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Effects of dual task exercise training on reaction time, agility and sprint in cricket players

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Abstract

Background: Cricket demands a harmonious blend of physical agility and cognitive alertness. Skills like quick direction changes, sprinting, and split-second decision-making are vital for optimal performance. Traditional training often emphasizes physical attributes, yet cognitive processing speed and coordination remain under-addressed. Dual-task training where athletes simultaneously perform cognitive and motor tasks aims to bridge this gap, offering a functional and sports-specific enhancement to performance.

Aim: To assess the effect of dual-task exercise training on reaction time, agility and sprint in cricket players.

Methodology: A comparative interventional study was conducted on 60 male cricket players aged 18–27 years. They were randomly assigned into two groups: Group A (dual-task training) and Group B (conventional training). Both groups trained thrice a week for 4 weeks (12 sessions). Pre- and post-intervention assessments were performed using the Alternate Hand Wall Toss Test (reaction time), T-test (agility), and 30-meter sprint test. Data were analysed using SPSS Version 29 with paired and unpaired t-tests.

Results: Group A showed significant improvement in all outcome measures compared to Group B ($p < 0.05$). Dual-task training improved neuromuscular coordination, cognitive-motor integration, and functional agility more effectively than conventional methods.

Conclusion: Dual-task training significantly enhances both physical and cognitive domains, demonstrating superior outcomes in agility, sprint speed, and reaction time. It presents a sports-specific, integrated approach ideal for performance enhancement in cricket.

Keywords: Dual-task training, cricket, reaction time, agility, sprint, cognitive-motor coordination

Introduction

Cricket is a multidimensional sport that demands a combination of motor skills, tactical awareness, and real-time cognitive processing. Players must frequently switch from a resting state to high-speed sprints, change direction, anticipate opponents' movements, and react to the ball all within milliseconds. These tasks require seamless communication between the brain and body. Cricket involves intermittent bursts of high-intensity actions interspersed with periods of low activity, making it metabolically demanding. Players engage in sudden sprints, quick directional changes, powerful arm movements (for bowling and throwing), and reflexive actions such as catching and diving all requiring anaerobic power, explosive strength, agility, and endurance.

Batsmen rely on lower limb power to run between wickets and core and upper body coordination for executing strokes. Bowlers, particularly fast bowlers, depend on eccentric and concentric strength in the quadriceps, hamstrings, glutes, and shoulder complex to generate speed and maintain balance throughout the delivery stride. Fielders require dynamic strength, rapid acceleration, and keen proprioception for effective ground coverage and safe ball retrieval. Cricket incorporates complex biomechanical movement chains involving coordination between multiple joints and muscle groups. Bowling, for instance, is a high-velocity, whole-body action that necessitates spinal stability, optimal pelvic alignment, and explosive lower limb drive. Poor biomechanics can lead to cumulative joint stress, contributing to injury risks in the lumbar spine, knees, and shoulders.

Proper kinetic chain function ensures force is generated efficiently from the ground up and transferred through the trunk to the upper extremity.

Movement efficiency not only improves performance but also reduces compensatory patterns that often lead to overuse injuries.

Traditionally, cricket training has focused on physical conditioning, skill execution, and endurance. However, growing evidence suggests that performance is also highly influenced by an athlete's cognitive functions such as attention, decision-making speed, and coordination. Cricket is classified as an open-skill sport, where players must adapt to constantly changing environments. Whether facing a bowler or fielding in the deep, players make split-second decisions based on visual cues, opponent positioning, and ball trajectory. This demands-Selective attention to filter relevant from irrelevant stimuli, Visual-spatial awareness to perceive ball movement and opponent actions, Reaction time to initiate physical responses accurately under pressure. Maintaining this level of attention throughout extended periods of gameplay introduces mental fatigue, which may impair motor execution and lead to performance decline or injuries. Integrating these two domains motor and cognitive during training may offer athletes a competitive edge.

Dual-task training involves performing two tasks simultaneously typically one motor and one cognitive. This form of training challenges the nervous system, improves central processing, and may better replicate the dynamic, multitask environment of a cricket match. This study investigates the effects of dual-task training on cricket-specific parameters including reaction time, agility, and sprint speed. Given the cognitive and physical demands placed on athletes, dual-task training has gained popularity in performance training and sports rehabilitation. It involves task performing agility drills while solving mental tasks or responding to external cues. This enhances neuroplasticity, improves functional motor control, and reinforces the brain-body connection essential in real-time sports scenarios.

The current study seeks to bridge the gap between traditional skill training and cognitive readiness by evaluating the impact of dual-task exercise training on agility, reaction time, and sprint performance in cricket players. It hypothesizes that blending physical exertion with cognitive load can lead to superior neuromechanical adaptations and improved performance under pressure.

Methodology

An interventional comparative study was conducted on cricket players to evaluate the effect of dual-task exercise training on reaction time, agility, and sprint performance. Ethical approval for the study was obtained from the Institutional Ethics Committee (BNH/0570/2024) and CTRI registration was done CTRI/2025/02/100328.The total duration of the study was one year.

A total of 60 male cricket players were enrolled using convenience sampling. Players were recruited from various cricket academies in Mumbai, including JVPG (Juhu), Shivaji Park (Dadar), and Jolly Gymkhana (Ghatkopar). To be eligible, players had to be between 18–27 years of age and actively involved in cricket training for at least 2 hours a day, 3 days per week, for a minimum of one year. Players with any recent musculoskeletal injuries, neurological conditions, or disorders affecting balance or motor performance within the past 6 months were excluded.

Participants were briefed about the purpose and procedures of the study. After confirming eligibility based on inclusion and exclusion criteria, written informed consent was obtained. Demographic data such as age, height, weight, BMI and training experience were recorded. Players were then assessed for baseline values of the selected outcome measures.

Outcome Measures

The following outcome measures were used for pre- and post-assessment:

1. **Alternate Hand Wall Toss Test (AHWTT):** Assessed reaction time. Players stood 2 meters away from a wall and threw a tennis ball alternately with one hand and caught it with the other for 30 seconds. The total number of successful catches was recorded.
2. **T-Test for Agility:** Evaluated change-of-direction speed. Players performed a T-shaped agility run involving forward sprints, side shuffles, and backpedals around pre-marked cones. The time taken to complete the course was measured using a stopwatch.
3. **30-Meter Sprint Test:** Measured straight-line sprinting speed. Players sprinted from a stationary position for 30 meters, and the time was recorded with a stopwatch from the starting line to the finish line.

Materials Used: Stopwatch, Tennis ball, Cones, Measuring tape, Reaction ball, Agility ladder, Colour-coded cues, Flashcards (numbers, colours, shapes).

Procedure

After baseline assessments, participants were randomly assigned into two groups using the lottery method:

Group A (Interventional Group): Received a 4-week dual-task training protocol combining physical drills with cognitive tasks (e.g., memory recall, colour and number recognition, verbal cues).

Group B (Conventional Group): Underwent routine cricket-specific physical training. Each group completed a total of 12 sessions (3 sessions per week for 4 weeks). Training sessions were conducted on-field under supervision. After completion of the 4-week training period, all participants were reassessed using the same outcome measures.

Exercise Protocol

	Week-1	**Week-2**	**Week-3**	**Week-4**
1.Mirror Drill	3 min			
2.Cone Reaction Drill	2 min			
3.Ball Pass with Specific Player Cues	2 min			
4.Cone Agility with cognitive task	1min			
1.Reaction Ball Drill		3 min		
2.Cognitive Agility Ladder		1 min		
3.Sprint Interval with memory cues		2 min		
4.Ball Dribbling with Reaction Drill		3 min		
1Jump Squats with Backward Counting.			4 min	
2.Lunges with Reaction time			3min	
3.Side Shuffle Hurdle jump			2min	
4.Hurdle jumps with flash card			3min	
1.Push up and tap specific cone				2min
2.Jump Squats with Specific cues				2min
3.Agility and Boundary Drill				3min
4.Hurdle Reaction Drill				5min
All exercises will begin with 10 min warm up And end with 5 min of cool down, rest For 1 min				

Results

All the results were recorded and analysed by using Statistical Package of Social Science (SPSS) software version 29. The results were concluded to be statistically significant with $p<0.05$. Paired t- test was used to compare within the group and independent t-test was used to compare between the groups.

The following table shows the baseline data of the subjects analysed for the study:

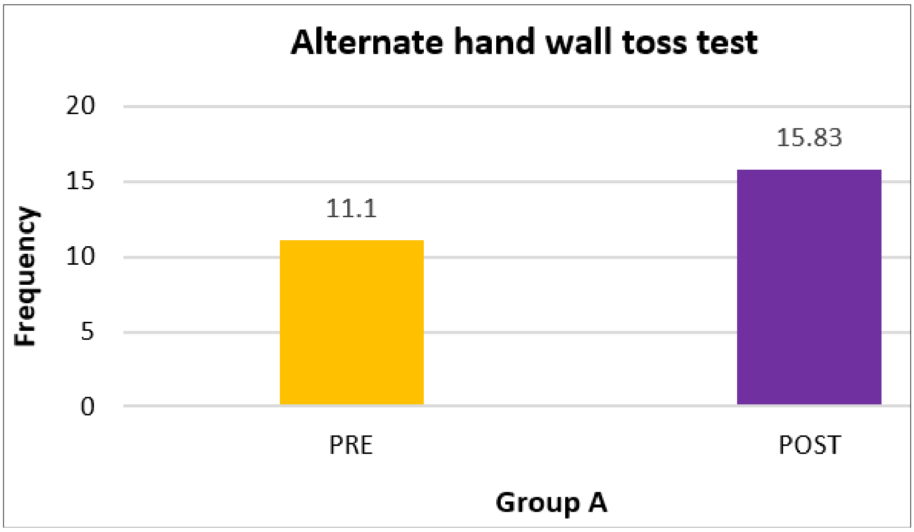
Table 1: Demographic data

Demographic Data	Group A (Mean ± SD)	Group B (Mean ± SD)
Age (years)	25.53 ± 2.416	24.13 ± 3.563
BMI (kg/m²)	22.45 ± 2.31	23.12 ± 2.89
Years of Practice	8.73 ± 3.305	9.67 ± 3.658

Group A: (Interventional Analysis)

Table 2: Analysis of AHWTT for group A

Outcome measure	Pre value	Post value	p-value
Alternate hand wall toss test	11.10 ± 4.46	15.83 ± 5.62	<0.001

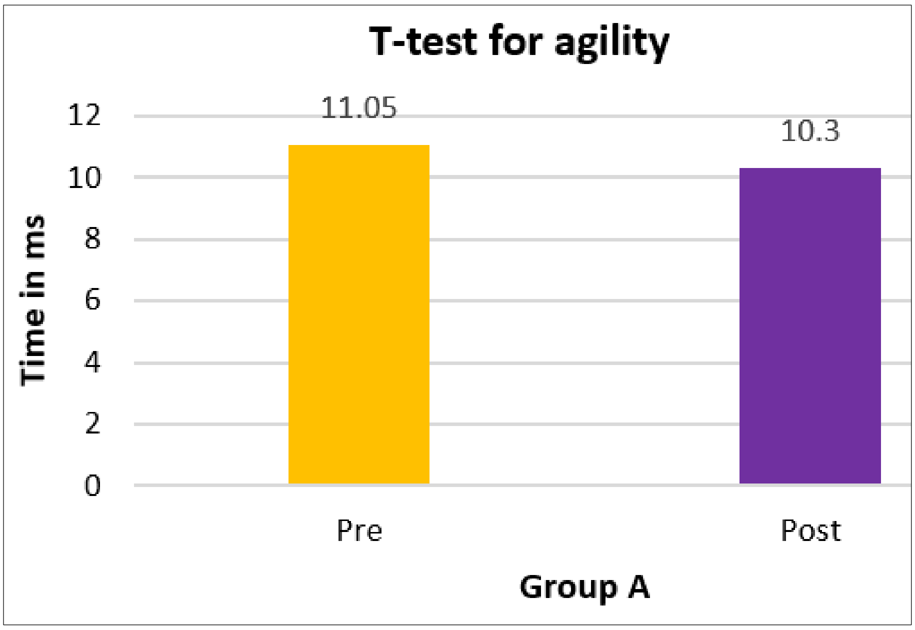


Graph 1: Alternate hand wall toss test result of group A

Inference: Table 2 and Graph 1 represent data analysed for the Alternate Hand Wall Toss Test of Group A. There is a statistically significant difference between pre- and post-values of the Alternate Hand Wall Toss Test in Group A, as $p > 0.05$.

Table 3: Analysis of T-test for agility for group A

Outcome measure	Pre value	Post value	p-value
T-test for agility	11.05 ± 1.35	10.30 ± 1.45	<0.001

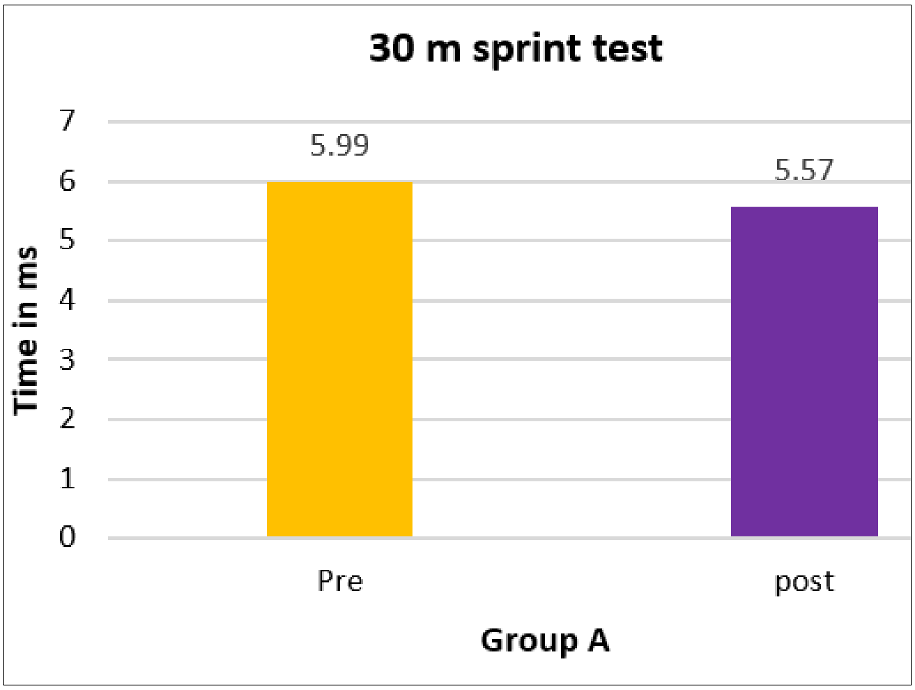


Graph 2: T-test for agility result of group A

Inference: Table 3 and Graph 2 represent data analysed for the T-test for agility of Group A. There is a statistically significant difference between pre- and post-values of the T-test for agility in Group A, as $p < 0.05$.

Table 4: Analysis of 30 m sprint test for group A

Outcome measure	Pre value	Post value	p-value
30 m sprint test	5.99 ± 1.65	5.57 ± 1.59	<0.001

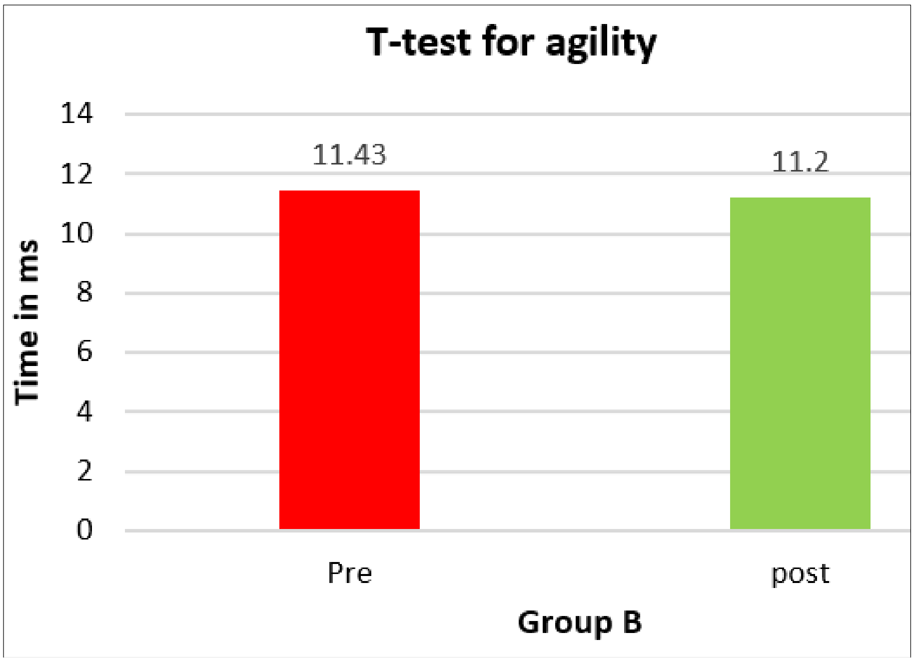


Graph 3: 30 m sprint test result of group

Inference: Table 4 and Graph 3 represent data analysed for the 30m sprint test of Group A. There is a statistically significant difference between pre- and post-values of the 30m sprint test in Group A, as $p < 0.05$.

Table 6: Analysis of T-test for agility for group B

Outcome measure	Pre value	Post value	p-value
T- test for agility	11.43 ± 1.46	11.20 ± 1.48	<0.003

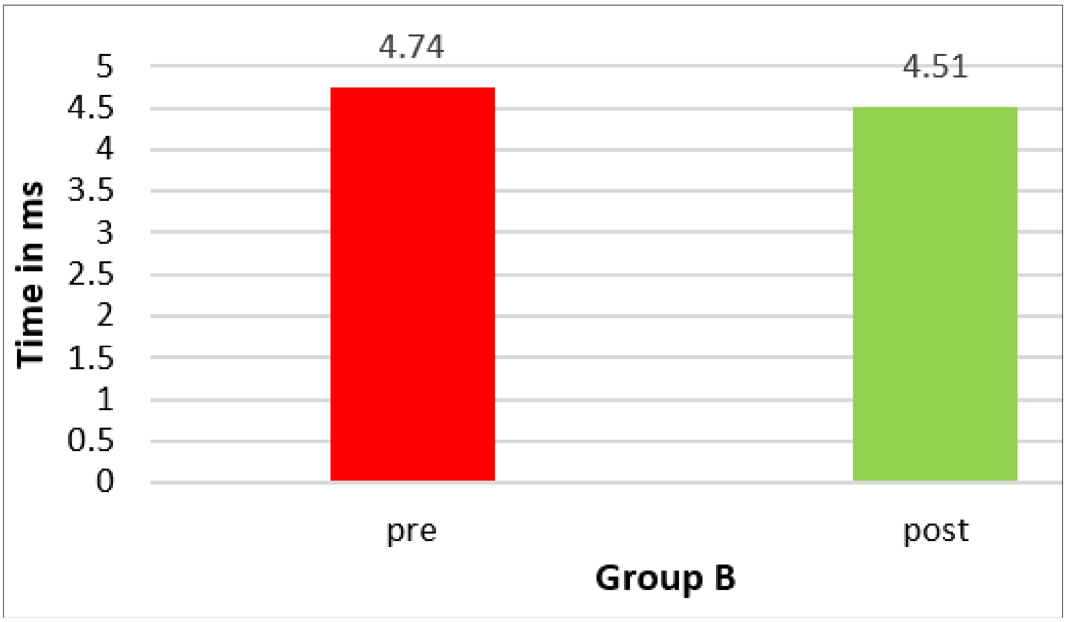


Graph 5: Test for agility result of group B

Inference: Table 6 and Graph 5 represent data analysed for the T-test for agility of Group B. There is a statistically significant difference between pre- and post-values of the T-test for agility in Group B, as $p < 0.05$.

Table 7: Analysis of 30 m sprint test for group B

Outcome measure	Pre value	Post value	p-value
30 m sprint test	4.74 ± 0.59	4.51 ± 0.56	<0.001



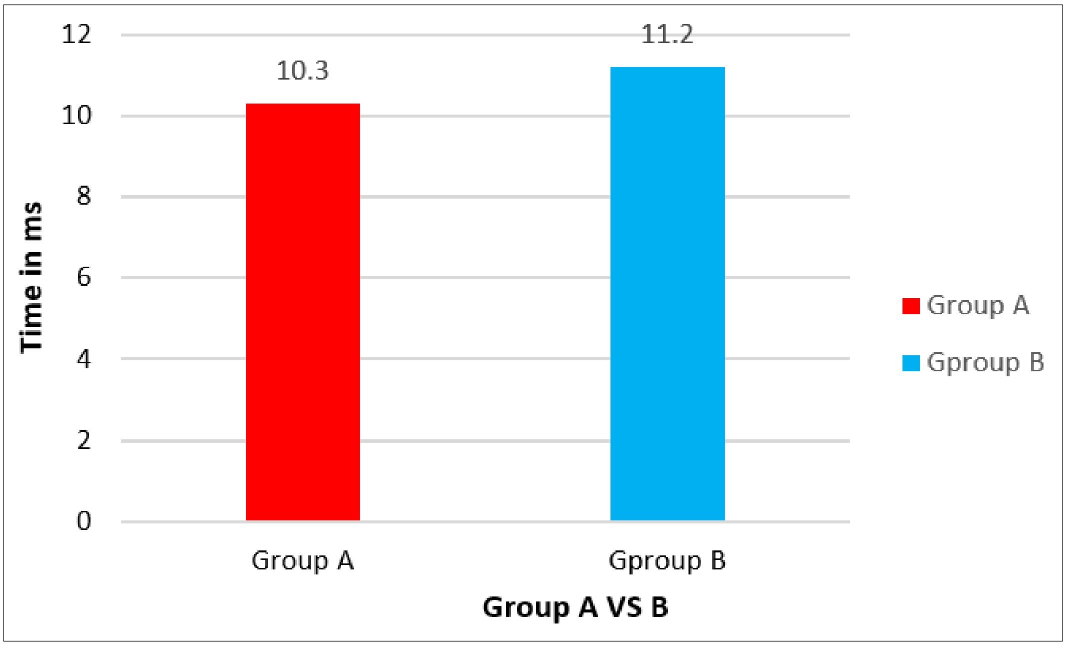
Graph 6: 30 m sprint test

Graph 6. 30 m sprint test result of group B

Inference: Table 7 and Graph 6 represent data analysed for the 30m Sprint Test of Group B. There is a statistically significant difference between pre- and post-values of the 30m Sprint Test in Group B, as $p < 0.05$.

Table 8: Intergroup Analysis of T-test for agility

T-test for agility	Group A	GROUP B	P VALUE
	10.30 ± 1.45	11.20 ± 1.48	0.02

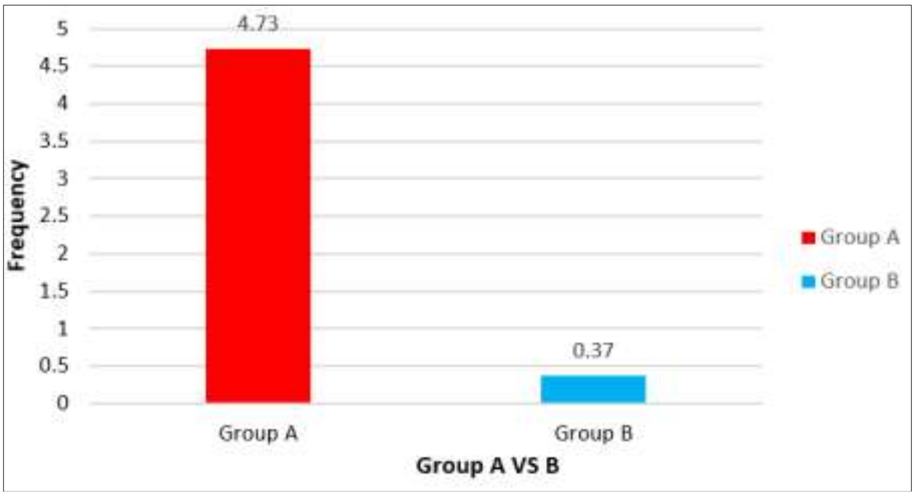


Graph 7: T-test for agility

Inference: There was a statistically significant difference in agility performance between Group A and Group B post-intervention, as p-value <0.05

Table 9: Difference of alternate hand wall toss test between both groups

Alternate hand wall toss test	Group A	GROUP B	P VALUE
	4.73 ± 4.20	0.37 ± 3.38	<0.001

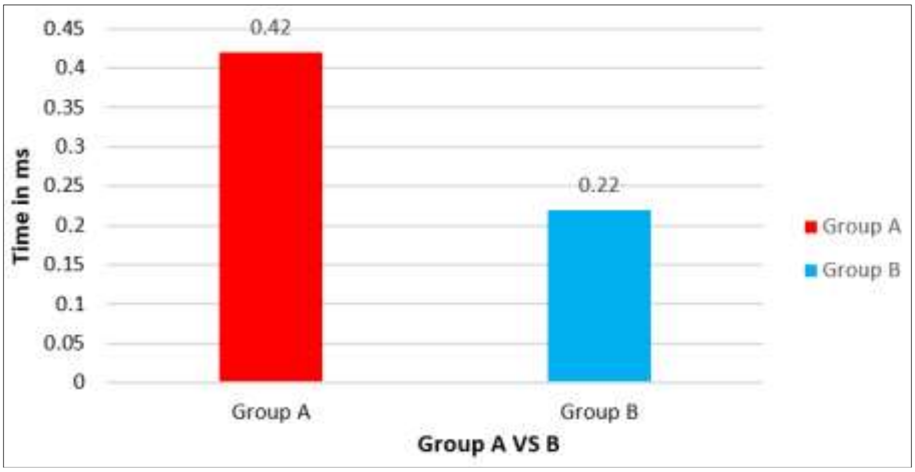


Graph 8: Difference of alternate hand wall toss test

Inference: There was a statistically significant difference in the improvement of alternate hand wall toss test performance between Group A and Group B post-intervention, as p-value = 0.001.

Table 10: Difference of 30 m sprint test between group

30 m Sprint test	Group A	GROUP B	P VALUE
	0.42 ± 0.48	0.22 ± 0.33	0.03



Graph 9: Difference of 30 m sprint test

Inference: There was a statistically significant difference in improvement in 30 m sprint test performance between Group A and Group B post-intervention, as the p-value = 0.03**.**

Discussion

The present study aimed to determine the effect of Dual-Task Exercise Training (DTET) on three key performance parameters - reaction time, agility and sprint in cricket players. Following a structured 4-week intervention protocol, significant improvements were observed in all outcome measures among participants in the dual-task group (Group A) when compared to those who underwent routine cricket training (Group B).

Cricket is a sport that inherently requires players to respond to multiple stimuli simultaneously whether it's anticipating the ball's trajectory, adjusting fielding positions, or making rapid decisions while batting or sprinting between wickets. These demands highlight the importance of cognitive-motor integration, which is often overlooked in traditional training programs. Dual-task training offers a method to simulate these real-game conditions by challenging both the neuromuscular and cognitive systems concurrently.

Reaction Time

The alternate hand wall toss test was used as a reliable measure of reaction time. Players in the DTET group demonstrated a significant improvement in the number of successful catches, indicating faster visual processing and motor response. This aligns with findings from Rajguru *et al*., who reported enhanced reaction time in football players following reaction ball drills integrated with cognitive tasks. The improvement may be attributed to neuroplastic adaptations that occur when the brain is regularly challenged to divide attention and process external cues under physical exertion. The exercises included reaction-based drills such as responding to unpredictable visual and auditory cues while performing agility tasks.

1. **Ball Toss with Cognitive Distraction:** Conducted during Week 2, this drill required players to track a ball while solving arithmetic problems. This exercise enhanced divided attention and quick motor execution by forcing players to multitask effectively.
2. **Reaction-Based Agility Ladder Drill:** Implemented in Week 3, this drill involved navigating an agility ladder while responding to unpredictable auditory cues. It reinforced reflexive decision-making and hand-eye

coordination, essential skills for reacting to fast-paced game situations.

When comparing the DTET group with the conventional training group, the former exhibited superior improvements in reaction time. The conventional training group, which focused on routine cricket-specific drills without cognitive engagement, showed only a marginal reduction in reaction time. This highlights the added benefit of incorporating cognitive elements into physical training. In cricket, where milliseconds can define the outcome of a catch or a run-out opportunity, such enhanced reaction speed is vital.

Agility

Agility was assessed using the T-test, which challenges an athlete's ability to change direction quickly while maintaining control and speed. The DTET group showed a notable reduction in completion time, suggesting improved neuromuscular coordination, balance, and decision-making. The agility gains were further supported by dual-task drills such as cone zig-zag runs with math cues and mirror drills used during the intervention. This enhancement in agility was facilitated by exercises that challenged athletes to make rapid decisions and adjust their movements accordingly.

Group A exhibited greater improvement in agility scores compared to Group B, highlighting the additional benefits of cognitive-motor integration in training protocols.

1. **Direction-Change Sprint with Cognitive Decision-Making:** Conducted in Week 4, this exercise required players to change direction based on randomly displayed color-coded signals. It enhanced reaction-based agility by forcing players to make quick decisions under unpredictable conditions.
2. **Reaction-Driven Cone Drill:** Implemented in Week 4, this drill involved navigating a series of cones while reacting to verbal commands. It reinforced movement adaptability and quick reflexes, crucial skills for fielding and batting in cricket.

These agility drills helped players develop faster decision-making capabilities under unpredictable conditions, a vital skill in sports where rapid adjustments are necessary. Increased Reaction Speed and Cognitive Processing**-** The cognitive demands of dual-task exercises likely enhanced reaction time and decision-making speed, allowing players to anticipate and execute movement transitions more efficiently. This aligns with the principles of neuroplasticity, where cognitive-motor integration strengthens synaptic connections and improves task execution under pressure. Incorporating cognitive stimuli during movement-based drills, such as agility ladders combined with memory recall tasks or cone agility exercises that require decision-making, enhances proprioceptive feedback mechanisms. This leads to more stable and controlled movements, reducing unnecessary deceleration and allowing for fluid transitions during direction changes. These findings are consistent with the study by Grooms *et al*. (2018), which demonstrated that dual-task training enhances cognitive-motor performance, reducing reaction time and improving agility in athletes by fostering better sensory-motor integration and coordination. Motor Learning and Skill Transfer- The specificity of dual-task drills closely mimicked game-like situations, reinforcing motor patterns relevant to cricket. Training under cognitively demanding conditions likely improved an athlete's ability to maintain optimal agility even under match pressure. Whereas in Group B this enhancement in agility was facilitated by their routine exercises, which included skill-based drills, footwork training, and reaction-based sprinting to simulate match conditions. Although Group B's training did not involve dual-task elements, the structured nature of their agility drills still contributed to neuromuscular improvements by refining fundamental movement mechanics and enhancing muscle coordination.

Sprint Performance

The 30-meter sprint test was used to evaluate straight-line speed and acceleration. Players in the dual-task group exhibited a significant reduction in sprint time compared to those in the conventional group. These gains can be linked to dual-task activities that challenged players to execute physical tasks such as sprinting while simultaneously solving problems or responding to unpredictable visual/auditory cues.

This enhancement in sprint speed was facilitated by exercises that focused on explosive power and neuromuscular coordination.

1. **Reaction-Based Sprint Start:** Conducted in Week 3, this drill required players to react to randomized visual cues before sprinting. It reinforced explosive power and reflexive acceleration, essential for quick bursts of speed in game situations.
2. **Cognitive Sprint Interval:** Implemented in Week 4, this exercise involved sprinting while simultaneously recalling a series of number sequences. It improved neuromuscular coordination and mental processing speed, allowing athletes to maintain focus while sprinting.

These sprint drills helped enhance players' acceleration and sprinting mechanics, leading to better performance in match situations where quick bursts of speed are necessary. Enhanced Explosive Power and Muscle Activation-Sprinting relies on the rapid activation of fast-twitch muscle fibers in the quadriceps, hamstrings, and gastrocnemius.

Increased sprint performance may be a result of enhanced motor planning, anticipatory postural adjustments, and neuromuscular recruitment, which were trained in a cognitively demanding environment. Such improvements are crucial in cricket where quick starts and stops determine successful running between wickets or chasing the ball in the field.

This study reinforces the importance of integrating cognitive challenges into physical training for athletes. As cricket continues to evolve, especially in faster-paced formats like T20 and IPL, players must perform under mental fatigue and cognitive load. DTET addresses these demands by preparing athletes not only to move quickly but to think quickly while moving**.**

Additionally, the results of this study provide insights for coaches, trainers, and physiotherapists aiming to design sports-specific conditioning programs that reflect actual match conditions and enhance overall player resilience.

Conclusion

The study concluded that Group A (dual-task training group) had significant effect on alternate hand wall toss test, T test for agility and 30 m sprint test ($p<0.05$) Whereas Group B (conventional training group) also demonstrated statistically significant improvements in agility and sprint speed (p<0.05) whereas, failed to show any statistically significant improvement in reaction time (p=0.558).However, when intergroup analysis was done, the dual-task training group A showed superior statistically significant improvements in all outcome measures as compared to group B. Therefore, this study concludes that incorporating dual-task training alongside conventional cricket training can significantly enhance reaction time, agility, and sprint performance in cricket players.

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