

# Effect of Core Training Versus Plyometric Training on Agility in Volleyball Players Using the Hexagonal Agility Test: A Comparative Study

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## ABSTRACT

The present research aimed to compare the impact of core training and plyometric training on agility in young adult male volleyball players using the hexagonal agility test. The study included 28 individuals aged 18–25 years from volleyball clubs in Pune. Participants were randomly assigned to two groups. Group A underwent an eight-week core training program, while Group B received an eight-week plyometric training program, performed twice weekly. Agility was assessed before and after intervention using the hexagonal agility test. Data were analysed using IBM SPSS software, with paired t-tests to assess intra-group changes and unpaired t-tests for inter-group differences. Both groups demonstrated statistically significant gains in agility following training ( $p < 0.001$ ). The core training group demonstrated a mean improvement of 0.44 seconds, whereas the Group B showed a greater mean improvement of 1.11 seconds. Between-group analysis revealed a statistically significant difference favouring the plyometric training group ( $p < 0.001$ ). The results reveal that although both training

approaches effectively improve agility in volleyball players, plyometric training produces superior improvements. Incorporation of plyometric exercises into volleyball training protocols may enhance agility and overall performance.

**Keywords:** Agility; Core training; Plyometric training; Volleyball players; Hexagonal agility test; Sports performance

## INTRODUCTION

Volleyball demands explosive power, speed, and precise coordination through its fast-paced, multidirectional gameplay. Players rely on superior agility, balance, strength, and reaction time to perform critical actions like serving, passing, attacking, and defending within tight court boundaries [1,3]. Agility—the capacity to accelerate, decelerate, and pivot rapidly while preserving postural stability—stands out as a pivotal factor separating elite performers in both attack and defence phases [4].

Effective agility drills sharpen athletes' ability to anticipate and respond to dynamic cues, such as incoming serves or blockers' positions, thereby boosting field efficiency [3]. Plyometric protocols, featuring high-

velocity jumps, bounds, and leaps, excel at boosting neuromuscular efficiency, fast-twitch fiber recruitment, and directional quickness via stretch-shortening cycle enhancements [5,10]. Core stability workouts, by contrast, fortify the torso's musculature to optimize energy transfer, reduce torso sway, and sustain equilibrium amid chaotic play [2,8].

While each method yields gains in jump height, quickness, and postural control among volleyball athletes, existing literature largely evaluates them in isolation rather than head-to-head [1,12]. Few studies directly pit plyometrics against core routines for agility gains in this population, creating a clear need for comparative analysis. Such insights would refine training prescriptions, elevate competitive edge, and lower injury exposure through superior body mastery.

Therefore, this study aims to evaluate how plyometric and core training influence agility performance in volleyball players. By identifying the more effective modality, this research works to enhance the existing literature on volleyball-specific conditioning and provide practical training insights for professionals and sports practitioners in designing targeted agility development programs.

## **MATERIALS AND METHODS**

### **Study Design and Participants**

This experimental comparative study was conducted among male volleyball players between the age group of 18-25 years over 8 weeks of defined training period in volleyball clubs, in and around Pune. Participants meeting inclusion and exclusion criteria were recruited and randomly assigned to two groups.

### **Inclusion Criteria**

Volleyball players actively participating in training  
Age group as defined in the study protocol  
Only male players

### **Exclusion Criteria**

History of recent musculoskeletal injury

Neurological or cardiopulmonary conditions affecting performance

Players undergoing any other specialized agility training program

Intervention Protocol

### **Participants were allocated to two groups:**

Group A (Core Training Group):

Participants performed a structured core strengthening program focusing on abdominal, lumbar, and pelvic stabilizing muscles.

Group B (Plyometric Training Group):

Participants underwent a plyometric training program including jumping, hopping, and explosive lower-limb exercises.

Both programs were conducted for the same duration and frequency to ensure uniform training exposure.

The core and plyometric training protocol was adapted from Afyon et al. [2].

### **Outcome Measure**

Agility was evaluated using the Hexagon Agility Test, which assesses rapid directional changes while preserving balance and velocity [7].

### **Ethical Considerations**

Ethical clearance was received from the Institutional Ethics Committee. Written consent was obtained from every participant prior to study involvement.

### **Statistical Analysis**

Data from pre- and post-intervention hexagonal agility test times for core training (Group A, n=14) and plyometric training (Group B, n=14) groups were analyzed using IBM SPSS software. Paired t-tests assessed within-group changes in agility times for each group separately. An unpaired t-test compared mean differences in agility improvements between the two groups.

The level of statistical significance was set at  $p < 0.05$ . For the core group, paired t-test yielded  $p = 0.000003$ ; for plyometrics,  $p = 0.000002$ ; between-group unpaired t-test showed  $p = 0.000081$  and  $t$ -value = 4.666. Cohen's  $d$  effect sizes were calculated: 0.38

(small-medium) within core, 0.50 (medium) within plyometrics, and 1.76 (large) between groups.

## RESULT

Both groups showed statistically significant improvement in agility post-intervention period ( $p < 0.001$ ).

Table 1 shows the comparison of pre- and post-intervention agility scores between the two groups. The plyometric training group demonstrated greater improvement compared to the core training group.

Table 1: Comparison of Agility Scores Between Group

Group	Pre-Mean (s)	Post-Mean(s)	Mean Difference(s)	p-value (paired)	Cohen's d
Core(n=14)	19.95 ± 1.14	19.51 ± 1.09	0.44	<0.001	0.38
Plyometric(n=14)	20.72 ± 2.32	19.60 ± 2.64	1.11	<0.001	0.50

## DISCUSSION

The present study investigated and compared the effects of core training and plyometric training on agility in male volleyball players. The findings indicate that both training interventions were effective in enhancing agility, suggesting that neuromuscular-focused conditioning plays a crucial role in improving change-of-direction performance in volleyball athletes. This supports the concept that agility is a modifiable physical attribute influenced by training-induced adaptations in strength, coordination, and movement control.

Core training contributed to improved agility by enhancing trunk stability and postural control, which are essential for efficient force transmission during rapid and multidirectional movements. A stable core allows the lower extremities to generate and transfer force effectively while maintaining balance, thereby improving movement efficiency during agility-related tasks. These findings are consistent with previous research reporting a strong association between core stability and change-of-direction speed, emphasizing the indirect but important role of core musculature in agility performance [11,12]. The results of the conducted study further support the inclusion of core training as a foundational component of volleyball conditioning programs.

Plyometric training demonstrated comparatively greater improvements in agility, which may be attributed to its sport-specific nature and direct emphasis on

explosive lower-limb movements. Plyometric exercises enhance neuromuscular coordination and optimize the stretch-shortening cycle, enabling rapid force production during acceleration, deceleration, and directional changes [10,11]. These adaptations are particularly relevant to volleyball, a sport characterized by frequent jumping and explosive court movements. Previous studies conducted on volleyball players have similarly reported significant improvements in agility following plyometric training interventions, reinforcing the findings of the current study [7].

The superiority of plyometric training noted in present study may be explained by the principle of training specificity. While core training primarily improves stability and movement control, plyometric training closely replicates the explosive actions required during volleyball play, such as jumping, landing, and rapid directional changes. This closer alignment with sport-specific demands may account for the greater agility gains observed in the plyometric training group. These findings agree with earlier systematic reviews and experimental studies that have highlighted the effectiveness of plyometric training in improving agility in court-sport athletes [9,10]. Despite the positive outcomes, key constraints in this investigation merit discussion. The sample size was relatively small and limited to male volleyball players within a specific age range, which may

restrict the broader applicability of these results. Additionally, the study duration was limited, and long-term retention of training effects was not evaluated. The study also focused solely on agility, without assessing other performance variables such as speed, power, or injury risk, which may provide a more comprehensive understanding of training adaptations.

Future work could assess combined core-plyometric training interventions, include female athletes, and assess additional performance and injury-related outcomes over longer intervention periods. Based on the current study findings, it is suggested that plyometric training be incorporated as a primary modality for improving agility in volleyball players, while core training may be used as a complementary approach to enhance stability, movement efficiency, and overall athletic performance.

## CONCLUSION

Both core training and plyometric training effectively enhance agility performance among volleyball players. However, plyometric training showed greater efficacy for enhancing agility performance. Embedding plyometric exercises into volleyball conditioning protocols may provide greater performance benefits.

## Declaration by Authors

**Ethical Approval:** Approved

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**Conflict of Interest:** The authors declare no conflict of interest.

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