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Comparative Effects Of Unstable Surface Training And Self-Myofascial Release On Vertical Jump Performance In Basketball Players

Manoj Kumar R, Srisaisantoshini Sankaranarayanan
(Mohammed Sathak AJ College Of Physiotherapy, India)
(Dr NY Tasgaonkar College Of Physiotherapy, India)

Abstract:
Background: *Vertical jump performance is a key determinant of basketball-specific athletic ability, reflecting lower-limb power and neuromuscular coordination. Unstable surface training and self-myofascial release are both widely used in athletic conditioning, yet their comparative effectiveness on jump performance remains unclear. This study aimed to compare the effects of BOSU ball training versus foam roller exercise on vertical jump performance in amateur basketball players.*
Materials and Methods: *A randomized, pre-post comparative study was conducted on 30 amateur male basketball players (18–25 years), allocated into a BOSU ball training group (n=15) and a foam roller exercise group (n=15). Both groups trained for 6 weeks (3 sessions/week). Vertical jump height was measured using the Vertec device before and after the intervention.*
Results: *Both groups showed significant within-group improvement ($p<0.001$). The BOSU group improved from 41.80±3.74 cm to 49.26±4.25 cm, while the foam roller group improved from 42.13±3.02 cm to 44.93±3.14 cm. The BOSU group showed significantly greater post-intervention improvement than the foam roller group ($t=3.07$, $p<0.001$).*
Conclusion: *BOSU ball training produces significantly greater improvements in vertical jump performance than foam roller exercise in amateur basketball players.*
Keywords: *BOSU ball, foam rolling, vertical jump, basketball performance, neuromuscular training.*
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I. Introduction

Vertical jump performance is a fundamental component of athletic ability in basketball, directly contributing to critical actions such as shooting, rebounding, blocking, and rapid changes in direction. It is widely recognized as a key indicator of lower-limb power and neuromuscular efficiency in basketball players[1,2]. Jump performance is determined by several interrelated physiological and biomechanical factors, including maximal force production, rate of force development, muscle stiffness, and the efficiency of the stretch-shortening cycle (SSC)[3].

Traditional methods for improving vertical jump performance have focused on resistance training and plyometric exercises. However, recent advances in sports science have introduced alternative approaches that target neuromuscular coordination and proprioception. One such approach is unstable surface training, which involves performing exercises on unstable platforms — such as BOSU balls, wobble boards, and foam pads — that challenge balance and postural control, requiring continuous neuromuscular adjustment[4].

The BOSU ball is a widely used unstable training platform consisting of a hemispherical dome attached to a rigid base. Training on a BOSU ball enhances proprioceptive input, neuromuscular activation, and dynamic stability[4]. The instability it induces forces the body to recruit stabilizing muscles and improve coordination between muscle groups, enhancing functional performance[5]. Unstable surface training in amateur athletes has been shown to have a particularly strong capacity for neuromuscular adaptation[6].

Foam rolling represents a recovery-oriented training modality based on self-myofascial release. Pressure is applied over soft tissue to reduce muscle tightness, improve blood flow, and increase range of motion[7]. The proposed physiological mechanisms include alterations in myofascial stiffness, neural modulation, and increased circulation. While foam rolling improves flexibility and reduces delayed-onset muscle soreness, its impact on performance outcomes remains unclear[8]. Some studies have reported small acute improvements in power output following foam rolling, potentially due to enhanced neuromuscular efficiency and reduced muscle tightness[9].

Despite the growing use of both BOSU ball training and foam rolling in sports conditioning, existing studies have largely examined these interventions in isolation and in nonspecific populations. Therefore, the

present study aims to compare the effectiveness of BOSU ball training versus foam roller exercises on vertical jump performance in amateur basketball players.

II. Material And Methods

This study used a randomized, pre-post comparative design to evaluate the effectiveness of BOSU ball training versus foam roller exercises on vertical jump performance in amateur basketball players. A total of 30 amateur male basketball players aged 18–25 years were recruited from a basketball academy using convenience sampling, and were subsequently randomly allocated to one of the two intervention groups.

Study Design: Randomized, pre-post comparative study
Study Location: Basketball Academy, Chennai, India
Study Duration: June 2021 to August 2021
Sample Size: 30 amateur male basketball players (15 per group)

Sample Size Calculation: An a priori power analysis (G*Power v3.1; two-tailed independent-samples t-test, α=0.05, power=0.80) was performed based on an anticipated large effect size (d=1.05) for the between-group difference in vertical jump improvement, derived from comparable unstable-surface and proprioceptive training studies in basketball populations. This indicated a minimum requirement of 15 participants per group, which was achieved in the present study (n=15 per group; total N=30).

Subjects & Selection Method: Participants were drawn from a basketball academy in Chennai between June and August 2021. Eligible players were randomly allocated into two groups using computer-generated random number sequence: Group A (n=15) underwent BOSU ball training, while Group B (n=15) performed foam roller exercises. Each training session lasted 30 minutes and included a standardized warm-up to ensure consistency across participants. Both groups trained for 6 weeks, three sessions per week.

Inclusion criteria:
1. Active club players
2. Male players only
3. Aged 18–25 years

Exclusion criteria:
1. Musculoskeletal injuries
2. Neurological disorders
3. Participation in other competitive sports

Procedure

Written informed consent was obtained from all participants prior to enrolment. The study protocol was conducted in accordance with the ethical principles of the Declaration of Helsinki. The BOSU ball training protocol consisted of single-leg holds, bird-dog movements, bridges, burpees, and lunges, targeting core stability, balance, and lower-limb strength. Progressive overload was applied by increasing repetitions and duration across the intervention period, with rest intervals provided between sets to minimize fatigue-related performance decline.

The foam roller group performed self-myofascial release targeting the quadriceps, hamstrings, and calf muscles. Participants applied body weight to generate pressure and performed rolling movements for 30–60 seconds per muscle group, with multiple repetitions per session. Rolling intensity was progressively increased over the six-week period.

Vertical jump performance was assessed using the Vertec device, a reliable and valid field tool for measuring jump height (ICC > 0.80)[10]. Participants performed maximal countermovement jumps with arm swing, and the best of three trials was recorded. Measurements were taken before and after the intervention period.

Statistical Analysis

Data were analyzed using SPSS version 20 (SPSS Inc., Chicago, IL). Descriptive statistics were calculated for all variables. Paired t-tests were used to evaluate within-group differences, and independent-samples t-tests were used to compare between-group differences. Statistical significance was set at $p<0.05$.

III. Result

Baseline comparisons revealed no significant difference between the BOSU and foam roller groups in pre-test vertical jump performance (p=0.790), confirming baseline homogeneity between groups. Both groups demonstrated statistically significant within-group improvement in vertical jump performance following the six-week intervention (p<0.001). The BOSU group increased from 41.80±3.74 cm to 49.26±4.25 cm, while the foam roller group improved from 42.13±3.02 cm to 44.93±3.14 cm. Between-group comparison of post-test scores revealed a statistically significant difference favoring the BOSU group (t=3.07, df=28, p<0.001; Cohen's d=1.16, indicating a large effect). The magnitude of improvement was greater in the BOSU group (+7.46 cm) compared with the foam roller group (+2.80 cm).

Table no 1: Comparison of Vertec Score Between Group – A and Group - B in Pre and Post Test

#TEST	#GROUP – A		#GROUP – B		t - TEST	df	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D			
PRE TEST	41.8	3.74	42.13	3.02	-0.268	28	.790*
POST TEST	49.26	4.25	44.93	3.14	3.07	28	.000***
(*- P > 0.05), (***- P ≤ 0.001)							

Table no2 : Comparison of Vertec Score within Group – A & Group – B between Pre & Post Test Values.

GROUP	PRE TEST		POST TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP- A	41.8	3.74	49.26	4.25	-24.35	.000***
GROUP- B	42.13	3.02	44.93	3.14	-16.03	.000***
(***- P ≤ 0.001)						

IV. Discussion

The present study compared the effectiveness of BOSU ball training and foam roller exercises on vertical jump performance in amateur basketball players. Both interventions produced significant within-group improvement; however, BOSU ball training produced a significantly greater improvement than foam roller exercise.

The greater improvement observed in the BOSU group can be attributed to the neuromuscular demands of unstable surface training. Performing exercises on a BOSU ball introduces continuous instability, requiring constant postural adjustment and activation of stabilizing musculature. This enhances proprioceptive input and neuromuscular coordination, both of which are critical to optimizing the stretch-shortening cycle involved in vertical jumping[4],[5]. The SSC allows muscles to store elastic energy during the eccentric phase and release it during the concentric phase; BOSU ball training appears to enhance this mechanism by improving the responsiveness of neuromuscular pathways and increasing motor unit recruitment[3]. Exercises performed on unstable surfaces may also improve intermuscular coordination and force transmission across the kinetic chain, contributing to greater power output.

In contrast, foam rolling primarily affects soft-tissue properties rather than neuromuscular performance. While it improves flexibility, reduces muscle stiffness, and supports recovery, it does not directly drive increased force production. The smaller improvement observed in the foam roller group is consistent with previous reports of foam rolling's limited effect on explosive performance[8],[9].

These findings align with previous literature. Behm et al.[4] reported that unstable surface training enhances balance and power performance, while Wiewelhove et al.[8] concluded that foam rolling has minimal impact on strength and power outcomes. Similarly, balance- and proprioception-based training has been shown to improve vertical jump performance, particularly in amateur and youth basketball players[6].

Several limitations should be acknowledged. The sample size was relatively small and limited to male amateur athletes, restricting generalizability to female or elite populations. The six-week intervention period was short, and longer-term adaptations were not assessed. Biomechanical and electromyographic analyses were not performed, which could have provided deeper insight into the underlying neuromuscular adaptations. The outcome assessor was not blinded to group allocation, which may have introduced measurement bias. Future research should employ larger sample sizes, longer intervention durations, and comparisons with other training modalities such as plyometric and resistance training. Investigating the combined effects of BOSU training and traditional strength training may also offer valuable insight.

V. Conclusion

Both BOSU ball training and foam roller exercises significantly improve vertical jump performance in amateur basketball players; however, BOSU ball training produces significantly greater gains. These findings support incorporating BOSU ball training into programs aimed at improving explosive performance in basketball players. Foam rolling remains a useful tool for recovery and flexibility but should not be relied upon as a primary intervention for enhancing vertical jump performance.

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