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# Comparison of static and dynamic balance among male Amateur basketball players

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**Abstract**
**Title:** Comparison of static and dynamic balance among male amateur basketball Players.
**Background:** The purpose of this study was to examine the relationship between Star Excursion Balance Test reach distance and lower extremity injury among male basketball players. In this study we can expected that reach distance will be normalized to limb length would be related to risk of lower extremity injury. Balance Error Scoring System is done to determine balance performance on subject before Players start to playing games.
**Objective:** The importance of this study is to determine effect on Swiss ball exercise of static balance among male basketball players. The importance of this study is to determine the effect on plyometric push up of dynamic balance among the male basketball players.
**Design:** An Experimental design.
**Subject:** 30 subjects were divided into two group. First 15 subject were assessed with Swiss ball exercise for static balance and another group will be assessed with plyometric push up for dynamic balance.
Main outcomes measure: Errors from the Balance Error Scoring System and normalized leg reach distances from the Star Excursion Balance Test were used to assess static and dynamic balance
**Results:** It showed statistical significance effect $p< 0.05$ of 95 % confidence interval. The mean and standard deviation of static firm are -0.4667 ± 3.883 and for foam are Vi-2.267±6.227.There is no significant effect on static balance test. The mean and standard deviation for dynamic are 5.574±4.489.There is significant effect on dynamic balance test.
**Conclusion:** The finding of this study shows that the Plyometric push up improve subject's dynamic balance within 6 weeks intervention compared to the Swiss ball exercise of static balance. There is no significant effect on static balance. The dynamic balance shows more significant compared to the static balance. This study was determined that players can be used plyometric technique to improve dynamic balance. It is found that plyometric is resistance training emphasizing the loading of muscle during an eccentric muscle action and knee extensor muscle. Thus, concluding Plyometric push should be included in the training program of the athletes especially those who require more dynamic balance such as basketball players in order to improve the athletic performance.

**Keywords:** Basket ball players, plyometric exercises, static balance, dynamic balance etc.

## 1. Introduction
Balance has the ability of maintaining the position of the centre of gravity (COG) and it vertically over the base of support and it related on rapid, continuous feedback from visual, vestibular and somatosensory Balance is make athletes prevent from injuries during playing basketball e.g. fracture, musculoskeletal disorder, and falls during playing [1-2]. The prescribed balance training programmed was developed for sports physical to ensure the exercises and well through to build up gradually. Balance training was demonstrated to reduce muscular strength, imbalance between the legs and to effective for gaining muscular strength [2].A proposed mechanism for the enhancement in motor skills from balance training is an increase in the rate of force development [3]. Dynamic balance may be considered as the ability to perform a task while maintaining or regaining a stable position [3]. When examining the relationships between balance ability and athletic performance and assess between static and dynamic [3]. Many studies were done on static and dynamic balance showed that make the athlete to maintain the stability during sports [4]. Static balance has the ability to maintain a base of support with minimal movement. Dynamic balance has the ability to perform a task while maintaining or regaining a stable position. For both static and dynamic balance training

programmed focused on the improving the motor skills and body control [3-4]. Static balance are evaluated with using of the Balance Error Scoring System (BESS) was developed as a standardized, objective assessment tool for the clinical assessment of postural control. James A. *et al* cited that BESS uses 3 stances (double, single and tandem) on both firm and foam was found has the reliability. In the static balance exercise the program that designed with swiss ball exercises has the effect on the static exercises [2-4] Swiss ball exercise will be improving the strength of performer. Dynamic balance are evaluated with using of the Star Excursion Balance Test (SEBT). Thomas *et al* cited that SEBT has reliable and predictive measures of lower extremity injuries [5]. It is also improving completing neuromuscular training programmed and described prevention. Therefore, the purpose of this study is done to examine the relationship between SEBT reach distance and lower extremity injury [5]. In dynamic balance exercise the programmed that designed with plyometric exercise. Plyometric exercise training has the effect on the dynamic exercise. Plyometric training is an essential part of players develop [6]. It also can be enhance strength and speed. It is applicable for upper limb and lower limb [7]. The mechanism of static and dynamic balance according to Bannister Is that on static balance adequate amount of muscle power at lower limb and trunk erect position with normal posture and impulses are needed in order to acquire the proper static balance [8]. Whereas, in the dynamic balance adequate amount of muscle power to maintain movement and stability along with normal postural sensibility to convey information regarding movement and impulses from vestibular and visual system occurs [9]. Taking all the above into account and literature support for the efficiency of the static and dynamic balance has the enhance of strength and speed. It is for the both upper limb and lower limb strength and the endurance level of the players [8-9].

**Methods and Materials**

Study design: An Experimental design

Study location: Study was conducted at ASIA Metropolitan University

**Inclusion Criteria**

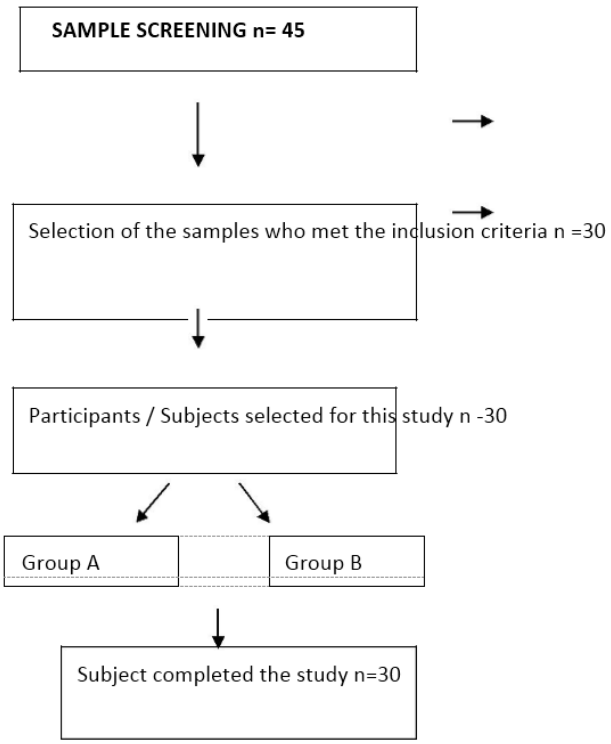
- Male amateur player aged 18-28years
- Cooperative subject
- Postural stability
- Healthy players

**Exclusion Criteria**

-Orthopedic problem
-Neurological problem
-History of fracture
-Cognitive problem

**Procedure:** Before the screening procedure was done, subjects were informed about the approval of the study by the proposal review committee of Bachelor of Physiotherapy in Asia Metropolitan University. About 45 subjects of male amateur basketball players were recruitment in AMU physio lab. Subject's recruitment was done on the basics of 18 to 25 years old amateur basketball players. Subjects were screened on the individual basics. Assessment was done for every subject following of the inclusion criteria of this study. Subjects weight and height were measured to calculate the Body Mass Index (BMI). Subjects whose BMI falls in the normal range (18.50-24.99) only were included in the study. After 10 days of screening, 30 male amateur basketball players who met the inclusion were assigned for the sampling procedure for the study.15 male amateur basketball players were excluded from this study because they did not meet the inclusion criteria. The reasons for their exclusion were, BMI range is not in the normal range and the amateur players physically not active. Besides that, the excluded subjects were affected with recent trauma, fracture and falls during playing basketball. So among 45 subjects, only 30 of them were assigned for this study. The subject 30 male amateur basketball players from the screening volunteered to participate in the study. Non probability purposive method was choosing to align subjects in the study. After the sampling procedure, 30 male were assigned for the study. All the subjects were assigned with the study and intervention period. A written consent was obtained from every participate and they were informed that they can withdraw from the study at any time during the intervention period without revealing any season. All 30 male were equally allocated into two groups. First 15 male were assigned in the Group A (Static) and balance 15 male were assigned in the Group B (Dynamic).There is no participate withdraw during the intervention period. All the participants were cooperative during the intervention period for 6 weeks duration.

**Consort Flow Chart**




**Pretest**

All 30 subjects who met the inclusion criteria were assigned for pre test procedures. All of them well explained to subject about the method and purpose of the procedures. The main measurement tools for the static and dynamic balance are;

Static Balance Exercise-Balance Error Scoring System
Dynamic Balance Exercise-Star Excursion Balance Test

First in Group A, there will be 15 subjects are divided for the static pre test intervention. Pre test intervention period will be done for first 3 weeks. Before static balance exercise was done

the subject should be measured of height and weight. The BMI should be in normal range. The subject should be excluded from the fracture or any trauma before start the intervention. If there included any of these they are unable to perform the intervention. The demonstration was done for the subjects before the procedure takes place. Subject were informed about the immediate stopping exercise if they experience of intolerable dyspnea, leg cramps and pale or ashen appearance. The exercise will be done with use of Swiss ball. The exercise should be done 10 reps and 3 sets before the amateur player's start playing basketball. While doing exercise players should be breathing normally. The exercise that should be done by amateur players is;

The subjects prone over the ball with arm folded over the chest, legs spread for balance. Action lifts the trunk and keeps the elbows pulled back over the head and hold. Subjects should be done 2 sets and hold for 10 second

**Fig 1:** Back extension exercise

The player are own supine position with heels resting on ball. Push your heel actively down into Swiss ball to contract hamstring and hold this for 3 to 6 seconds. Then relax and gently force subjects further forward. Repeat this 3 to 4 times

**Fig 2:** Hamstring stretch

-The players are standing with one foot resting on ball, back straight. Action lower bodyweight hold, return to start.

**Fig 3:** Quadriceps stretch

Second in the Group B, there will be done pre test intervention for dynamic balance. The pre test intervention for the dynamic balance will be done for the 3 weeks. Before the pre test intervention procedure done the subjects should be measured of height, weight and limb length measurement. The measurement of leg length was done with a tape measure from the anterior superior iliac spine to the center of medial malleolus.

The subject should be excluded from the fracture or any trauma before start the intervention. If there included any of these they are unable to perform the intervention. The demonstration was done for the subjects before the procedure takes place. Subject were informed about the immediate stopping exercise if they experience of intolerable dyspnea, leg cramps and pale or ashen appearance. The exercise will be done in dynamic balance are Plyometric Push Up. The exercise should be done 10 reps and 3 sets before the amateur players start playing basketball. While doing exercise players should be breathing normally. The Plyometric Push Up that should be done by ammature players are shown below this diagram;

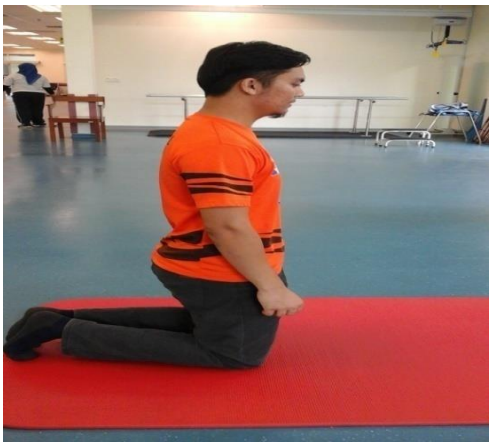


**Fig 4:** Starting position

**Fig 5:** Drop down

**Fig 6:** Bottom push up

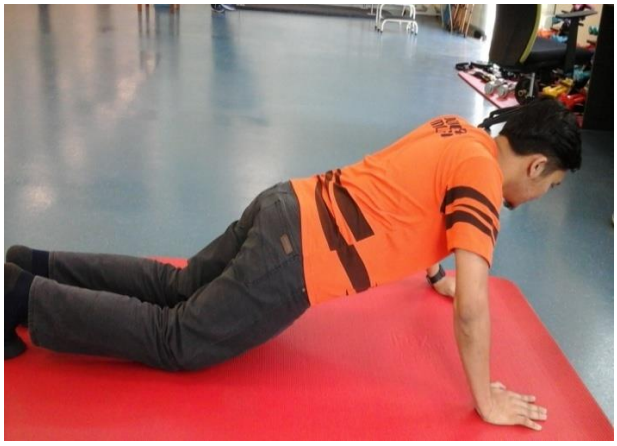


**Fig 7:** Extend arms

**Post Test**

After the pre test done for 3 weeks there should be done the measurement for describe the comparative difference between pre test and post test. At the end of 6 weeks all the 30 subjects were assigned for the post test intervention by measured with Balance Error Scoring System (BESS) for static balance test and Star Excursion Exercise Test (SEBT) for dynamic balance test for the final result from the total intervention period. After the Pre test intervention done for 6 weeks, the post test will be done at the end of the 6th weeks. The static balance will be measured with used of BESS Scoring system are as;

Before done Balance Error Scoring System there should be prepare foam pad, stop watch and an assistant to act as a spotter. The purpose of the foam pad is to create unstable surface and a more challenging balance task, which varies by body weight. The subject can be immediately stop done BESS procedure if they are unable to balance on the foam pad and feel dizziness. Test will be done for firm and foam testing position. Subject should be closed their eyes while done testing position. Firm and foam testing position will be done into 3 categories:

-Double leg stance
-Single leg stance
-Tandem stance

Firm testing position will be done on the ground and foam testing position will be done with using of foam pad. Take your shoe off. This test will consist of 6 - twenty second tests with three different stances on two surfaces. Scoring will be calculated with the type of error below:

Balance Error Scoring System

Types of error

Procedure;

1) Hands lifted off iliac crest
2) Opening of eyes
3) Step, stumble, or fall
4) Moving hip into>30 degrees abduction
5) Lifting forefoot or heel
6) Remaining out of test position

| Score Card (#Error) | Firm Surface | Foam Surface |
|---|---|---|
| Double Leg Stance | | |
| (feet together) | | |
| Single Leg Stance | | |
| (non dominant foot) | | |
| Tandem Stance | | |
| (non dom foot in back) | | |
| Total scores | | |

*The subjects should be closed their eyes while performing firm / foam testing position.

Dynamic balance will be measured with used of Star Excursion Balance Test (SEBT). The SEBT was performed with participants standing in the middle of a grid formed by eight lines extending out at 45° from each other in (figure 1).The subjects used their dominant leg and stood on the centre of grid by placing the most distal part of the great toe there. While balancing in a single leg stance, the subjects used the opposite leg to reach as far as possible towards the end of the line along a grid in the anterior, posteromedial and posterolateral. Then they tap or lightly touched the ground with the distal part of reaching foot before returning to beginning position. The subjects hand were placed on the iliac crest throughout the test and all the tests were performed barefoot in order to rule out the influence of footwear. Six practice trial were performed by the subjects and were given 2 minutes of rest after completion and then three trials were performed in each direction. The reaching order was randomized in each direction. Before recording the reading there should be taken 3 trial for the SEBT then it should be taken which one is the highest from the 3 trial then it should be calculate with using of the formula;

{(sum of all three direction) / (limb length*3)}*100

**Data Analysis:** Statistical analysis for this study was done by using the statistical software SPSS 18.0 version. An independent t- test was used as the statistical tool to compare the results between the Group A and Group B. The probability value for this study was less than P > 0.05 which was considered as statistically significant. All scoring was performed by the same 30 subject who divided into two groups. The BESS test involved 3 stance positions each on stable and unstable surfaces for the dominant limbs. The 3 stance position was double leg stance with feet together, single leg stance and tandem stance. Static balance was assessed using the Balance Error Scoring System (BESS).SEBT were averaged over 3 trials and normalized to leg length. For the calculation were will be used formula of {(sum of all three direction) / (limb length*3)}*100.Dynamic balance was assessed using of the Star Excursion Balance Test.

**Table 1:** Paired t- test data

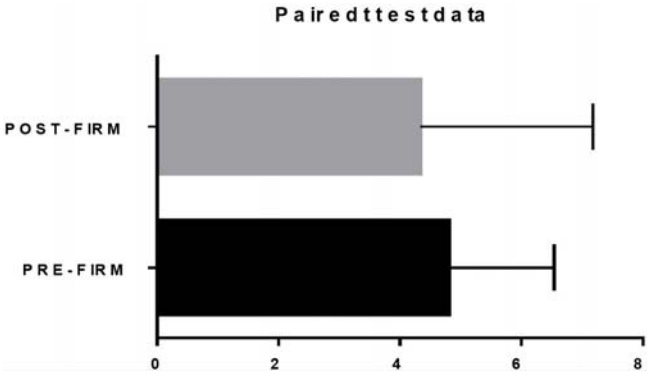
| Group A | Mean | S. Deviation | T. Value | P. Value | Significant |
|---|---|---|---|---|---|
| | | | | | DIFFERENCE |
| (STATIC) | | | | | |
| FIRM | -0.4667 | 3.833 | 0.47215 | 0.6446 | NO |
| FOAM | -2.267 | 6.227 | 1.410 | 0.1805 | NO |

**Table 2:** Paired t-test data

| Group B | Mean | S.Deviation | T.Value | P.Value | Significant |
|---|---|---|---|---|---|
| | | | | | DIFFERENCE |
| DYNAMIC | 5.574 | 4.489 | 4.809 | 0.0852 | YES |

Above table shows data obtained from the static and dynamic balance for both group which was done before and after the intervention period. In table 1 shown that static balance has no significant effect. Table 2 showed that there is significant effect on dynamic test p>0.05.

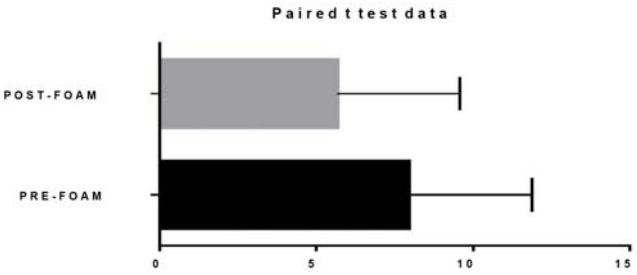
**Results:** Statistical analysis for this study was done by using the statistical software SPSS 18.0 version. Paired t- test was done to compare the static firm and foam of pre and post of trial test. Static firm and foam test showed significantly no different p > 0.05.Paired t- test was done to evaluate the result of dynamic balance scoring system. It showed statistical significance effect p< 0.05.The mean and standard deviation of static firm are -0.4667 ± 3.883 and for foam are -2.267±6.227.There is no significant effect on static balance test. The mean and standard deviation for dynamic are 5.574±4.489.There is significant effect on dynamic balance test. The t value for static firm 0.47215 and foam are 1.410.The p value that shown on static firm 0.6446 and foam are 0.1805.The t value that shown on dynamic are 4.809 and p value are 0.0852.




**Graph 1:** Paired t –test for pre and post firm for static balance.

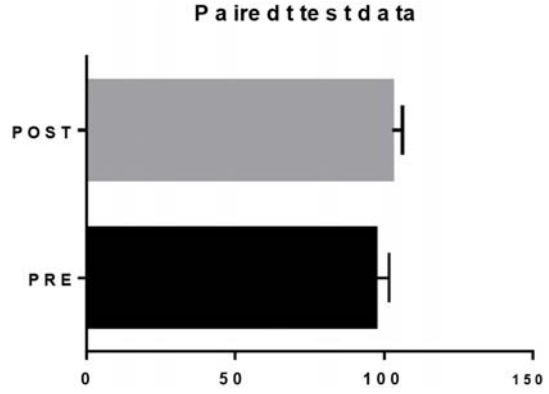
**Interpretation**

Table above showed the mean differences in pre firm are higher than post firm trial. There is no significant difference between pre and post trial. Paired t – test were done for pre and post firm trial test. The mean differences that occur between both group are - 0.4667




**Graph 2:** Mean value for pre and post foam for static balance.

The above showed that there is no differences occur between pre and post foam trial test. Pre foam is higher compared to post foam trial test. There is no significant difference occur between pre and post foam trial test. The mean differences between pre and post foam trial test are – 2.267




**Graph 3:** Paired t- test for pre and post test of dynamic balance.

The graph above showed the differences that occur in dynamic balance trial. There is post trial is higher than pre dynamic trial. There is significantly different occur. The mean value for dynamic trial is 5.574.

**Discussion**: The results for this study showed statistical significance effect for dynamic balance with using of SEBT. Null hypothesis was not rejected where there is no significant different on the dynamic balance among the male amateur basketball players. Similar outcomes have been described by Atushi Imai *et al* concluding that SEBT is effective in immediately improving dynamic balance. However static balance did not showed significance effect on the BESS which used to evaluate subjects functional performance. There is the subject were involved in recent trauma such as hamstring strain and ankle sprain. Due to that subjects are unable to perform well in static trial test with using using of BESS scoring sheet as instructed. In addition to knowing which balance training programs are effective, athletic trainers would benefit from knowing which athletes require more balance training to reduce musculoskeletal injuries. Initially balance training reduces the risk of some musculoskeletal injuries such as ankle sprains, especially if one or more balance components. The BESS and SEBT considered limitation of this study. SEBT study was designed to examine the role of foot type, height, leg length and range of motion measurement on excursion distance while performing SEBT of dynamic balance test. The advantage of assessing dynamic, range of motion and strength are required along with the ability to remain upright and steady. It is involves having participant maintain a base of support with one leg while maximally reaching in different direction with opposite leg, without compromising the base of support of stance leg. In this study can found that SEBT maximally reach distances improved at posttest using healthy subjects compared with a BESS after 6 weeks intervention. The 3 reach directions of SEBT used in this study thought to evaluate balance and stability before involved in sports activity. However Pearson D *et al* stating that principles are needed to be followed during physical

training for achieving the optimal performance level, and in one of the basic physical training which is SAID principles states that the human body will adapt precisely in response to the demands and stresses placed on it. SEBT is a reliable measure and dynamic test to predict of lower limb injury, to identify dynamic balance deficits in athlete with lower extremity condition. Therefore the purpose of this study was to examine the relationship between SEBT reach distance and BESS.

**Conclusion**: The finding of this study shows that the Plyometric push up improve subject's dynamic balance within 6 weeks intervention compared to the Swiss ball exercise of static balance. The dynamic balance shows more significant compared to the static balance. This study were determined that players can be used plyometric technique to improve dynamic balance. It is found that plyometric is resistance training emphasizing the loading of muscle during an eccentric muscle action and knee extensor muscle. Thus, concluding Plyometric push should be included in the training program of the athletes especially those who require more dynamic balance such as basketball players in order to improve the athletic performance.

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