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## Effect of hip sliding exercise on hip mobility and performance in football players

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### Abstract

**Background:** Football is the world's leading sport, which requires players to perform repeated, high-intensity movements as well as quick direction changes. Football players require flexibility, power, strength, agility, and endurance in every muscle throughout the body in order to perform these skills. Hip mobility also contributes to better balance and stability, which are essential for maintaining control during dynamic movements and resisting forces from opponents.

**Aim:** To study the effect of hip sliding exercises on Hip ROM, Hip flexibility, dribbling time and Kicking velocity on football players.

**Methodology:** Total no. of 55 players were selected according to inclusion and exclusion criteria. Assessments of the outcome measures were conducted before and after ten sessions of hip sliding exercise. The outcome measures were Hip ROM, Bent knee fallout test, Thomas test, 90-90 straight leg test, dribbling test, and kick velocity.

**Results:** The comparison between pre and 10 sessions post hip sliding exercises showed Statistically and clinically significant improvement in all the outcome measures. (p-value < 0.05).

**Conclusion:** The study conclude that hip sliding exercise is very effective in improving Hip ROM, Hip Flexibility which contribute to significant improvement in performance in football players.

**Keywords:** Football, hip flexibility, kicking, slider exercise

### Introduction

Football is the world's leading sport, which requires players to perform repeated, high-intensity movements as well as quick direction changes<sup>[1]</sup>. The athlete must perform a range of explosive motions, including kicking, cutting, tackling, jumping, sprinting, and changing pace, in order to accomplish sporting goals. In contact sports like football, agility is a crucial attribute for both attackers and defenders. Kicking and jumping are a very important factor in football and one of the most fundamentally used skills<sup>[2]</sup>.

In football, A skilled dribbler may disrupt opponents' defensive lines, cause instability, and provide versatility on the field, all of which boost a team's performance as a whole. In football goal kicking, it is crucial to attain a highball velocity since, in addition to enhancing a player's opportunities of scoring, it also reduces the goalkeeper's reaction time. This is particularly essential for long passes and goal kicks<sup>[3]</sup>.

During training sessions and activities, these motions may strain the joints and create a biomechanical inconsistency that could restrict their standard range of motion (ROM). Any biomechanical changes, particularly in the lower limb, have the potential to impair healthy motor development and result in pain during playing sports<sup>[1]</sup>.

The mobility of hip muscles is crucial in football for several reasons. It allows players to execute a wide range of movements, including quick changes in direction, dynamic accelerations, and effective defensive maneuvers. In football, hip muscles are pivotal for various aspects of performance. These muscles play a crucial role in actions like changing direction, maintaining body control, and executing powerful shots or passes<sup>[4]</sup>.

During dribbling in football hip muscles play an important role by providing stability, balance, and power to players. Overall, well-developed hip muscles enhance a player's agility and control during dribbling situations.

Slider exercises target multiple muscle groups while emphasizing controlled movement and stability. These exercises are particularly beneficial for athletes, fitness enthusiasts, and individuals undergoing rehabilitation, as they can help prevent injuries, enhance performance, and promote overall functional movement patterns. Slider exercises, which require coordinated muscle activation to perform movements smoothly, can help enhance muscle activation patterns and improve joint mobility over time. Joint mobilization exercises are effective for improving joint mobility and reducing pain. Slider exercises often involve multi-planar movements that mimic real-life activities, helping individuals develop better movement mechanics and overall mobility [7].

### Methodology

An Interventional study was conducted on football players. Ethical committee approval was taken (BNH/0799/2023) and the study was registered in CTRI (CTRI/2023/10/058983). The study duration was 1 year. The sample size was 55 collected by convenience sampling. Football players, both male and Female, aged between 18-35 years and having minimum 2years of training for 2hrs/day for 3 days/week were included in the study. Players with Any musculoskeletal disorders and injury which can affect their play or assessment within last 6 months were excluded from the study. Subjects were selected as per the inclusion and exclusion criteria. They were explained about the rationale and the need of the study. A signed informed consent was taken from the subjects included in the study. Subjects were assessed with outcome measures which were Hip ROM, Bent knee fallout test, 90-90 straight leg test, Thomas test, kick velocity and dribbling test. Materials used were Bushnell velocity speed radar gun, Football, Goniometer, inch tape, Stopwatch, measuring tape, cones, sliders.

Hip ROM was assessed using Goniometer [8]. Hip Flexibility was assessed using Thomas test and Bent Knee fall out test, in which the players were asked to lie in crook lying position. The player was then instructed to let both of his knees drop to the side. Next, an inch tape was used to measure the distance between the player's knee (head of the fibula) and the ground [9].

Hamstring flexibility was assessed using 90-90 straight leg test, in which Player were instructed to be in supine position and to bring the hip and knee into 90 of flexion, also were asked to hold the thigh to maintain the hip 90 flexion. Then the player was asked to active extend the knee and the angle formed by the shaft of femur and the line of tibia was measured using goniometer [11].

Performance of the players were assessed using kicking velocity and dribbling test. For Dribbling test 6 cones were placed at 3m distance each and with start and finish gates 2.5m apart from each other. Players were asked to Stand at the start gate with football and on the "go" command the stopwatch was started and the players had to run and dribble the football around the cones in zig zag manner then turn around from the 6<sup>th</sup> cone i.e. at 18m and come back the same way up to the finish line. Once the players reached the finish gate the stopwatch was stopped and the time was noted [12]. For kicking velocity, the radar gun was held by the therapist at 1-meter distance behind and diagonal to the player. The trigger was engaged on the initiation on the kick, and was followed along the course of the football. The minute the ball reached the target the trigger was released; the maximum speed was reflected on the radar. The speed was noted into meter per hour (Mph) [13].

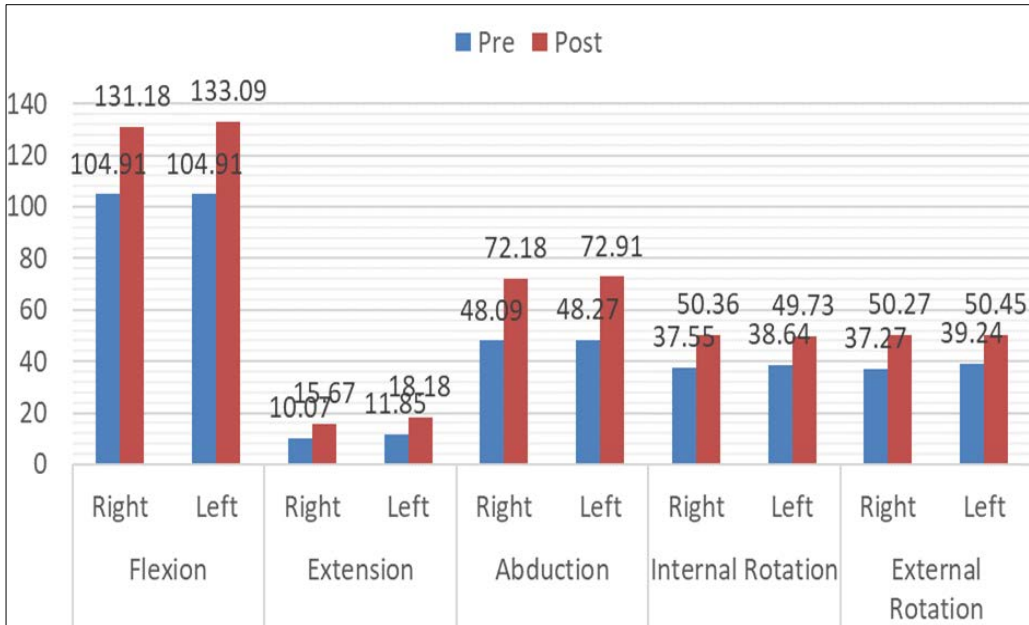
### Exercise Protocol

Players were made to perform 5 min jogging as a warm up.

Sessions	Exercise	Repeation
Session 1 and 2	Adductor sliding - single leg Hamstring sliding - single leg Quadriceps sliding - single leg	10 reps
Session 3 and 4	Adductor sliding - single leg Hamstring sliding - single leg Quadriceps sliding - single leg	10 reps with 5sec hold
Session 5 and 6	Adductor sliding - bilateral leg Hamstring sliding - bilateral leg Quadriceps sliding - bilateral leg	15 reps with 5 sec hold
Session 7 and 8	Adductor sliding - bilateral leg Hamstring sliding - bilateral leg Quadriceps sliding - bilateral leg	15 reps with 10 sec hold
Session 9 and 10	Hip circumduction - single leg Downward dog sliders - bilateral leg	10 reps with 10 sec hold - 2 sets

**Table 1:** Pre and Post Hip ROM

Hip Movements		Mean ± SD		P-Value
		PRE	Post	
Flexion	Right	104.91± 8.89	131.18±7.87	<0.001
	Left	104.91± 6.49	133.09±7.35	<0.001
Extension	Right	10.07±0.37	15.67±1.40	<0.001
	Left	11.85±1.89	18.18±2.42	<0.001
ABDUCTION	Right	48.09±4.02	72.18±7.05	<0.001
	Left	48.27±5.79	72.91±7.24	<0.001
Internal rotation	Right	37.55±2.41	50.36±4.17	<0.001
	Left	38.64±3.37	49.73±3.89	<0.001
External rotation	Right	37.27±2.85	50.27±5.22	<0.001
	Left	39.24±4.06	50.45±5.21	<0.001

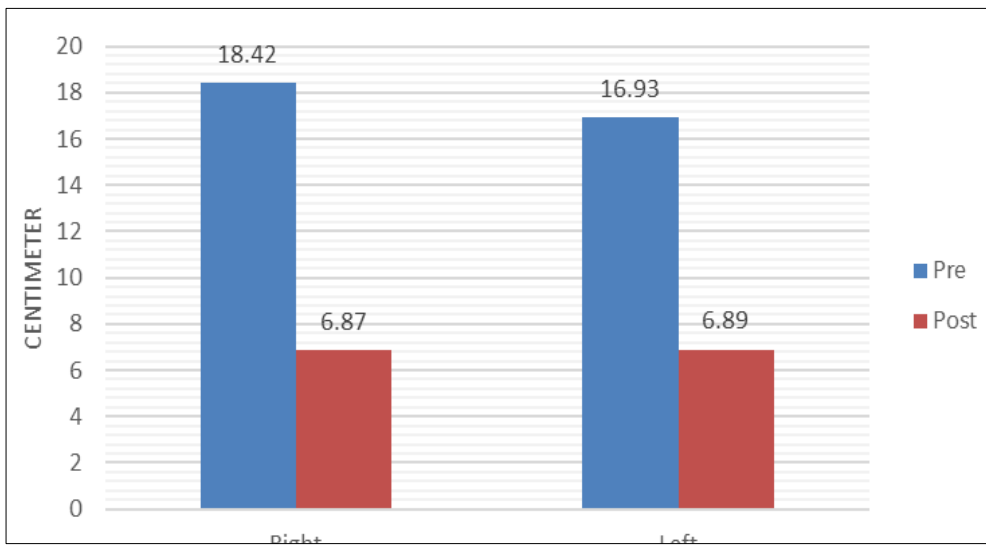


**Graph 1: Hip Rom**

Interpretation - As seen above there is a clinically and statistically significant improvement in intervention of hip slider exercises on hip Range of Motions. p-value is <0.001

**Table 2: Pre and Post bent knee fallout test**

Bent Knee Fallout Test		Mean ± SD	P-Value
Right	Pre	18.42±2.54	<0.001
	Post	6.87±1.38	
Left	Pre	16.93±4.38	<0.001
	Post	6.89±1.93	

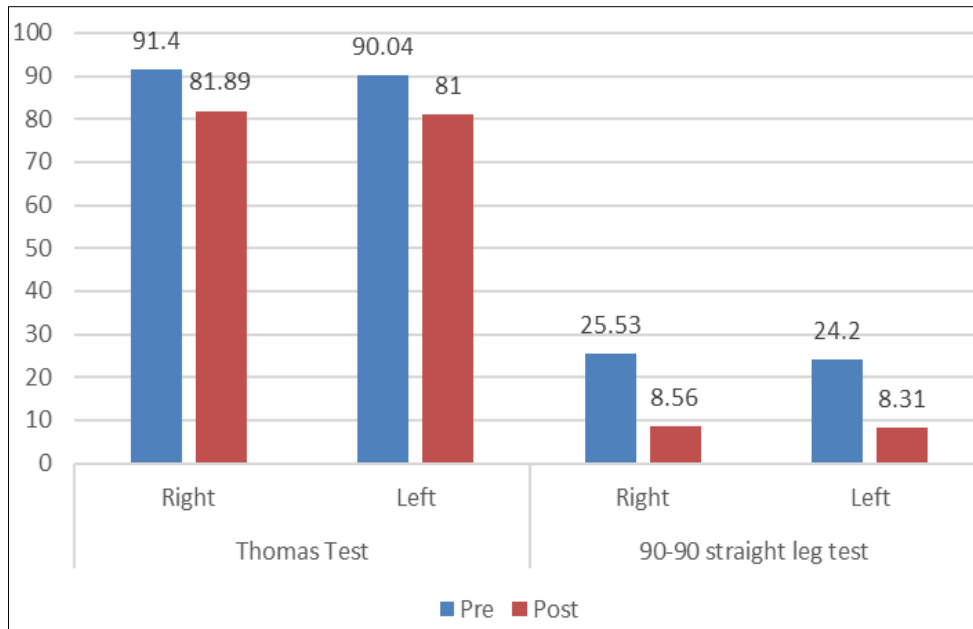


**Graph 2: Bent Knee Fallout test**

Interpretation - As seen above there is a clinically and statistically significant improvement in intervention of hip slider exercises on bent knee fallout test. p-value is <0.001.

**Table 3: Pre and post 90-90 Straight leg test and Thomas Test**

		Mean ± SD		P-Value
		Pre	Post	
90-90 Straight Leg Test	Right	25.53±2.48	8.56±2.63	<0.001
	Left	24.20±4.53	8.31±2.63	<0.001
Thomas Test	Right	91.40±3.23	81.89±3.24	<0.001
	Left	90.04±3.52	81.00±4.85	<0.001

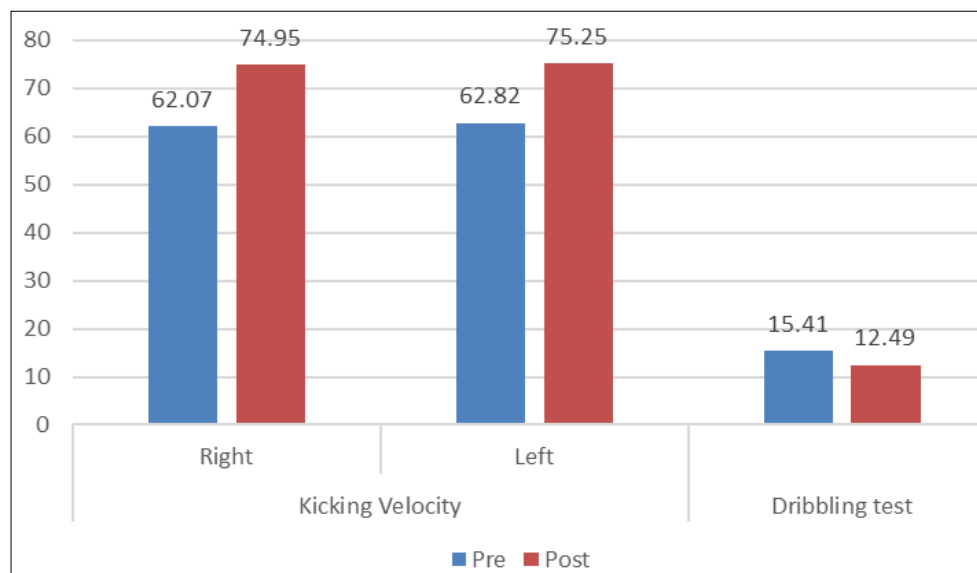


**Graph 3:** Show Thomas test and 90-90 straight leg test

Interpretation - As seen above there is a clinically and statistically significant improvement in intervention of hip slider exercises on Thomas test and 90-90 Straight leg Test. p-value is < 0.001.

**Table 4:** Pre and post of kicking velocity

Performance Tests		Mean ± SD		P-Value
		PRE	Post	
Kicking Velocity (Mph)	Right	62.07±7.32	74.95±8.30	<0.001
	Left	62.82±8.03	75.25±9.79	<0.001
Dribbling test (secs)		15.42±1.52	12.49±1.33	<0.001



**Graph 4:** Show kicking velocity and dribbling test

Interpretation - As seen above there is a clinically and statistically significant improvement in intervention of hip slider exercises on kicking velocity and Dribbling test. p-value is <0.001.

**Results**

The results were analyzed using SPSS software version 29. A paired t-test was applied for group comparisons. A total of 55 football players were recruited, out of which 48 were male and 7 were female using convenience sampling. The mean age was 25.02±3.206 with the mean years of training 8.69±2.94.

**Discussion**

The study examined the effects of hip sliding exercises on various parameters related to hip function and performance. After 10 sessions of these exercises, significant developments were observed in hip range of motion (ROM), flexibility, dribbling time, and kicking velocity. The exercises involved using sliders for targeting different

muscle groups such as adductors, hamstrings, quadriceps, and gluteal.

The sliding exercises were performed continuously and without holds, emphasizing oscillatory joint movements. This constant movement facilitated the activation of proprioceptors and mechanoreceptors, reducing joint stiffness and promoting synovial fluid production for lubrication.

Specific exercises like adductor sliding, hamstring sliding, and quadriceps sliding were detailed, each targeting different muscle groups and joint capsules to enhance flexibility and muscle length. These exercises also engaged muscle spindles and Golgi Tendon Organs (GTO) to regulate muscle tension and promote relaxation.

The result of the current study was in accordance of previous study conducted by Bar Kohavi *et al.* on the effect of sliding hip exercise on Hip muscle strength, which showed That the participants had to exert a lot of effort to progressively lower their center of gravity while extending their legs outward and then return to their starting position utilizing the eccentric strength of their adductors and abductors [6].

Clinically and statistically significant improvements were noted in flexibility tests (Bent knee fallout, Thomas test, 90-90 straight leg test), dribbling time, and kicking velocity post-intervention. The improvement in kicking velocity was attributed to enhanced muscle coordination, stability, and possibly post-activation potentiation (PAP) effects.

The hip circumduction sliding exercise, initiated in the 9th session with 2 sets of 10 reps, engages all hip joint muscles through outward and forward-backward leg sliding, providing a stretch at end range. Similarly, the downward dog sliding exercise targets hip and core muscles, requiring constant core activation for stability of the lumbo-pelvic complex during extremity movements and force transfer. Improved kicking velocity may stem from enhanced kinetic chain activity, where a stable core supports distal segment mobility and force transmission. Furthermore, these exercises activate specific neural pathways, potentially enhancing motor unit activation crucial for explosive activities like kicking. They also reduce muscle stiffness, possibly increasing rate of force development and power output during kicks.

Similarly, Karl F, Orishimo *et al.*, conducted a study on the effect eccentrically based hamstring strengthening exercise on the strength and length tension relationship, they proposed that the slider activated the hamstrings at nearly maximum during the eccentric phase and at significantly lower levels during the unloaded concentric phase. In contrast to using exercises that target each component separately, this study enhanced the overall flexibility and strength and may also improve core control. Exercises for strength that incorporate flexibility and balance components could also accelerate an athlete's recovery and transition from the rehabilitation stage to the return to competition phase [14].

Overall, the sliding exercises not only improved physical parameters but also contributed to breaking down muscle stiffness, enhancing muscle power, and optimizing neuromuscular coordination for better athletic performance.

## Conclusion

The study concluded that hip sliding exercise had a significant effect on the hip rom, hip flexibility, dribbling

time and kick velocity test ( $p$ -value < 0.05). Hence hip sliding exercise showed clinically and statistically significant improvement on mobility as well as performance in football players. The study conclude that sliding exercises can be effectively used for improving hip mobility in football players.

**Limitation:** The sport is dynamic but the assessment of kicking velocity was done in a static manner.

## Abbreviation

ROM - Range of Motion

Mph - Meter Per Second

PAP - Post Activation Potential

GTO - Golgi tendon Organ

**Conflict of interest:** None

**Financial support:** None

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