

STUDY PROTOCOL

Title of the Study

Effect of Core Stability Training Combined with Plyometric Exercises on Vertical Jump Performance in High Jump Athletes

Objectives

Primary Objective:

To evaluate the effect of plyometric training alone versus combined core stability and plyometric training on vertical jump performance in high jump athletes.

Secondary Objective:

To determine whether adding core stability exercises enhances explosive lower limb performance compared to plyometric training alone.

Study Design

Type of Study: Non-randomized comparative interventional study

Study Setting: Three affiliated sports training centers in Mangalore, Karnataka, India

Study Duration: 11 months

Groups:

Group 1: Plyometric Training Only (PLYO)

Group 2: Combined Core Stability + Plyometric Training (COMBO)

Rationale for Non-Randomized Design:

Due to practical and ethical constraints in athletic training environments, random allocation was not feasible. Athletes followed structured training programs, and disruption could affect performance and fairness. This design improves ecological validity and reflects real-world sports practice.

Methodology

Participants Inclusion Criteria

- Total Sample Size: 24 high jump athletes (accounting for 20% dropout)
- Age Range: 19-24 years
- Gender: Male and/or female
- Training Background: Minimum 3 years of structured high jump training
- Activity Level: At least 3 sessions per week

- Elite voluntary high jump athletes
- Medically fit for plyometric and core training
- Regular participation in training programs

Exclusion Criteria

- Lower limb injury within past 3 months
- Chronic asthma
- Ongoing physiotherapy for musculoskeletal pain
- Neurological disorders
- Severe anxiety or depression

Recruitment Strategy

Participants were recruited after obtaining permission from the local sports council. After obtaining the institutional ethical board approval, the data collections initiated Athletes were approached directly at training centres.

Intervention and Procedure

Group 1: Plyometric Training (PLYO)

- Duration: 6 weeks
- Frequency: 3 sessions/week
- Session Length: ~30 minutes

Structure:

- o Warm-up: 5-10 minutes
- o Cool-down: 10 minutes

Progression:

- Weeks 1-2: Basic movements (standing long jump, squat jump, depth jump)
- Weeks 3-4: Moderate complexity (zig-zag hops, lateral hops, triple jump)
- Weeks 5-6: High intensity (single-leg jumps, bounding, box jumps)

Group 2: Combined Training (COMBO)

- Same plyometric program as PLYO group
- Additional core stability training (12-15 minutes/session)

Core Training Progression:

- Week 1: Pelvic tilts, bilateral bridges

- Week 2: Unilateral bridges, quadruped exercises
- Weeks 3-4: Static core stabilization
- Weeks 5-6: Dynamic core exercises

General Procedure

- Familiarization session conducted before intervention
- Baseline assessment: Anthropometry and vertical jump
- Total Sessions: 18
- Supervision by physiotherapists and coaches
- Compliance monitored weekly
- No financial incentives provided

Safety Monitoring and Adverse Events

- Continuous monitoring during training
- Adverse events recorded in training logs
- Immediate management and referral when required
- Session checklists used to ensure adherence

Outcome Measures

Primary Outcome:

Vertical Jump Height (cm)

Measurement Method:

- Difference between standing reach and maximal jump reach
- Three trials performed
- Best score recorded
- Assessed by a blinded independent evaluator

Sample size

- Significance Level: $\alpha = 0.05$
- Power: 80%
- Sample size accounts for 20% dropout

- Comparative analysis between groups will be conducted
- Detailed statistical methods are provided in the separate Statistical Analysis Plan (SAP)

Ethical Considerations

- Approved by: Review Board on Ethics for Research Committee, Alva's College of Physiotherapy, Karnataka, India
- Informed consent obtained from all participants
- Conducted in accordance with CERT guidelines

Statistical analysis Plan

Statistical analysis is using the RCTapp Shiny app (<https://sciencer.shinyapps.io/RCTapp/>). Descriptive statistics are reported as frequencies and percentages for categorical variables and as mean \pm standard deviation for continuous variables. Missing data are reported transparently. A linear mixed model with participants and time as random factors is used to test the main and interaction effects of group (PLYO, COMBO) and time (Pre, Post) on jump height, adjusted for baseline values, height, and weight. Regression diagnostics, including normality of residuals, homoscedasticity, and influential outliers, are to be performed. An interaction plot with 95% confidence intervals is constructed to visualize the group-by-time interaction. Categorical outcomes are analyzed using the Rdit method. Two-sided p-values < 0.050 are considered statistically significant. Effect sizes (Cohen's d) are calculated from adjusted estimates and interpreted using Cohen's (1988) criteria, where 0.20-0.49 indicated a small effect, 0.50-0.79 a medium effect, and ≥ 0.80 a large effect.