

**EFFECT OF JUMP ROPE TRAINING PROGRAM ON DYNAMIC
BALANCE AND SOCCER SPECIFIC SKILL PERFORMANCE
- AN EXPERIMENTAL STUDY**

by

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Dissertation Submitted to the

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In Partial fulfillment of the requirements for the degree of

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In

SPORTS PHYSIOTHERAPY

Under the guidance of

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Bhubaneswar, Odisha

2022-2024



DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled **“EFFECT OF JUMP ROPE TRAINING PROGRAM ON DYNAMIC BALANCE AND SOCCER SPECIFIC SKILL PERFORMANCE - AN EXPERIMENTAL STUDY”** is a bonafide and genuine research work carried out by me under the guidance of Dr. Deepak Kumar Pradhan, Assistant Professor, Abhinav Bindra Sports Medicine and Research Institute, Odisha.

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LIST OF ABBREVIATIONS

- 1. BMI** - Body Mass Index
- 2. DLBT** - Dynamic Leap Balance Test
- 3. F-MARC** - FIFA Medical Assessment And Research Centre
- 4. ICC** - Interclass Correlation Coefficient
- 5. JR** - Jump Rope
- 6. LSPT** - Loughborough Soccer Passing Test
- 7. SEBT** - Star Excursion Balance Test

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ABSTRACT

EFFECT OF JUMP ROPE TRAINING PROGRAM ON DYNAMIC BALANCE AND SOCCER SPECIFIC SKILL PERFORMANCE - AN EXPERIMENTAL STUDY

BACKGROUND: In the world, soccer is the most popular organized sport. Soccer is an intricate sport that requires a lot of agility and involves a wide variety of movement patterns, including side-cut movements, sprints, and jumps, all of which are typically executed at high to peak intensity. In particular, it has been discovered that balance in soccer is essential for basic motor abilities including kicking, striking, hopping, and skipping. Essential elements of playing soccer include the actual motor tasks of passing, controlling, dribbling, and shooting the ball. Various tests were used to assess the dynamic balance and soccer specific skills.

METHODS: 30 players were taken for this study. The participants were randomly divided into experimental and control group. Dynamic balance was assessed using Dynamic Leap Balance Test and soccer specific skills were assessed using LSPT and F-MARC Battery Test. The experimental group underwent Jump Rope Training Program for 8 weeks. The control group continued regular soccer training. Post 8 weeks, outcome measures were assessed again.

RESULTS: After 8 weeks of jump rope training there was significant difference found in the Dynamic Balance, LSPT and F-MARC Battery Test (juggling and long pass) in the Experimental group with the $p < 0.05$ when compared to control group.

CONCLUSION: There is significant difference in the dynamic balance and soccer specific skills in experimental group after 8 weeks of jump rope training.

KEYWORDS- Soccer, Jump Rope Training, Dynamic Balance, DLBT, LSPT, F-MARC Battery Test

EFFECT OF JUMP ROPE TRAINING PROGRAM ON DYNAMIC BALANCE AND SOCCER SPECIFIC SKILL PERFORMANCE - AN EXPERIMENTAL STUDY

INTRODUCTION

In the world, soccer is the most popular organized sport. The Fédération Internationale de Football Association (FIFA) has about 200 million male and 21 million female players registered. (1) Performance in competitive soccer is influenced by a wide range of characteristics, including technical, tactical, mental, physiological, and physical. High levels of cognitive, perceptual, and motor skills are necessary for elite soccer in a setting that is changing quickly.

(2)

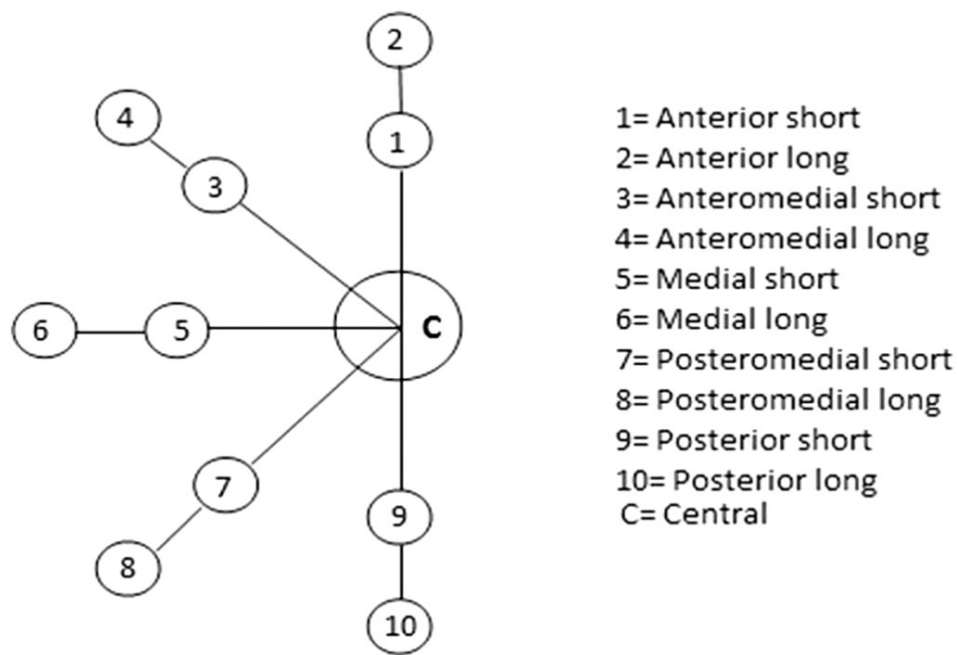
Soccer is an intricate sport that requires a lot of agility and involves a wide variety of movement patterns, including side-cut movements, sprints, and jumps, all of which are typically executed at high to peak intensity. (3) Between 1000 to 1500 distinct movement modifications are thought to occur during a match at a rate of every 5–6 seconds, with a 3-second break every two minutes. (3)

The process of maintaining the body's centre of gravity vertically over the base of support is known as balance, and it is based on the quick and continuous integration of afferent information from the vestibular, somatosensory, and visual systems, as well as rapid feedback to produce smooth and coordinated neuromuscular movements. In sports, balance has been identified as one of the most crucial elements for the prevention of non-contact injuries and the evaluation of the benefits of rehabilitative training. (4)

In soccer, one of the most popular team sports worldwide, balance appears to be connected to technical skill level. (5) In particular, it has been discovered that balance in soccer is essential for basic motor abilities including kicking, striking, hopping, and skipping. (6)

The capacity to keep the body's centre of mass stable while moving or carrying out a functional task is known as dynamic balance. (7) The synchronization of contraction between agonists and antagonists of the lower body and trunk muscle groups does need muscular coordination, in fact. Furthermore, the utilization of the visual, vestibular, and somatosensory systems to sustain a stable and balanced posture is made possible by sensory organization. Fitness tests have been proposed as a means to better evaluate balance performance and help develop this skill. (7)

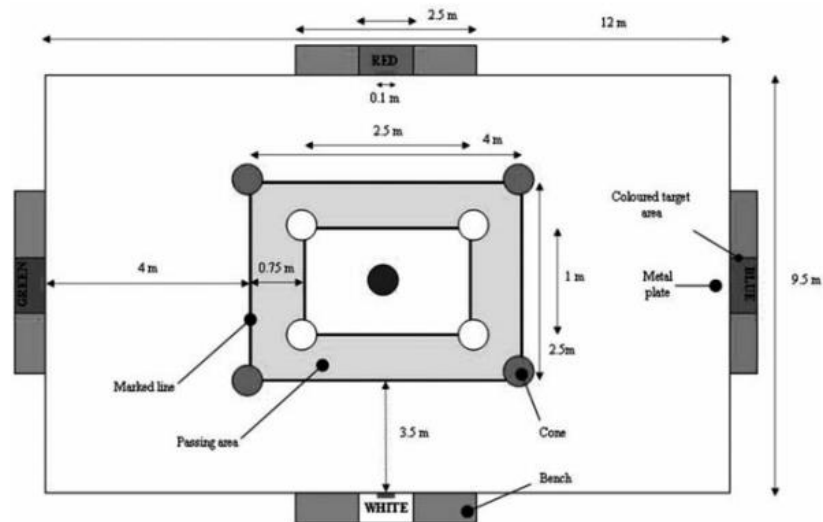
Based on the ideas of earlier balancing tests including the Balance Error Scoring System (BESS), Star Excursion Balance Test (SEBT), Time-to-stabilization (TTS), and Modified Bass Test, the Dynamic Leap and Balance Test (DLBT) is a low-cost clinical exam. The dynamic balance test, or DLBT, simulates everyday activities and athletic endeavours that call for repetitive shifts in the base of support, alternating limb weight bearing, and an amount of effort that ought to be taxing for a population that is active. DLBT demands the controlled movement of body segments over a base of support that is serially changing with alternating limb weight bearing. It simulates the usual movement patterns involved in activities (e.g., walking, running, cutting, etc.) conducted in daily life and sports. (8)



DYNAMIC LEAP BALANCE TEST

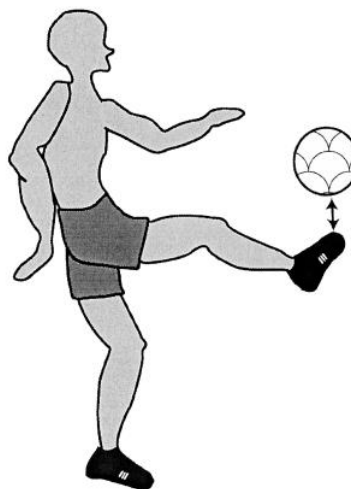
Soccer players' cognitive and perceptual abilities are crucial factors in determining their ability to play the game because they must navigate a complicated and ever-changing environment. Essential elements of playing soccer include the actual motor tasks of passing, controlling, dribbling, and shooting the ball. Scholars and practitioners have tried to measure these kinds of motor skills during soccer in a variety of methods. (9)

The Loughborough Soccer Passing Test (LSPT) is a testing protocol created by Ali et al. to evaluate several soccer skills such as dribbling, passing, control, and decision making. Players must make 16 accurate and fast passes to four coloured targets in order to pass the LSPT. While one examiner announces the pass order, another records the test results, noting movement time (the amount of time needed to finish each trial), penalty time (the amount of time added for mistakes, erroneous passes, and slow performance), and total performance time (the total of movement time and penalty time). (2)

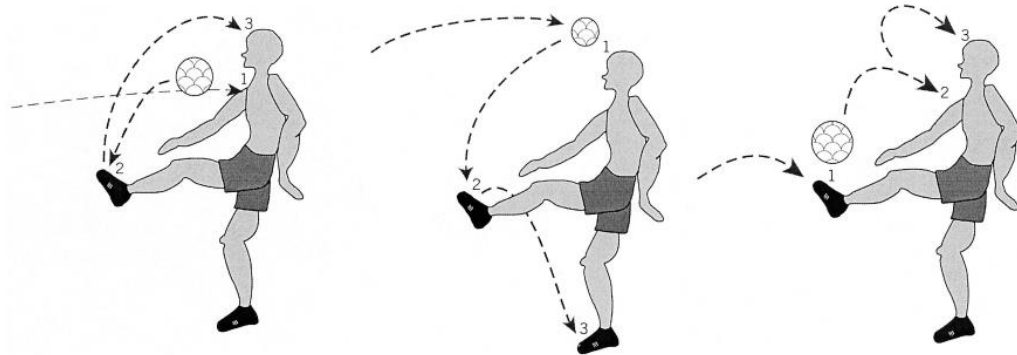


LOUGHBOROUGH SOCCER PASSING TEST

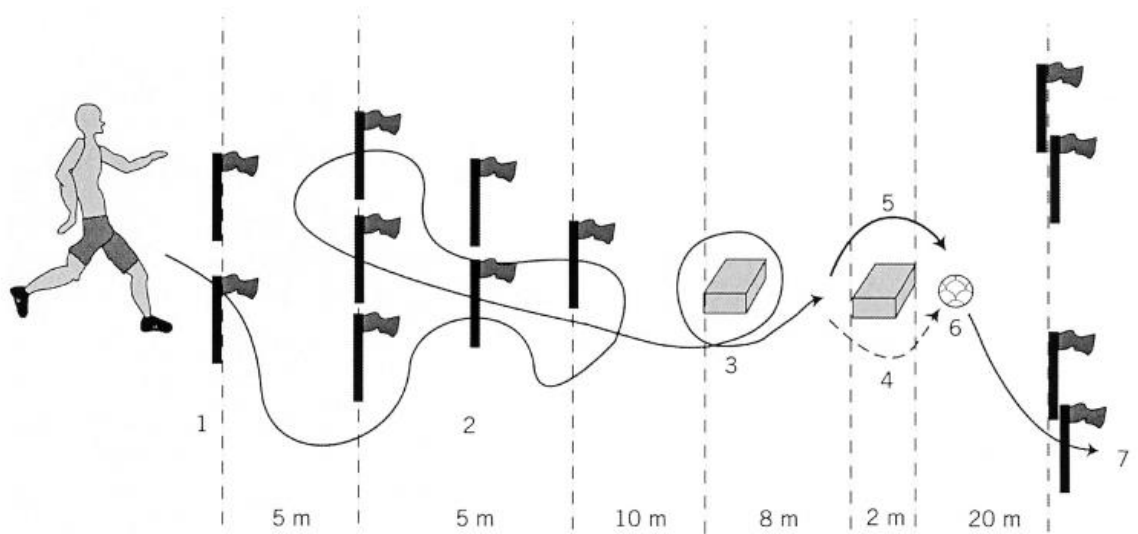
The FIFA Medical Assessment and Research Centre (F-MARC) battery is a frequently referenced set of tests developed by FIFA (Fédération Internationale de Football Association) in scientific literature. A number of technical skills were intended to be evaluated by this battery, including juggling, speed dribbling, passing, shooting, and heading. (10) A player's profile was evaluated in relation to the eight football skill tests, which included shooting dead ball, shooting from a pass, speed dribbling, long and short passing, and juggling with the foot and body. (10)



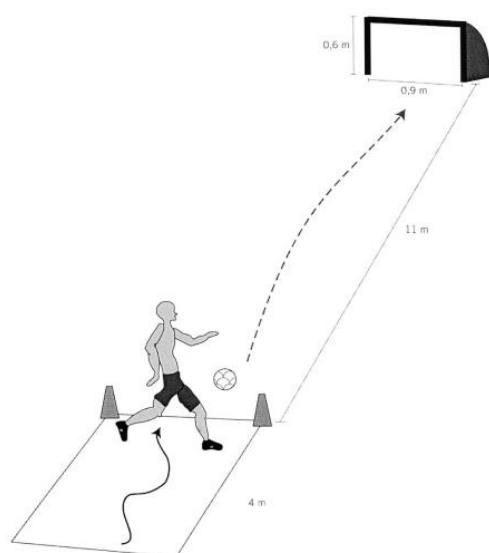
JUGGLING (FOOT)



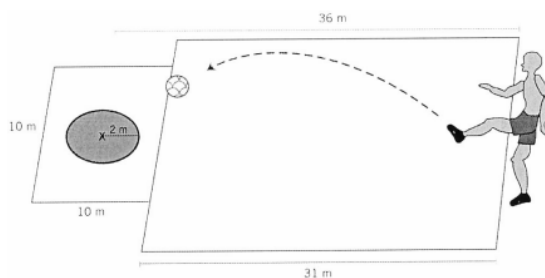
JUGGLING (BODY)



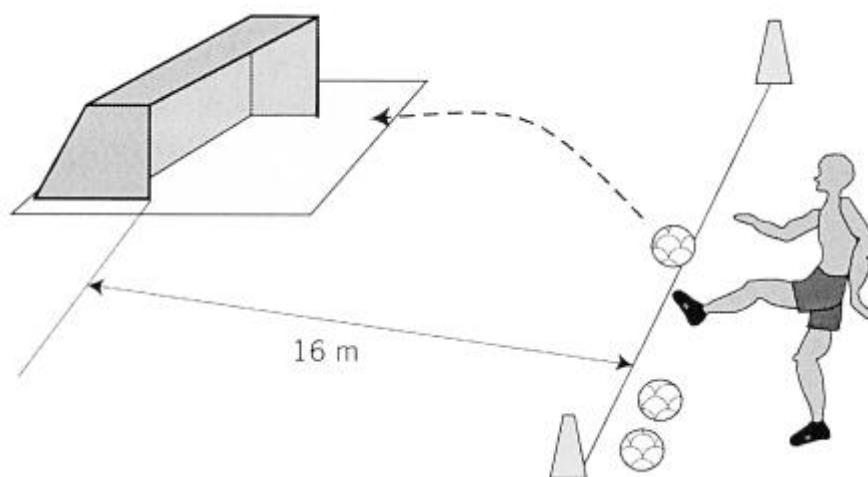
SPEED DRIBBLING



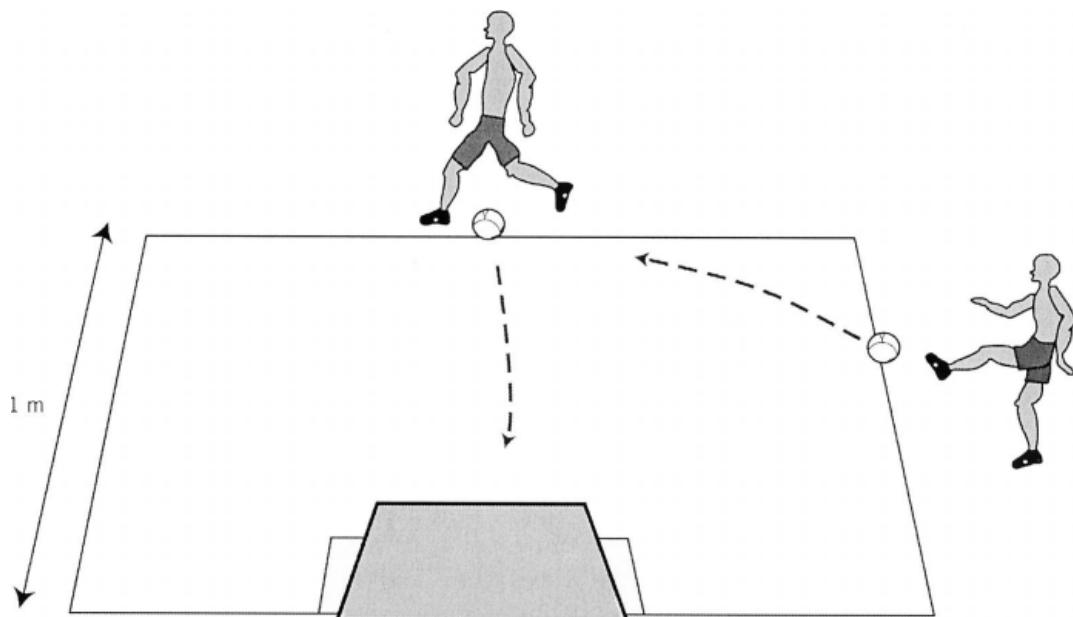
LONG PASSING



SHORT PASSING



SHOOTING A DEAD BALL



SHOOTING FROM A PASS

There have been many experimental protocols established to improve balance and sports specific skills in soccer players such as Balance Training (4), Agility and Plyometric Training (11), Isoinertial Eccentric-Overload Training (12), High-Intensity Interval Training and Small-Sided Game Training (13), Neuromuscular Training Program (14) and Core Training (15).

Soccer players' training sessions should incorporate exercises that are different from what they typically do, as participation in a variety of free play activities (such as running, climbing, and jumping) is a major multidimensional stimulus. (16)

Another type of exercise that works both the upper and lower bodies is jumping rope (JR). In order to sustain a continuous vertical take-off and landing phase until the workout is finished, arms twirl the rope while legs bounce back and forth repeatedly. The body must regain equilibrium and propelling force during subsequent jumps by using the muscles in the upper and lower body regions in unison. In particular the ability to balance is essential to achieve a successful

pushing phase. (16) It is a type of stretch-shortening cycle movement in which the lower limb muscles contract and extend quickly on several occasions. (17) For numerous sports, including boxing, wrestling, tennis, and martial arts, the jump rope has been an essential training aid. To maintain the perfectly timed and rhythmic motions that are essential to the workout, jumping rope calls for the synchronization of multiple muscle groups. An athlete's ability to maintain dynamic balance is enhanced by the coordination of various muscle groups. Additionally, jumping rope can be utilized to improve muscle strength, cardiovascular endurance, and neuromuscular coordination. It increases upper and lower body strength and burns calories. (18)

NEED OF THE STUDY

- We know that, soccer is a highly demanding sport which requires one to perform various fast movements such as passing, kicking, shooting, dribbling, etc.
- In order to perform these movements efficiently, a player needs to maintain his balance and pass accurately.
- Professionals can be encouraged in developing their training program with a combination of general physical activities and sport-specific exercises which include jump rope training.
- Therefore, we will perform this study to know the impact of jump rope training on dynamic balance and soccer specific skill.

AIM OF THE STUDY

- To determine the effect of jump rope training on dynamic balance and soccer specific skill performance in club level soccer players.

OBJECTIVES OF THE STUDY

- To find the effect of jump rope training on dynamic balance using Dynamic Leap Balance Test in club level soccer players.
- To find the effect of jump rope training on soccer specific skill performance using LSPT in club level soccer players.
- To find the effect of jump rope training on soccer specific skill performance using F-MARC Battery test in club level soccer players.

HYPOTHESIS

NULL HYPOTHESES

- H₀₁: There will be no significant effect of jump rope training on dynamic balance in collegiate level soccer players.
- H₀₂: There will be no significant effect of jump rope training on soccer specific skills performance.

ALTERNATE HYPOTHESES

- H₁₁: There will be a significant effect of jump rope training on dynamic balance in collegiate level soccer players.
- H₁₂: There will be a significant effect of jump rope training on soccer specific skills performance.

REVIEW OF LITERATURE

1. A study “Evidence of balance training-induced improvement in soccer-specific skills in U11 soccer players” by ceE E, Longo S, Paleari E reported that Balance training obtained greater improvements in passing and shooting accuracy, evaluated by the penalty time in LSPT.
2. A study “ Jump Rope Training: Balance and Motor Coordination in Preadolescent Soccer Players” by Athos Trecroci reported that incorporating JR protocol at the beginning of training sessions was effective to improve motor coordination and balance in preadolescent soccer players over a period of 8 weeks
3. A study “Effects of Non-Sport-Specific Versus Sport-Specific Training on Physical Performance and Perceptual Response in Young Football Players” by Damiano Formenti reported that the current findings provide evidence that performing 10 weeks of non-sport-specific training can promote greater improvements on general motor coordination and dynamic balance than sport-specific training in youth football players.
4. A study “Interrater, Test-retest Reliability of the Y Balance Test: A Reliability Study Including 51 Healthy Participant” by Frederik n. Foldager reported that the YBT showed good relative and absolute reliability. The YBT is therefore considered suitable at both group and individual level in physically active populations
5. A study “Measurement properties and feasibility of the Loughborough soccer passing test” by Daizong Wen reported that the LSPT has acceptable test-retest reliability and discriminative validity.

6. A study “The Dynamic Leap and Balance test (dlbt): a test-retest reliability study” by Abbas H. Jaffri, Thomas M. Newman reported that this test is a cost-effective, easy to administer and clinically relevant novel measure for assessing dynamic balance that has excellent test-retest reliability.
7. A study “Test–Retest Reliability of Skill Tests in the F-MARC Battery for Youth Soccer Players” by Alexis Padro’n-Cabo reported that the following technical skill tests of the F-MARC battery were reliable methods of examining soccer skills in young soccer players: (a) the dribbling test, (b) right foot juggling test, (c) shooting a dead ball right test, (d) short passing test, (e) shooting from a pass test, and (f) heading test.

METHODOLOGY

- Study Design: Experimental Study
- Sampling Technique: Purposive Sampling
- Study Population: Club level Soccer Players
- Sampling Size: 30
- Study Setting: Soccer clubs In Bhubaneswar
- Study Duration: 1 year

INCLUSION CRITERIA: -

- Club level soccer players (minimum 3 days per week for minimum one year)
- Gender: Male
- Age: 18-24 years

EXCLUSION CRITERIA: -

- Recent fracture or any musculoskeletal condition strain, sprain, dislocation in less than 6 months.
- Any neurological, cardiac, respiratory diseases.
- Any other medical, surgical, or psychological condition in past 1 year.

STUDY MATERIALS: -

- Measuring tape
- Soccer specific rebound boards
- Soccer balls 2
- Stop watch
- Cones
- Coloured cards
- Metronome
- Pens
- Chalks
- Papers
- Jumping rope

OUTCOME MEASURES: -

1. Dynamic leap balance test
2. Loughborough Soccer Passing Test
3. F-marc battery test

PROCEDURE

Ethical clearance was obtained from the ethical committee. Sample selection was based on selection criteria. Recruitment of the participants was carried out from various soccer clubs from Bhubaneshwar in India by purposive sampling method. Voluntary participation was ensured and written consent was obtained from the participants. Each subject's age, weight, height, and BMI was recorded, among other demographic details. Every step of the testing process was explained to the participants prior to the final data collection. The Dynamic Balance and soccer specific skills tests were conducted. To avoid tiredness, each exam was administered three times, with a 4–5-minute break in between. The following testing process were administered to the subjects:

1. Dynamic leap balance test (19):

The directional layout of the medial half of a SEBT matrix is used in the dependable dynamic balancing test known as the DLBT, however participants must jump between targets on the matrix lines. From a central point at a 45° angle, all five directions extend toward one another. One center target and two peripheral targets on each directional line make up the total of 11 objectives.

Based on average normalized SEBT reach distances, target distances are determined. The participants' leg length was multiplied by the average normalized reach lengths (%) to establish the short targets. 150 percent of this distance was the setting for each direction's long targets. Standing on the center target on the tested limb, the subject started the test. The unweighted foot was

held adjacent to the medial malleolus while maintaining a single-limb stance position on the center target.

The subject started jumping from the center target to the short and long peripheral targets in the predetermined order from 1 to 10, returning to the central target to retain their starting stance between each peripheral target as soon as the investigator gave the all-clear to jump. The first stance limb was supposed to land on the center target with every leap, however the participants were told to always switch limbs. Each circular target, both central and peripheral, had a diameter of 15.24 cm. All that was asked of the participants was to return to the central target after touching the peripheral target as rapidly as they could with their first non-stance leg. The amount of time needed to finish the leaping pattern was timed with a stopwatch.

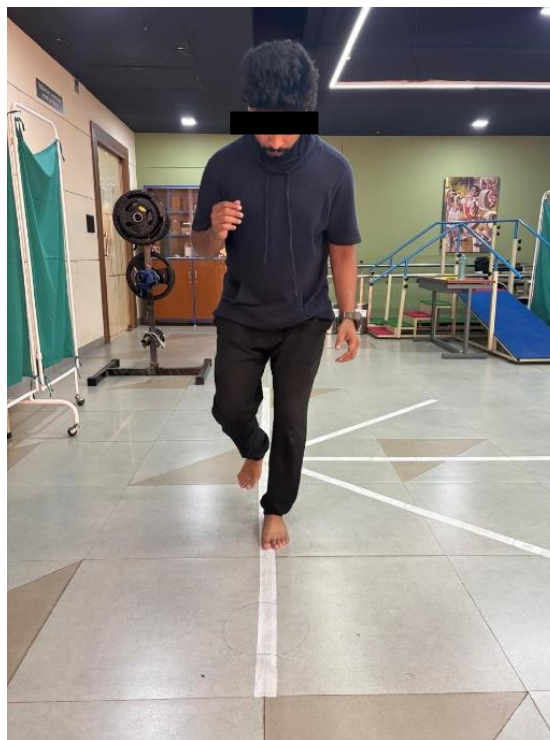
Every time a participant landed on the center target, they had to hold their starting position for two seconds. The participant was given the order "Go" and permitted to move on to the next peripheral target if the investigator judged them to be stable on the central target for two seconds (counted as one thousand one, one thousand two). The Balance Error Scoring System (BESS) criteria, which include touching down with the opposite foot, hip abduction/flexion greater than 30°, and stepping, stumbling, or falling, were used to evaluate stability. The participant had to make contact with the target in order to continue leaping, however stability was not evaluated at peripheral targets. In order to continue the trial, participants had to promptly correct for missing a target, which was regarded as a mistake.

The player had to jump with one leg and land on the other after each leap. It was instructed to the participants to finish this activity as soon as possible. The

dependent measure for this test was the amount of time it took the participant to finish the task by jumping to every peripheral target and then landing back on the central target. Before completing three recorded trials with two minutes of pause in between, participants completed three practice trials with one minute of rest in between. The three testing trails' average was determined for data analysis. Every participant's favorite sporting shoes were used for the testing. The reliability of DLBT was demonstrated excellent with in the tester test-retest reliability with ICC=0.93.

FIGURE 1

Dynamic Leap Balance Test





2. Loughborough Soccer Passing Test (20) :

Four plastic rebound boards customized for soccer were positioned as indicated on each of the four lines denoting the grid measuring 12 by 9.5 meters (within the boards). Prior to placement, four 0.6×0.3 m colored target areas—yellow, blue, green, and red—were affixed to the center of each board.

Furthermore, the center of the target regions were painted with a black piece measuring 0.1×0.15 m. The various zones were identified by colored cones. When the soccer ball was played out of the inner rectangle, the examiner began timed the test (using data acquisition software specifically created for this study for more efficient data collecting).

Participants began with the ball by the central cone. Just before the participant finished the current pass, the specific color was called out. To remove interexperimenter variability, the same examiner was utilized.

The software randomly created 8 trial orders, each of which controlled the order of passes.

This resulted in 8 long (green and blue) and 8 short (yellow and red) passes for each trial. It was explained to participants that passes could only be made from inside the passing area.

The players were also told that completing the test as fast as possible with the fewest errors possible would be necessary for optimal success on the LSPT. When the last pass was finished, the time was noted. Recording the penalty time points accumulated during the trials was another responsibility of the examiner. As a result, the examiner positioned themselves to view all four target regions

Penalty time was awarded for the following errors:

- Five seconds for missing the bench completely or passing the wrong target.
- Three seconds for missing the target area.
- Three seconds for handling the ball.
- Two seconds for passing the ball from outside of the designated area.
- Two seconds for the ball touching any cone.
- One second for every second taken over the allocated 43 seconds to complete the test.

Additionally, 1 second was deducted from the total time if the ball hit the 10-cm strip in the middle of the target.

FIGURE 2

Loughborough Soccer Passing Test



3. F-marc battery test (21) :

Juggling (Foot): The examination of football coordination is possible with this test. The player uses his foot to juggle the ball, attempting to touch it as many times as he can without letting it fall to the ground. No more tries are required if he completes 25 touches on his initial try. The ball is first manually dropped to

the foot. The best three efforts on the left and right sides are measured by the examiner. Each ball touch results in one point being measured.

FIGURE 3

Juggling (Foot)



Juggling (Body) : This test evaluates the body's coordination for several football skills. The player receives a ball thrown by the examiner five meters away, and they attempt to play it in the following order: 1) Head-left foot-right foot, 2) Chest-foot-head, and 3) Foot-chest-head. For each exercise, the examiner records three attempts in total. One point is awarded for each successful attempt.

FIGURE 4

Juggling (Body)





Speed Dribbling : This test enables the evaluation of speed and coordinated dribbling under time constraints. The player begins with the ball from behind the line (1 on the diagram) when the signal "Ready—Go" is given. Five meters later, he dribbles around the first post of a triangle (2) to the right. He dribbles around the other posts in accordance with the established arrangement. He dribbles around a block (3) after ten meters. Next, he goes around one side of a square (5) to retrieve the ball (6) and plays the ball around the opposite side (4) after eight meters. After that, he dashes through a gate and steps on the ball (7). The examiner clocks how long it takes the player to get the ball under his foot after the "Go" signal. A stopwatch is used to measure in intervals of 0.1 seconds.

FIGURE 5

SPEED DRIBBLING



Long Passing : This exam enables evaluation of long-range shooting ability and passing accuracy. From its dead position on the line, the player passes the ball into a circle designated in the center of a square target area (10 meters; radius, 2 meters; distance, 36 meters). First, the player gets a trial run. Five tries are measured in total by the examiner. Points are used as the measuring unit; three points are awarded if the ball touches the circle or lands inside it, and one point is awarded if it lands outside of the square.

FIGURE 6

LONG PASSING



Short Passing : This test allows you to evaluate your coordination and accuracy when passing a moving ball. The player passes the puck precisely into an 11-meter-distance short goalpost after dribbling it inside a specified rectangle up to a line. Five tries are measured by the examiner, who awards three points for a goal and one point for striking the crossbar or goalpost.

FIGURE 7

SHORT PASSING



Shooting (Dead ball) : The exam enables the evaluation of shooting from a dead ball with accuracy and agility. The midpoint of the goal is 16 meters away from where the ball is placed. The goal is made up of six components that the player fires into. The top left part is his second goal after the top right. For both the top left and top right parts, the examiner counts three tries in total. If the player aims into the correct part, they will score three points; if they fire into the top middle segment, they will score one point; if they shoot into the lower segments, they will receive zero points.

FIGURE 8

SHOOTING (DEADBALL)



Shooting from a pass : In order to conduct this test, we set up with the ball at the height of the goalkeeper's box on the edge of the penalty area, and we passed it to the player 20 meters on the ground. Players had to shoot the ball straight into the goal from the researcher's pass after sprinting five meters. The player could try again if they felt that the pass was not accurate enough. Five tries were used to calculate scores. Players received six points for hitting the upper right or left segments, one point for hitting the goalpost or crossbar in these segments, two points for hitting the upper center segment, and one point for hitting the bottom segments.

FIGURE 9

SHOOTING (FROM A PASS)



Heading : There were two sections to the heading test. A researcher stood in front of the soccer goal's center for the first portion of the test, passing the ball to the player's head. The players divided the ball into six equal portions and rushed three meters from the penalty spot to head it into the goal. After a first trial attempt, each participant made three further attempts. If the ball struck the goalpost or crossbar in this segment, it would score one point; if it struck the lower left or right segments, it would score three points. Six points would be awarded for hitting either of the top right or top left sectors. If the ball landed in the bottom middle segment, there was no point awarded.

The ball was thrown to the player's head by the researcher, who was three meters (right) from the goalpost for the second heading test portion. The player has to head the ball into the goal from three meters behind the penalty spot. The researcher allowed for three attempts in total, awarding six points for each attempt if the ball entered the top left segment, one point for hitting the segment's crossbar or goalpost, three points for entering the lower segment, two points for entering the top middle segment, and one point for entering the lower middle segment. In the event that the ball entered the right segment.

FIGURE 10

HEADING (FRONT)



FIGURE 11

HEADING (RIGHT)



INTERVENTION

Jump Rope Training (16)

- Jumping rope (JR) represents a form of exercise that involves upper and lower body movements. During the execution, arms rotate the rope while legs perform repeated bounces with the aim to maintain constant vertical take-off and landing phases until the end of the exercise. During successive jumps, the body needs to re-establish balance and propulsion force through a coordinated action of upper and lower body region muscles. In particular, balance abilities are essential to obtain an effective pushing phase. Jump rope training of the players will be given for 8 weeks which will be divided in 2 DAYS/WEEK . The training will be done for 20 minutes per each session. Regular warmup and cool down periods will be advised to the players. The jump rope intervention consists of 3 exercises :

Basic Bounce Step [30 Secs – 3 Sets]

Double Bounce Step [30 Secs – 3 Sets]

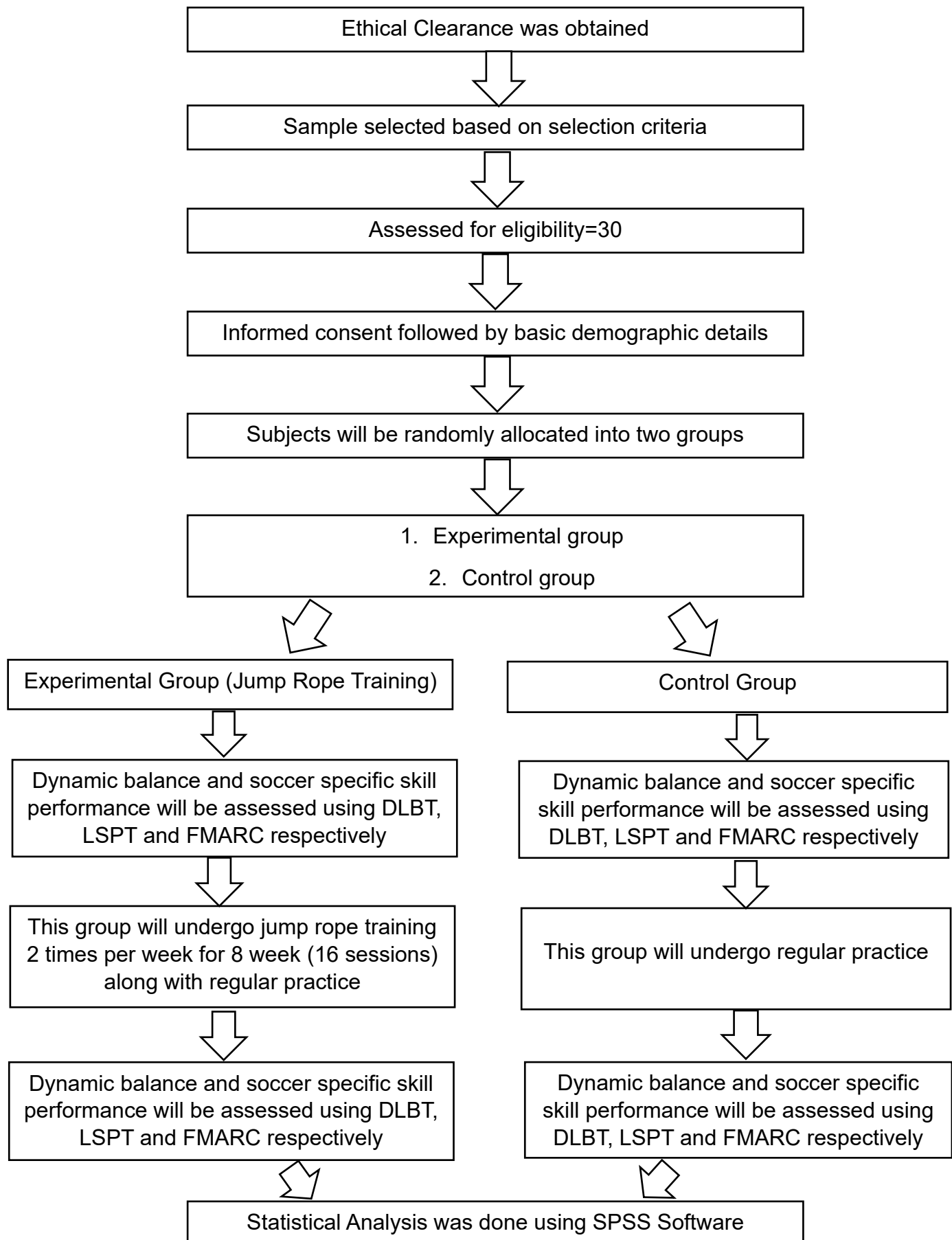
Alternate Foot Step [30 Secs – 3 sets]

FIGURE 12

JUMP ROPE EXERCISES



Methodology flow chart



SAMPLE SIZE ESTIMATION

A sample size of 30 subjects was estimated using a medium effect size of 0.5, a power of 0.95, and a level of significance set at 0.05. 15 participants were allocated to Experimental group and 15 participants were allocated to control group

RESULTS

The data collected in fragmented form was presented in an orderly manner and tabulated form in Excel. Data was analysed using SPSS software. Normality was taken out using Shapiro Wilk test represented in Table 1. Descriptive statistics summarize or describe the characteristics of data set in Table 2. In inferential statistics, Paired t-test was used to measure within group differences of two variables shown in Table 3 and 4. Unpaired t-test was used to measure between group differences of two variables shown in Table 5. Graphical representation of the data is done in the graphs 1-9.

TABLE 1

Tests of Normality

	Shapiro-Wilk		
	Statistic	df	Sig.
DLBT_R_PRE	.944	15	.441
DLBT_R_POST	.964	15	.759
DLBT_L_PRE	.939	15	.368
DLBT_L_POST	.939	15	.376
LSPT_PRE	.963	15	.743
LSPT_POST	.940	15	.387
DRIB_PRE	.924	15	.218
DRIB_POST	.867	15	.030
JUGG_F_R_PRE	.946	15	.467
JUGG_F_R_POST	.900	15	.095
JUGG_F_L_PRE	.962	15	.734
JUGG_F_L_POST	.936	15	.332
JUGG_B_PRE	.889	15	.064

JUGG_B_POST	.891	15	.070
SHORT_P_PRE	.930	15	.271
SHORT_P_POST	.942	15	.412
LONG_P_PRE	.890	15	.066
LONG_P_POST	.922	15	.204
SHOOT_D_PRE	.917	15	.172
SHOOT_D_POST	.909	15	.130
SHOOT_P_PRE	.946	15	.465
SHOOT_P_POST	.934	15	.312
HEAD_F_PRE	.918	15	.178
HEAD_F_POST	.918	15	.179
HEAD_R_PRE	.925	15	.230
HEAD_R_POST	.846	15	.015

It was found that the data follows normal distribution, therefore paired t-test was performed for within group analysis and unpaired test was performed for between group analysis.

TABLE 2

Demographic Characteristics

	MEAN	STANDARD DEVIATION	95%CI (LOWER– UPPER LIMIT)
AGE	21.90	2.35401	18-25

GRAPH 1

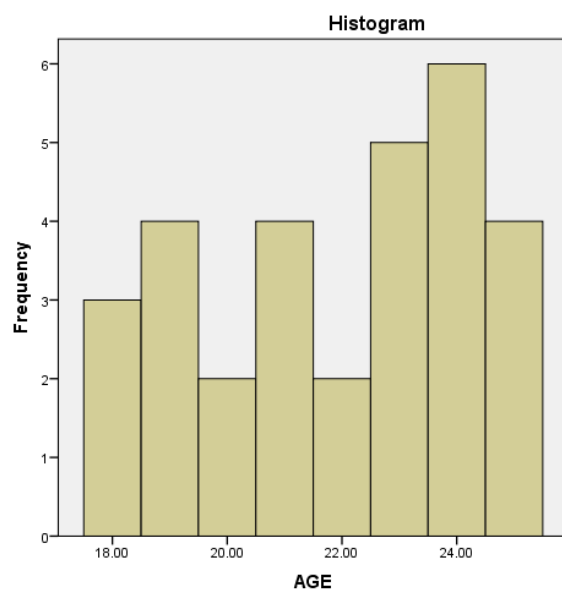


TABLE 3

EXPERIMENTAL GROUP - PAIRED T-TEST

Experimental Group	Mean	Sd	N	P Value
DLBT- RIGHT				
Pre	34.3333	2.89499	15	<0.05
Post	27.8000	2.42605	15	
DLBT- LEFT				
Pre	34.7333	3.03472	15	<0.05
Post	27.9333	2.01660	15	
LSPT				
Pre	68.2667	2.78944	15	<0.05
Post	53.8667	3.02056	15	

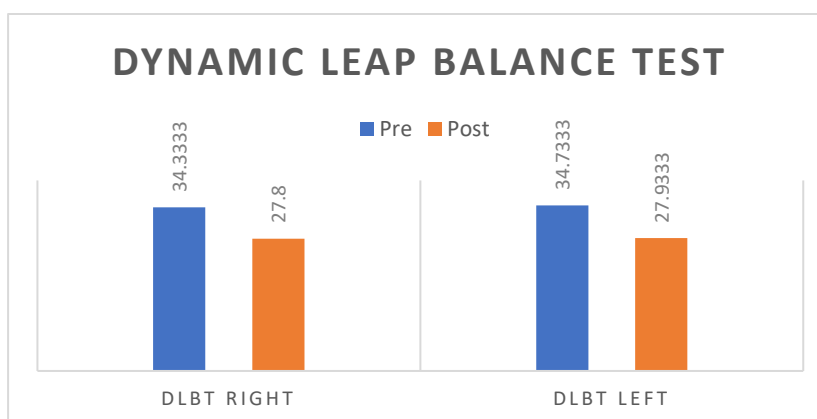
F-MARC BATTERY TEST				
DRIBBLING				
Pre	24.6000	1.18322	15	>0.05
Post	24.4000	1.35225	15	
JUGGLING (FOOT RIGHT)				
Pre	13.7333	2.15362	15	<0.05
Post	21.0667	2.25093	15	
JUGGLING (FOOT LEFT)				
Pre	7.8667	2.44560	15	<0.05
Post	13.1333	2.32584	15	
JUGGLING (BODY)				
Pre	5.5333	1.06010	15	<0.05
Post	6.3333	.97590	15	
SHORT PASS				
Pre	8.5333	1.68466	15	<0.05
Post	11.4667	1.84649	15	
LONG PASS				
Pre	5.9333	1.48645	15	<0.05
Post	8.5333	1.55226	15	
SHOOTING (DEADBALL)				
Pre	6.2667	1.48645	15	<0.05
Post	7.2667	1.66762	15	
SHOOTING (FROM A PASS)				
Pre	8.0667	1.79151	15	<0.05

Post	8.7333	1.75119	15	
HEADING (FRONT)				
Pre	6.0000	1.64751	15	>0.05
Post	6.2000	1.56753	15	
HEADING (RIGHT)				
Pre	5.3333	1.23443	15	>0.05
Post	5.4667	1.30201	15	

It was found that there is significant difference in Dynamic Balance after application of Jump rope training in the experimental group with the p value <0.05. As for the passing skills, significant difference was found in the LSPT scores post jump rope training (p<0.05). The F-MARC Battery test showed varied results. There was significant difference found in the scores of Juggling (Foot), Juggling (Body), Short Passing, Long Passing, Shooting a Deadball and Shooting from a Pass with the p value <0.05. But there was no significant difference found in Dribbling, Heading (Front) and Heading (Right) with p value more than 0.05 after jump rope training in experimental group.

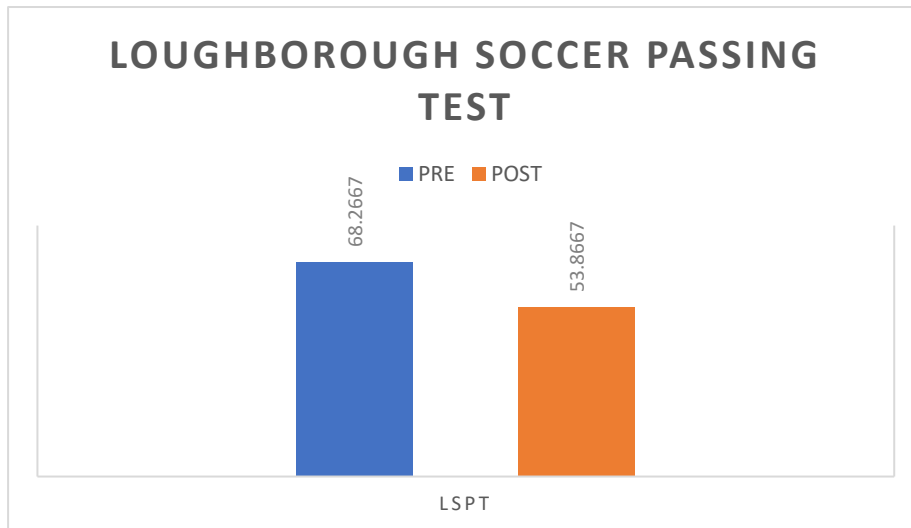
GRAPH 2

Dynamic Leap Balance Test – Experimental Group



GRAPH 3

Loughborough Soccer Passing Test– Experimental Group



GRAPH 4

F-MARC Battery Test– Experimental Group

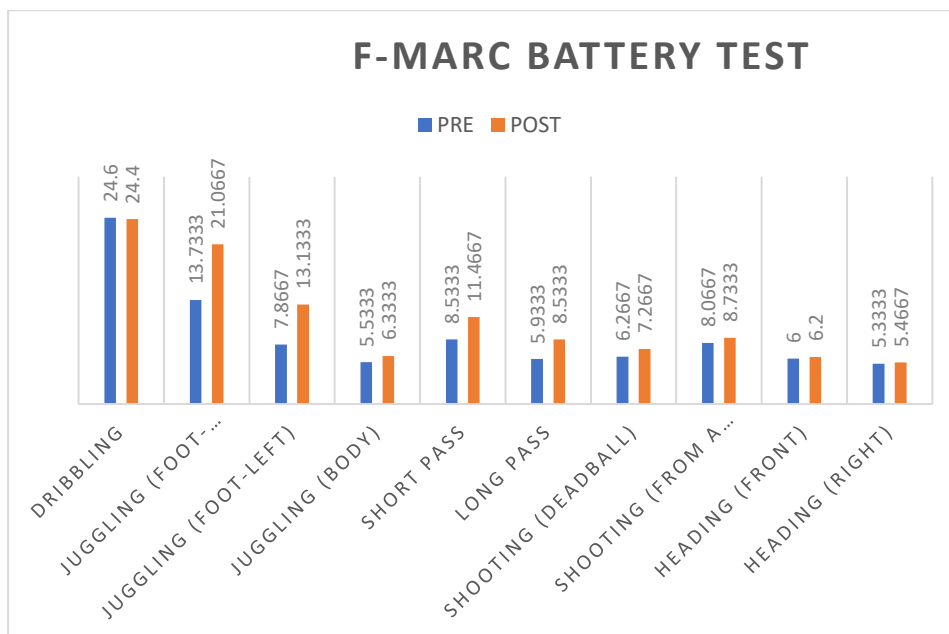


TABLE 4

CONTROL GROUP - PAIRED T-TEST

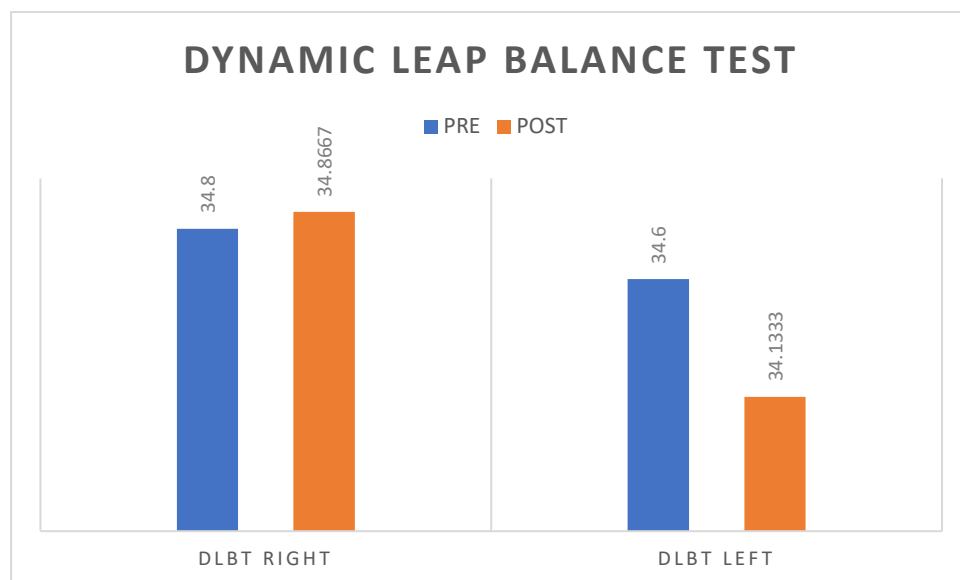
Control Group	Mean	Sd	N	p value
DLBT- RIGHT				
Pre	34.8000	2.85857	15	>0.05
Post	34.8667	2.50333	15	
DLBT- LEFT				
Pre	34.6000	2.74643	15	>0.05
Post	34.1333	2.19957	15	
LSPT				
Pre	68.2000	3.62925	15	>0.05
Post	67.1333	2.38647	15	
F-MARC BATTERY TEST				
DRIBBLING				
Pre	24.1333	1.24595	15	>0.05
Post	23.6667	1.04654	15	
JUGGLING (FOOT RIGHT)				
Pre	14.1333	2.35635	15	>0.05
Post	14.6000	2.13140	15	
JUGGLING (FOOT LEFT)				
Pre	8.2000	2.04241	15	>0.05
Post	8.7333	1.70992	15	

JUGGLING (BODY)				
Pre	5.8667	1.06010	15	>0.05
Post	5.9333	1.03280	15	
SHORT PASS				
Pre	8.4000	1.63881	15	<0.05
Post	10.6667	1.87718	15	
LONG PASS				
Pre	6.0000	1.46385	15	<0.05
Post	6.9333	1.38701	15	
SHOOTING (DEADBALL)				
Pre	5.6667	1.54303	15	<0.05
Post	6.4000	1.29835	15	
SHOOTING (FROM A PASS)				
Pre	8.3333	1.54303	15	<0.05
Post	9.0667	1.33452	15	
HEADING (FRONT)				
Pre	6.4000	1.50238	15	>0.05
Post	6.4667	1.35576	15	
HEADING (RIGHT)				
Pre	5.6667	1.44749	15	>0.05
Post	6.0000	1.06904	15	

In the control group, there was no significant difference found in the Dynamic Balance of the players after 8 weeks of regular training($p>0.05$). The passing skills also did not show any significant improvement on Loughborough Soccer Passing Test with the p value greater than 0.05. As for the soccer specific skills, there was significant difference found only in Short pass, Long pass, Shooting from a Deadball and Shooting from a Pass($p<0.05$). The other skills on F-MARC Battery Test i.e Dribbling, Juggling (Foot), Juggling (Body), Heading (Front) and Heading (Right) did not show any significant improvement in the control group after 8 weeks of regular soccer training.

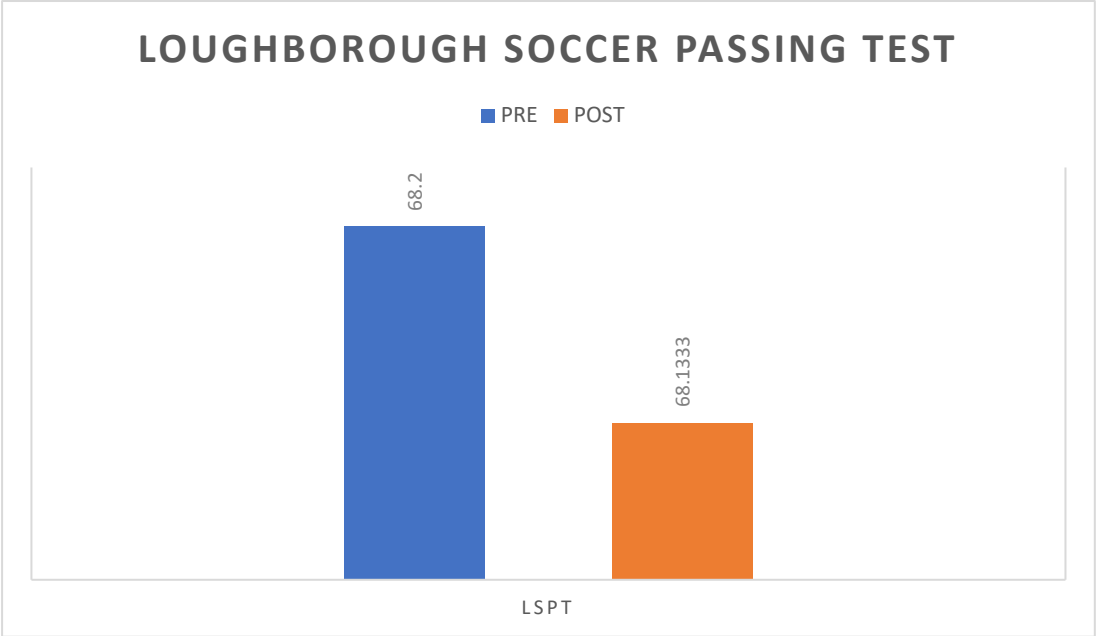
GRAPH 5

Dynamic Leap Balance Test – Control Group



GRAPH 6

Loughborough Soccer Passing Test– Control Group



GRAPH 7

F-MARC Battery Test– Control Group

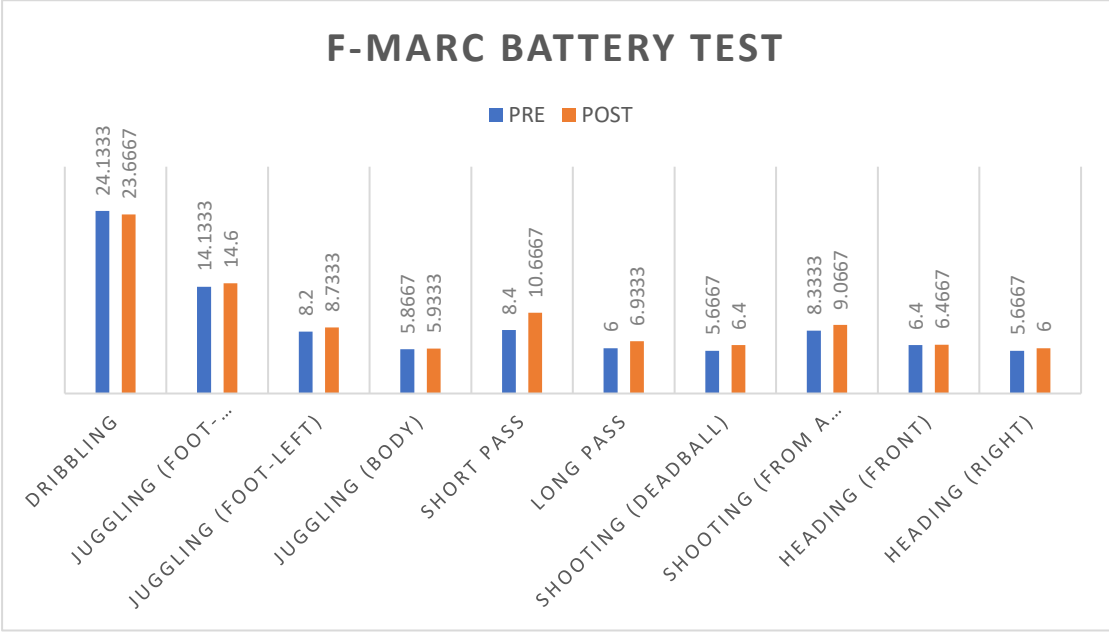


TABLE 5

UNPAIRED T-TEST

	MEAN	SD	N	P VALUE
DLBT- Right				
EXPERIMENTAL	27.8000	2.42605	15	<0.05
CONTROL	34.8667	2.50333	15	
DLBT- Left				
EXPERIMENTAL	27.9333	2.01660	15	>0.05
CONTROL	34.1333	2.19957	15	
LSPT				
EXPERIMENTAL	53.8667	3.02056	15	<0.05
CONTROL	67.1333	2.38647	15	
F-MARC BATTERY TEST				
DRIBBLING				
EXPERIMENTAL	24.4000	1.35225	15	>0.05
CONTROL	23.6667	1.04654	15	
JUGGLING (foot right)				
EXPERIMENTAL	21.0667	2.25093	15	<0.05
CONTROL	14.6000	2.13140	15	
JUGGLING (foot left)				
EXPERIMENTAL	13.1333	2.32584	15	<0.05
CONTROL	8.7333	1.70992	15	
JUGGLING (BODY)				

EXPERIMENTAL	6.3333	.97590	15	>0.05
CONTROL	5.9333	1.03280	15	
SHORT PASS				
EXPERIMENTAL	11.4667	1.84649	15	>0.05
CONTROL	10.6667	1.87718	15	
LONG PASS				
EXPERIMENTAL	8.5333	1.55226	15	<0.05
CONTROL	6.9333	1.38701	15	
SHOOTING (DEADBALL)				
EXPERIMENTAL	7.2667	1.66762	15	>0.05
CONTROL	6.4000	1.29835	15	
SHOOTING (from a pass)				
EXPERIMENTAL	8.7333	1.75119	15	>0.05
CONTROL	9.0667	1.33452	15	
HEADING (FRONT)				
EXPERIMENTAL	6.2000	1.56753	15	>0.05
CONTROL	6.4667	1.35576	15	
HEADING (RIGHT)				
EXPERIMENTAL	5.4667	1.30201	15	>0.05
CONTROL	6.0000	1.06904	15	

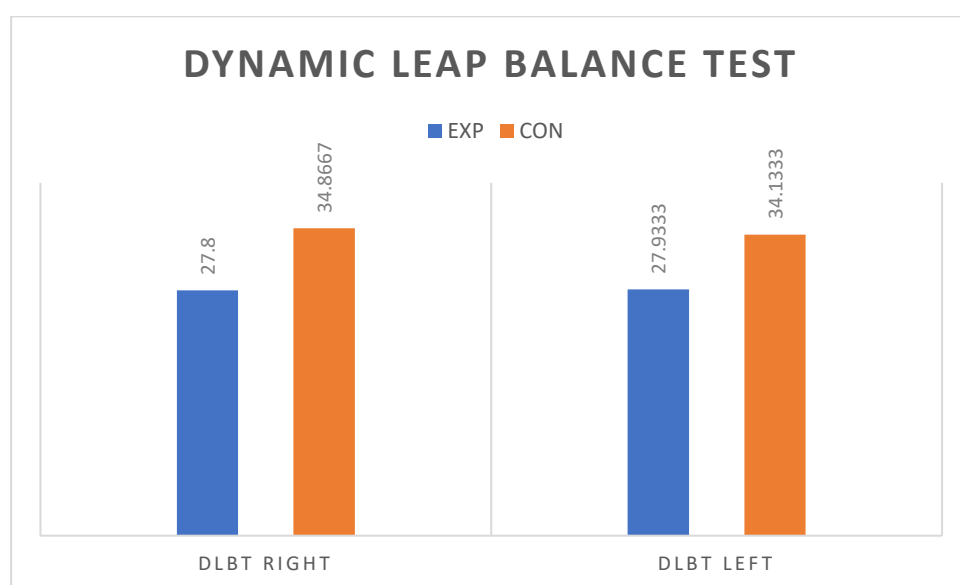
Upon the unpaired t-test analysis, it was found that Jump rope training had a significant difference in Dynamic Balance of the Right (Dominant) foot with $p < 0.05$ in the Experimental group.

Also, it was found that after implementation of jump rope training, there was significant improvement in the passing skills (LSPT scores) of the experimental group when compared to the control group ($p < 0.05$).

Among the soccer specific skills, significant difference was found only in Juggling (Foot) and Long Pass between the experimental and control group after 8 weeks of intervention.

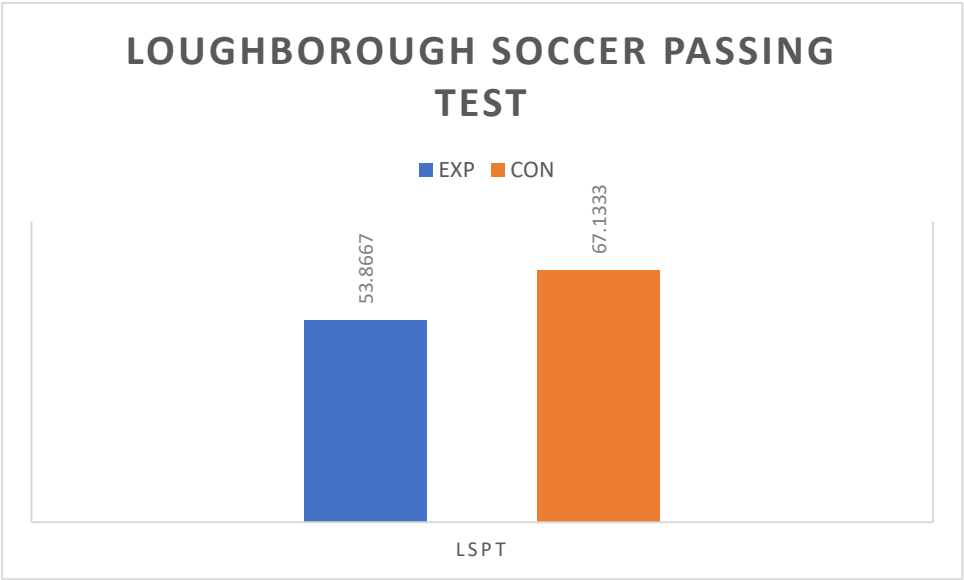
GRAPH 8

Dynamic Leap Balance Test



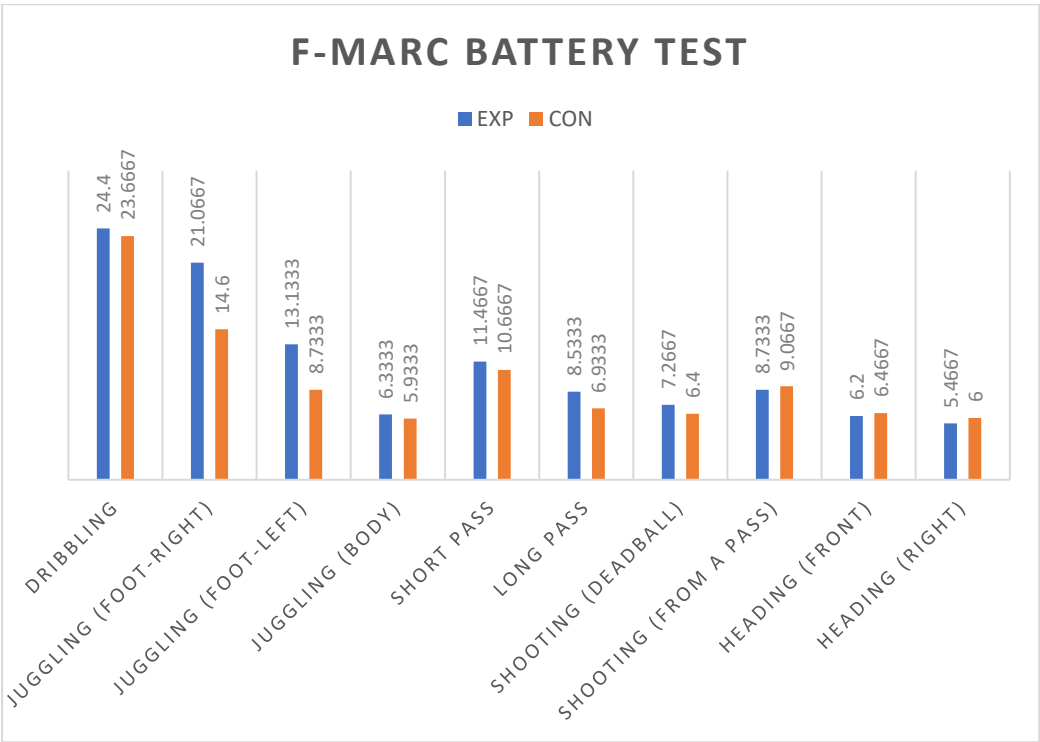
GRAPH 9

Loughborough Soccer Passing Test



GRAPH 10

F-MARC Battery Test



DISCUSSION

According to the Federation Internationale de Football Association (FIFA), soccer is the most popular organized sport in the world, with over 200 million men and 21 million women registered. (1) It is a difficult sport that requires a lot of agility and involves a variety of movement patterns, including side-cut movements, sprints, and jumps, all of which are regularly executed at high to peak intensity. (22)

Performance in competitive soccer is influenced by a wide range of characteristics, including technical, tactical, mental, physiological, and physical. High levels of cognitive, perceptual, and motor skills are necessary for elite soccer in a setting that is changing quickly. (2)

In soccer, one of the most popular team sports worldwide, balance appears to be connected to technical skill level. (5) In particular, it has been discovered that balance in soccer is essential for basic motor abilities including kicking, striking, hopping, and skipping. (6).

Hence, enhancing young soccer players' motor ability should involve the use of closed skill activities (e.g. sprinting, changing of direction and jumping), as well as open skills activities (e.g. balance, orientation tasks and reactive movements) in the form of non-specific training within regular sessions (Gabbett et al., 2008).

A study by Bacon, CS and Mauger, AR, found that there was higher incidence of overuse injuries among soccer players from the age group of 18 to 21 years of age. (23) Therefore, with the reference to additional standard published

articles for this study the age criteria was taken from 18-25 years old soccer players.

In order to acquire human dynamic balance, one must reduce their area of support with the ground. This is important for young athletes performing complex athletic tasks and helps prevent falls during functional tasks. By flexing the hip and knee joints during the jumping stomp, the double foot rotation mono shock jump ensures the practitioner's dynamic stability. The left and right feet alternately provide support during the exercise. The primary goals of this quick single-swing jump rope exercise are to strengthen the ankle joint's quick super-isometric contraction capacity and the hip and knee joints' stability. Improved control of the body by the neurological system and muscle proprioceptors during movement, particularly in the lower limb and trunk muscles, results from effective activation of the ankle, knee, and hip joints, which are important in body posture and balance regulation. (24)

A randomised controlled trial study was conducted by Athos Trecroci, they concluded that Jump rope training protocol at the beginning of training sessions was effective to improve motor coordination and balance in preadolescent soccer players over a period of 8 weeks. In the present study, effect of jump rope training programme on dynamic balance was found to be significant. (16)

Another study by Zuozheng Shi, stated that Junior tennis players' dynamic balance and hitting stability can be effectively improved with 12 weeks of jump rope training. Additionally, the combined effects of jump rope and special preparatory activity training outperform those of special preparatory activity training alone. (24)

In correspondence to the above articles, we also found that jump rope training had a significant improvement in the dynamic balance in club level soccer players as the p value was <0.05 when compared using the Dynamic Leap Balance Test pre and post intervention.

An author Cè E stated in his study that young soccer players may benefit from extra balance training added to their regular training, as balance training enhanced several technical soccer skills more than habitual soccer training alone. (4)

Ioannis Mitrousis, in his study on the Effect of a Balance Training Program on the Balance and Technical Skills of Adolescent Soccer Players found that an 8-week tailored BTP can help adolescent soccer players improve their dynamic and static balance, as well as their ability to shoot with their dominant leg. Soccer players' technical skill development may be enhanced by balancing training programs. (25)

In our study we also observed that along with improvement in the Dynamic balance, the soccer specific skills i.e passing , juggling, shooting, short passing and long passing also improved significantly in the experimental group after implementation of 8 weeks of jump rope training program along with regular soccer training

CONCLUSION

In club level soccer players, the study result shows that there was a significant difference found in DLBT, LSPT and F-MARC Battery Test [Juggling (Foot), Juggling (Body), Short Passing, Long Passing, Shooting a Deadball and Shooting from a Pass] in the experimental group after 8 weeks of jump rope training program.

The control group did not show any significant difference in DLBT and LSPT scores after 8 weeks of regular soccer training program. But the control group showed improvement in short pass, long pass and shooting.

Lastly, when both the control and experimental groups were compared it was found that the experimental group showed significant improvement in DLBT, LSPT and F-MARC Battery Test (juggling and passing).

Hence, our study suggest that Jump Rope Training should be included in the regular soccer training program as an adjunct to improve Dynamic Balance and Soccer specific skills in soccer players.

LIMITATIONS

This study has few limitations. Firstly, given that the sample size of the study is small, it is advisable to conduct the research with a larger sample in order to enhance the reliability and applicability of the findings. Secondly, only male participants were included in the study. Lastly, this study lacks a comparison between male and female genders.

FUTURE SCOPE OF STUDY

Future studies should aim at larger sample size and distinction between groups that participate in various levels of competitions. Physiologically male and female individuals exhibit distinct body compositions, which may affect study results. Therefore, it is essential to conduct separate studies for male and female populations. Additional research may also assess effect of jump rope training in athletes involved in sports like rugby, badminton, tennis and hockey etc that require balance and motor co-ordination.

SUMMARY

In the world, soccer is the most popular organized sport. Soccer is an intricate sport that requires a lot of agility and involves a wide variety of movement patterns, including side-cut movements, sprints, and jumps, all of which are typically executed at high to peak intensity. In particular, it has been discovered that balance in soccer is essential for basic motor abilities including kicking, striking, hopping, and skipping. Essential elements of playing soccer include the actual motor tasks of passing, controlling, dribbling, and shooting the ball. Various tests were used to assess the dynamic balance and soccer specific skills.

This study's aim was to determine the effect of jump rope training on dynamic balance and soccer specific skill performance in club level soccer players. Also, the objective of the study was to find the effect of jump rope training on dynamic balance using Dynamic Leap Balance Test and soccer specific skill performance using LSPT and F-MARC Battery test in club level soccer players.

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ANNEXURE: 1

CONSENT FORM

I confirm that I have understood about about Effect Of Jump Rope Training Program On Dynamic Balance And Soccer Specific Skill Performance as explained by Master Abhishek Bhambal and is as mentioned in her study which is taking place under the guidance of Dr. Deepak Kumar Pradhan Assistant professor, Abhinav Bindra Sports Medicine and Research Institute (ABSMARI). I understand that my participation is voluntary and I'm free to withdraw at any time, without giving any reason. I understand that confidentiality will be maintained. I voluntarily agree to and give my consent to be a part of the above-mentioned study.

(Signature)

(Date)

ANNEXURE: 2

ETHICAL COMMITTEE CLEARANCE CERTIFICATE



ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE,
BHUBANESWAR, ODISHA

Prof. (Dr.) E. Venkata Rao
Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

ABSMARI/IEC/2024/069

Ref. No. _____

APPROVAL LETTER
APPENDIX- VIII

Date: 22/06/2024

To,

Abhishek Bhambal
ABSMARI
273, PAHAL, BHUBANEWAR-752101

**Protocol Title: EFFECT OF JUMP ROPE TRAINING PROGRAM ON
DYNAMIC BALANCE AND SOCCER SPECIFIC PERFORMANCES
- AN EXPERIMENTAL STUDY**

Protocol ID.: ABS-IEC-2023-PHY-021

Subject: Approval for the conduct of the above referenced study

Dear Mr./Ms./Dr **Abhishek Bhambal**

With reference to your Submission letter dated 12/08/2023 the ABSMARI IEC has of the Ethics reviewed and discussed your application for conduct of clinical trial on dated 02/09/2023 (Sat Day).

The following documents were reviewed and discussed

S.N.	Documents	Document (Version/Date)
1	IEC Application Form	08-08-2023
2	Informed Consent Form	08-08-2023
3	Undertaking form PI	08-08-2023
4	CRF	08-08-2023
5	COI from the Investigators	08-08-2023

The following members were present at meeting held on 02-09-2023

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. Satyajit Mohanty	Director-Medcare Hospital, BBSR	Basic Medical Scientist	M	N
3	Dr. Ashok Singh Chouhan	PhD. Pharmacology, Assoc. Prof. Dept. of Pharmacology, Hi-Tech Medical College & Hospital, BBSR	Basic Medical Scientist	M	N



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ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE,
BHUBANESWAR, ODISHA

Prof. (Dr.) E. Venkata Rao
Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2024/069

Date: 22/06/2024

MEMBERS

Dr. Smaraki Mohanty,
Clinician

Dr. Satyajit Mohanty,
Basic Medical Scientist

Dr. Ashok Singh Chouhan
Basic Medical Scientist

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. Raychoudhary

S.N.	Name of the Member	Designation & Qualification	Representation as per NDCT 2019	Gender (M/F)	Affiliation with the Institution (Y/N)
4	Dr. Smaraki Mohanty	Asst. Prof-IMS & Sum Hospital/MBBS, MD [Community Med]	Clinician	F	N
5	Mr. Chinmaya Kumar Patra	Principal-ABSMARI, MPT	Member Secretary	M	Y
6	Mr. Shiba Sankar Mohanty	Junior Counsel-Lt. Ramachandra Sarangi's Chamber / BA LLB	Legal Expert	M	N
7	Ms. Annie Hans	Disability Inclusive Development Co-Ordinator in Humanity and Inclusion (India/Nepal/Srilanka). /MA in Social Work	Social Scientist	F	N
8	Ms. Subhashree Samal	Ref. Reader-Pol Sc.	Lay Person	F	N
9	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 trial in the presented form with necessary recommendation.

The ABSMARI IEC must be informed about the progress of the study, any SAE occurring in the course of the study, any changes in the protocol and patient information/informed consent and requests to be provided 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

Member Secretary
ABSMARI ETHICS COMMITTEE



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ANNEXURE: 3

PROFORMA FORMAT

Name:

Age:

Dominance:

Years of experience:

Lower limb length:

1. Dynamic Leap Balance Test

	TRIAL 1	TRIAL 2	TRIAL 3
RIGHT			
LEFT			

2. LOUGHBOROUGH SOCCER PASSING TEST

TIME TAKEN TO COMPLETE THE TEST (SECONDS)	
PENALTY TIME (SECONDS)	
PERFORMANCE TIME (SECONDS)	

3. F-MARC Battery Test

	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
DRIBBLING					
JUGGLING(FOOT)					
JUGGLING(BODY)					
SHORT PASS					
LONG PASS					
SHOOTING(DEADBALL)					
SHOOTING(FROM PASS)					
HEADING(FRONT)					
HEADING(RIGHT)					

MASTERCHART

EXPERIMENTAL GROUP

Sr. No.	Age	Gender	DLBT				LSPT		F-MARC BATTERY TEST																				
			Right		Left				Dribble		Juggling (foot)				Juggling (body)		Short pass		long pass		Shooting deadball		Shooting from a pass		heading (front)		head right		
											Right		left																
			pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post	pre
1	23	M	33	26	39	28	69	53	24	24	14	20	11	13	6	6	9	12	7	9	5	5	8	9	6	6	5	5	
2	25	M	38	30	31	26	66	50	23	23	12	19	9	12	5	6	7	9	5	7	4	5	9	9	7	7	7	7	
3	20	M	31	25	35	27	70	59	25	25	16	23	7	10	4	5	8	11	4	6	7	9	6	7	5	5	6	6	
4	21	M	36	29	33	26	65	55	26	26	11	18	5	12	7	7	10	13	8	10	5	6	10	11	8	8	4	4	
5	18	M	32	28	38	30	68	56	24	23	15	25	8	15	6	6	6	8	6	9	6	7	7	7	4	5	6	6	
6	22	M	39	32	30	25	70	55	27	27	13	20	4	10	5	7	11	13	7	11	8	9	8	8	7	7	7	8	
7	23	M	34	29	36	28	68	54	25	25	10	19	10	16	6	8	9	12	5	9	7	8	11	12	6	6	5	5	
8	24	M	30	23	32	27	67	52	23	23	14	21	6	13	7	7	7	9	4	8	5	6	6	7	5	5	4	4	
9	22	M	37	30	37	30	72	54	24	24	12	20	9	15	5	6	10	14	5	7	6	8	10	10	8	8	3	3	
10	25	M	35	27	34	29	64	48	25	25	16	24	7	13	4	5	8	11	8	11	8	9	6	7	3	4	6	6	
11	21	M	32	28	39	31	67	55	25	25	11	20	11	16	6	6	6	10	7	9	9	10	8	9	8	9	5	5	
12	24	M	38	30	31	25	70	56	23	22	15	19	12	17	5	5	9	13	6	9	5	5	9	9	5	5	4	5	
13	23	M	31	25	35	29	73	57	24	24	17	25	8	10	7	8	11	14	4	6	8	8	5	6	6	6	6	6	
14	24	M	36	29	33	27	64	49	26	26	14	22	5	11	6	7	7	12	8	9	6	8	10	11	4	4	5	5	
15	19	M	33	26	38	31	71	55	25	24	16	21	6	14	4	6	10	11	5	8	5	6	8	9	8	8	7	7	

CONTROL GROUP

Sr. No.	Age	Gender	DLBT				LSPT		F-MARC BATTERY TEST																			
			Right		Left				Dribble		Juggling (foot)				Juggling (body)		Short pass		Long pass		Shooting deadball		Shooting from a pass		heading (front)		head right	
									Right		left																	
									pre	post	pre	post																
1	19	M	37	37	35	33	68	69	23	24	14	14	8	8	5	5	8	11	5	6	4	5	9	9	7	8	4	5
2	21	M	32	31	32	32	71	70	24	23	16	15	10	9	7	6	10	13	7	7	5	5	8	10	5	6	6	6
3	23	M	39	39	38	37	64	66	26	25	13	13	8	8	6	7	7	11	6	7	7	8	9	9	8	9	7	7
4	18	M	35	35	33	33	66	64	25	23	15	17	9	10	4	4	9	12	4	5	5	6	7	8	6	6	5	6
5	20	M	31	33	36	33	66	67	22	24	14	14	6	7	5	6	6	8	8	8	4	6	10	11	4	5	4	4
6	19	M	34	34	30	32	74	72	24	23	17	15	11	11	6	6	11	14	5	6	8	8	8	9	7	6	7	6
7	25	M	38	38	37	36	69	68	22	21	11	12	7	7	7	7	8	10	7	9	5	6	6	7	6	5	7	7
8	24	M	33	33	34	34	66	67	25	24	12	13	9	9	5	5	9	11	6	6	8	9	7	8	9	8	6	7
9	25	M	36	36	32	33	62	63	26	25	18	16	6	9	4	5	7	9	4	5	5	6	6	7	6	6	5	5
10	24	M	30	32	39	38	67	66	24	23	14	13	12	12	6	6	10	13	8	9	4	5	9	9	4	4	5	6
11	21	M	37	37	35	35	67	64	24	24	10	12	9	11	7	7	6	8	5	7	8	8	7	8	8	8	9	8
12	18	M	32	32	31	30	70	67	25	23	13	15	5	6	6	5	8	10	7	8	7	7	10	11	5	6	6	7
13	23	M	35	34	38	37	66	68	23	24	12	13	7	8	6	6	9	9	6	6	5	6	8	9	7	7	4	5
14	24	M	39	38	33	34	75	69	24	25	16	18	10	9	7	6	11	12	4	6	4	5	10	10	8	7	6	6
15	19	M	34	34	36	35	72	67	25	24	17	19	6	7	7	8	7	9	8	9	6	6	11	11	6	6	4	5