

Effects of Plyometric and BOSU Ball Training on Agility and Vertical Jump Performance in Young Amateur Football Players- A Randomized Clinical Trial

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Abstract :

Background: Explosive jumping and rapid changes of direction are central to football performance. Plyometric exercises and training on an unstable BOSU surface may improve these abilities through different neuromuscular mechanisms.

Aim: To study the effects of plyometric training and BOSU ball training on vertical jump and agility performance in young amateur football players.

Material and Method: Thirty male amateur football players aged 15-20 years were randomly allocated to plyometric training (Group A, n=15) and BOSU ball training (Group B, n=15). Both groups trained three times weekly for four weeks. The Vertical Jump Test and Arrowhead Agility Test were administered before and after intervention. Paired t tests were used for VJT, Wilcoxon tests for AAT, and between-group comparisons used independent t tests or Mann-Whitney tests as appropriate.

Results: VJT improved in Group A from 41.60 +/- 4.69 cm to 43.60 +/- 4.40 cm and in Group B from 41.40 +/- 4.24 cm to 43.73 +/- 4.30 cm (both p=0.001). AAT time decreased in Group A from 11.56 +/- 0.75 s to 11.20 +/- 0.72 s and in Group B from 11.30 +/- 0.67 s to 11.17 +/- 0.67 s (both p=0.001). No significant between-group differences were observed at post-intervention for VJT (p=0.934) or AAT (p=0.884).

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Conclusion: Both four-week programs were associated with significant improvements in vertical jump and agility.

Index Terms: plyometric training; BOSU ball; vertical jump; agility; football;

I. INTRODUCTION

Football is a widely popular sport, engaging numerous athletes across various age group, from young to professionals. It is a cooperative sport played in leagues and contests. It is a enjoyable workout for health and fitness. Football performance is influenced by a range of individual, technical, and tactical abilities as well as team dynamics. Superior physical skills, including particular physiological and neuromuscular talents, are displayed by players on winning teams⁽¹⁾.

Football is associated with a significant risk of injury because it is a fast-paced, high-energy sport that requires a variety of motor movements, including sprinting, agility, ball-specific skills, jumping, and player-to-player contact . Play and practice can result in injuries, particularly when full contact and high speed are combined⁽¹⁾.

Men's football continues to have the greatest injury rates of any sport, despite the fact that the physical demands of the game vary depending on the level of play (amateur club, sub-elite, open club, or international).⁽¹⁾

The majority of football injuries usually impact the thigh and calf muscles and ligaments, as well as the knee and ankle joints. Contusions, joint and ligament injuries, and muscle/tendon injuries were the most frequent categories of injuries. For players and their teams, muscle injuries are a significant issue. Both professional and amateur football players immediate and long-term health are greatly impacted by sports-related injuries. Given the prevalence of severe diagnoses, such as thigh muscle strains, rips and cramps, ankle ligament sprains, and hip/groin muscle strains, appropriate preventative measures must be established, particularly for amateur football players who are more likely to sustain catastrophic injuries⁽¹⁾.

Agility is a rapid change of direction in response to sport-specific stimulation. Throughout the game, football players must quickly change direction, accelerate, and decelerate. Agility, which is made up of perceptual and decision-making elements including scanning and anticipation, is a crucial performance characteristic in soccer.⁽²⁾

In football, the ability to jump is crucial. Jumping is defined as the capacity for maximal muscular activation that permits both single-leg hopping and horizontal ,vertical jumping. Maximum force, pace of force development, muscle strength, and muscle stiffness are critical factors for jump performance. Athlete's ability to jump is frequently used to gauge their lower extremity explosive strength and power during fitness evaluations.⁽³⁾

Plyometric is a type of exercise training that uses speed and force of different movements to build muscle power. It consist of dynamic and rapid stretching of muscles and immediately followed by shorting action of the same muscles and involves hops and jumps that are intended to take advantage of the muscles stretch. Plyometric training can boost agility and can lessen the possibility that injuries will occur.⁽⁴⁾

Proprioceptive training mainly improves balance skills also has effect on jump, sprint, and strength . BOSU ball is a balance trainer, providing the user with unstable surface on which to perform exercises that engage a variety of muscles BOSU ball can have an impact on proprioception and neuromuscular control and activation of skeletal muscle at the start of a voluntary motion like jump⁽⁴⁾. The likelihood of sustained injuries is reduced by neuromuscular training that incorporates basic and particular movements through dynamic stability and balance exercises.⁽⁴⁾

II. MATERIALS AND METHODS

Participants

This randomized clinical trial was conducted in Miraj-Sangli City, Maharashtra, India. Written informed consent before participation. Thirty male amateur football players aged 15-20 years with more than two years of football experience were recruited by simple random sampling and randomly allocated to Group A (plyometric training, n=15) or Group B (BOSU ball training, n=15). Players were excluded if they had a recent lower-limb fracture, soft-tissue injury, cardiorespiratory disease, or a neurological condition affecting balance or coordination. All participants completed the intervention and were assessed before and after training.

III. A. INTERVENTION PROTOCOL

Before the intervention period started, baseline VJT and AAT measurements were recorded for all participants. Each training session began with standardized warm-up exercises like jogging, running and stretching for 13-15 minutes followed by the allocated intervention. The plyometric group performed single-leg hops, lateral bounds, and jumps over a barrier. The BOSU ball group performed BOSU squat jumps, lateral jumps, and BOSU mountain climbers.

Each exercise was performed for two sets of 10 repetitions, with 60-90 seconds of rest between sets. Both groups trained three times per week for four weeks. On completion of the four-week intervention, VJT and AAT were measured again using the same procedures.

Descriptive statistics are reported as mean $\pm$ standard deviation. Shapiro-Wilk testing assessed normality. VJT was analysed with paired and independent-samples t tests; AAT was analysed with paired-sample Wilcoxon and Mann-Whitney tests. Cohen d was reported for VJT and standardized correlation coefficients for AAT. Statistical significance was set at $p < 0.05$.

IV. B. OUTCOME MEASURES AND STATISTICAL ANALYSIS

Vertical Jump Test: Participants stands beside a wall with both feet flat and marked the standing reach height with their fingertips. They then performed a maximal vertical jump to touch the wall at the highest possible point. The score was the difference between standing reach height and jump touch height, recorded. The best of three attempts was used for analysis.

Arrowhead Agility Test : Participants completed a 15 m x 5 m arrowhead course as quickly as possible, performing right- and left-direction trials with five minutes of recovery. The best time from three trials was recorded. Lower times represented better agility performance.

V. RESULTS

All 30 participants were male. Mean age was 18.40 $\pm$ 1.35 years in Group A and 18.33 $\pm$ 1.29 years in Group B, with no significant baseline difference ($p = 0.870$).

Vertical Jump Test performance improved significantly in both groups. In the plyometric group, the mean VJT increased from 41.60 $\pm$ 4.69 cm before intervention to 43.60 $\pm$ 4.40 cm after intervention ($p = 0.001$; effect size 1.31). In the BOSU ball group, the mean VJT increased from 41.40 $\pm$ 4.24 cm to 43.73 $\pm$ 4.30 cm ($p = 0.001$; effect size 1.56).

Arrowhead Agility Test completion time decreased significantly in both groups, indicating improved agility. In the plyometric group, mean time decreased from 11.56 $\pm$ 0.75 s to 11.20 $\pm$ 0.72 s ($p = 0.001$; effect size 0.98). In the BOSU ball group, mean time decreased from 11.30 $\pm$ 0.67 s to 11.17 $\pm$ 0.67 s ($p = 0.001$; effect size 0.88).

Within-group statistical results

Outcome	Group	Pre-intervention	Post-intervention	Effect size	p value
VJT (cm)	Plyometric	41.60 $\pm$ 4.69	43.60 $\pm$ 4.40	1.31	0.001
VJT (cm)	BOSU	41.40 $\pm$ 4.24	43.73 $\pm$ 4.30	1.56	0.001
AAT (s)	Plyometric	11.56 $\pm$ 0.75	11.20 $\pm$ 0.72	0.98	0.001
AAT (s)	BOSU	11.30 $\pm$ 0.67	11.17 $\pm$ 0.67	0.88	0.001

There were no significant differences between groups at baseline or after intervention. For VJT, between-group p values were 0.903 before intervention and 0.934 after intervention. For AAT, between-group p values were 0.493 before intervention and 0.884 after intervention.

Between-group statistical results

Outcome	Time point	Plyometric mean +/- SD	BOSU mean +/- SD	p value
VJT (cm)	Pre	41.60 +/- 4.69	41.40 +/- 4.24	0.903
VJT (cm)	Post	43.60 +/- 4.40	43.73 +/- 4.30	0.934
AAT (s)	Pre	11.56 +/- 0.75	11.30 +/- 0.67	0.493
AAT (s)	Post	11.20 +/- 0.72	11.17 +/- 0.67	0.884

VI. DISCUSSION

Both interventions produced statistically significant within-group improvements in jump and agility performance, while between-group comparisons did not demonstrate a difference at the end of four weeks. The magnitude of within-group VJT effects was large in both groups, and the agility effects were also substantial according to the study analysis.

The improvement following plyometric training is consistent with its emphasis on rapid stretch-shortening cycle activity, which may enhance force development and explosive lower-limb performance. The observed improvement in the BOSU group may reflect the repeated balance and postural-control demands imposed by the unstable surface. These demands may improve neuromuscular coordination and dynamic control relevant to jumping and directional changes.

The absence of a significant between-group difference should be interpreted cautiously. The trial included 15 players per group, lasted four weeks, and did not include a no-training control group. Accordingly, the results support the use of either program in this population but do not establish comparative equivalence or superiority. Larger, longer trials with control groups and additional performance measures are needed.

The findings are limited by the small, male-only sample, the four-week duration, the single geographic setting, and the use of only two performance outcomes. Differences in training history and physical activity outside the intervention may also have influenced the results.

VII. CONCLUSION

Four weeks of either plyometric or BOSU ball training, performed three times weekly, were associated with significant improvements in vertical jump and Arrowhead Agility Test performance in young male amateur football players.

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