ORIGINAL ARTICLE

IJPHY

EFFECTS OF BOSU BALL EXERCISE ON JUMP PERFORMANCE IN FOOTBALL PLAYERS

[1]**Charmi Salot**
[2]**P. Sathya**
[*3]**Jibi Paul**

ABSTRACT

Background: Football is the sport that requires a lot of high-intensity dynamic movements like jump, i.e., while heading and kicking a ball. Unstable surfaces like Bosu ball in the fields of rehabilitation and general fitness are effective in joint stabilization by improving the sensory efficiency of soft tissue during dynamic activities. Thus the purpose of the study was to see the effects of Bosu ball exercise on jump performance in football players.

Methods: A total of 90 football players participated in the study. The players were categorized into two groups experimental group (n=45) who underwent Proprioceptive training on Bosu ball with their regular football training program and control group (n=45) underwent regular football training program. The players were trained for six weeks. Jump assessment at pre and post-intervention was done for all subjects using the single-leg hop test and Vertical Jump test.

Results: The results revealed a significant difference in pre and post assessment experimental > control group single-leg hop test and vertical jump test with p-value 0.000 (< 0.05).

Conclusion: Bosu ball training was effective in improving the single-leg hop distance and vertical jump height in male football players.

Keywords: Bosu ball, Proprioceptive training, jump, football.

Received 25th May 2020, accepted 22nd July 2020, published 09th August 2020

www.ijphy.org

10.15621/ijphy/2020/v7i4/740

[1]MPT Student, School of Physiotherapy, D.Y. Patil University, Nerul, Navi-Mumbai, India.
[2]Associate Professor, School of Physiotherapy, D.Y. Patil Deemed University, Nerul, Navi-Mumbai, India. Mail id: drsathyagp@gmail.com

CORRESPONDING AUTHOR

[*3]**Jibi Paul**

Professor, Faculty of Physiotherapy, Dr.MGR Deemed University, Chennai, Tamilnadu, India. Mail id: physiojibi@gmail.com

INTRODUCTION

The skill to perform a jump is of most considerable importance in various team sports like basketball, football, and volleyball [1]. Jump is described as the ability of maximal muscle activation that allows the acceleration of a body in an activity like horizontal, vertical jump, and single-leg hop [2,3]. The important factors for jump performance are maximal force, rate of force development, muscle stiffness, and muscle strength. The skill to jump is frequently used for fitness assessment in athletes to measure lower extremity explosive strength and power.[1]

Football is a sport that requires strength, power, agility, speed, and hypertrophy for success [4]. It involves a lot of high-intensity movements like jump, i.e., while heading a ball and single-leg balance while kicking a ball, dribbling with speed, push pass, long pass, backward pass, piercing passing a ball, shooting a ball in the air or receiving the ball from the player. These technical skills in football require balance, i.e., both static balance and balance while in motion [4,5].

The exercise equipment used in training an athlete has variable degrees of difficulty and instability to enhance balance and skeletal muscle health to meet the demands of various skills in sports. This equipment helps to provide unstable surface training environment to increase the difficulty levels which includes hard rubber air pressurized inflatable ball (e.g., Swiss or Pilates exercise balls), inflatable disc, half-sphere dome-shaped ball bosu balls, wooden wobble board, high to low-density foam pad of different size and many of such kind. These unstable devices help to enhance postural sway, i.e., postural disequilibrium, which adds stress to the neuromuscular system to an extent [6]. The reason is that these unstable surface training devices, i.e., postural disequilibrium training environment, may improve and enhance proprioception and neuromuscular adaptations [6].

Proprioception is the central nervous system process of determining the relative position or motion of limbs/trunk while balancing [7]. Also, it enhances the rate of force development of skeletal muscle activation during voluntary motion [8]. This suggests that the possibility of training on an unstable device like bosu ball can have an impact on proprioception and neuromuscular system by enhancing explosive strength, neuromuscular control, and activation of skeletal muscle at the start of a voluntary motion like jumping. Thus the purpose of the study was to see the effects of Bosu ball exercise on jump performance in football players.

METHODOLOGY

Male football players age 14-15 years were selected for the study. The players should have a minimum of 2 years of experience in football. Ninety football players participated in the study by convenient sampling method. The exclusion criteria include those players who have undergone any surgery or injury of the lower limb in the past six months of duration, obvious deformity of lower limb, goalkeeper, and players playing any other sports other than football.

STUDY PROCEDURE

The 90 subjects were divided into two groups, i.e., experimental group (n=45) and control group (n=45) by random allocution method (Lottery method). The informed consent was taken from the parents, and the ascent form was taken from all the players before the assessment.

The pre-participation screening was done using the Physical Activity Readiness Questionnaire (PAR-Q form) [9]. Performa for assessment was filled by interviewing the subjects, and the BMI matching player was selected. A pre and post assessment for the jump was done using a single-leg hop test and vertical jump test. Vertical jump power was calculated using Lewis Formula [10]:

$$Power\ (watts) = \sqrt{4.9 \times body\ mass\ (kg)} \times \sqrt{jump\ reach\ score\ (m)} \times 9.18$$

The experimental group was trained for Bosu ball exercises which include Bosu ball squat jump, Bosu ball lateral jump, single-leg hop on Bosu ball, scissor jump on Bosu ball, and Single leg balance Volley kicks on Bosu ball (10 reps × 1, 2 & 3 sets) along with their football training program and control group underwent only football training program. The total training session was for six weeks, three times per week.

RESULTS

Comparison between Experimental and Control Group:

Statistically, analysis for the data was done using SPSS version 23 and GraphPad InStat 3.

Table 1: Demographic data of experimental and control group

Demographic Data								
	Age		Height (cm)		Weight (kg)		BMI	
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Mean	S. D.
Experiment	14.44	0.546	163.74	14.94	54.266	9.784	20.431	3.269
Control	14.47	0.548	164.19	14.03	54.222	8.759	20.336	3.282
Mean difference	0.022		0.449		0.444		0.098	

The mean difference in age is 0.022. The difference between the mean age for the experimental and control group is statistically insignificant. The mean difference in height is 0.449 cm. The difference between mean height for the experimental and control group is statistically insignificant. The mean difference in weight is 0.444 Kg. The difference between mean weights for the experimental and control group is statistically insignificant. The mean difference in BMI is 0.098. The difference between mean BMI for the experimental and control group is statistically insignificant.

Table 2: Comparison of Mean difference of Single leg hop at Pre and Post between Experimental and Control Groups:

Paired Samples Test					
Mean		Paired Differences		T	Sig. (2-tailed)
		S. D.			
Pre-post SLHT right leg	Exp	-12.755	6.206	-13.78	.000
	Control	-1.744	1.684	-6.94	.000
Pre-post SLHT left leg	Exp	-11.644	6.675	-11.71	.000
	Control	-2.144	1.053	-13.65	.000

Inference: For the experimental and control group, the mean difference between single-leg hop test for right leg (SLHT Rt) at pre and post level was statistically significant since P-value = 0.000, which is <0.05. The mean difference observed in of experimental group (-12.755+/-6.206) is more than the mean difference of the control group (-1.744 +/-1.684). For the experimental and control group, the mean difference between the single-leg hop test for the left leg (SLHT Lt) at pre and post level was statistically significant since p-value = 0.000, which is <0.05. The mean difference observed in of experimental group (-11.644+/-6.675) is more than the mean difference of the control group (-2.144 +/-1.053).

Table 3: Comparison of Mean difference of vertical jump power at Pre and Post between Experimental and Control Groups:

Paired Samples Test					
Mean		Paired Differences		T	Sig. (2-tailed)
		S. D.			
Pre- Post- VJT Power	Exp GP	-25.11	10.76	-15.64	.000
	Control GP	-4.412	4.405	-6.719	.000

For the experimental and control group, the mean difference between leg vertical jump power at pre and post level was statistically significant since P-value = 0.000, which is <0.05. The mean difference observed in of experimental group (-25.11+/-10.76) is more than the mean difference of the control group (-4.412+/-4.405).

DISCUSSION

The findings of the above study show that after six weeks of Bosu ball training, there was a significant increase in single-leg hop distance and vertical jump power in both groups in pre and post-assessment with p-value 0.000 (< 0.05). The mean difference observed in the experimental group is more than the mean difference of the control group for both the test.

The above findings were supported by the study done by Diana V. et al. (2016) which states that single-leg exercises, on unstable surfaces – Bosu balls - improve proprioception and dynamic stability of the leg joints by developing the strength of the muscles around joints, and default force of the lower limbs [11]. A study also states that there was a relationship between strength capacity and balance, which would be a reason for the improvement of SLHT difference [11].

The above findings were supported by the study done by Lizardo F. et al. (2017), which states that instability training devices like bosu ball trainer undermines the principle of training, i.e., specificity which poses specific demands on the neuromuscular system thus by improving the balance in motion for dynamic activities like a jump. This improvement in vertical jump performance is due to proprioception influences neuromuscular system, which initiates generated forces by improving maximum force production in minimum time and neuromuscular activation pattern at the start of a musculoskeletal activity during voluntary motion. It also has a positive influence on neural activation – excitation of the motor-neural system, which is concerned by the stretch-shortening cycle [8].

A previous study was done by Lizardo F. et al. (2017), and Gaurav S. et al. (2013) also shows that inhibition of stretch reflex along with an increase in strength of plantar flexor, dorsiflexor muscle, hamstring, and gluteal muscle can be the rationale for the rise in vertical jumping performance. This increase in strength will help to generate maximum force in minimum time in vertical jump performance and is influenced by the rapid stretch-shortening cycle of active muscle. It is also possible that proprioceptive training on multi-station apparatus may challenge more active muscle work by rapid force generation to produce strength as well as early and a higher rate of inclusion of motor units. The proprioception is further regulated by central and peripheral mechanisms mainly form muscular receptors but also cutaneous, tendinous, and articular receptors [8,12]. The present roles of muscular receptors, which are considered to be the most important part of limb proprioception elaboration, show that partially altering the functional state of muscle could affect the precision of position sense [12].

Split and squat jump exercises can improve balance in motion among netballers. However, the squat jump exercise is more effective in improving dynamic balance among netball players. Coordination exercise can enhance knee proprioception joint among male professional footballers [13,14].

CONCLUSION

The six weeks of Bosu ball was effective in increasing the single-leg hop distance and vertical jump power in male football players. This suggests that the Bosu ball exercise can be a part of other fitness training programs for improving Jump Performance in Football Players.

Ethical Approval: Ethical clearance has obtained by the school of physiotherapy from the Ethical committee, D. Y. Patil Deemed University, Navi- Mumbai.

Reference number: DYPUSOP/019A/2018

Source of Funding: It was a self-financed study.

Conflicts of Interest: There was no conflict of interest to conduct this study.

Acknowledgement: The authors sincerely thanked the Football school of India and the Mumbai Striker team for giving me permission to do the project and also appreciate the players for their valuable contribution to the study.

REFERENCE

[1] Son C, Stewart A, Ward J, Farrar K. Lower body strength-training versus proprioceptive exercises on vertical jump capacity: A feasibility study. Journal of chiropractic medicine. 2018 Mar 1; 17(1):7-15.

[2] Nunome H, Asai T, Ikegami Y, Sakurai S. Three-dimensional kinetic analysis of side-foot and instep soccer kicks. Medicine and science in sports and exercise. 2002 Dec;34(12):2028-36.

[3] Bangsbo J. Time and motion characteristics of competitive soccer. Science and football. 1992(6):34-42.

[4] Gaurav S., Pooja A., Shishir N., Tanvi A. Comparative analysis of effectiveness of conventional proprioceptive training and multi-station proprioceptive training on vertical jump performance in Indian basketball players. 2013; 9(2): 97-104.

[5] G. Cerulli, D. I. Benoit, A. Caraffa, E Ponteggia. Proprioceptive training and prevention of anterior cruciate ligament injuries in football.JOSPT. 2001;31(11):655-660.

[6] Behm DG, Muehlbauer T, Kibele A, Granacher U. Effects of strength training using unstable surfaces on strength, power and balance performance across the lifespan: a systematic review and meta-analysis. Sports Medicine. 2015 Dec 1;45(12):1645-69.

[7] Ogard WK. Proprioception in sports medicine and athletic conditioning. Strength & Conditioning Journal. 2011 Jun 1; 33(3):111-8.

[8] Lizardo FB, Ronzani GM, Sousa LR, de Oliveira Silva DC, dos Santos LA, Lopes PR, Bérzin F, Bigaton DR. Proprioceptive exercise with bosu maximizes electromyographic activity of the ankle muscles. Bioscience Journal. 2017 May 1;33(3).

[9] Ageberg E, Roberts D, Holmström E, Fridén T. Balance in single-limb stance in healthy subjects–reliability of testing procedure and the effect of short-duration sub-maximal cycling. BMC Musculoskeletal disorders. 2003 Dec; 4(1):14.

[10] Nicholas Ratamess, ACSM's foundations of strength training and conditioning, Wolters Kluwer health? Lippincott Williums and Wilkins, 2011; Page 472-474.

[11] Diana V. Influence of proprioceptive training on the strength of the lower limb in women soccer players. "MirceacelBatran" Naval Academy Scientific Bulletin. 2016:19(1).

[12] Gaurav S., Pooja A., Shishir N., Tanvi A. Comparative analysis of effectiveness of conventional proprioceptive training and multi-station proprioceptive training on vertical jump performance in Indian basketball players. 2013; 9(2): 97-104.

[13] Paul J, Kumar S. Comparative effect of squat jump and split jump exercise on dynamic balance among female netball players Int J Physiother. April (2018), Vol 5(2), 57-62.

[14] Paul J, Nagaraj MS, Solomon J. Effectiveness of coordination exercise on proprioception of knee injured male professional footballers. Drug Invention Today. 2018 Jan 1; 10(10):1887-91.