"EFFECTS OF PLYOMETRIC EXERCISES VERSUS LADDER DRILL EXERCISES ON CRICKET PERFORMANCE IN AMATEUR FEMALE CRICKET PLAYERS: A COMPARATIVE STUDY

Onkar Kashid[1]; Dr Sadaf Patel[2],

Dr Gunjan Dewan[3], Dr Bhaswati Baishya[4], Dr Apoorva Nagar[5]

BPT Intern[1]; Assistant Professor[2],

Assistant Professor[3], Assistant professor[4], Assistant professor[5]

[1,2]Dr. APJ Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences, Loni, Ahilyanagar, Maharashtra, India.

[3,4]I.T.S. College of Health and Wealth Sciences, Greater Noida, Uttar Pradesh, India

[5]Santosh College of Physiotherapy, Santosh deemed to be a university

ABSTRACT

Introduction: Cricket is experiencing a global surge in female participation, yet amateur female cricketers often lack access to evidence-based training compared to their male counterparts. Success in cricket requires a blend of speed, agility, and explosive power for tasks such as sprinting between wickets and high-velocity bowling.

Objectives: This study aimed to compare the effectiveness of Plyometric Training (PT) and Ladder Drill Training (LDT) on improving agility and explosive strength in amateur female cricketers.

Methods: Forty amateur female players (ages 18–26) were recruited from Pravara Rural Hospital and local cricket clubs. Participants were divided into Group A (Plyometric Training, n=20) and Group B (Ladder Drill Training, n=20). Both groups trained for 20 minutes per session, five days a week, for six weeks. Agility was measured using the T-Test, and explosive power was assessed via the Vertical Jump Test.

Results: Both groups showed significant improvement ($p < 0.01$). Group B (LDT) demonstrated superior gains in agility, with T-test times decreasing from 12.35 seconds to 9.85 seconds ($p < 0.0001$). Group A (PT) achieved greater improvements in explosive strength, increasing vertical jump height from 26.20 cm to 31.55 cm ($p = 0.0002$).

Conclusion: Both training methods are effective, but they target different physiological attributes. Ladder drills significantly enhance coordination and movement awareness, while plyometrics optimise muscular power. A combined training approach is recommended for amateur female cricketers to maximise performance and reduce injury risks.

Keywords: Plyometric Exercises, Ladder Drill Exercises, Agility, Strength, Agility T-Test, Vertical Jump Test.

INTRODUCTION

Sport is a fundamental physical activity that plays a vital role in enhancing human health and assisting individuals in attaining success. Cricket, recognised as the second most popular sport globally after football, holds a unique cultural significance, particularly in India. Played by teams of 11 across three formats: Test, One-Day, and T20, the game demands specialised fitness involving power, speed, and agility. Success in

cricket requires immense physical endurance, anaerobic capacity, and swift reactions from both batters and bowlers. While women's cricket has rapidly evolved over the past decade, amateur female cricketers often face significant hurdles, including limited access to professional coaching and scientific support compared to male athletes. Physiological distinctions such as injury patterns and muscle fibre distribution further necessitate gender-specific training. Muscle injuries account for over 40% of cricket-related injuries, frequently affecting the shoulders, lumbar region, and knees.

A. Plyometric Training Protocols

Plyometric exercises, or "plyos," utilise the Stretch-Shortening Cycle (SSC) to produce powerful, fast movements. This neuro-mechanical process improves concentric muscle action following a quick eccentric phase. By activating muscle spindles and accumulating elastic energy in tendons, plyometrics enhance "stiffness" in the lower limb joints. This rigidity allows for a more efficient transfer of force during the foot-strike phase of sprinting and the deceleration phase of agility movements.

B. Ladder Drill Exercises

Ladder drill training (LDT) is utilised to enhance footwork, speed, and coordination. By requiring precise foot placement within a fixed space, LDT improves the "cognitive-motor" linkage, similar to the reactive decision-making required in cricket. While plyometrics focus on the "hardware" (muscular power), ladder drills refine the "software" (motor control), reducing "neural noise" and perfecting motor primitives for complex directional changes.

C. Agility and Strength Performance

Agility is the synergy between perceptual-cognitive decision-making and Change of Direction Speed (CODS). Previous research indicates that while plyometrics are superior for developing explosive-reactive strength and vertical jump height, ladder drills are more potent for improving agility scores, such as the T-Test. This is likely due to the emphasis on shuffling and backpedalling patterns consistent with match-play demands.

Despite these known benefits, there is a scarcity of well-designed studies comparing the efficacy of plyometric versus ladder drill exercises specifically for amateur female cricketers. This study seeks to fill this gap to improve clinical practice and training interventions for this population.

METHODOLOGY

- **Study Design:**

The present study was designed as a Comparative study to determine the effectiveness of plyometric exercise and ladder drill exercise on cricket performance in amateur female cricket players to improve agility and strength. Ethical approval was obtained from the Institutional Ethics Committee of Dr APJ Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Sciences (PIMS), Loni (Approval Number: PIMS/DR.APJAKCOPT/IEC/2025/749). All procedures were carried out in accordance with institutional and national ethical guidelines. Written informed consent was obtained from each participant in their native language before inclusion in the study. Participants were recruited in coordination with the Departments of Sports at Dr Vitthalrao Vikhe Patil Pravara Rural Hospital under Pravara Institute of Medical Sciences.

- **Sample Size:**

40 amateur female cricket players. A random sampling method was used.

- **Materials Used:**

The following equipment was used for the study:

- Agility ladder
- Stopwatch
- Measuring tape
- Cones
- Rings and boxes
- Data recording sheets

Inclusion Criteria:

- Amateur Female Cricket players
- Physically Fit Individuals (3- minute step test)
- No H/O of Cardiovascular diseases
- No Physical disability
- Age between 18-26 years

Exclusion Criteria:

- Male Cricket players
- History of any Recent Surgery
- Any Physical disability
- Age above >26

PROCEDURE

Ethical approval was obtained, and 40 participants were recruited following informed consent. Participants were randomly divided into two groups, each performing a 5-minute standardised warm-up before training. Baseline and post-intervention measurements were recorded for agility (**T-Test**) and explosive power (**Vertical Jump Test**). The six-week training protocol was integrated with regular cricket practice, followed by statistical analysis. Participants were randomly divided into two groups:

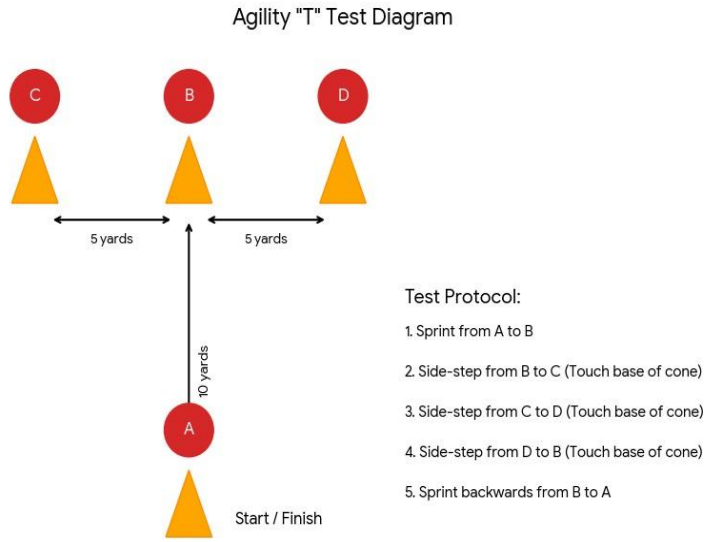
Group A: Plyometric Training (20 participants)

Group B: Ladder Drill Training (20 participants)

OUTCOME MEASURES

- Agility T-Test

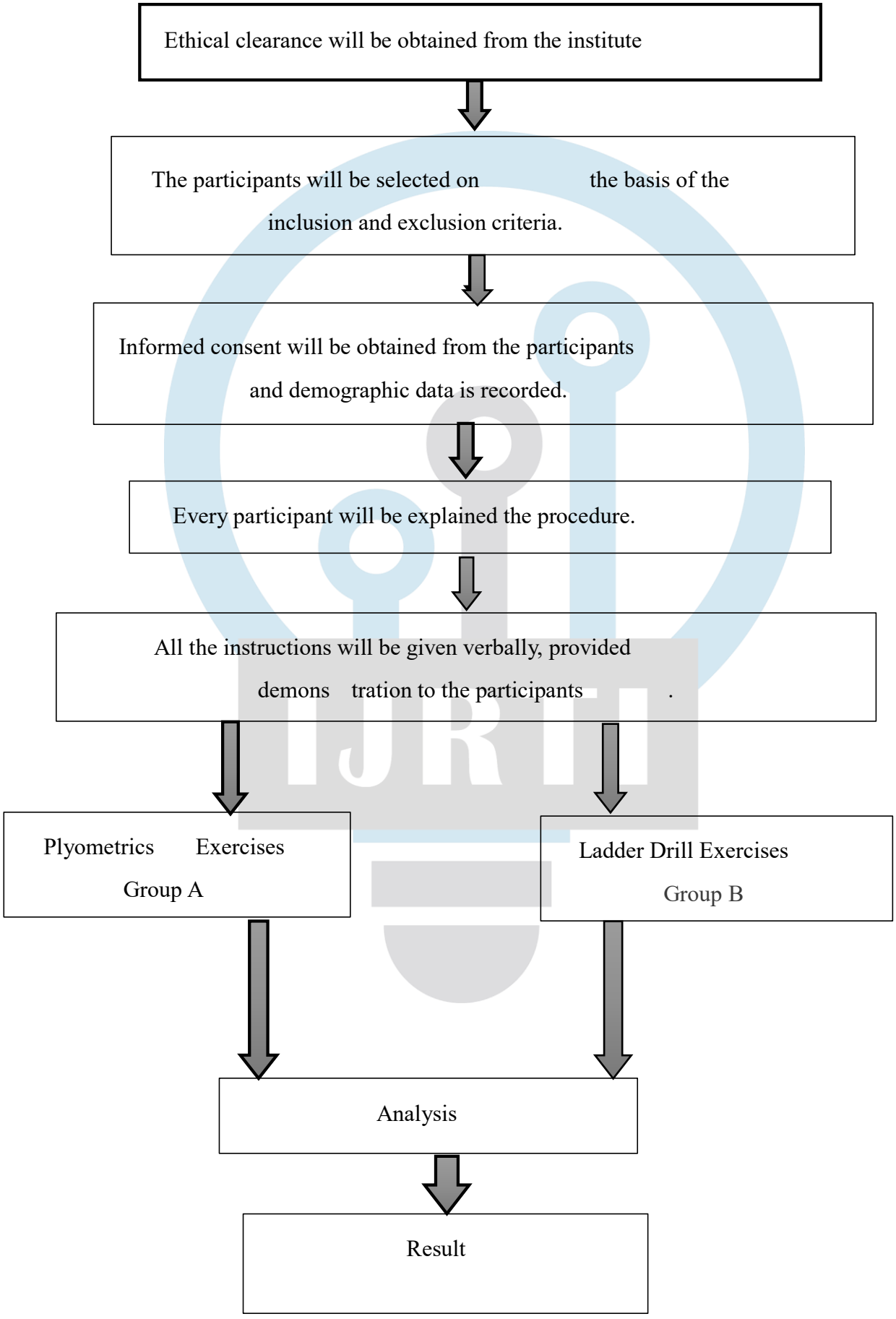
The Agility T-Test was used to measure agility and change-of-direction speed. The test requires participants to sprint forward, shuffle laterally, and run backwards in a T-shaped pattern between cones. The time taken to complete the test was recorded using a stopwatch.



- Vertical Jump Test

The Vertical Jump Test was used to measure explosive lower limb strength. Participants performed a maximal vertical jump, and the difference between standing reach height and jump height was recorded.

FLOW DIAGRAM



INTERVENTION PROTOCOL

Each training session consisted of:

- 10 minutes warm-up
- 20-minute training intervention
- 10 minutes cool-down

Training sessions were conducted five days per week for six weeks. After six weeks, post-training measurements were recorded using the same outcome measures.

TABLE NO.1: Six-Week Intervention for Group A And Group B

Number of weeks	**Group A** Participants received Plyometric Training	**Group B** Participants received Ladder Training	**No. of repetition**
Week 1 & 2	○ Sprint ○ Single leg hop ○ Jumping lunges	○ One Foot Run ○ Hopscotch ○ Straight run	3 repetition × 2 sets 20 second recovery between repetition 30-second recovery between sets
Week 3 & 4	○ Double leg lateral cone jump (35 cm) ○ Single leg lateral cone jump (25cm) ○ Alternate lunges jump	○ Two Foot Run ○ Sideways Run ○ Backwards Hopscotch	3 repetition × 2 sets 20 second recovery between repetition 30-second recovery between sets
Week 5 & 6	○ Single leg forward hop ○ Single leg 2 forward & 1 back ○ Split Squat jump	○ Fast feet run (Fast) ○ High Knee Up Run ○ Hopscotch variation	3 repetition × 2 sets 20 second recovery between repetition 30-second recovery between sets

DATA ANALYSIS AND RESULTS:

TABLE NO. 2: Sample size

Intervention	**Amateur Female Cricket Players**
Group A (plyometric exercises)	20
Group B (ladder drill exercises)	20

The six-week intervention effectively **enhanced athletic performance**, as evidenced by the directional improvements in both core metrics. **Improved agility** was demonstrated by a significant **reduction in T-test**

completion times, while **increased vertical jump height** confirmed a substantial gain in **lower-body explosive power**. Collectively, these results indicate that the protocol successfully **optimized the physical functional components** required for high-level cricket performance.

WITHIN THE GROUP ANALYSIS

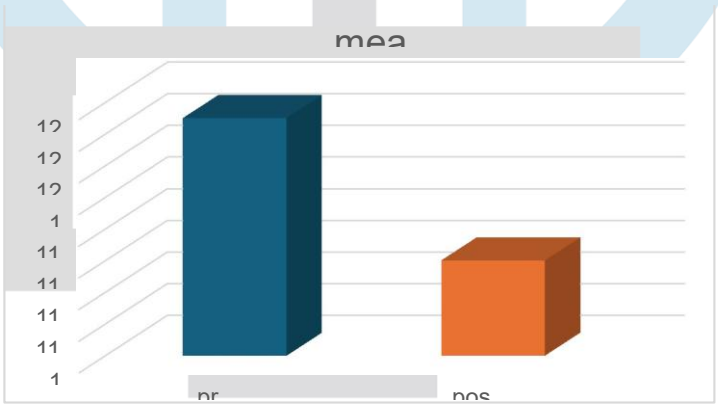
GROUP A (Plyometric Exercise**)**

1) AGILITY T-TEST:

TABLE NO. 3: Difference between pre and post Agility T test

Agility T-test	MEAN	SD	T VALUE	P VALUE	LEVEL OF SIGNIFICANCE
PRE-INTERVENTION	12.500	1.440	8.374	< 0.0001	EXTREMELY SINGIFICANT
POST - INTERVENTION	11.630	1.342			

GRAPH: 1 Difference between pre and post Agility T Test



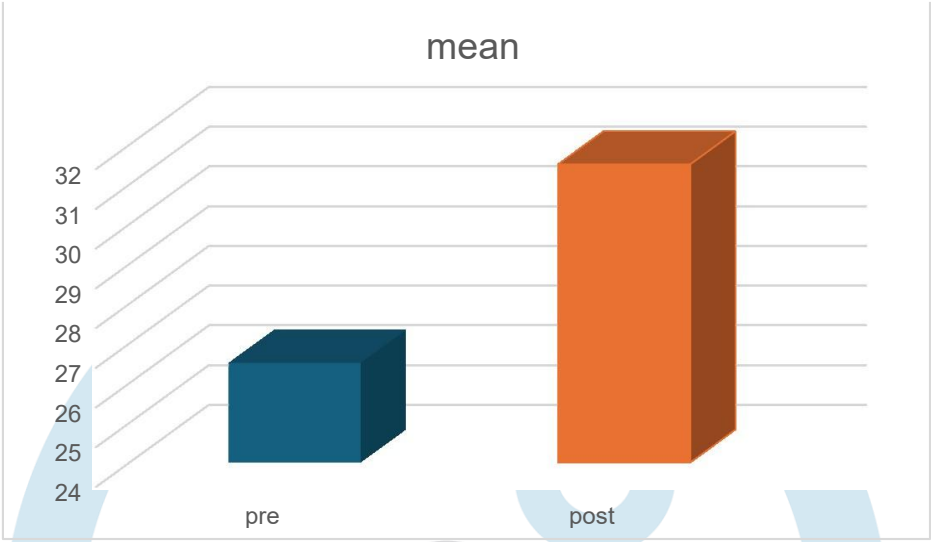
The six-week intervention yielded a **statistically significant improvement** in agility, with mean times decreasing from **12.500 s** to **11.630 s** ($p = 0.0018$). A paired t-test confirmed this gain with a t-value of **3.911** and a mean difference of **0.87 s**. These results validate the protocol's effectiveness in enhancing the participants' agility performance.

2) VERTICAL JUMP TEST

TABLE NO.4 Comparison of pre and post-intervention of Vertical Jump Test.

VERTICAL JUMP TEST	MEAN	SD	T VALUE	P VALUE	LEVEL OF SIGNIFICANCE
PRE-INTERVENTION	26.200	4.213	20.240	0.0001	EXTREMELY SIGNIFICANT
POST – INTERVENTION	31.550	4.006			

GRAPH: 2 Difference between pre and post Vertical Jump Test



The six-week protocol resulted in an **extremely significant improvement** in vertical jump height, with the mean increasing from **26.200 cm** to **31.550 cm** (mean difference: **-5.35**). A paired t-test confirmed this gain with a t-value of **20.240** (p = 0.0001), demonstrating the intervention's high effectiveness in enhancing explosive power for cricket

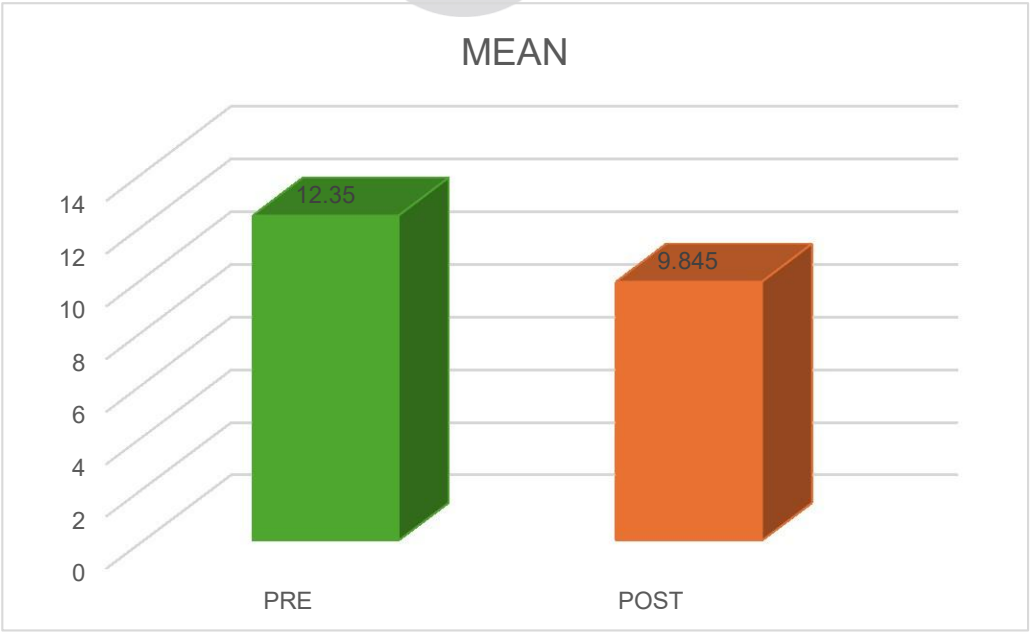
GROUP B (Ladder Drill Exercises**)**

1) AGILITY T-TEST:

TABLE NO 5: Comparison of pre and post-intervention of the agility test

AGILITY TEST	MEAN	SD	T VALUE	P VALUE	LEVEL OF SIGNIFICANCE
PRE-INTERVENTION	12.35	14.09	14.114	< 0.0001	EXTREMELY SIGNIFICANT
POST-INTERVENTION	9.845	10.39			

GRAPH: 3 Difference between pre and post Agility Test



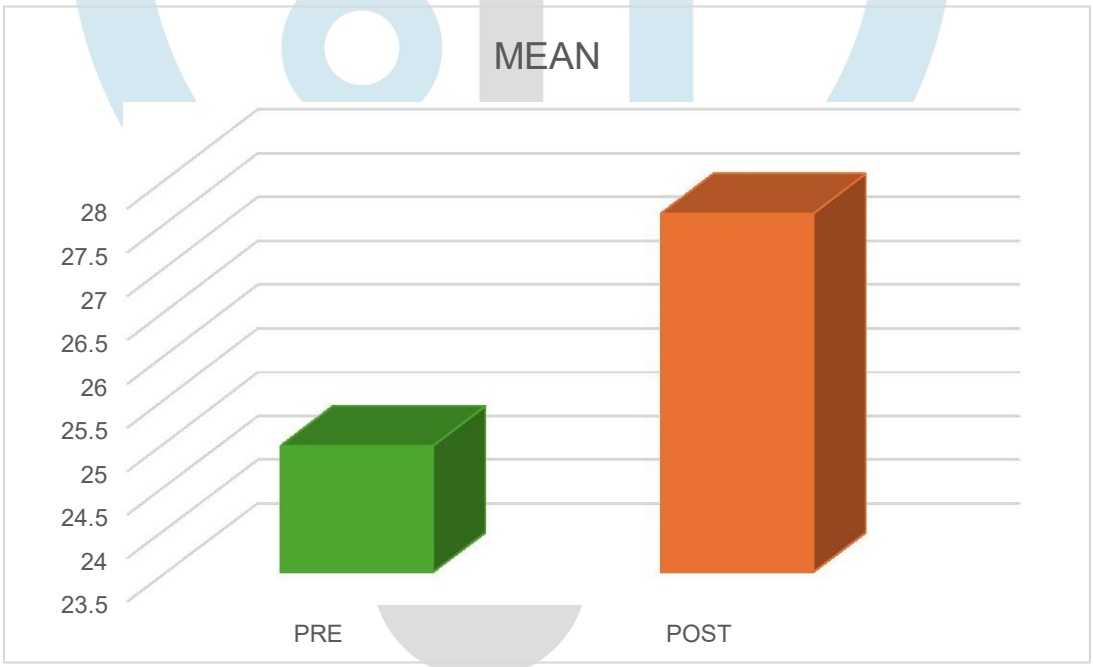
The six-week protocol yielded an **extremely significant improvement** in agility, with mean times decreasing from **12.350 s** to **9.845 s** ($p < 0.0001$). A paired t-test confirmed this substantial gain with a t-value of **14.114** and a mean difference of **2.505 s**. These results validate the intervention's high effectiveness in enhancing athletic performance.

2) VERTICAL JUMP TEST

TABLE NO. 6: Comparison of pre and post intervention of the Vertical Jump Test.

VERTICAL JUMP TEST	MEAN	SD	T VALUE	P VALUE	LEVEL OF SIGNIFICANCE
PRE-INTERVENTION	24.95	4.286	13.543	< 0.0001	EXTREMELY SIGNIFICANT
POST – INTERVENTION	27.6	4.235			

GRAPH: 4 Difference between pre and post Vertical Jump Test.



The six-week protocol yielded an **extremely significant improvement** in vertical jump height, with mean scores increasing from **24.950** to **27.600** ($p < 0.0001$). A paired t-test confirmed this gain with a t-value of **13.543** and a mean difference of **-2.65**. These results validate the intervention's effectiveness in enhancing explosive power for cricket performance.

COMPARISONS BETWEEN (Post Interventions)

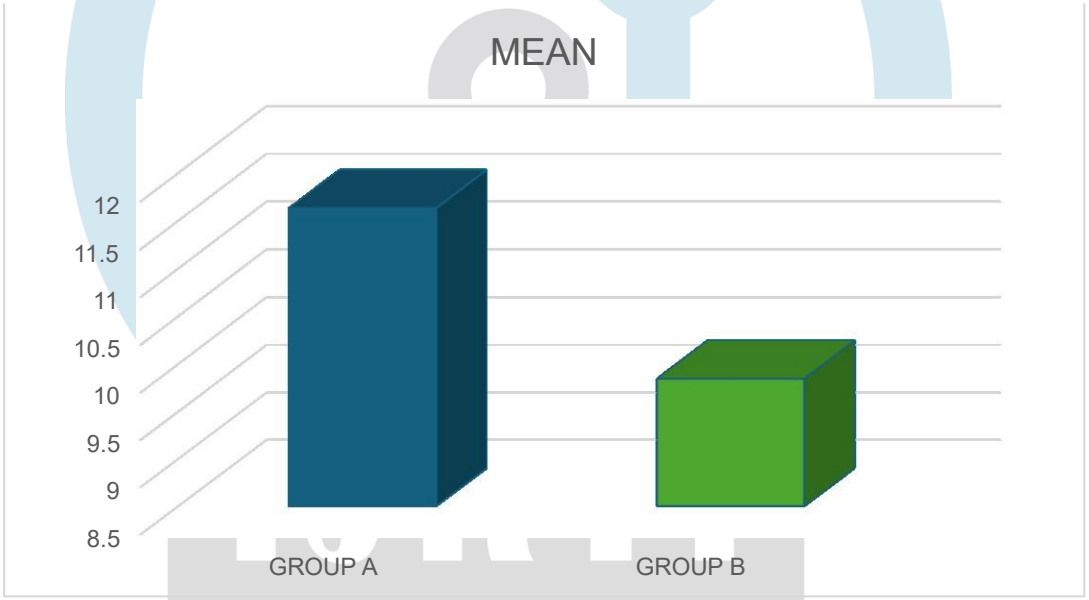
GROUP A AND GROUP B

1) **AGILITY T TEST**

TABLE NO. 7: Group comparisons: Group A and Group B Agility T Test

AGILITY T-TEST	MEAN GROUP A	MEAN GROUP-B	T VALUE	P VALUE	LEVEL OF SIGNIFICANCE
	11.63	9.845	4.703	< 0.0001	EXTREMELY SIGNIFICANT

GRAPH: 5 Group A And Group B Post Comparison of Agility T Test



GRAPH: 5 Group A And Group B Post Comparison of Agility T Test

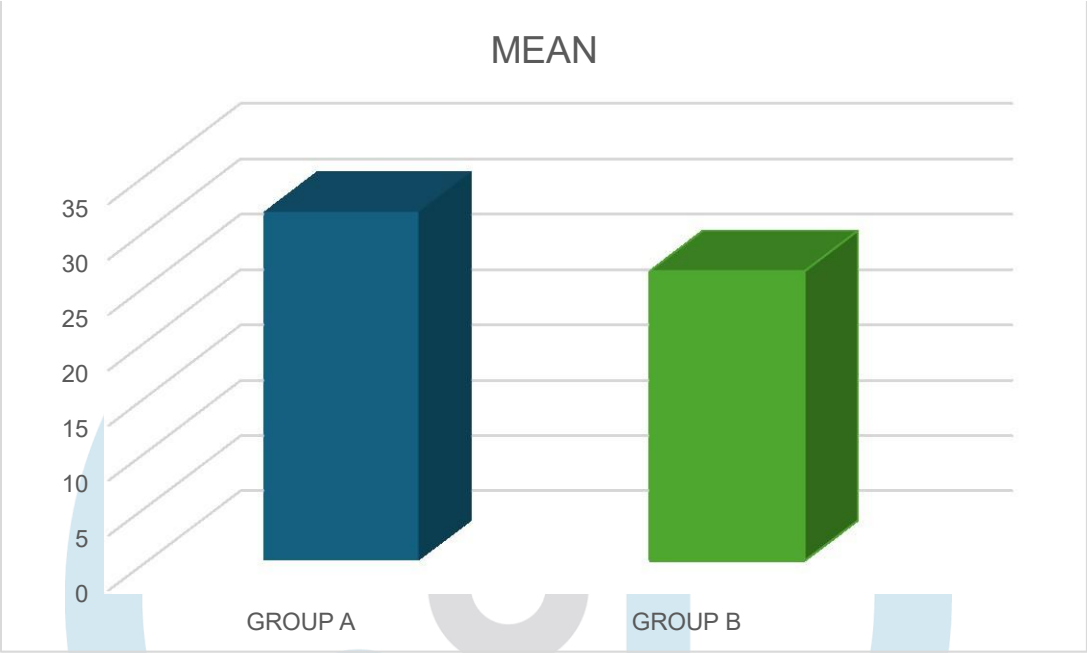
The six-week protocol yielded an **extremely significant difference** between groups, with Group B (mean: **9.845)** outperforming Group A (mean: **11.630)**. An unpaired t-test confirmed this gap with a t-value of **4.703** and a p-value of **< 0.0001** (mean difference: **1.785)**. These results indicate that while both groups improved, the protocol for Group B was notably more effective in enhancing agility.

2) **VERTICAL JUMP TEST**

TABLE NO 8: Group comparisons of group A and group B Vertical Jump Test

VERTICAL JUMP TEST	MEAN GROUP A	MEAN GROUP B	T VALUE	P VALUE	LEVEL OF SIGNIFICANCE
	31.550	26.200	4.053	0.0002	EXTREMELY SIGNICANT

GRAPH 6: Group A And Group B Post Comparison of Vertical Jump Tests



The six-week protocol yielded an **extremely significant difference** between groups, with Group A (mean: **31.550**) significantly outperforming Group B (mean: **26.200**). An unpaired t-test confirmed this gap with a t-value of **4.053** and a p-value of **0.0002** (mean difference: **5.35**). These results indicate that the intervention for Group A was notably more effective in enhancing lower body explosive strength.

DISCUSSION

The primary objective of this study was to compare the effectiveness of **Plyometric Training (Group A)** versus **Ladder Drill Exercises (Group B)** on agility and explosive power in amateur female cricket players. The results revealed a distinct dichotomy in training adaptations. While both groups demonstrated statistically significant improvements, Group B showed superior efficacy in improving **Agility** (9.845 vs. 11.63), whereas Group A showed superior efficacy in improving **Vertical Jump Power** (31.55 cm vs. 26.20 cm). These findings suggest that both modalities target distinct neuromuscular mechanisms specific to the demands of cricket.

Agility Performance: The Superiority of Ladder Drills. The dominance of ladder training in reducing agility T-test times suggests it specifically addresses the rapid foot turnover and "fast feet" required in fielding. In an agility assessment like the T-test, a reduction in time indicates improved performance. This success can be attributed to Kinesthetic Differentiation, where the central nervous system is trained to minimise ground contact time through improved motor programming. Ladder drills force the athlete to control body movements within confined spaces, reducing "neural noise" and improving movement economy. In contrast, plyometric training focuses on the Stretch-Shortening Cycle (SSC). While plyometrics improve the force of the push-off, they may not necessarily improve the precision of foot placement required to navigate multidirectional paths without losing balance.

Explosive Power: The Dominance of Plyometrics

For the Vertical Jump Test, a direct measure of lower limb explosive power, Group A showed a remarkable improvement. Strength is measured by increased height, and the higher post-test results in the plyometric group confirm its effectiveness. This finding is consistent with the physiological principles of overloading the muscle-tendon unit, training the Series Elastic Component to store and release energy more efficiently.

Why Ladder Drills Lag in Strength

The inferior performance of the ladder group in the vertical jump is explained by the lack of vertical ground reaction force in the training stimulus. Ladder drills focus on movement frequency (speed of feet) rather than amplitude (force applied). While ladder drills contribute to muscle activation rates, they do not provide the mechanical load necessary to induce the hypertrophy or tendon stiffness required for maximal vertical displacement. For amateur female cricketers, the high-impact nature of plyometrics provides the stimulus needed to recruit **Type II fast-twitch fibers**.

The Amateur Female Context

The subjects were amateur players, a demographic with specific physiological needs. The rapid improvement in both groups suggests that novices are highly responsive to neural adaptations. Initial gains in female athletes are often substantial due to neural learning, learning how to fire muscles rather than immediate structural muscle growth.

In this study, the massive agility gain in the ladder group implies that these players likely had inefficient movement patterns at the start. The drills acted as a corrective mechanism, teaching "movement literacy." Additionally, the dynamic stretching inherent in plyometric movements may improve the range of motion in the hip and ankle, contributing to improved jump height and aiding in injury prevention during bowling delivery strides.

Synthesis of Results

The data proves that **Ladder Drills** are the tool of choice for horizontal and lateral agility, while **Plyometrics** are the tool of choice for vertical and explosive power.

- **For a Fielder:** Who needs to move laterally quickly to stop a ball, ladder drills appear more beneficial.
- **For a Fast Bowler or Batter:** Where ground reaction force is paramount for pace or power hitting, plyometrics are indispensable.

Consequently, a holistic training program for amateur female cricketers should periodize both methods. Considerations such as Body Mass Index (BMI) might also dictate which method is introduced first; players may benefit from lower-impact ladder drills to build coordination before progressing to high-impact plyometrics to avoid injury.

CONCLUSION

This research shows that Plyometric Training and Ladder Drill Exercises both significantly improve the physical capabilities of amateur female cricketers, although they focus on different athletic qualities. In Group B's Ladder Drills, agility was determined to be more effective. Enhancing foot turnover and neuromuscular coordination makes them more efficient for the quick direction shifts needed in fielding and running between wickets. Plyometrics (Group A) exhibited a distinct superiority in explosive Strength. By utilising the Stretch-Shortening Cycle, these workouts greatly enhanced vertical leap height, rendering them crucial for high-force movements such as fast bowling and power hitting. Ultimately, a "universal solution" is inadequate for achieving optimal growth. Ladder drills enhance coordination (the steering), while plyometrics develop pure strength (the engine). For optimal performance, coaches and physiotherapists need to create a unified training program that merges both approaches, guaranteeing that female cricketers cultivate the well-rounded attributes of speed, agility, and power essential for contemporary play

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