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## Star excursion balance test as a predictor of risk of lower extremity injuries in basketball players

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### Abstract

**Objectives:** i) To assess reach distance in basketball players. ii) To compare risk of lower extremity injuries in various age groups. iii) To compare reach distance between professional and recreational players.

**Method:** The sample size of the study was 80. Basketball players were divided into professional and recreational group. The players were asked to perform the Star Excursion Balance Test and the reach distance was calculated.

**Results:** The maximum reach distance in professional players was in posteromedial right and in recreational players was anterior left. The players in age group 15-18 were at high risk of injuries compared to players in age group 25-30.

**Conclusion:** Players with a greater anterior right/left reach distance difference were more likely to sustain lower extremity injury. Recreational players were more likely to sustain lower extremity injury than professional players.

**Keywords:** Star excursion balance test, balance, recreational players, professional players, basketball

### 1. Introduction

Basketball is a limited contact sport played on a rectangular court. The objective of basketball is to shoot a ball through a hoop 18 inches (46 cm) in diameter and 10 feet (3.048 m) high that is mounted to a backboard at each end of the court (Bhatt A and Trivedi R 2018) <sup>[1]</sup>. A team scores a field goal by shooting a ball through the basket being defended by the opposition team during play. If the player shoots from behind the three - point line, a field goal scores three points and two points if shot from front of the line. The team also scores via free throws, which are worth one point, if the other team is assessed with certain fouls. The team with most points at the end of the game wins. If the score is tied at the end additional time (overtime) is mandated. The ball can be advanced on the court by passing it to a team mate, or by bouncing it while walking or running (dribbling). To lift or drag one's pivot foot without dribbling the ball to carry it, or to hold the ball with both hands then resume dribbling are violations to the game. There are various individual techniques for displaying skill - ball handling, shooting, passing, dribbling, dunking, shot blocking and rebounding. Basketball is a high - intensity intermittent team sport (McInnes *et al* 1995) <sup>[2]</sup>, which involves frequent jumping, accelerating, decelerating, turning, and pivoting, which requires a combination of good fitness and repeated high - intensity bouts of exercise interspersed with brief periods of low - intensity movement (Carvalho *et al* 2011) <sup>[3]</sup> in addition to superb skill execution (Apostolidis *et al* 2004) <sup>[4]</sup>. Basketball is an intermittent sport incorporating quick and repeated changes in movement directions.

Basketball teams generally have player position, the tallest and strongest member of team are called center or power forward, while slightly shorter and more agile players are called small forward, and the shortest player or those who possess the best ball handling skills are called point guard or shooting guard. The point guard directs on the court action of the team, implementing the coach's game plan and managing the execution of offensive and defensive plays (player positioning).

Common injuries seen in basketball are Achilles tendonitis, Sever's disease, Patellar tendonitis, muscle strains, ACL tears, Finger injuries, Ankle sprain etc.

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Balance is considered to be one of the most important coordination skills in sport and even more so in basketball. (Mc Leod *et al* 2009) [5] Observed the importance of good balance skills in minimizing the risk of injury. Balance is a crucial precursor to movement. In basketball, to move from one side of the court to the other, balance must be continually established and re-established many times over. Balance helps to keep the movements more coordinated and efficient, it ensures better awareness about the body and strengthens proprioceptive ability. In basketball, abrupt and intense change of direction, frequent commencement and stopping and contact among players largely depend on dynamic balance (Nikolaos *et al* 2012) [6]. In basketball, good balance enables players to control their bodies, to minimize errors, to protect themselves against falling when they change direction and to move fast within the pitch to implement technical skills effectively (Mahmoud *et al* 2011) [7].

Star Excursion Balance Test is a dynamic test that requires strength, flexibility and proprioception. The SEBT has been shown to be a reliable measure and has validity as a dynamic test to predict risk of lower extremity injury (Gribble *et al* 2012) [8]. It is a measure of dynamic balance that provides a significant challenge to athletes and physically active individual. This test can be used to assess physical performance, but also be used to screen deficits in dynamic postural control due to musculoskeletal injuries, to identify athletes at greater risk for lower extremity injury, as well as during rehabilitation of orthopedic injuries in healthy active individuals. The SEBT uses a single - leg stance to maintain a stable base of support while performing a maximum reach of the free leg in specific directions. Poor performance on the SEBT may be related to an increased risk for sustaining a noncontact lower extremity injury (Butler *et al* 2013) [9].

Therefore, the purpose of this study was to examine the relationship between SEBT reach distance and lower extremity injury among high school basketball players.

**2. Methods: Materials and methods**

**2.1 Research approach:** Cross sectional survey study

**2.2 Study setting**

- Sports Academy, Nerul,
- Navi Mumbai Sports Association,

- Nerul Gymkhana

**2.3 Study sample:** 80 basketball players

**2.4 Sampling technique:** Convenience sampling

**2.5 Inclusion criteria**

- Male basketball players
- Basketball players in the age group 15-30.
- Basketball players playing since 1 year

**2.6 Exclusion criteria**

- Any previous injuries

**2.7 Procedure**

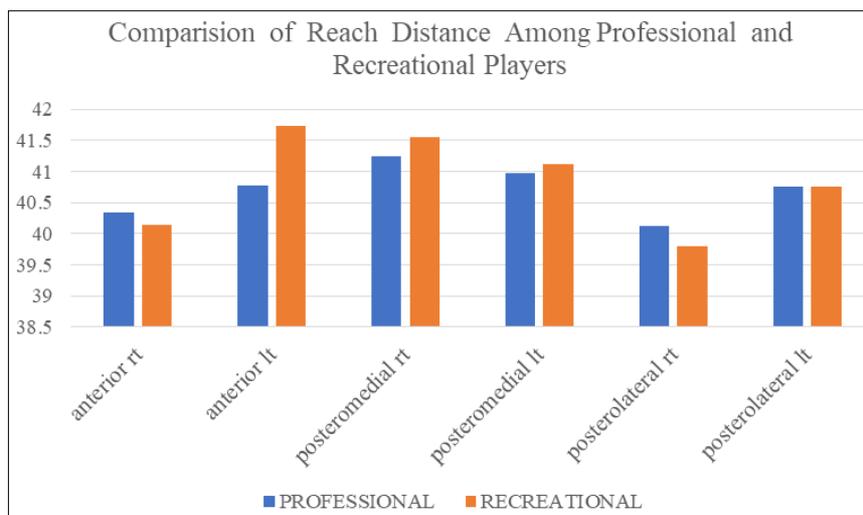
Demographic details of the subjects were collected age, height. Weight and height were measured using a weighing scale and a tape respectively. Subjects were chosen as per the inclusion criteria with no previous lower extremity injuries. Also the subjects were well informed about the procedure and the need for this study.

The reach distance was measured using star excursion balance test. The player was made to stand in the center of the grid with the most distal aspect of the toe at starting line. While maintaining single leg stance, the player was asked to reach with the free limb in the anterior, posteromedial and posterolateral direction in relation to the stance foot. The maximal reach distance was then marked. The trial was discarded and repeated if the player (1) failed to maintain unilateral stance, (2) lifted or moved the stance foot from the grid, (3) touched down with the reach foot, or (4) failed to return the reach foot to the starting position. The process was repeated while standing on the other leg.

**2.8 Ethical approval**

The study was approved by Institutional Ethics and Research committee of D.Y Patil University. Written informed consent was taken from all subjects and their identification information which was collected during the study was kept strictly confidential.

**3. Results**



**Graph 1:** Showing the comparison of reach distance between professional and recreational players

**3.1 Inference:** In professional players, the mean reach distance was found to be highest in posteromedial right (41.24 cm), posteromedial left (40.98 cm) and anterior left (40.78

cm) followed by posterolateral left (40.75 cm), anterior right (40.35 cm) and posterolateral right (40.12 cm). In recreational players, the mean reach distance was found to be highest in

anterior left (41.74 cm), posteromedial right (41.56 cm) and posteromedial left (41.11 cm) followed by posterolateral left (40.76 cm), anterior right (40.15 cm) and posterolateral right

(39.8 cm). No significant difference was found in the mean reach distance of professional and recreational players.

**Table 1:** Table showing the risk of injury among players

|                      |           | Group          |              | Total  |        |
|----------------------|-----------|----------------|--------------|--------|--------|
|                      |           | professional   | Recreational |        |        |
| diff anter Rt Lt cat | 0 to 3.99 | Count          | 30           | 20     | 50     |
|                      |           | % within group | 73.2%        | 51.3%  | 62.5%  |
|                      |           | Residual       | 4.4          | -4.4   |        |
|                      | => 4      | Count          | 11           | 19     | 30     |
|                      |           | % within group | 26.8%        | 48.7%  | 37.5%  |
|                      |           | Residual       | -4.4         | 4.4    |        |
| Total                |           | Count          | 41           | 39     | 80     |
|                      |           | % within group | 100.0%       | 100.0% | 100.0% |

**3.2 Inference:** Amongst 41 professional players 11 players (26.8 %) were at high risk of lower extremity injury and in recreational group out of 39 players 19 players (48.7%) were at high risk of lower extremity injury. The difference between proportions of risk of lower extremity injury is statistically significant. Risk of lower extremity injury was more in recreational group compared to professional group. P value = 0.043 which is < 0.05.

#### 4. Discussion

In this study, a total sample of 80 basketball players, professional and recreational were taken. The objectives of the study were; 1) To assess the mean reach distance using SEBT, 2) To compare risk of lower extremity injuries in various age groups. 3) To compare reach distances between professional and recreational players.

1) According to the first objective, the mean reach distance was found to be maximum in posteromedial right (41.24cm) followed by posteromedial left (40.98cm) and anterior left (40.78cm) in professional players as compared to anterior right (40.35 cm), posterolateral left (40.75cm) and posterolateral right (40.12cm). In recreational players, the mean reach distance was found to be maximum in anterior left (41.74cm) followed by posteromedial right (41.56cm) and posteromedial left (41.11cm) as compared to anterior right (40.15cm), posterolateral left (40.76cm) and posterolateral right (39.80cm). No significant difference was found in the values of mean reach distance of professional and recreational players.

The SEBT also requires lower extremity strength, range of motion, and coordination. (Earl *et al.* 2001) <sup>[10]</sup> found similar results to this study. They found that each reach direction activated the stance lower extremity muscles to a different extent. They reported that in the anterior reach direction the vastus medialis and lateralis were most active. During the posterolateral reach, the biceps femoris and anterior tibialis were most active. The anterior tibialis was most active in the posteromedial reach direction.

2) According to the second objective, the mean reach distance in age group 15 - 18 was found to be: anterior right (36.93cm), anterior left (38.15cm), posterolateral right (36.13cm), posterolateral left (37.00cm), posteromedial right (37.44cm) and posteromedial left (38.12cm). In age group 18 - 25, the mean reach distance was found to be: anterior right (41.66cm), anterior left (42.63cm), posterolateral right (41.58cm), posterolateral left (42.51cm), posteromedial right (43.19cm) and posteromedial left (42.09cm). In age group 25 - 30, the mean reach distance was found to be: anterior right (44.38cm), anterior left (44.77cm), posterolateral right

(44.77cm), posterolateral left (44.72cm), posteromedial right (45.77cm) and posteromedial left (45.61cm). It shows that the younger population is at high risk of injury. The difference between proportions of risk of lower extremity injury was found to be statistically significant. High training volume and intensity may predispose young athletes to overuse injuries. Children are more vulnerable to injuries as there are different physical and physiological changes in children and adults (Adirim *et al* 2003) <sup>[11]</sup>.

3) According to the third objective, it was found that recreational players were at high risk of lower extremity injuries as compared to professional players. Plisky *et al* (2006) <sup>[12]</sup> observed that >4 cm symmetry on the anterior reach was associated with an elevated injury risk. The results indicated that greater anterior right/left reach distance difference on the SEBT predicted lower extremity injury. Similar results were found in the study done by McGuine *et al* <sup>[13]</sup>.

#### 5. Conclusion

Players with a greater anterior right/left reach distance difference were more likely to sustain a lower extremity injury. Recreational players were more likely to sustain lower extremity injury than professional players.

#### 6. Acknowledgement

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