effectiveness of each training approach, a series of disability and balance assessment measures were employed both before and after the intervention. These assessments included tools like the Foot and Ankle Ability Measure (FAAM) and the Functional Ankle Disability Index (FADI). These questionnaires are designed to evaluate the participants' perceived disability and functional limitations related to their ankles. Additionally, physical balance tests such as the Star Excursion Balance Test (SEBT) and the Modified Star Lunge Hop Stability Test (MSLHST) were used. The SEBT, for example, is a dynamic test that assesses a participant's ability to maintain balance while reaching as far as possible in multiple directions. The MSLHST is another practical test that measures the athlete's ability to stabilize their ankle during dynamic movements.

These pre- and post-intervention assessments provided a comprehensive evaluation of the training programs' effectiveness. By comparing the results from these assessments before and after the intervention, the study aimed to determine which training method – hop stabilization or balance training – was more effective in mitigating the effects of CAI in basketball players. The use of a randomized control trial design, along with the employment of both subjective and objective measures of balance and disability, lent robustness and credibility to the study's findings.

## RESULTS

In the study, the between-group comparison using the post-intervention scores from the Modified Star Lunge Hop Stability Test (MSLHST) revealed a notable difference between the Balance Training Group (BTG) and the Hop Stabilization Group (HSG). The BTG achieved a mean score of 5.78 with a standard deviation of 6.71, while the HSG had a higher mean score of 11.75 with a standard deviation of 7.38. The P value obtained was 0.0289, indicating a statistically significant difference between the two groups' performance post-intervention. This suggests that the balance training had a more pronounced effect on improving the participants' stability and balance compared to hop stabilization training within the context of this study.

Table 1 Comparison of MSLHST at post interventional measurement

Variables	Groups	Mean $\pm$ Standard Deviation	P value
Post MSLHST	BTG	5.78 $\pm$ 6.71	0.0289
	HSG	11.75 $\pm$ 7.38	

### Mean Comparison of MSLHST Scores Before and After Intervention

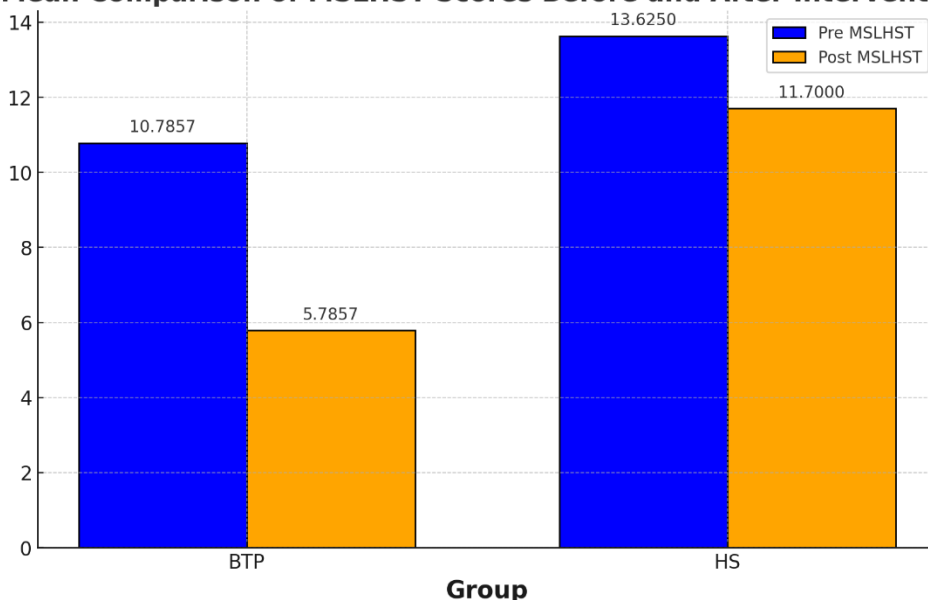


Figure 1 Comparison of MSLHST at post interventional measurement at baseline and post interventional measurement

The bar chart demonstrates that both training groups in the study improved after the intervention, as seen in their Modified Star Lunge Hop Stability Test (MSLHST) scores. The Balance Training Program (BTP) group's mean score notably decreased from 10.7857 to 5.7857, showing significant improvement. The Hop Stabilization (HS) group also improved, with their mean score reducing from 13.625 to 11.7, though not as markedly as the BTP group. This indicates that while both groups benefited, the BTP group experienced a greater enhancement in balance and stability.

## DISCUSSION

Chronic ankle instability (CAI) has been a focal point for numerous studies, seeking to understand its impact not just at the site of injury but throughout the lower kinetic chain. This condition's capability to induce impairments that affect the trunk, hip, thigh, and knee is evident but not thoroughly synthesized. In an effort to bridge this gap, Dejong et al. (2020) conducted a meta-analysis aiming

to synthesize neuromuscular and biomechanical outcome measures during functional assessments, comparing individuals with CAI to healthy groups (3). Their work is pivotal in identifying proximal adaptations that can inform more holistic rehabilitation strategies. Adding to the understanding of motor control deficits associated with conditions like CAI, Hsiao et al. (2020) implemented a novel experimental paradigm to differentiate weight transfer biomechanics between individuals with chronic stroke and able-bodied controls (7). The study revealed marked differences in joint angular displacement and velocity, timing coordination, and stability measures, such as center of mass displacement and center of pressure velocity. These findings underscore the complex interplay between different body segments during motor tasks and the potential parallels in rehabilitation needs between stroke and CAI patients.

Roshni et al. (2021) extended this line of inquiry by examining the effects of wobble board and bosu ball training, combined with strength training, on the lower limb strength and dynamic balance of runners with lateral ankle instability (17). Their study, conducted over a two-month period from November to December 2019, provided insights into targeted interventions that could ameliorate the disability experienced by CAI sufferers.

Jiang et al. (2021) and Kamani et al. (2021) further contributed to the field by assessing the impact of home-based (HB) rehabilitation and functional movement (FM) on various aspects of CAI, including strength, range of motion, postural sway, and overall functionality (8, 12). Their work highlights the role of proprioceptive training in restoring balance and the importance of accessible interventions that individuals can perform outside of clinical settings.

The research by Werasirirat et al. (2022) took a different approach by evaluating the effectiveness of supervised rehabilitation with and without blood flow restriction (BFR) on muscle strength, cross-sectional area, dynamic balance, and functional performance in athletes with CAI (21). This randomized placebo-controlled trial showed the potential of BFR as an adjunct to traditional rehabilitation in enhancing the recovery of athletes with CAI.

Addressing the issue of lower limb asymmetry, Yalfani et al. (2022) focused on the bilateral symmetry of vertical time to stabilization (vTTS) in postural sway after double-leg landing in elite athletes with unilateral CAI (22). Their objective to understand the potential for reinjury paves the way for more symmetrical training approaches in rehabilitation programs.

Asl et al. (2022) provided another layer of depth by comparing the effect of wobble board training with and without cognitive intervention on balance, ankle proprioception, and jump-landing kinetic parameters in active men with CAI (20). Their findings suggest that integrating cognitive tasks into physical training can lead to significant improvements in various aspects of neuromuscular control.

Hoch et al. (2023) focused on a critical population affected by CAI—military service members and civilians (9). Their work on the Foot Intensive Rehabilitation (FIRE) protocol examined its efficacy compared to the standard of care (SOC) rehabilitation for patients with CAI, potentially guiding future clinical practice.

These studies collectively contribute to a growing body of literature that not only expands our understanding of CAI and its extensive impact on the body but also underscores the importance of comprehensive, multifaceted rehabilitation approaches that consider the interconnectedness of body segments and the role of cognitive integration in physical rehabilitation.

## CONCLUSION

The conclusion of this study underscores the superior efficacy of balance training over hop stabilization in enhancing balance and reducing disability among basketball players with chronic ankle instability (CAI). This finding has significant implications for clinical practice and rehabilitation protocols in sports medicine. It suggests that incorporating balance training into rehabilitation regimens for athletes with CAI could lead to more pronounced improvements in functional outcomes and potentially quicker return to play. The study highlights the need for clinicians and trainers to prioritize balance-focused exercises when designing rehabilitation programs for this population. Moreover, the results serve as a valuable guide for future research and clinical interventions aimed at optimizing rehabilitation strategies for athletes suffering from CAI, ensuring a more targeted and effective approach to their recovery and overall athletic performance.

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