

# Effects of Pilates and Conventional Core Stability Exercises on Core Stability and Vertical Jump Performance in Basketball Players

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## ABSTRACT

**Introduction:** Basketball is a high-intensity sport characterized by frequent explosive movements, where vertical jump performance is a primary determinant of success in both offensive and defensive manoeuvres. The core musculature acts as the central link in the kinetic chain, providing the necessary trunk stability to "shunt" ground reaction forces from the lower extremities to the centre of mass. Despite the widespread use of conventional core stability exercises in athletic conditioning, there is growing interest in the Pilates method, hence this study aims to find out the effects of Pilates and conventional core stability on core stability and vertical jump performance in basketball players.

**Methodology:** A pre and post experimental study design. 40 healthy male basketball players are taken and they were divided into two groups by purposive sampling, Pilates (group A) and Conventional core stability exercises (group B). Both groups underwent 6 weeks of intervention. Core stability is assessed using plank test and Vertical jump performance using vertical jump test (sergeant jump). Statistical analysis was done using paired and independent 't' tests with significance level set at  $p < 0.05$ .

**Results:** Both groups showed significant pre-post improvements, Group A achieved higher scores compared to group B in plank test ( $t=8.38$ ) and Vertical jump test ( $t=7.98$ ).

**Conclusion:** Pilates is more effective than conventional core stability exercises in enhancing core stability and vertical jump height in basketball players. Incorporating Pilates into athletic strength and conditioning programs may optimize the kinetic chain, leading to improved functional performance on the court.

**Keywords:** Core stability, Pilates, Plank test, Conventional core stability, Vertical Jump

## INTRODUCTION

In competitive basketball, the vertical jump is a fundamental determinant of success, essential for rebounding, shot-blocking, and offensive scoring. Vertical jump height is a key indicator of explosive power and athletic performance<sup>1, 2</sup>. However, this power is not solely dependent on lower-limb strength. Researchers emphasize that optimizing basketball-specific performance requires robust core strength training<sup>3</sup>. The core serves as the central link in the kinetic chain, providing the stability necessary to transfer ground reaction forces into vertical displacement<sup>1</sup>.

Traditionally, conventional core stability exercises have been used to enhance the "muscular ability" and jumping components in athletes. These exercises focus on building the foundational strength of the trunk to support high-intensity movements<sup>5</sup>. Conversely, the Pilates method is increasingly utilized in athletic populations, including adolescent baseball players and basketball players, to improve body composition and isokinetic muscular strength<sup>4, 6</sup>. The neurophysiology of these exercises lies in their ability to "tune" the nervous system for explosive action. Functional physical training affects heart rate, endurance, and overall body composition through neuromuscular adaptation<sup>8</sup>. Core training—whether conventional or Pilates-based—enhances neuromuscular recruitment patterns, reducing energy leaks within the kinetic chain. This allows for a more efficient shunting of force from the legs through a stabilized torso, a concept demonstrated that adding core stability to plyometric training significantly increases jump height compared to power training alone<sup>7</sup>.

To evaluate these improvements, two primary outcome measures are utilized. Vertical Jump Test: The Sergeant Jump Test is a validated and reproducible tool for assessing explosive strength in athletes<sup>9</sup>. In Core Stability (Plank) Test, endurance and functional tests are critical for measuring the physiological adaptations of the core muscles in college-level players<sup>3, 8</sup>.

Studies confirm that core training improves athletic performance, there is a need to distinguish either the specialized motor-control focus of Pilates or the strength-based focus of Conventional Core Stability is superior for the specific demands of basketball<sup>1, 7</sup>. Pilates offers unique benefits for jump performance, but a direct comparison against conventional methods in a basketball-specific context is necessary to optimize conditioning protocols<sup>4</sup>.

Hence, there is need for the study to compare the effects of Pilates exercises and conventional core stability exercises on core

stability and vertical jump performance in basketball players. The objectives of the study were to evaluate the improvement in core stability via the plank test following a 6-week intervention of Pilates versus conventional exercises. To measure and compare the changes in explosive power via the vertical jump test between the two groups. To determine if the Pilates group shows a statistically significant superior improvement in performance metrics compared to the conventional group.

## **MATERIALS & METHODS**

### **Study design**

The present study employed a pre & post-test comparative study design to explore differences in core stability and vertical jump performance in basketball players. Prior to administration, all participants were informed about the purpose of the study. Informed consent was obtained from the participant in compliance with ethical research guidelines.

### **Samples**

40 basketball players are recruited from PSG College of Technology; participants were allocated into two groups by purposive sampling method. The study was conducted in the college campus for duration of 6 months. The Participants between age-18 to 25 years, male basketball players were included. Age less than 18 and more than 25 years, recent surgeries, recent injuries in both upper limb and lower limb, cardiac diseases, prior back or abdominal surgeries, pain or disability in upper or lower limb, neuromuscular disorders, scoliosis, limb length discrepancy and postural asymmetries were excluded.

### **Study tools**

Core stability of the players was measured using plank test or core stability test. Vertical jump performance was measured using Vertical jump test or sergeant jump test.

1. **Plank test:** Participants start in a plank position followed by lifting the alternate

arms and legs with holding it in static position. The subject must attempt to maintain the position.

While testing, the examiner will observe for any number of inefficiencies in the core such as feet flattening, external rotation, knees turn inward, knees bowing outwards, asymmetrical weight shifting, low back arching, low back rounding, abdomen protruding, shoulder protraction, shoulder elevation, scapular winging and head in flexion. Subjects were then scored on two variables, the number of inefficiencies seen and the level of assessment achieved.

- Sergeant Jump test:** The participant stood sideways to the wall with feet flat and reached as high as possible with the hand closest to the wall. This point was marked as the "Standing Reach". The Jump from a stationary standing position, the participant performed a rapid downward squat (eccentric phase) followed immediately by an explosive upward jump (concentric phase). Marking at the peak of the jump, the participant touched the scale/wall with the chalked fingers. The distance is measured between jump and standing reach.

### Interventions

The intervention was conducted over 6 weeks. Group A underwent Pilates training and Group B underwent conventional core stability exercises. Pilates training consists

of hundreds (abdominal curls), articulating bridge, plank, reverse plank and side plank. Conventional core stability exercise includes Abdominal in drawing, abdominal controlled curls, bridging, wall squats and bird dog. Participants were asked to perform with hold of 5-10 seconds.

### Statistical methods

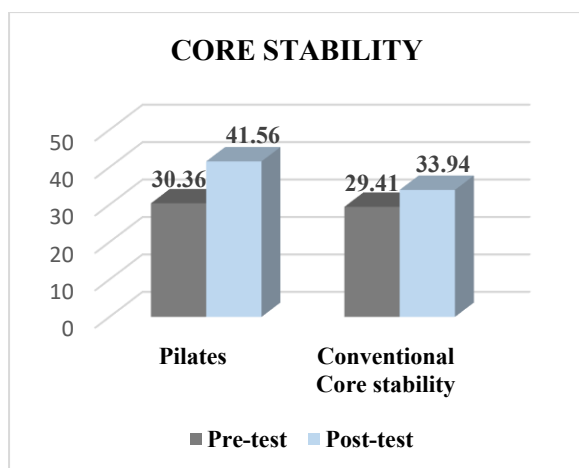
Between-group differences in pre- to post intervention change scores were examined using independent-samples t-tests, whereas within-group differences from baseline to post intervention were assessed using paired samples t-tests. Statistical significance was set at  $p < 0.05$  (two tailed) for all analyses.

## RESULTS

### Within group analysis

#### Core stability of Pilates group & Control group:

For 19 degrees of freedom and at 5% level of significance, the table "t" value is 2.093 and the calculated "t" value was 53.77. The mean difference within Pilates group showed value of 11.2 shown in graph I. Hence there was significant effect of Pilates on core stability in Basketball players. For 19 degrees of freedom and at 5% level of significance, the table "t" value is 2.093 and the calculated 't' value was 21.89, mean difference showed 4.53. Hence there was significant effect of conventional core stability exercises on core stability in Basketball players.



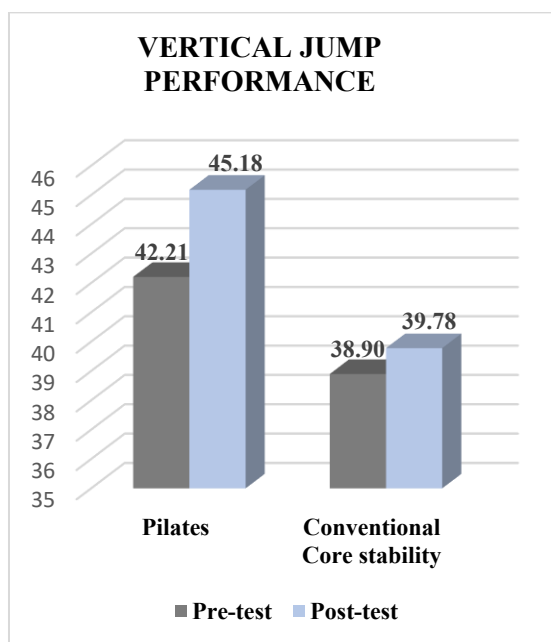
Graph I

This graph shows paired 't' test mean values of Vertical jump test within Pilates group (Group A) and control group (Group B).

### Vertical jump performance of Pilates group & Control group:

For 19 degrees of freedom and at 5% level of significance, the table "t" value is 2.093 and the calculated "t" value was 20.79. The mean difference within Pilates group showed value of 2.97 shown in graph II. Hence there was significant effect of Pilates

on Vertical jump performance in Basketball players. For 19 degrees of freedom and at 5% level of significance, the table "t" value is 2.093 and the calculated 't' value was 24.45 mean difference showed 0.88. Hence there was significant effect of conventional core stability exercises on core stability in Basketball players.



This graph shows the paired 't' test mean values of plank test within Pilates group (Group A) and control group (Group B).

Graph II

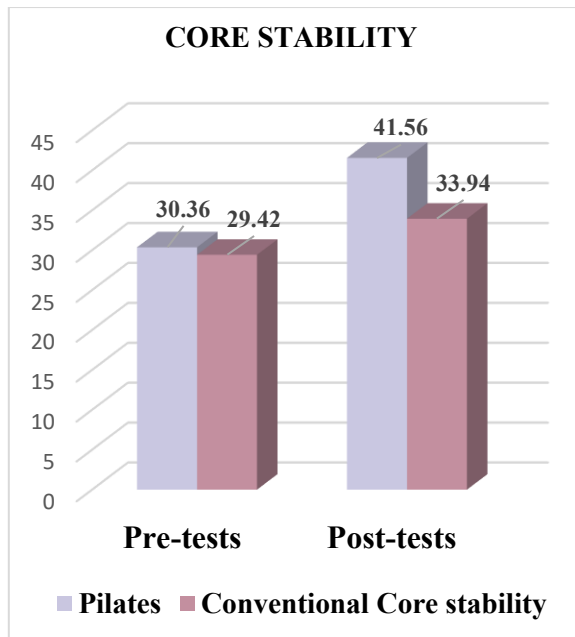
### Between group analysis

#### Core stability of Pilates group & Control group:

For 38 degrees freedom and 5% level of significance, the table "t" value 2.086 and the calculated "t" value is 1.12. As the calculated "t" value was lesser than the table value, there was no significant difference between the pre-test values of both groups. Hence there was homogeneity between both the groups before the experiment. For 38 degrees of freedom and 5% level of significance, the table "t" value 2.086 and the calculated "t" value is 8.38. The calculated "t" value was greater than the table "t" value, there was significant difference found between both the groups shown in graph III.

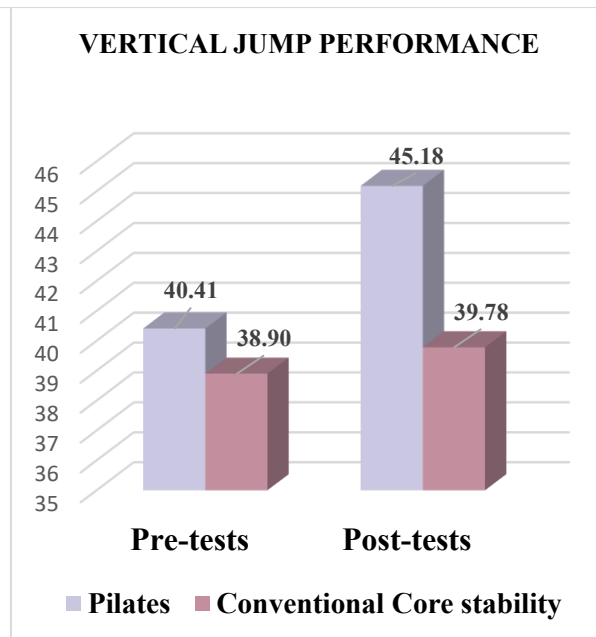
#### Vertical jump performance of Pilates group & Control group:

For 38 degrees of freedom and 5% level of significance, the table "t" value 2.086 and the calculated "t" value 0.74. As the calculated "t" value was lesser than the table "t" value, there was no significant difference between the pre-test values of both groups. Hence there was homogeneity between both the groups before the experiment. For 38 degrees of freedom and 5% level of significance, the table "t" value 2.086 and the calculated "t" value is 7.98. The calculated "t" value was greater than the table "t" value, there was significant difference between both the groups shown in graph IV.



*Graph III*

Independent 't' test mean values of core stability between Pilates group (Group A) and control group (Group B).



*Graph IV*

Independent 't' test mean values of Vertical jump performance between Pilates group (Group A) and control group (Group B).

## DISCUSSION

The primary objective of this study was to compare the effects of Pilates and conventional core stability exercises on core stability and vertical jump performance in basketball players. The results demonstrated that while both interventions were effective, the Pilates group achieved a statistically significant superior improvement in both outcome measures.

The superior increase in vertical jump height within the Pilates group aligns with the findings of study when integrated into athletic training, significantly enhances explosive power<sup>4</sup>. Similarly, studies observed that Pilates exercises directly impact the muscular ability and specific components of jumping in athletes<sup>5</sup>. The mechanism for this superiority likely relates to the neuromuscular specificity of Pilates. While conventional core exercises focus on global muscle endurance, Pilates emphasizes isokinetic muscular strength and segmental control<sup>6</sup>. This refined control allows basketball players to optimize their power centre, ensuring that the force generated in the lower limbs is efficiently transferred through the trunk without energy

leaks, a concept supported by the systematic findings regarding core training and jump height<sup>1,2</sup>.

In terms of core stability, the Pilates group outperformed the conventional group in the plank endurance test. This supports the evidence which suggests that optimizing basketball-specific performance requires core training that goes beyond basic strength to include functional physical adaptations<sup>3</sup>. Pilates targets the deep stabilizers, creating a more stable "chassis" for the athlete<sup>3</sup>. Functional physical training significantly impacts heart rate, endurance, and body composition. The Pilates intervention in this study likely provided a more "functional" challenge to the basketball players' nervous systems, improving their ability to maintain spinal alignment during the high-velocity movements required for a vertical jump<sup>8</sup>. This is further reinforced by researchers, who highlighted that adding core stability to existing athletic protocols—such as those found in Pilates—leads to better jump outcomes than standard power training alone<sup>7</sup>.

Conventional core exercises often lead to bracing (holding the breath), which is not functional during a 40-minute basketball game. Pilates emphasizes lateral breathing and constant recruitment of the "Powerhouse." This builds the functional endurance needed to maintain a high vertical jump even in the 4th quarter of a game, rather than just having strength for a single jump<sup>3, 8</sup>.

The superiority of the Pilates intervention may be attributed to its emphasis on isokinetic strength and segmental dissociation. Unlike conventional methods, Pilates provides the 'neuromuscular bridge' necessary to convert raw core endurance into the explosive vertical power required on the court<sup>6</sup>. The use of the Sargent Jump Test provided a reliable and reproducible measure of this explosive strength<sup>9</sup>. The significant p-values observed in the Pilates group suggest that the intervention effectively addressed the kinetic chain requirements of the sport, allowing for better force production compared to the conventional group.

Furthermore, the integration of Pilates into basketball conditioning appears to optimize "functional physical training" markers more effectively than conventional strengthening alone. Therefore, it is recommended that physiotherapists and coaches prioritize Pilates-based protocols to maximize the vertical jump height and core stability of competitive basketball players.

## CONCLUSION

This study concludes that while both Pilates and conventional core stability exercises significantly improve core endurance and vertical jump performance in basketball players, the Pilates method is a superior intervention allows for a more efficient transfer of ground reaction forces, reducing energy leaks during explosive movements.

### **Declaration by Authors**

**Ethical Approval:** Approved

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**Conflict of Interest:** No conflicts of interest declared.

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