ORIGINAL ARTICLE

COMPARATIVE STUDY OF 4 WEEKS OF DYNAMIC BALANCE TRAINING PROGRAM IN COLLEGIATE FOOTBALL PLAYERS: RANDOMIZED CLINICAL TRIAL

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ABSTRACT: BACKGROUND: Balance is highly integrative dynamic process involving coordination of multiple neurological pathways that allows for the maintenance of the COG over BOS. Football players often perform lower extremity passing, shooting, twisting, cutting and dribbling skills while wearing shoes, these actions require body to be in the equilibrium position to perform the task. This leads to the conclusion of the great importance of the ability of balance in football. **AIMS:** 1. To study the effect of 4 week multidirectional balance board training on dynamic balance in football players. 2. To study the effect of 4 week Both Sides Up ball training on dynamic balance in football players. 3. To compare the effect of multidirectional balance board training program and BOSU ball training program on dynamic balance in football players. **STUDY DESIGN:** Randomized Clinical trial. **METHODS:** Total of 60 competitive badminton players with age group between18-25 were recruited in this study. The participants were allocated into 2 groups viz., Group A (multidirectional balance board training) and Group B (BOSU ball Training) for a period of 4 weeks. Participants were test for SEBT and vertical jump test on first day and after 4 weeks of balance training. **STATISTICAL ANALYSIS:** Student t test, Chi-Square Test. **RESULTS:** The data analysis and statistical inference showed that, after 4 weeks of balance training there was improvement in dynamic balance in both the groups but there was no significant difference in dynamic balance between two groups. As seen by difference in the SEBT and VJT scores pre and post training with $p<0.001$. **CONCLUSION:** 4 weeks balance training using BOSU and multidirectional balance board is effective in improving dynamic balance and vertical jump performance in football players and also can be used as a component of multifaceted training to improve dynamic balance and game skills.

KEYWORDS: Balance training, BOSU Ball, football, SEBT, vertical jump.

INTRODUCTION: Balance is an integral component of almost every activity of daily living (ADL).[1] According to academy of sports medicine, with respect to human body, balance is defined as, highly integrative dynamic process involving coordination of multiple neurological pathways that allows for the maintenance of the COG over the BOS.[2] Factors that influence balance include sensory information obtained from the somatosensory, visual, and vestibular systems and motor responses that affect coordination, joint range of motion (ROM), and strength.[3,4] The control of balance involves a continuous feedback system of processing visual, vestibular and somato-sensory inputs and executing neuro-muscular actions. One of the components of somato-sensory system is proprioception.[5] Balance training involves the use of unstable surfaces which are considered to be unique because of its stimulation of multiple planes of ankle movement on a

weight bearing foot.[6] According to the chosen exercise and corresponding geometry of the facility we can determine most suitable load for each individual. The effects of balance training are: the increase in muscular activation after the injury, the reduction of reflex-reaction times on stretching, the improvement of inter-muscular coordination, the improvement of poise and balance, the improvement of the awareness of one's body in a room and therefore, the reduced susceptibility to injuries.[7] Each sport likely requires different levels of sensori-motor processes to perform skills and protect the neuromuscular system from injury.

Football contains all forms of movements like running, stops, turns, jumps, falls, throws, pushing, taking place at a different intensity, pace and duration, for the purpose of defense and strike action. Football players often perform lower extremity passing, shooting, twisting, cutting and dribbling skills while wearing shoes.[8] These actions require body to be in the equilibrium position to perform the task and avoid injury. This leads to the conclusion of the great importance of the ability of balance in football. The aim of balance training is to supply the players with dynamic firmness. As a consequence of balance training, players learn to make use of their muscles resourcefully and quickly. This is to say that balance training offers to develop a sturdy and coordinated base which sustains fast bodily actions.[9]

Balance training can be given by various devices such as tilt boards, wobble board, BOSU (Both Side Utilised) ball, T- bow, dyna-discs etc. Wobble board also known as Multi directional balance board is made up of a round, disk-like platform over a partial or half ball affixed to the centre, bottom of the platform and allows multi-planar movements. Using a wobble board on a regular basis can help retrain the proprioceptors and improve coordination, hence preventing further injury. 5 A BOSU balance trainer, or BOSU ball as it is often called, is a fitness training device, invented in 1999 by David Weck, consisting of an inflated rubber hemisphere attached to a rigid platform measuring 24. 6 x 24. 6 x 6 inches.[10]

Balance training is used in rehabilitation following sports-related injuries and is becoming recognized as an important element in injury prevention in sports.[11] To our knowledge, studies comparing balance abilities among football players competing in different levels using different balance boards are less, so it is important from physiotherapeutic point of view to incorporate balance training along with daily exercise protocol to improve performance and reduce injuries. There is an evidence to show that both that is multidirectional board and BOSU ball balance training tools are effective in terms of improving balance in basketball, handball and soccer but there are fewer studies comparing the effectiveness of these two measures in football. Therefore the present study was intended to investigate the outcome of balance training in football players by using two different balance boards so as to provide the best available training and improve skills.

MATERIAL AND METHODS: 60 competitive male football players from the district football association who were willing to participate for 4 weeks were recruited in the study. The subjects were screened and were put in either of the two groups- group A (Multi directional balance board training), group B (Both sides up BOSU ball Training) by convenience method. A written informed consent was taken from each participant. Ethical clearance was obtained from university's institutional review board. Inclusion Criteria were(1) Male competitive football players between 18

and 25 years and Participants volunteering to participate in the study. Participants with history of cerebral concussions, vestibular disorder any lower limb trauma in past 6 months and participants who undertook prior balance training were excluded.

INTERVENTIONS: Participants in group A received multi-directional balance training 12 and group B received BOSU ball training three times a week for a period of 4 weeks. The patients were asked to maintain a record of the exercises done and the number of sessions completed. At the end of 4 weeks of training post- measurements of the same outcomes were obtained. The exercises performed are as given in Table No. 1 and Table No. 2 for multi-directional balance training and BOSU ball training respectively. Progression of exercises was done by eyes open to eyes closed.

Outcome measures: Star excursion balance test (SEBT) - The SEBT a functional test that incorporates a single-leg stance on one leg (e. g. right leg) whilst trying to reach as far as possible with the opposite leg (e. g. left leg). The participants stood in a square at the centre of the grid with 8 lines extending from the centre at 45°. Each of the 8 lines extending represent the individual directions which each subject is required to reach out with the most distal part of their reach foot. The eight directions are antero-lateral (AL), anterior (A), antero-medial (AM), medial (M), postero-medial (PM), posterior (P), postero-lateral (PL) and lateral (L). A standard tape measure (cm) was used to quantify the distance the participant had reached from the centre of grid to the point that the participant managed to reach along each diagonal line. Each participant performed 3 trials of the SEBT. Each trial consisted of reaches in each of the 8 directions. Subjects were given a 15 second rest between each trial.[13,14]

Vertical jump test: The participant stands side on to a wall and reaches up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips is marked or recorded. This is called the standing reach height. The participant then stands away from the wall and leaps vertically as high as possible using both arms and legs to assist in projecting the body upwards. The participant attempted to touch the wall at the highest point of the jump. The difference in distance between the standing reach height and the jump height is the score. The best of three attempts is record.[15]

STATISTICAL ANALYSIS: Statistical analysis for the present study was using the statistical software SPSS 15.0, as to verify the results obtained. Statistical measures such as mean, standard deviation (SD) and test of significance such as Student t test, Chi-Square Test, for paired comparisons were utilized for all available data. Demographic data of the participant's that is age, height, weight were analysed using chi square test. Comparison of the pre training and post training outcome measures within the groups was done by using student paired 't' test and between the groups was done using unpaired 't' test and test of proportion. Probability values less than 0.05 were considered statistically significant and probability values less than 0.001 were considered highly significant.

RESULTS: Age of the participants in this study was between 18 to 25 years. The mean age of the participants in Group A and B was 19.97±1.277 and 20.20±1.29. There was no statistically significant difference between the mean age and standard deviation of the participants in the two groups. (Table no. 3). Out of 60 participants 30 participants had right leg dominance and rest 30 participants had left leg dominance. There was no statistically significant difference of leg dominance between two groups. (p=0.143). Mean BMI with SD of group A was 20.58±1.99 and group B was 21.11±1.38. There was no significant difference between mean body mass index and SD of the participants in the group A and group B. (p=0.242). (Table no. 4).

The differences in all eight directions of SEBT compared by paired t test were presented in table 4. For right and left leg in group A the difference in distance for anterior direction are 4.50±1.04 and 5.17±1.32 respectively and for group B are 4.80±1.58 and 3. 80±2.25. Distances for antero-medial direction were 4.36±2.06 and 5.77±3.11 for group A and 3.93±1.74 and 3.30±1.58 for group B. For antero-lateral direction the distance reached were 5.27±1.66 and 4.43±1.50 in group A participants while for group B participants were 4.50±1.11 and 3.57±1.04. For posterior directions the reach distances were 2.90±2.31 and 4.23±2.71 in group A and for group B were 3.00±1.76 and 2.77±1.41. Participants in group A reached 3.63±1.45 and 4.03±2. 06 distance in postero-medial direction and in group B 2.90±1.27 and 3.23±1.52 respectively for right and left leg. For postero-lateral direction participants in group A reached 3.77±1.96 and 4.03±1.47 distance and in group B 3.50±1.46 and 4.23±2.29. For medial and lateral directions participants in group A reached 4.97±1.52 and 5.07±0.87; 4.93±1.34 and 3.20±1.88 and participants in group B reached 4.43±1.61 and 5.03±1.03; 2.97±1.81 and 3.40±1.73.

The difference in pre and post scores of vertical jump test shows statistical significance which was analyzed by paired t test. The difference in group A was 3.31±1.37 and in group B was 4.72±1.37.

DISCUSSION: The aim of the present study was to determine whether multi-directional balance training and BOSU ball training were effective in improving dynamic balance in competitive football players. Results of this study were focused on dynamic balance training with two different balance boards. It was noticed that there was improvement in all the parameters in both the groups but there was no statistically significant difference when compared between the two groups. The age, BMI and gender distribution showed no statistical difference in the groups, which represents the homogeneity of the participants. The age of the participants included in this study was between 18 to 25 years.

The results of the present study showed improvement in SEBT scores in all eight directions by using both multidirectional balance board and BOSU ball but was more significant in antero-lateral, post-med and lateral direction in group A for right lower extremity and in anterior, ant-med, posterior direction for left lower extremity which were similar to the study, done by Alyson Filipa who compared neuromuscular training with strength training in improving SEBT scores in athletes. The results of above study showed that there was a low to moderate correlation between SEBT performances and lower extremity strength. Therefore, other factors, such as muscle activation and proprioception, may have a stronger relative relationship to the SEBT performance than non–weight-bearing strength testing.[16] Mark paterno gave neuromuscular

training using BOSU ball in female athletes for 6 weeks. After 6 weeks of training there was improvement in single limb stability in anterior-posterior, and medial-lateral direction. The results of this study were similar to the present study in anterior, ant-med and post direction for both right and left leg for the period of 4 weeks.[17] The present study results were similar to the findings of Arnold et al, who showed a strong correlation between total stability index and AP stability index for the right leg and the left leg and only moderate correlation between total stability index and ML stability index for the right leg and the left leg.[18] The stance on unstable surface typically exhibited a posture that causes a slight dorsiflexion angle in the ankle. With the joint in this closed-packed orientation and loaded in a single-legged stance, the proprioceptive influence of the joint may have been agitated to meet the demand of stressed joints, eliciting a more controlled stance. Furthermore Hakkinen and Myllyla[19] reported that force production and reaction in athletes training for activities using balance are more than strength training. The significant improvement in dynamic tasks like excursion and vertical jump are attributed to neural adaptation to activity and proprioceptive action in joints and soft tissues.

In the present study the effect of 4 weeks of balance training program showed improvement in vertical jump test in both the groups but the reach height was significantly more for group B. This result was similar to the study done by Yaggie JA. In which subjects performed balance training using BOSU ball that showed improvement in sports specific skill.[20]

Similarly, D Stasinopoulos compared technical training and balance training methods to improve balance in volleyball players during entire season. He concluded that technical training is more effective in improving balance as it involves sports specific tasks like landing, jumping and blocking task also stated that this kind of training stimulates ankle joint in multiple planes in weight bearing positions.[21]

In female athlete's plyometric exercises and balance training was compared on power generation and vertical jump. Both the training showed improvement in vertical jump but balance training group showed more vertical jump height than plyometric group which also correlates to the results of the present study. The improvement in vertical height is due to sports specific and injury relevant training adaptation, since the athletes in the current study performed a more sports related task that required a dynamic ground based landing with immediate control of the ground reaction forces to maintain balance and COP control. The role of COP control and improved balance further supports the positive nature of this improved jump height.[17]

Eisen TC, Danoff JV compared two different types of unstable surfaces, uniaxial and multiaxial balance boards on soccer and volleyball players on balance. Star excursion balance test scores were taken before and after balance training. The result of this study concludes that there was significant improvement in all eight directions in both the groups. There was significant improvement in reach distance in multiaxial balance board group as compared to uniaxial group which suggests that mutiaxial balance training promotes neuromuscular mechanisms responsible for the co-contraction of agonist and antagonist muscles that enhance active joint stability.[22]

CONCLUSION: The present study concludes that 4 weeks balance training using BOSU and multidirectional balance board is effective in improving dynamic balance and vertical jump

performance in football players and also can be used as a component of multifaceted training to improve dynamic balance and game skills.

LIMITATIONS: The Subjects were not blinded to the training sessions which could have created some amount of bias. The players were not categorized according to their competitive level. The carry over effect of 4 weeks of agility and plyometric training was not considered.

In future the prospective study can be done on large sample size to generalize the results. The study can be conducted by giving more complex tasks on balance boards which will challenge neuro-muscular system. Also the effect of balance training on rate of injury prevention can be recorded.

Exercise	Repetitions	Sets
Double limb stance	1 minute	3
Anterior/posterior tilts	10 repetitions	3
Medial/lateral tilts	10 repetitions	3
Knee flexion	10 repetitions	3
Rotations	1 minute	3
Single limb stance	1 minute	3

Table No. 1: Group A- Multi-directional balance training protocol

Exercise	Repetitions	Sets
Double limb stance	1 minute	3
Anterior/posterior tilts	10 repetitions	3
Medial/lateral tilts	10 repetitions	3
Knee flexion	10 repetitions	3
Lunges	10 repetitions	3
Single limb stance	1 minute	3

Table No. 2: Group B-BOSU ball training protocol

	Group A n=30	Group B n=30
Age (yrs)	19.97±1.277	20.20±1.29
Height (cm)	165.78±9.56	164.26±8.79
Weight (kg)	56.40±4.26	56.93±4.57
BMI	20.58±1.99	21.11±1.38

Table No: 3 Demographic Details

SEBT DIRECTIONS	Group A		Group B	
	Right	left	right	left
Anterior	4.50±1.04	5.17±1.32	4.80±1.58	3.80±2.25
Antero-medial	4.36±2.06	5.77±3.11	3.93±1.74	3.30±1.58
Antero-lateral	5.27±1.66	4.43±1.50	4.50±1.11	3.57±1.0
Posterior	2.90±2.31	4.23±2.71	3.00±1.76	2.77±1.41
Postero-medial	3.63±1.45	4.03±2.06	2.90±1.27	3.23±1.52
Postero-lateral	3.77±1.96	4.03±1.47	3.50±1.46	4.23±2.29
Medial	4.97±1.52	5.07±0.87	4.43±1.61	5.03±1.03
Lateral	4.93±1.34	3.20±1.88	2.97±1.81	3.40±1.73
VERTICAL JUMP SCORE	**3.31±1.37**		**4.72±1.37**	

Table No. 4: Difference in pre-post values of group A and B

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