

**“Effect of Core Stabilization and Core Strengthening exercise on speed,
coordination and reaction time in Field Hockey Players”**

By

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In

SPORTS

Under the guidance of

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ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE

Bhubaneswar, Odisha 2023-2025

Odisha University of Health Science

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I hereby declare that this dissertation/thesis entitled “**Effect of Core Stabilization and Core Strengthening exercise on speed, coordination and reaction time in Field Hockey Players**” is a bonafide and genuine research work carried out by me under the guidance **Senior assistant Professor of department of Neuroscience, ABSMARI** and there is no conflict of interest associated with this dissertation work.

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This is to certify that the dissertation entitled “**Effect of Core Stabilization and Core Strengthening exercise on speed, coordination and reaction time in Field Hockey Players**” is a bonafide research work done by **Sanskriti Rajurkar** under the guidance of **Dr Asma Parveen, Senior assistant Professor, ABSMARI.**

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LIST OF ABBREVIATIONS USED

1	SD	Standard Deviation
2	p value	Significant value
3	M	Male
4	F	Female
5	40m sprint	40metre sprint
6	ONTHPC	Odisha Naval Tata High performance centre
7	ABSMARI	Abhinav Bindra Sports Medicine and Research Institute.
8	Group A	Control group
9	Group B	Core strengthening and stabilization group
10	N	Number of participants
11	Df	Degree of freedom
12	t value	Student t test statistics value

ABSTRACT

Title: Effect of Core Stabilization and Core Strengthening exercise on speed, coordination and reaction time in Field Hockey Players.

Background and objective: Skill related components can be stated is ability to maintain high level of performance on the playing Hockey. Speed, co-ordination and reaction time has direct relationship with core training. Aim of the study is to find the effect of core strengthening and core stabilization on speed, coordination and reaction time in professional hockey players is a interconnection between the upper limb and lower limb of the human body. A strong core can lead to improve performance of lower limb as well as upper limb which can affect speed, coordination, reaction time. There is paucity of research on core training on speed, coordination, reaction time in field hockey players.

Method:32 participants took part in the study, of which 16 were group A is Core strengthening and stabilization group and 25 were B regular core training protocol. is there were randomly assigned.

Results: Experimental group demonstrated significant improvements in all measured parameters. These findings highlight the multidimensional role of core training in enhancing athletic performance.

Conclusion: Incorporating structured core stabilization and strengthening exercises into regular training routines significantly improves speed, coordination, and reaction time in field hockey players.

KEYWORDS: Core stabilization, Core strengthening, Field hockey, Speed, Coordination, Reaction time, injury prevention.

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1. Introduction

Hockey is a fast-paced, exciting sport played by both men and women around the world, from casual weekend games to the grand stage of the Olympics. Beyond the thrill of competition, playing hockey regularly can be great for your health, offering the benefits of consistent physical activity. But like any demanding sport, it comes with its fair share of risks. In fact, studies have shown that up to 75% of field hockey players have experienced at least one injury during a game or practice.^[1] And while injuries are part of almost any sport, they can have personal consequences for the player—and even broader impacts on healthcare systems and communities.^[2] What makes hockey particularly intense is the way it's played. It's a team sport that demands constant movement—sprinting, sudden stops, sharp turns, and quick changes in direction—all while staying focused on controlling the ball and outplaying the opponent. It's no surprise, then, that injuries are fairly common. Around 40% of them involve issues like ankle sprains, muscle strains in the hamstrings and quads, meniscus damage, ligament sprains in the knee, or even fractures in the lower legs. To compete at a high level in hockey—or any sport—physical fitness plays a key role. Fitness isn't just about endurance or strength; it also includes skill-based components like agility, balance, coordination, power, speed, and reaction time. These elements help athletes move more efficiently, react faster, and stay sharp during the game. Training the core muscles, for example, is great for building strength and stability but translating that into faster sprints or sharper ball control depends on how well that strength is applied through sport-specific practice.^{[3][4]} Coordination testing such as the stick flip test evaluates fine motor control and hand-eye coordination. Effective force transfer and trunk control are foundational to upper-limb tasks; hence, core strengthening could indirectly improve stick flip performance by providing a stable base for accurate wrist and arm

movement^[5]. Similarly, the ruler drop test (stick drop) assesses simple reaction time. Improved reaction time typically arises from enhanced neuromuscular processing and motor coordination^[6]. Core training is not directly studied with reaction time; the neuromuscular adaptation will improve motor unit recruitment which leads to stability, can reduce extraneous movements and allow for, more efficient limb response.

Core training which has gathered attention recently affects the daily living and rehabilitation rate. The core is the unit formed by waist, pelvis and hip. As the intermediate ring of the human body the term refers to the area below the shoulder joint, including the pelvis and above the hip. Core strengthening is thoughtfully structured beginning with activation, progressing through stabilization and integration and culminating in perturbation and it cultivates a resilient athlete whose trunk can reliably transfer force, maintain control in extreme positions, and rapidly react to dynamic triggers.^[8] These adaptations bolster sprint efficiency, make coordination during high-speed technical play more precise, increase reaction time to opponents and game events, and collectively decrease injury risk through reinforced proximal stability and neuromuscular control.^[21] Ultimately, for field hockey players, the strategic incorporation of core training not in isolation, but as part of a holistic athletic development plan yields a powerful dual benefit which include enhancement of performance and protective resilience on the field. Core muscle composes of two muscle fibres: slow twitch fibre and fast twitch fibre. Slow twitch fibres comprises of muscle like transversus abdominus, multifidi, internal oblique, deep transversus spinalis and pelvic floor muscle. Fast twitch fibres include erector spinae, external oblique, rectus abdominis and quadratus lumborum. A strong core muscle not only makes the body more efficient but also plays a key role performing an integrated motor

function that delivers the force generated in trunk, pelvis and hip to the limb.^{[22] [23]} It can also improve physical balance develop neural control the function of muscle, coordination skill. Proprioception and others type of muscular strength. While the studies demonstrated the positive effect of core training on the physical strength of athletes they show different result regarding the effect of sport specific performance reported that core training improved core endurance and maximal isometric strength in hand ball players. However it did not improve not improve throwing speed which is important in performance. In soccer player core training can improves showed that it can improve agility but not speed. And a study on badminton players improve balance but not agility of the players. Speed, coordination and reaction time has direct relationship with core training.^[25] Core training improve balance and posture which improves coordination. Strong core improves power transfer which increase speed, it enhances quicker change in direction which improve reaction time^[26]. 40 m sprint test is used to measure speed which is one of the important physical fitness component used for improving hockey players sports performance with good reliability of 0.92 - 0.96.^[22] Regarding anaerobic performance relevant to sprinting and explosive efforts, a randomized controlled trial comparing progressive core stabilization training (PCST) versus standard core strengthening in elite athletes showed that PCST improved measures like anaerobic capacity and vertical jump—traits relevant to acceleration and explosive speed. For field hockey players translating improved anaerobic power to better 40 m sprint times seems plausible, particularly when added with targeted drills.

“Core strength helps virtually everything... I felt a lot faster... core workouts legitimately help speed,” attributing improved speed to core conditioning Another user describing

football performance improvement noted, “It improved my reaction time massively,” attributing this to core training. The synthesized evidence from meta-analyses, sports science reviews, and related field interventions suggests that core stabilization and core strengthening exercises contribute meaningfully to performance through multi-faceted pathways it improved force transfer and trunk stability enabling better acceleration and sprint mechanics (potential improvements in 40 m sprint).Enhanced neuromuscular control and coordination, underpinning precise motor tasks like stick flipping.Supports reactive motor responses by reducing extraneous movement and stabilizing limbs, potentially improving ruler drop (reaction time).Augments change-of-direction speed, especially in younger or less-skilled athletes, which is directly relevant to agility and sprint performance in field hockey. From a mechanistic standpoint, the core serves as a central link in force transmission between the lower and upper body optimized postural stability can enhance the athlete’s ability to generate and transfer power efficiently during sprinting or multi-directional movement. Unilateral and functional core exercises, by engaging stabilizing muscles and promoting neuromuscular control, may further elevate this force transfer capacity, potentially resulting in faster accelerations and more precise coordinated movements. Notably, although force transfer was not directly measured in that specific field hockey–related study, the observed strength gains suggest potential improvements in speed and reactive force development. Meanwhile, although no study has directly measured changes in reaction time via the ruler drop test (stick drop), core stability has been linked with enhanced neuromuscular control, which arguably supports faster motor response and coordination.Further reinforcing core training’s relevance, progressive core stabilization regimes have proven beneficial for neuromuscular function following ACL

reconstruction—improving hip strength, core endurance, and landing mechanics. Although not directly related to field hockey, this demonstrates how enhancing core function can refine movement quality and control, which likely manifests as improved coordination and reaction during sport-specific tasks like stick flipping or reactive catching.

Performance enhancements also serve as protective mechanisms against injury. Improved postural and dynamic Core stability lowers the risk of injuries, especially to the lower back, hips, and knees, by ensuring that proximal segments (the trunk and pelvis) effectively manages the load and coordinate with distal segments. Research on athletes after ACL reconstruction demonstrated that core stability and strengthening exercises significantly enhances core endurance, hip strength, and landing mechanics specifically increasing knee flexion angles and reducing knee valgus during single-leg landing thereby directly lowering known risk for re-injury. From a structural view, core strengthening enhances superior trunk control, thereby minimizing lateral trunk motion during weight-bearing tasks, which is particularly relevant in hockey's frequent low and dynamic postures. Excessive lateral trunk movement can increase the lever arm at the knee, increasing valgus stress and raising the risk of ACL injury imbalances corrected through structured core interventions. Programs implementing the “Core Four Pyramid Principle” that are activation, stabilization, integration, perturbation which aim to progressively enhance control from breathing and bracing fundamentals to dynamic perturbation control hereby gradually equipping athletes to sustain complex trunk control in chaotic match conditions, reducing injury risk while reinforcing reactive stability. In the context of field hockey, where explosive acceleration, rapid lateral movements, and reactive stick techniques are constant, these core improvements synergistically amplify performance and safeguard

against common injuries. Enhanced core endurance ensures athletes maintain optimal trunk posture throughout matches, limiting fatigue-related breakdowns that increase hamstring, groin, or lower-back strains. Better coordination reduces faulty biomechanics during high-speed movements lowering the likelihood of muscle pulls or joint overuse injuries. Improved reaction time enables quicker stabilization during imbalanced plays, preventing falls or awkward collisions.

Need of the Study

- Hockey is a national sport of India which is played by men and women at every players ranging from junior to professionals players. It requires various movement pattern of combine upper limb and lower limb like jumping, running, stepping, hitting goals, handling the ball, Stick coordination, etc.
- This all movement require a great skill related fitness components of an individual like balance, coordination, reaction time to a spectacular performance of an individual.
- Core is a interconnection between the upper limb and lower limb of the human body. A strong core can lead to improve performance of lower limb as well as upper limb which can affect agility, power, balance, speed, coordination, reaction time.
- So a strong upper limb, lower limb and core can lead to decrease risk of injuries which aids the players to contribute to the game more effectively
- There is paucity of research on core training on balance, coordination, reaction time in hockey players.

2. Aim & Objectives

Aim of the study

- To find the effect of core strengthening and core stabilization on speed, coordination and reaction time in professional hockey players.

Objective of the study

- To determine the effect if core stabilization and core strengthening on speed in professional hockey players by using 40m Sprint test.
- To determine the effect if core stabilization and core strengthening on coordination in professional hockey players by using stick flip test.
- To determine the effect if core stabilization and core strengthening on reaction time in professional hockey players by using ruler drop test.

3. Hypothesis

Null Hypothesis

H⁰1- There will be no effect of Core stabilization and core strengthening exercise on speed, coordination and reaction time in field hockey players.

H⁰2- There will be no effect of Core stabilization and core strengthening exercise on speed, coordination and reaction time in field hockey players

H⁰3- There will be no effect of Core stabilization and core strengthening exercise on speed, coordination and reaction time in field hockey players

Alternate hypothesis:

H¹1- There will be significant effect of Core stabilization and core strengthening exercise on speed in field hockey players.

H¹2- There will be significant effect of Core stabilization and core strengthening exercise on coordination in field hockey players

H¹3- There will be significant effect of Core stabilization and core strengthening exercise on reaction time in field hockey players

4. **Review of Literature**

1. **Sharma, Hanjabam B.; Kailashiya, Jyotsna** Effects of 6-Week Sprint-Strength and Agility Training on Body Composition, Cardiovascular, and Physiological Parameters of Male Field Hockey Players.2019.Body weight , body mass index, percentage body fat, lean body mass, resting heart rate, resting blood pressure, resting double-product, P/power (using Running-based Anaerobic Sprint Test), vertical jump, seated shot put test, ball-hitting speed, Tm , and VO2max were measured, and changes (d) after specified training regime were studied. Change in VJ (dVJ) was associated with change in Tm (dTm); change in SP (dSP) with change in VO2max, which also related to change in rHR, rBP and rDP. Change in BS (dBS) was more among those with lower initial BW, BMI, and BF. dBS, along with change in VO2max/LBM, was more mainly among those with lower initial anaerobic-aerobic fitness.
2. **Kuan Dong,Tenghao Yu and Buongo Chun.** Effects of Core Training on Sport-Specific Performance of Athletes: A Meta-Analysis of Randomized Controlled Trials.2023.Pubmed. The purpose of this study was to investigate the effect of core training on the sport-specific performance of athletes through a meta-analysis. Relevant studies on randomized controlled trials were selected, and they calculated the effect size using standardized mean difference values and the random effects model. Results showed that core training had almost no effect on athletes' power and speed, while agility showed a medium effect size but no statistical significance. On the other hand, there was a large effect on general athletic performance, such as core endurance and balance. This result implies that more elaborate core training programs should be designed to improve the sport-specific performance of athletes.

3. **Yusuke Wada, Koji Kaneoka, Masahiro Takemura, Yuki Yamamoto** The effect of core stability exercise on the reaction time of deep trunk muscles 2020. The study has 2 group Patient with core training and one group with no training of core stabilization exercise 2-week exercise intervention has a lower value after 2 weeks due to an improvement of neuromuscular function by the central nervous system, and an immediate effect could not be obtained with the same exercise as at the time of intervention.

4. **Senthilkumar Ramasamy, John Franklin, Pitchaimani Govindhara.** The effect of core training on dynamic balance and strength endurance in junior field hockey players endurance in junior field hockey players.2022. Baltic journal of health and physical activity. The study was conducted with 30 regular junior hockey players (15 in the control group and another 15 in the experimental group). The modified Star Excursion Balance Test (mSEBT) and Biering-Sorensen muscle endurance tests were used , the players in the experimental group performed the core muscle strength training daily for 45 minutes per session for eight weeks. The result showed The mSEBT had a higher mean score in the experimental group, right limb (97.6%) and left limb (97.9%), than the control group right limb (91.7%) and left limb (92.6%). The mean endurance time in the experimental group had a higher endurance time of (135.4 sec) than the control group (176.2 sec). This study showed that core muscle strengthening exercises enhance the dynamic balance and endurance in junior field hockey players.

5. **Urs Granacher, Jörg Schellbach, Katja Klein, Olaf Prieske, Jean-Pierre Baeyens, and Thomas Muehlbauer.** Effects of core strength training using stable versus unstable surfaces on physical fitness in adolescents: a randomized controlled trial. 2014. This randomized controlled study specifically investigated the effects of core strength training performed on stable surfaces compared to unstable surfaces on physical fitness in school-aged children. Twenty-seven (14 girls, 13 boys) healthy subjects (mean age: 14 ± 1 years, age range: 13–15 years) were randomly assigned to a CSTS ($n = 13$) or a CSTU ($n = 14$) group. Significant main effects of Time (pre vs. post) were observed for the TMS test (8-22%, $f = 0.47-0.76$), jumping sideways test (4-5%, $f = 1.07$), and the Y balance test (2-3%, $f = 0.46-0.49$). Significance were found for the standing long jump test (1-3%, $f = 0.39$) and the stand-and-reach test (0-2%, $f = 0.39$).
6. **Jeppe F Vigh-Larsen, Marko T Haverinen.** 2021. The study had 199 players performed off-ice tests (countermovement jump height (CMJ) and body composition) and on-ice tests (5-10-5 Pro Agility test, 30-m sprint test and the maximal Yo-Yo Intermittent Recovery Ice Hockey test) for assessment of aerobic capacity. No overall correlations between age and performance were present except small-moderate positive associations between age and body- and muscle mass ($r = 0.24-0.30$, $P \leq 0.05$). The youngest age group (YOU; 18-21 years) were 4-9% lighter than all other age groups and possessed 7% less muscle mass compared to the oldest players (OLD; 30-33 years) ($P \leq 0.05$). OLD were 2-3% inferior to the second youngest (SEC; 22-25 years) and mid-age group (MID; 26-29 years) in sprint and agility in addition to a 6-10% lower CMJ height ($P \leq 0.05$).

7. **Shengyao Luo, Kim Geok Soh**, Effect of core training on skill-related physical fitness performance among soccer players: A systematic review. 2023. The study aims to present an in-depth review of the available literature on the effect of core training on skill-related physical fitness performance among soccer players, as well as to offer suggestions for researchers and coaches. The data in this study were presented based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline. Using scientific databases and web search engines including Scopus, Ebscohost, Web of Science, PubMed, and Google Scholar, researchers collected studies from the published literature. Only 26 of the 84 articles satisfied all the inclusion criteria and were thus included in the systematic review. The quality of each study was determined using the PEDro scale. The scores for 26 studies range between three and six. Core training can improve soccer players' skill-related physical fitness, including their power, speed, balance, and agility.
8. **Dennis G. Parra, Darwin D. Ofrin**. Hiit (High Intensity Interval Training), Calisthenics and Plyometric Exercises, and the Secondary Schools Athletes' Skills Related Physical Fitness Components: Basis for Training Routine Exercises Plan. The study involves three groups of athletes participating in a 6-week group exercise experiment. Each group engages in a specific exercise type: calisthenics, plyometrics, or high-intensity interval training. Incorporating these three exercise proves to be effective in augmenting the skill-related physical fitness components of athletes. The study recommends integrating HIIT, calisthenics, and plyometrics into training routines to improve overall performance

9. **Ahmet Atlı**, The Effect of a Core Training Program Applied on Football Players on Some Performance Parameters 40 football players, aged between 18 and 24 years old, who regularly trained in football and were from various amateur football teams participated: 20 athletes in the training group and 20 athletes in the control group. It was taken the pre-test measurements of the athletes' vertical jump, 30-m speed, agility, and flexibility; after the 6-week core training program, which was applied three days a-week, and it was taken the post-test measurements of the athletes. the 6-week core training program that was applied to football players improved the performance of vertical jump, 30-m speed, agility, and flexibility.
10. **Prieske O, Muehlbauer T, Borde R, Gube M, Bruhn S, Behm DG, et al.** Neuromuscular and athletic performance following core strength training in elite youth soccer: Role of instability. the purpose of the study was to investigate changes in neuromuscular and athletic performance following core strength training performed on unstable (CSTU) compared with stable surfaces (CSTS) in youth soccer players. Thirty-nine male elite soccer players (age: 17 ± 1 years) were assigned to two groups performing a progressive core strength-training program for 9 weeks (2-3 times/week) in addition to regular in-season soccer training. Statistical analysis revealed significant main effects of test (pre vs post) for trunk extensor strength (5%, $P < 0.05$, $d = 0.86$), 10-20-m sprint time (3%, $P < 0.05$, $d = 2.56$), and kicking performance (1%, $P < 0.01$, $d = 1.28$). No significant Group \times test interactions were observed for any variable. In conclusion, trunk muscle strength, sprint, and kicking performance improved following CSTU and CSTS when conducted in combination with regular soccer training.

11. **Reed CA, Ford KR, Myer GD, Hewett TE.** Core stability and its relationship to lower extremity function and injury. Core stability training, operationally defined as training focused to improve trunk and hip control, is an integral part of athletic development, yet little is known about its direct relation to athletic performance. Studies were evaluated using the Physical Therapy Evidence Database (PEDro) scale. The 24 articles were separated into three groups, general performance (n = 8), lower extremity (n = 10) and upper extremity (n = 6), for ease of discussion. In the majority of studies, core stability training was utilized in conjunction with more comprehensive exercise programmes. As such, many studies saw improvements in skills of general strengths such as maximum squat load and vertical leap.

12. **Saki F, Tahayori B, Abbasi L, Mokhtarinia HR.** Effect of core stability training on dynamic balance and knee kinematics during single-leg drop landing after ACL reconstruction. Twenty-six male athletes (20-30 years old) with a history of ACL surgery with hamstring tendon autograft were randomly divided into training (n = 13) and control groups (n = 13). .. The training group showed a significant increase in core endurance, hip abductor and external rotator strength, knee flexion angle, and a significant decrease in the knee valgus angle during single-leg landing in post-training tests compared to their baseline tests ($P < 0.05$). Our results demonstrated that core stability exercise alters neuromuscular function to a level that is clinically acceptable and statistically significant. Because of the high incidence rate of secondary ACL injury after ACLR, it is recommended that athletes with a history of ACLR benefit from adding core stability exercises to warm-up routines or tertiary prevention program.

13. **Ramasamy S, Srivastava A, Shukla N, Agarwal N, Sharma D.** Effect of core strengthening and ag By preparing the body holistically, safely, and effectively, core strengthening promotes balance and postural control. Hypothesis: It is hypothesized that there will be no effect of core strengthening and agility training on balance of cricketers. Methodology: The study was a single group pre-test post-test quasi experimental design. The study recruited 12 participants, between the age of 21-26 years and were recreational cricket players. The study recruited both male and female recreational cricket players with the % of males being 57% and females being 43%. The pre-test and post-test analysis was done using the Y-balance test. The intervention was divided into three broad sections warm up phase, training phase and cool down phase. Results: The normality testing of the data showed normal distribution. Thus, paired t-test was applied to obtain the difference between pre-test and post-test value scores. There was significant difference between the pre-test and post-test values (p -value <0.05).

14. **Willardson JM.** Core stability training: applications to sports conditioning programs. In recent years, fitness practitioners have increasingly recommended core stability exercises in sports conditioning programs. Traditional resistance exercises have been modified to emphasize core stability. Such modifications have included performing exercises on unstable rather than stable surfaces, performing exercises while standing rather than seated, performing exercises with free weights rather than machines, and performing exercises unilaterally rather than bilaterally. Despite the popularity of core stability training, relatively little scientific research has been conducted to demonstrate the benefits for healthy athletes. Therefore, the purpose of this review was to critically examine core stability training and other issues related to this topic to determine useful applications for sports conditioning programs.

15. **Bashir M, Khan M, Ali S, et al.** Enhancing physical fitness in elite field hockey players through functional training. *J Sports Sci Med.* 2024 This systematic review aims to illuminate the effects of functional training on sprinting, jumping, and functional movements in athletes. The Physiotherapy Evidence Database (PEDro) scale was used to measure the methodological quality of the studies included in the systematic review. Results: From a total of 220 studies, 15 included ones met all eligibility criteria and were scored between 4-5 points—considered as “moderate quality”—by the PEDro scale. squat jump, vertical jump, and countermovement jump due to the short duration and frequency of the training, as well as the lack of additional exercises that come with the interventions. Furthermore, the reviewed studies reveal that there is limited research within the literature on 5, 15, 25, and 50 m sprinting, squat jump, quadrant jump, and functional movement in athletes. Conclusion: Although the length of training interventions varied across studies in this systematic review, functional training interventions were found to help improve athletes’ performance.

5. Methodology and Procedures

Methodology

- Study design: Randomized

Control Trial

- Sampling: Purposive sampling
- Sample size: 32
- Study Duration: 1 year

➤ **Inclusion criteria**

- Professional hockey players- Playing hockey 5days/week,
- Players consider as physically fit by the coaches,
- Male and Female,
- Mc Gill Core endurance test should be fair to good,
- Age- 18 – 30.

➤ **Exclusion criteria**

- Players playing other sports beside hockey,
- Any Concussion or High grade injury within 6month
- Any severe abdominal injury

Participants :

32 players took part in the study with 16 in core strengthening and core stabilization group A and 16 in Group B in regular core training group. The mean age of the participants were 18 and 19 respectively. The participants were recruited from ONTHPC

Ethical Statement: The research met all applicable standards for ethics and was approved by the ABSMARI ethical committee Bhubaneswar.

Materials Used

Stopwatch, 40m track, Sticks, Ruler.

Outcome measures

- MC Gill Core test
- 40m sprint test
- Stick flip test
- Ruler drop test

Procedure

- Ethical approval was gathered from ethical committee.
- Samples for the study is taken from OTHPC.
- Each participant was informed about the study procedure. Before commencing the study, a detailed briefing and written consent were obtained from all 32 participants.
- All athlete had gone through MC gill core endurance test from these 32 hockey player were recruited.
- Pre data for speed, coordination and reaction time.
- The subjects recruited had practiced Core strengthening and core stabilization training. Group allocation was conducted using a randomized Singe blind method.

Group A: 16 subjects were placed : For core strengthening and core stabilization.

Group B:25 subjects were placed : Regular core training

- Core training program was given to the group A and Group B for 4 week and after 4week Post data was calculated
- Data was statistically analyzed using SPSS Software and Result for the study was formed .

Exercise protocols

Treatment time:- 15min - 30min

Frequency: 3session / week

Intensity:- 10 Rep.

Type :- Core strengthening and core stabilization exercise

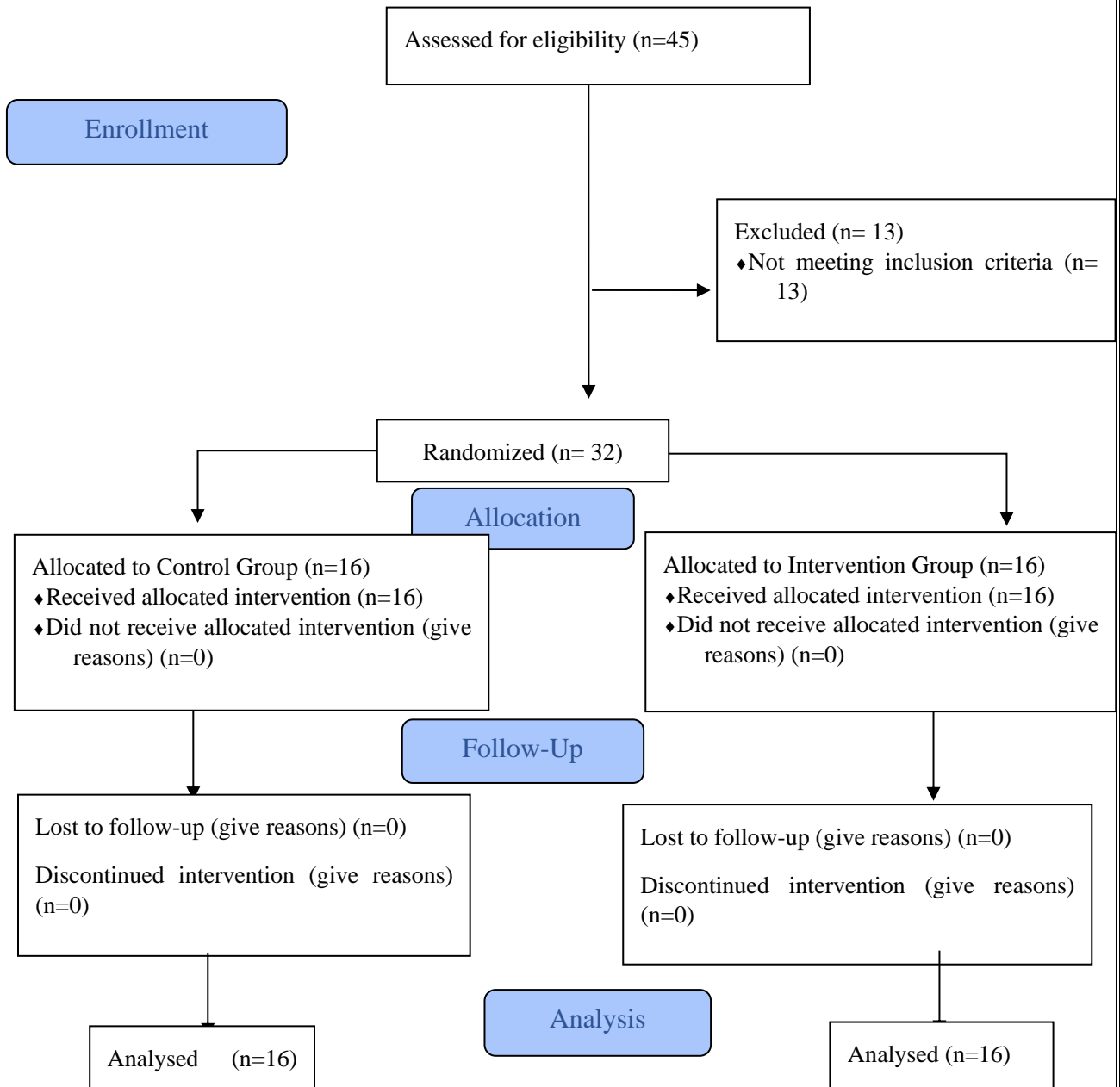
Time:- 4week = 4*3= 12 Sessions.

1 st week	2nd week	3rd week	4th week
Abdominal Drawing	Abdominal Drawing with heel slide	Abdominal Drawing with both heel slides	Abdominal Drawing with Straight leg raise
Abdominal drawing in with crunches	Abdominal drawing in crunches with hand behind head	Bicycle crunches for 60sec	Bicycle crunches for 120sec
Scissors 90degree	Scissors 60degree	Scissors 30degree	V hold and scissors 30degree
Birdog Quadriped	Birddog with abdominal drawing in	Birddog with planks	Birddog with planks
Plank 1min	Plank with abdominal drawing in	Plank with alternate leg raise 30sec	Plank with alternate leg raise 1min Side plank
Commando 30sec	Commando 1min	Burpes	Burpes + kettle bell walking (2min)

Table1:- Core strengthening and stabilization exercise regime

FLOW CHART

CONSORT 2010 Flow Diagram





Abdominal Crunch



Right side Plank



Single leg Plank



Burpes

6. Statistical Analysis

Data Analysis

- Data was entered in Microsoft Excel 2021 and analyzed using IBM SPSS version 27.
- Descriptive Statistics (mean, standard deviation) were used for demographic and outcome measures.
- Paired student t test was applied to compare pre and post intervention value of Mc gill core endurance test, 40m sprint test, Stick flip test and ruler drop test.
- A p value < 0.05 was considered statistically significant.
- Graphical representation (bar graph, line graph) were prepared using Excel.

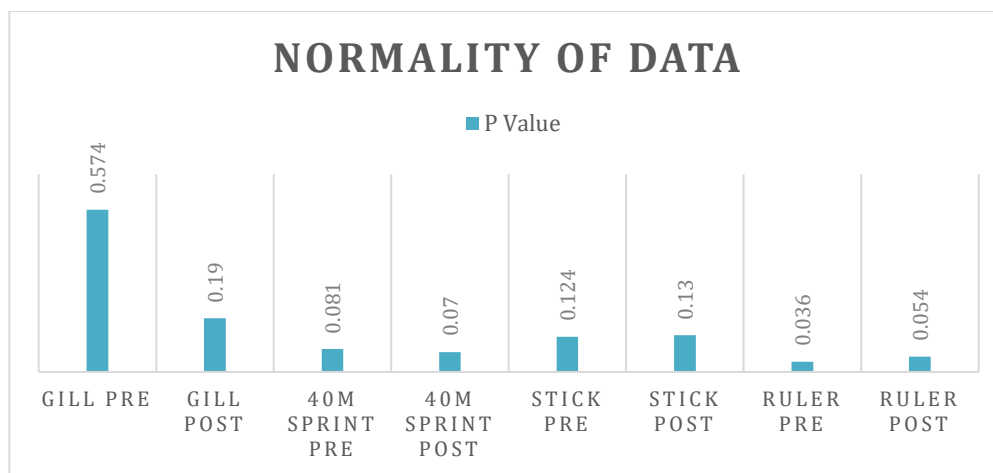
Statistical tool used

- Microsoft Excel 2021: Data Entry, Chart Creation, Descriptive statistics
- IBM SPSS Version: Paired T test and Inferential Statistics
- Significance level: pvalue<0.05

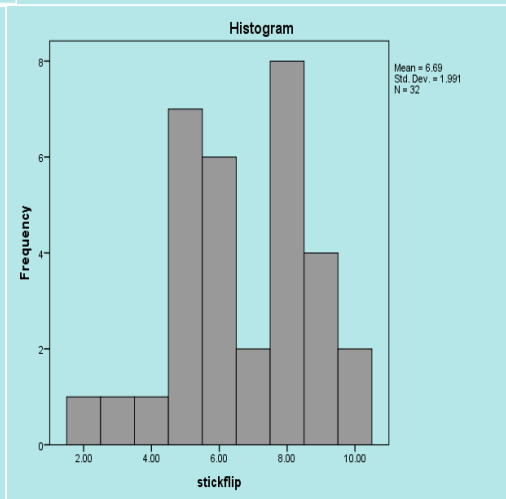
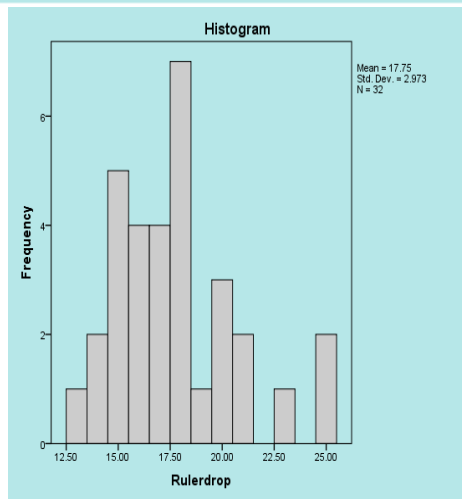
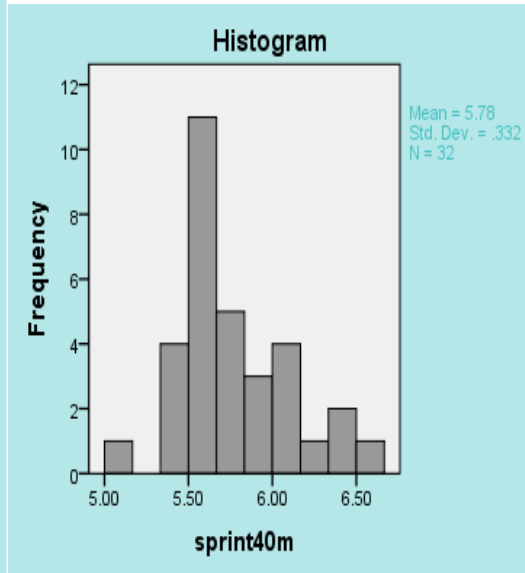
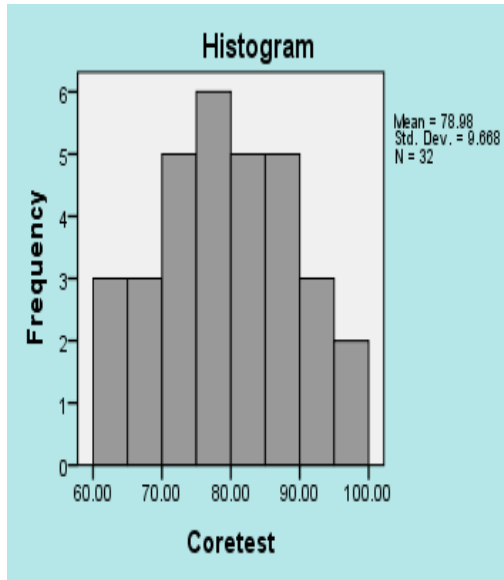
Normality of the data :

Variables	p Value	Normality
Core endurance test (PRE)	0.574	Normal
Core endurance test (POST)	0.190	Normal
40m Sprint (PRE)	0.081	Normal
40m Sprint (POST)	0.07	Normal
Stick Flip (PRE)	0.124	Normal
Stick Flip (POST)	0.130	Normal
Ruler Drop (PRE)	0.036	Not Normal
Ruler Drop (POST)	0.054	Normal

TABLE 2. Normality of data distribution



Graph 1. Normality of data distribution



Interpretation: Data normality is analyzed using Shapiro Wilk Test as sample Size is less than 50 which implies that data is distributed normally except for Ruler drop test. So we are using Paired t-test for normally distributed data.

DEMOGRAPHIC AND BASELINE DATA

Table 2 shows demographic and baseline characteristics of both the groups

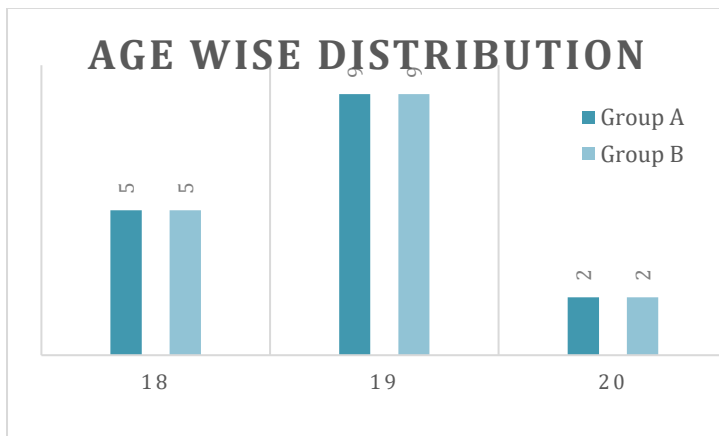
<i>BASELINE CHARACTERISTICS</i>	<i>GROUP A</i>	<i>GROUP B</i>	<i>P VALUE</i>
Participants	n=16	n=16	
Age	18.75 ± 0.683	18.53 ± 0.573	0.023
gender	8(F)8(M)	8(F) 8(M)	

● **Age Wise Distribution**

The age distribution of participants across both groups is presented in Table 3.

Age in years	Group A		Group B	
	No. of patients	Percentage	No. of patients	Percentage
18	5	31.3%	5	31.3%
19	9	56.3%	9	56.3%
20	2	12.4%	2	12.4%
Total	16	100%	16	100%

Table 3: Age wise distribution

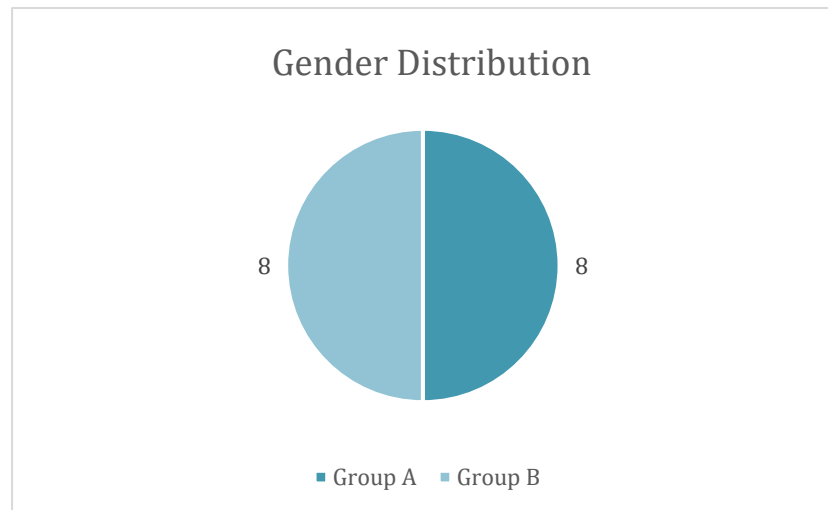


In Group A, the largest proportion of patients (56.3%) belonged to the age of 19years, followed by 31.3% in the 18, 12.4% in the 20 years group.

In Group B, is same as group B with Largest portion belongs to 19 year and same as in group A.

● **Gender Wise Distribution :**

Gender	Group A		Group B	
	No. of patients	Percentage	No. of patients	Percentage
Female	8	50.00%	8	50.00%
Male	8	50.00%	8	50.00%
Total	16	100%	16	100%



- The gender distribution of participants is shown in **Table 4**.
- In Group A, males constituted with 50 %, while females accounted for 50 %.
- In Group B, males constituted with 50 %, while females accounted for 50%.

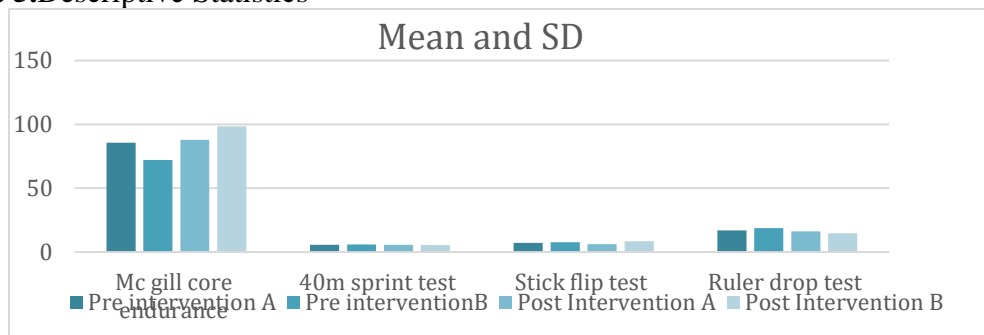
Descriptive Statistics

Comparison of pre and post with in group A and group B

Mean and standard deviation was calculated for Mc gill core endurance test, 40m sprint test, Stick flip test and ruler drop test.

Outcome Measure	Pre intervention (Mean \pm SD)	Post Intervention (Mean \pm SD)	Mean difference
Mc gill core endurance A	85.78 \pm 7.93	87.87 \pm 7.87	2.09
Mc gill core endurance B	72.17 \pm 5.59	98.51 \pm 11.26	26.34
40m sprint test A	5.67 \pm 0.31	5.61 \pm 0.28	0.06
40m sprint test B	5.88 \pm 0.32	5.37 \pm 0.22	0.51
Stick flip test A	7.25 \pm 1.65	7.75 \pm 1.98	0.50
Stick flip test B	6.12 \pm 2.18	8.56 \pm 1.36	2.44
Ruler drop test A	16.87 \pm 2.24	16.12 \pm 1.85	0.75
Ruler drop test B	18.62 \pm 3.40	14.81 \pm 2.16	3.81

Table 5. Descriptive Statistics



Interpretation:-

The mean Mc Gill core endurance score pre intervention was 85.78 \pm 7.93 which increased to 87.87 \pm 7.87 in group A and for group B it was 72.17 \pm 5.59 pre training which was improved to 98.51 \pm 11.26. The mean 40m sprint test pre intervention was 5.67 \pm 0.31 which increased to 5.61 \pm 0.28 in group A and for group B it was 5.88 \pm 0.32 pre training which was improved to 5.37 \pm 0.22. The mean Stick flip test pre intervention was 7.25 \pm 1.65 which increased to 7.75 \pm 1.98 in group A and for group B it was 6.12 \pm 2.18 pre training which was improved to 8.56 \pm 1.36. The

mean ruler drop test pre intervention was 16.87 ± 2.24 which increased to 16.12 ± 1.85 in group A and for group B it was 18.62 ± 3.40 pre training which was improved to 14.81 ± 2.16 . There was significant improvement in group B in all the 4 outcome measure which was statistically significant with mean difference of 26.34, 0.51, 2.44 and 3.81 significantly.

❖ **Mcgill core endurance test**

<i>GROUPS</i>	<i>PRE-INTERVENTION</i>	<i>POST-INTERVENTION</i>	<i>MEAN DIFFERENCE</i>	<i>P VALUE</i>
	<i>MEAN ± SD</i>	<i>MEAN ± SD</i>		
<i>GROUP A</i>	85.78 ± 7.93	87.96 ± 7.87	85.78	0.03
<i>GROUP B</i>	72.17 ± 5.59	98.51 ± 11.26	98.51	0.01

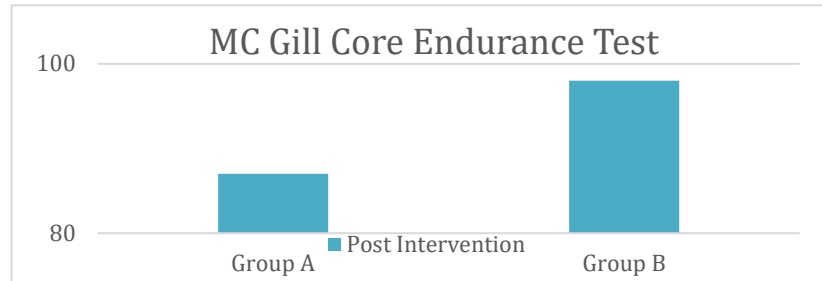
Table 6. Mcgill core endurance test pre-post



Interpretation – There was significant improvement in Mc gill core endurance test in group after the core training in group B.

Between group

	GroupA	GroupB	P Value
<i>POST-INTERVENTION</i>	87.96 ± 0.87	98.51	0.001



Interpretation – While comparing that both group has improvement in Core test but experimental group has more significant improvement in group B.

❖ **40m sprint test**

<i>GROUPS</i>	<i>PRE-INTERVENTION</i>	<i>POST-INTERVENTION</i>	<i>MEAN DIFFERENCE</i>	<i>P VALUE</i>
	<i>MEAN ± SD</i>	<i>MEAN ± SD</i>		
<i>GROUP A</i>	5.67 ± 0.3101	5.61 ± 0.2878	0.06	0.04
<i>GROUP B</i>	5.88 ± 0.325	5.37 ± 0.2275	0.51	0.01

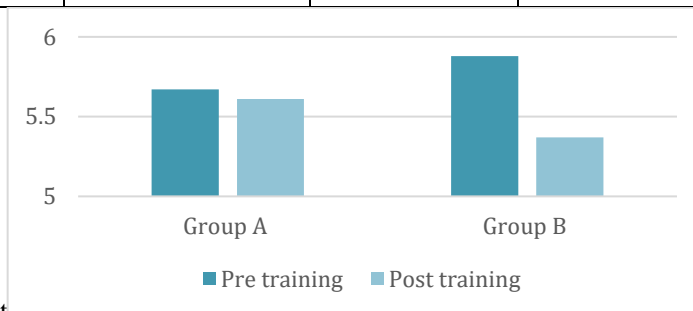


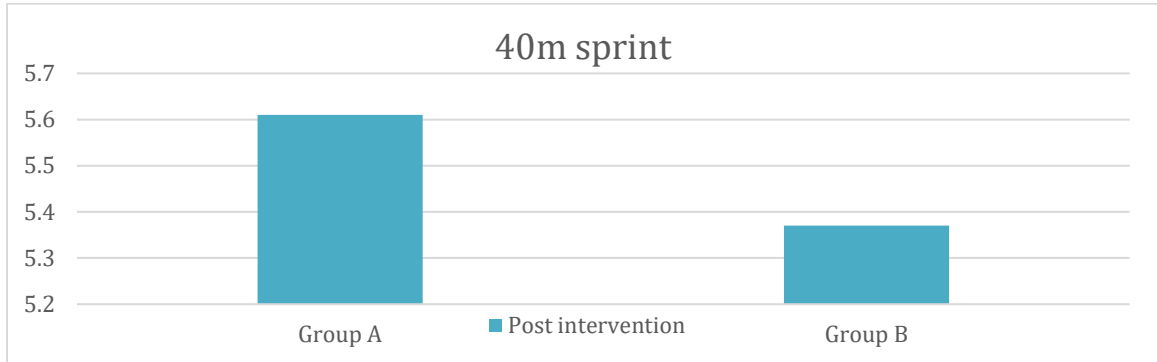
Table 7 40m sprint test pre-post

Graph 40m sprint test pre-post

Interpretation – There was significant improvement in 40m sprint test in group after the core training in group B which is reduction in sprint time

Between Group

	GroupA	GroupB	P Value
<i>POST-</i>	5.6194±	5.3725±	0.003
<i>INTERVENTION</i>	0.2878	0.2272	

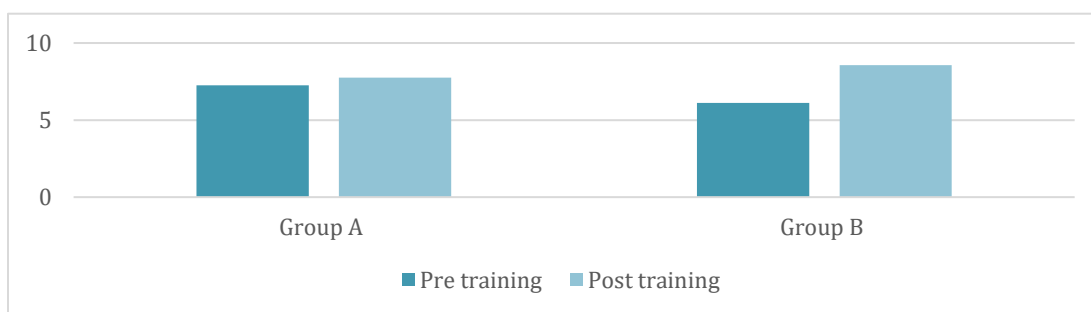


Interpretation – While comparing that both group has improvement in 40 m sprint test but experimental group has more significant improvement in group B.

❖ Stick flip test

<i>GROUPS</i>	<i>PRE-INTERVENTION</i>	<i>POST-INTERVENTION</i>	<i>MEAN DIFFERENCE</i>	<i>P VALUE</i>
	<i>MEAN ± SD</i>	<i>MEAN ± SD</i>		0.00
<i>GROUP A</i>	7.25 ± 1.65	7.75 ± 1.653	0.50	0.007
<i>GROUP B</i>	6.12 ± 2.18	8.56 ± 1.36	2.44	0.04

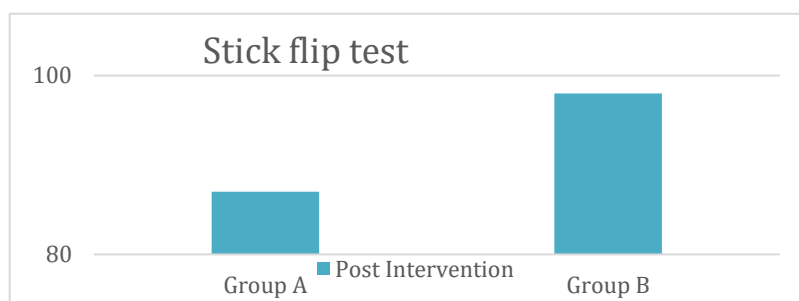
Table 8 Stick flip test pre-post



Graph Stick flip test pre-post

Between group

	Group A	Group B	P Value
<i>POST-INTERVENTION</i>	7.75 ± 1.98	8.561 ± 0.36	0.009

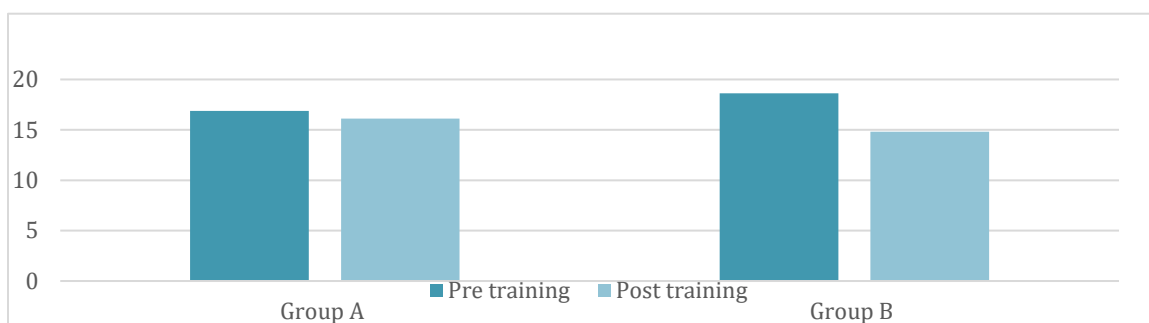


Interpretation – While comparing that both group has improvement in Stick flip test but experimental group has more significant improvement in group B

❖ **Ruler drop test**

<i>GROUPS</i>	<i>PRE-INTERVENTION</i>	<i>POST-INTERVENTION</i>	<i>MEAN DIFFERENCE</i>	<i>P VALUE</i>
	<i>MEAN ± SD</i>	<i>MEAN ± SD</i>		0.00
<i>GROUP A</i>	16.87 ± 2.24	16.12 ± 1.853	0.75	0.04
<i>GROUP B</i>	18.62 ± 3.40	14.81 ± 2.16	3.81	0.007

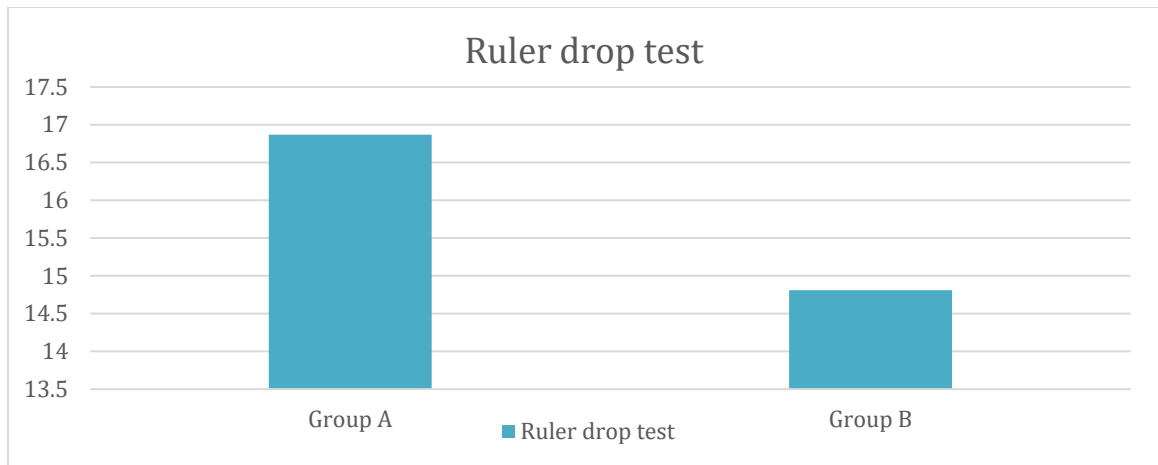
Table 9 Ruler drop test pre-post



Graph Ruler drop test pre-post

Between group

	Group A	Group B	Value
<i>POST-INTERVENTION</i>	16.12 ± 1.85	14.81 ± 2.166	0.009



Interpretation – While comparing that both group has improvement in ruler drop test but experimental group has more significant improvement in group B.

Inferential Statistics

Outcome Measure	t value	df	P value	Effect size	Significance
Mc gill core endurance test	5.46	31	0.04		Significant
40m sprint test	5.12	31	0.04		Significant
Stick flip test	4.37	31	0.05		Significant
Ruler drop test	5.81	31	0.03		Significant

Interpretation:

- There is a significant improvement in the score of Mc gill core endurance test, 40m sprint test, stick flip test, ruler drop test in with p value < 0.05.

7. Results

Data collected from 32 hockey players to determine the effect of core strengthening and core stabilization on speed, coordination and reaction time in professional hockey players. Data Entry was done using Microsoft Excel 2021 and statistical analysis was carried out using IBM SPSS version 27. Descriptive and inferential statistics were used. A paired t test was applied to compare pre and post intervention value. P value <0.05 was considered statistically significant. Graphical representation were created using Microsoft Excel. There is significant improvement in core endurance in experimental group with mean of 98.51 ± 11.26 in MC gill core endurance test. Which directly improved there speed, coordination and reaction time.

Discussion

The findings of the study compile evidence that core stabilization and strengthening exercises significantly improve speed, coordination, and reaction time in field hockey players. While both groups were comparable at baseline in terms of demographic characteristics, only the group receiving additional core training (Group B) demonstrated consistent and statistically significant improvements across all physical performance measures. These results reinforce the growing body of literature emphasizing the central role of the core musculature in athletic performance and functional movement.

The McGill Core Endurance Test results highlight the efficacy of targeted core strengthening in improving trunk stability. Group B's significant gains are consistent with McGill (2010), who stressed that trunk musculature plays a crucial role in maintaining spinal stability and transmitting forces during dynamic athletic movements. Behm et al. (2010) further argued that core endurance enhances an athlete's ability to resist fatigue during repeated bouts of play, which is critical in intermittent sports like hockey. The absence of significant improvement in Group A underscores the limitations of routine training alone in addressing core-specific endurance capacities. This suggests that conventional field hockey drills may not adequately challenge the deep stabilizing muscles of the spine and pelvis. Improvements in the 40 m Sprint Test in Group B also align with previous findings. Sprinting speed depends on optimal force transfer between the lower limbs and the ground, mediated through the trunk. Sato and Mokha (2009) demonstrated that a strong and stable core facilitates improved running kinematics, including reduced ground contact time and better stride efficiency. In our study, Group B's reduced sprint time likely reflects enhanced neuromuscular efficiency and trunk stiffness, allowing for more effective power transmission. Meanwhile, Group A's lack of improvement may

indicate that without specific core conditioning, athletes are unable to refine sprint mechanics purely through general training. Similar findings were reported by Stanton et al. (2004), who found significant sprint enhancements after six weeks of core stability training in recreational athletes. The improvement in speed observed among participants performing core strengthening exercises can be attributed to enhanced neuromuscular efficiency. Strengthening the core muscles stabilizes the spine and pelvis, providing a solid foundation for lower limb movements. This aligns with the work of Rodríguez-Perea et al. (2023), who reported that core training facilitates better force transfer during dynamic actions, resulting in more efficient sprinting mechanics. In field hockey, where rapid acceleration and deceleration are crucial, a strong core minimizes energy leaks and allows players to produce force more effectively, explaining the observed improvements in 40m sprint performance.

The significant improvement observed in the Stick Flip Test in Group B suggests that core strengthening also supports fine motor coordination. This may be explained by the kinetic chain principle, wherein stability of the proximal segments (trunk) facilitates more controlled and precise movements in the distal segments (arms and hands) (Kibler et al., 2006). Hoshikawa et al. (2013) reported that enhanced trunk control is associated with improvements in coordination tasks in athletes, supporting the present findings. Since stick handling and rapid directional changes are essential in hockey, superior trunk stabilization likely allowed participants in Group B to execute motor control tasks with improved efficiency and reduced compensatory movements. Coordination, as measured by the Stick Flip Test in this study, showed significant gains post-intervention. This can be interpreted through the lens of motor control theory, where the core acts as the central stabilizer that

integrates upper and lower limb movements. Core stabilization exercises likely improved proprioceptive feedback and postural control, enabling smoother and more synchronized movements. Similar findings were reported by Saeterbakken et al. (2020), who noted that trunk stabilization programs enhance coordination and technical skill execution in team sports. These improvements are beneficial in field hockey, where hand-eye coordination, stick handling, and rapid changes of direction are demanded. The Ruler Drop Test results further demonstrate the impact of core strengthening and core stabilization on reaction time. Neuromuscular adaptations resulting from core stabilization training such as increased proprioceptive sensitivity and improved activation of deep stabilizing muscles, may contribute to faster reaction responses that is faster reaction time (Vera-Garcia et al., 2014). Faster reaction time are essential in hockey for responding to unpredictable ball movements, tackling opponents, and quick passes. Group B's improvements align with the findings of Panjabi (1992), who emphasized that a robust core system enhances sensorimotor feedback and enhanced reflexive control of spinal and limb movements. Conversely, Group A's lack of meaningful change reinforces the view that traditional core training with short duration and unidirectional alone is insufficient to optimize reaction time without targeted neuromuscular training. The positive effects on reaction time, as assessed by the Ruler Drop Test, suggest that core training influence not only physical but also cognitive-motor aspect. A stable core allows for faster initiation of limb movements in response to stimuli, reducing latency between perception and action. This finding is similar with the research of Lee et al. (2021), who proposed that enhanced postural stability contributes to Faster motor responses by optimizing neuromuscular readiness. In the

context of field hockey, faster reaction times can translate to improved defensive and offensive techniques.

These findings underscore the multiple benefits of core strengthening and stabilization on sport-specific performance. Core improve fatigue resistance, sprint performance reflects improved power transfer, coordination benefits from proximal stability, and reaction time is refined through neuromuscular control. Importantly, these dimensions are interdependent; improvements in one causes benefits in others. For instance, better trunk stability not only help in sprinting but also supports balance during high-speed directional changes, thereby indirectly benefiting coordination and reaction time. The study's findings have directly applicable for coaches and sports scientists. Incorporating structured core training into regular field hockey sessions can enhance multiple performance simultaneously. Exercises such as planks, rotational medicine ball throws, and dynamic bridging can be integrated to target both core strength and stabilization. Periodized core training may serve as an increase injury-prevention , as stronger and more stable trunks reduce excessive stress on lower extremities during rapid , frequent movements and collisions.

The findings of the present study align with previous systematic reviews. Prieske et al. (2016) concluded that core training lead to significant improvements in measures of balance, strength, and sport-specific performance in young athletes. Similarly, Reed et al. (2012) highlighted the role of core training in enhancing agility, balance, and coordination. These reviews matches with the present study's outcomes and strengthen the evidence base for incorporating structured core stabilization programs in hockey training regimens.

Mechanistically, the improvements observed in Group B can be attributed to both neuromuscular and biomechanical adaptations. Neuro muscularly, core strengthening and stabilization enhances recruitment of deep stabilizers like the transversus abdominis and multifidus, which increase spinal stiffness and sensorimotor control (Akuthota and Nadler, 2004). Biomechanically, enhanced trunk stability reduces energy leaks during force transmission allowing for greater effect in sprinting and explosive movements (Kibler et al., 2006). Together, these adaptations enable hockey players to sustain higher performance levels under the physical demands of the game and the athlete. It is also noteworthy that the present study observed greater improvements in Group B despite their lower baseline values in some measures .This suggests that athletes with lower initial performance may benefit even more from structured interventions, a finding consistent with the principle of diminishing returns in training (Baechle and Earle, 2008). Hence, targeted core programs may be especially beneficial for younger or less experienced athletes in developmental stages.Despite these promising results, it must be acknowledged that the magnitude of improvement differed across outcome measures. While reaction time and sprint performance showed pronounced gains, coordination improvements were relatively modest. This may reflect the complexity of coordination, which is influenced not only by core stability but also by perceptual-motor integration and skill acquisition Schmidt and Lee, 2011. Thus, while core strengthening forms an essential component, sport-specific drills and perceptual training should complement such programs to maximize coordination outcomes.

Another point of discussion is the transferability of training effects to match performance. Although improvements in physical test measures are encouraging, the ultimate goal is to

enhance on-field hockey performance. Previous studies Zemková, 2014 have suggested that while laboratory-based measures show significant gains, the degree to which these improvements translate into competitive advantage depends on the integration of core training with skill-based practice. Therefore, future studies should assess match statistics such as ball control efficiency, successful tackles, and sprint performance during play to validate the ecological validity of these interventions. Finally, the findings contribute to the broader debate on the relative importance of core stability versus general strength training. While some authors Nuzzo, 2018 argue that traditional strength training may indirectly enhance core function, the present study demonstrates that targeted core interventions provide unique and additive benefits beyond general training alone. This supports the integration of both general and specific approaches in hockey conditioning programs.

Conclusion

The study clearly denotes that core training significantly enhances athletic performance. Core stabilization exercises and core strengthening primarily improve coordination and reaction time by enhancing postural control and proprioception, whereas sprint performance increase through force generation and neuromuscular efficiency. These results underscore the importance of incorporating structured core training into regular training routines, not only for optimizing performance but also for potentially reducing the risk of injuries. This implies that duration of core training should increase and focus should be made on anterior, posterior and lateral core muscle.

Limitations and Recommendations for future study

LIMITATIONS

This study, while demonstrating meaningful insights into the effects of core stabilization and core strengthening exercises on field hockey performance, had several limitations that should be considered. The small sample size of 32 athlete may limit the generalizability of the findings to the broader population of field hockey players. The short duration of the training program may not accurately reflect the long-term adaptations associated with core training. Assessment should based on performance. Participants were of similar age and competitive level, To have generalizability the study should monitor on different age groups.

Future Scope

Larger, more diverse populations across different ages, skill levels, and competitive standards should be examined to generalize the findings. Longitudinal studies should perform to see effects of core training on performance, injury prevention, and postural stability. Motion analysis systems, wearable sensors, and electromyography allow precise evaluation of muscle activation patterns, biomechanics, and neuromuscular adaptations. Exploring the combination of core training with other conditioning programs, including plyometrics, agility drills, and strength training, may optimize holistic athletic development. Examination of psychological and cognitive aspects, such as decision-making under pressure and reaction time in game situations, could broaden understanding of how core stability contributes to overall performance.

Summary and Study Funding

Summary

Ethical approval from ethical committee was taken to perform the research. After searching for studying setting ONTHPC, Bhubaneswar was chosen. From there permission was granted for data collection. Athletes from there gone through selection criteria, Informed Consent was signed by the players. Hockey player above 18 with MC gill core endurance test grading of fair and as baseline data demographic data, 40m sprint test, stick flip test and ruler drop test was calculated. Then subjects were randomly divided into 2 group of 16 each. Group A ws control group with regular core training protocol and Group B with Experimental core training. WhatsApp group was formed for easy communication. The training was given for 4week and after that post data was taken. Data was analysis with Excel and statistics was Done with the help of SPSS . Result and conclusions was formed.

Funding

No type of funding was done for the study

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ANNEXURES

ANNEXURES.1

Informed Consent Form

Study title Effect of core Stabilization and Core strengthening exercise on speed, coordination and reaction time in Field Hockey Players

Subject 's Name: _____

Subject 's Initials: _____

Date of Birth / Age: _____

Address of the Subject _____

Qualification _____

Occupation: Student/Self-Employed/ Service/Housewife/Others (Please tick as appropriate)

(Subject)

(i) I confirm that I have read and understood the information sheet dated _____ for the above study and have had the opportunity to ask questions.

(ii) I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.

(iii) I understand that, if in case is there any medical emergency while the study is going on there will be medical supervision and team for my help and if any injury occur we will be getting first aid and nearby hospital facility.

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s)

(v) I agree to take part in the above study.

Signature (or Thumb impression) of the Subject/Legally

Acceptable

Representative:

Date: ____/ ____/ ____

Signatory 's Name: _____

Signature of the Investigator: _____

Date:

Study Investigator 's Name: _____

Signature of the Witness: _____

Date: ____/ ____/ ____

Name of the Witness: _____

ANNEXURES.2

NAME:

AGE:

GENDER:

DOMINANCE:

OCCUPATION:

ADDRESS:

CONTACT NUMBER:


OUTCOME MEASURE	PRE INTERVENTION SCORE
Mc gill core endurance test	
40 M sprint test	
Stick flip test	
Reaction time ruler drop test	

OUTCOME MEASURE	POST INTERVENTION SCORE
Mc gill core endurance test	
40 M sprint test	
Stick flip test	
Reaction time ruler drop test	

Group	Gender	Age	Dominance	Gill core endurance		40 sprint test		Stik flip Test		Ruler drop test	
				Pre	Post	Pre	Post	Pre	Post	Pre	Post
A	Male	18	Right	87.5	89.5	5.5	5.5	10	10	17	16
A	Male	18	Right	86.5	88.2	5.6	5.57	5	5	18	18
A	Male	19	Right	84.5	86	5.63	5.59	6	8	16	15
A	Male	19	Right	83.25	85	5.06	5.04	9	10	20	18
A	Male	19	Right	63.25	65.45	5.59	5.55	8	11	15	16
A	Male	19	Right	85.75	87.25	6.57	6.47	6	8	14	17
A	Male	20	Right	98.5	100.5	5.47	5.42	9	9	18	15
A	Male	18	Right	76.25	79.6	5.55	5.58	8	8	13	12
A	Female	19	Right	95	96	5.8	5.8	8	6	20	18
A	Female	19	Right	91	94	5.97	5.8	5	5	17	15
A	Female	19	Right	85	91	5.7	5.65	5	5	15	15
A	Female	18	Right	83	84.5	5.65	5.6	9	7	15	15
A	Female	19	Right	90	91	5.64	5.58	6	6	16	14
A	Female	18	Right	91	93.5	5.84	5.76	8	9	21	19
A	Female	19	Right	84	85	5.64	5.54	8	10	18	18
A	Female	20	Right	88	91	5.51	5.46	6	7	17	17

Group	Gender	Age	Gill core endurance		40 sprint test		Stik flip Test		Ruler drop test	
			Pre Data	Post Data	Pre Data	Post Data	Pre Data	Post Data	Pre Data	Post Data
B	Male	19	65.75	82.97	6.39	5.7	6	9	16	13
B	Male	19	77	95.8	6.5	5.65	9	6	15	12
B	Male	18	67.75	85.05	5.45	5.45	5	9	25	18
B	Male	19	78	96.3	5.76	5.33	10	10	19	15
B	Male	18	71.75	98.2	5.63	5.42	8	10	16	12
B	Male	20	62.25	83.6	5.42	5.07	7	9	14	14
B	Male	18	75.75	104.5	5.76	5.6	8	10	17	14
B	Male	19	75.5	98.55	5.55	5.3	8	10	18	15
B	Female	19	77	85.9	6.03	5.06	5	9	20	15
B	Female	18	74	96.49	6.06	5.45	6	9	15	12
B	Female	20	72	106.5	6.18	5.26	5	9	18	14
B	Female	19	68	97.9	6.13	5.47	3	7	21	16
B	Female	19	71	110.59	5.87	5.4	2	7	18	14
B	Female	19	72	125	6.08	5.4	4	6	23	19
B	Female	19	64	110.1	5.57	4.85	5	8	25	18
B	Female	18	83	98.8	5.82	5.55	7	9	18	16

ANNEXURES 4



ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE,
BHUBANESWAR, ODISHA

CDSO Reg. No.: ECR/1981/Inst/OD/24

Prof. (Dr.) E. Venkata Rao
Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2025/143 Date: 02/05/2025

S.N.	Name of the Member	Designation & Qualification	Representation as per NDCT 2019	Gender (M/F)	Affiliation with the Institution (Y/N)
1	Prof. Dr. E. Venkata Rao	Professor (MBBS, MD, Dept. of Community Med.) IMS & Sum Hospital, BBSR	Chair Person	M	N
2	Dr. Smaraki Mohanty	Asst. Prof-IMS & Sum Hospital/MBBS, MD (Community Med)	Clinician	F	N
3	Mr. Shiba Sankar Mohanty	Junior Counsel-Lt. Ramachandra Sarangi's Chamber / BA LLB	Legal Expert	M	N
4	Mr. Chinmaya Kumar Patra	Principal-ABSMARI, MPT	Member Secretary	M	Y
5	Ms. Annie Hans	Disability Inclusive Development Co-Ordinator in Humanity and Inclusion (India/Nepal/Srilanka). /MA in Social Work	Social Scientist	F	N
6	Ms. Subhashree Samal	Ret. Reader-Pol Sc.	Lay Person	F	N
7	Mr. Deepak Kumar Pradhan	Asst. Prof-ABSMARI, MPT	Scientific Member	M	Y

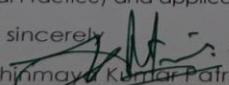
This is to confirm that only members who are independent of the Investigator and the Sponsor of the trial have voted/ provided opinion on the trial.


This Committee approves the documents and the conduct for the study in the presented form with necessary recommendation.

The ABSMARI IEC must be informed about the progress of the study in the prescribed format attached, any SAE occurring in the course of the study, any changes in the protocol and patient information/informed consent/assent and request to provide a copy of the final report.

The ABSMARI IEC follows procedures that are in compliance with the requirements of ICH (International Conference on Harmonization) guidance related to GCP (Good Clinical Practice) and applicable Indian regulations.

Yours sincerely,


 Mr. Chinmaya Kumar Patra
 Member Secretary
 ABSMARI ETHICS COMMITTEE
 Pahal, Bhubaneswar


 Dt.....

MEMBERS

Dr. Smaraki Mohanty
Clinician

Dr. Satyajit Mohanty
Scientific Member

Mr. Shib Shankar Mohanty
Legal Expert

Ms. Annie Hans
Social Scientist

Ms. Subhashree Samal
Lay Person

Mr. Deepak Ku. Pradhan
Scientific Member

IEC-SECRETARIAT

Mr. Gouranga Ku. Padhy
Mr. Susant Ku. Raychudamani

2

Utkal Signature, Plot No.-273,
Ground Floor, Pahal, Bhubaneswar-752101 +91-63707-03654 iec@absmari.com



ABSMARI

ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE,
BHUBANESWAR, ODISHA

CDSO Reg. No.: ECR/1981/Inst/OD/24

Prof. (Dr.) E. Venkata Rao
Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2025/143

Date: 02/05/2025

APPROVAL LETTER APPENDIX- VIII

To,

RAJURKAR SANSKRUTI CHHAGAN
ABSMARI
273, PAHAL, BHUBANEWAR-752101

Protocol Title: Effect of core Stabilization and Core strengthening exercise
on speed, coordination and reaction time in Field Hockey Players

Protocol ID.: ABS-IEC-2025-PHY-063

Subject: Approval for the conduct of the above referenced study

Dear Mr./Ms./Dr Rajurkar Sanskruti Chhagan

With reference to your Submission letter dated 06/01/2025 the ABSMARI IEC has reviewed and discussed your application for conduct of the study on dated 25/04/2025.

The following documents were reviewed and discussed

S.N.	Documents	Document (Version/Date)
1	IEC Application Form	25/04/2025
2	Informed Consent Form	25/04/2025
3	Undertaking form PI	25/04/2025
4	CRF	25/04/2025
5	COI from the Investigators	25/04/2025

The following members were present at meeting held on 25-04-2025



MEMBERS
Dr. Smaraki Mohanty Clinician
Dr. Satyajit Mohanty Scientific Member
Mr. Shib Shankar Mohanty Legal Expert
Ms. Annie Hans Social Scientist
Ms. Subhashree Samal Lay Person
Mr. Deepak Ku. Pradhan Scientific Member
IEC-SECRETARIAT
Mr. Gouranga Ku. Padhy Mr. Susant Ku. Raychudamani

Sanskruti Rajurkar

Effect of Core Stabilization and Core Strengthening exercise on speed, coordination and reaction time in Field Hockey Players

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- Odisha University of Health Sciences

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