

Impact of Nordic Hamstring Curls and Retro Walking on Improving Hamstring Strength, Endurance in Athletes: A Case Report

Chaithra B Shetty¹, Abhilash P V², P Deeksha Kumari³

¹Assistant professor, Laxmi Memorial College of Physiotherapy, Mangalore. Rajiv Gandhi University of Health Sciences, Karnataka.

²Associate professor, Laxmi Memorial College of Physiotherapy, Mangalore. Rajiv Gandhi University of Health Sciences, Karnataka.

³BPT Intern (Presenting Author), Laxmi Memorial College of Physiotherapy, Mangalore. Rajiv Gandhi University of Health Sciences, Karnataka.

ABSTRACT

Background: Hamstring weakness, tightness, and reduced muscular endurance are common problems among athletes and can negatively affect sports performance, agility, and functional efficiency. Inadequate hamstring strength and flexibility may also increase the risk of hamstring strain injuries during high-intensity athletic activities. Nordic Hamstring Curls are widely used eccentric strengthening exercises known to improve hamstring muscle performance, while retro walking promotes neuromuscular coordination, flexibility, and functional lower limb activation. However, limited evidence is available regarding the combined effectiveness of Nordic Hamstring Curls and retro walking on hamstring strength, endurance in athlete.

Objective: To evaluate the effectiveness of Nordic Hamstring Curls and retro walking on improving hamstring strength, endurance in athlete.

Methods: A case study was conducted on an athlete aged 22 years presenting with reduced hamstring flexibility and muscle strength. Participant underwent a 5-week intervention program consisting of Nordic Hamstring Curls and retro walking performed 4 sessions per week under supervision. Hamstring muscle strength was assessed using a Hand-Held Dynamometer (HHD), and functional hamstring endurance was evaluated using the Single Leg Bridging Test (SLBT). Assessments were performed before and after the intervention.

Outcome measures: Included the Hand-Held Dynamometer (HHD) and Single Leg Bridging Test (SLBT), assessed pre- and post-intervention.

Result: The participant demonstrated improvement following the intervention program. HHD values showed increased hamstring muscle strength bilaterally, while SLBT scores improved significantly, indicating enhanced hamstring endurance and functional performance. Participant also reported reduced hamstring tightness and better sports performance following the 5-week training protocol.

Conclusion: The combined intervention of Nordic Hamstring Curls and retro walking was effective in improving hamstring muscle strength, endurance in athlete. The program also enhanced functional performance and may help reduce the risk of hamstring-related injuries. Therefore, this combined training

approach can be considered a useful physiotherapy intervention for athletic conditioning and rehabilitation.

Keywords: Hamstring strength, Nordic Hamstring Curls & Retro walking, Muscular endurance.

INTRODUCTION

Hamstring muscle injuries are among the most common musculoskeletal injuries seen in athletes participating in sprinting, jumping, kicking, and rapid acceleration-deceleration activities. The hamstring muscle group consists of the biceps femoris, semitendinosus, and semimembranosus muscles, which play an important role in hip extension and knee flexion during athletic movements. Due to the high mechanical demands placed on these muscles during sports activities, athletes are particularly susceptible to hamstring tightness, fatigue, weakness, and strain injuries. Reduced hamstring strength, poor flexibility, and decreased muscular endurance can negatively affect athletic performance and increase the risk of recurrent injuries.¹

Hamstring injuries account for a large proportion of sports-related injuries in football, cricket, athletics, basketball, and other running-based sports. These injuries often result in loss of playing time, decreased performance, and prolonged rehabilitation periods. Therefore, prevention and strengthening strategies focusing on the hamstring muscles are essential in sports rehabilitation and conditioning programs. Improving hamstring muscle strength, flexibility, and endurance has become an important goal for physiotherapists, athletic trainers, and sports medicine professionals.²

Among various strengthening techniques, the Nordic Hamstring Curl (NHC) has gained considerable attention as an effective eccentric strengthening exercise for the hamstring muscles. The Nordic Hamstring Curl is performed by lowering the body forward from a kneeling position while resisting the movement eccentrically using the hamstring muscles. Eccentric strengthening exercises are known to increase muscle fascicle length, improve muscle strength, and reduce the incidence of hamstring strain injuries in athletes. Research has demonstrated that Nordic Hamstring exercises significantly improve eccentric knee flexor strength and enhance neuromuscular control.³

Several studies have shown that Nordic Hamstring training improves muscle performance, sprint ability, and lower limb function. Systematic reviews and meta-analyses have reported that Nordic Hamstring exercises increase eccentric hamstring strength and contribute to improved muscle architecture adaptations such as increased fascicle length. These adaptations are important because shorter fascicle lengths and weak eccentric strength are associated with a higher risk of hamstring injuries.⁴

Retro walking, also known as backward walking, is another therapeutic and training intervention increasingly used in sports rehabilitation and conditioning programs. Retro walking differs biomechanically from forward walking as it alters muscle activation patterns, joint loading, and neuromuscular demands. During retro walking, greater activation of the hamstring and quadriceps muscles occurs to maintain balance and propulsion. It is believed that retro walking enhances muscular endurance, improves proprioception, increases lower limb strength, and reduces stress on joints.⁵ Studies suggest that retro walking can improve lower limb muscle performance and functional mobility by increasing neuromuscular recruitment and muscular control. The altered gait mechanics involved in backward walking require greater muscle activation and energy expenditure compared to forward walking, which may contribute to improvements in muscular endurance and strength. In athletes, retro walking may

therefore serve as a beneficial adjunct training strategy for enhancing hamstring muscle performance and reducing injury risk.⁶

Strength, endurance, and flexibility are essential physical components required for optimal athletic performance. Hamstring muscle strength is necessary for sprinting speed, jumping, acceleration, and deceleration activities. Muscular endurance helps athletes sustain repeated contractions during prolonged sports participation, while flexibility contributes to efficient movement patterns and reduced risk of muscle strains. Deficits in any of these components may impair athletic performance and predispose athletes to injuries. Therefore, interventions aimed at improving all three parameters are valuable in sports physiotherapy and rehabilitation.⁷

The present study aims to investigate the impact of Nordic Hamstring Curls and Retro Walking on improving hamstring muscle strength, endurance in athletes. By comparing these interventions, the study seeks to identify effective exercise strategies that can be incorporated into athletic conditioning and injury prevention programs. To evaluate the outcomes of the study, specific outcome measures were utilized. Hamstring muscle strength was assessed using a Hand-Held Dynamometer (HHD). The Hand-Held Dynamometer is a reliable and objective instrument commonly used to measure muscle force production and assess muscular strength in clinical and sports settings. It provides quantifiable measurements that help determine improvements in muscle performance following intervention.⁸ Hamstring muscle endurance was assessed using the Single Leg Bridging Test (SLBT). The SLBT is a functional performance test widely used to evaluate hamstring endurance and fatigue resistance. During the test, the participant performs repeated single-leg bridge movements until fatigue occurs. The test has demonstrated acceptable reliability and validity in assessing hamstring muscle endurance and function in athletes.⁹

METHOD

A brief introduction about the procedure was explained to the athletes and consent was obtained from the participant. Participant was selected based on the inclusion and exclusion criteria. Pre-test assessment of hamstring strength and flexibility was conducted using Hand Held Dynamometer and Single Leg Bridging Test (SLBT). Following the intervention, post-test assessment was conducted using the same outcome measures to evaluate the improvement in hamstring strength and flexibility for athlete. The participant received a combined Nordic Hamstring Curl exercise and Retro Walking training program for a duration of 5 weeks, with 4 sessions per week. The Nordic Hamstring Curl exercise was performed in kneeling position with the ankles stabilized and the hands crossed across the chest, where participants gradually lowered the trunk forward using eccentric hamstring control and returned to the starting position with support as needed. Each session included 3 sets of 8–10 repetitions with adequate rest intervals between sets. Retro walking was performed on a flat floor surface under supervision for 10–15 minutes at a comfortable speed while maintaining proper posture and balance. Participant was closely monitored throughout the sessions to ensure correct technique, safety, and progression according to individual tolerance.

- **Outcome measure:**

Hand-Held Dynamometer (HHD)

The Hand-Held Dynamometer (HHD) is a reliable and objective clinical tool used to assess muscle strength. In this study, the push mode of the Hand-Held Dynamometer was used to measure hamstring muscle strength in athletes. The participant was instructed to perform maximal isometric contraction

against the dynamometer while the examiner provided resistance. The device records muscle force in kilograms (kg), allowing accurate assessment of hamstring strength before and after intervention.

Interpretation:

Higher values indicate greater hamstring muscle strength. Improvement in post-intervention values indicates increased hamstring strength and muscle performance.

Single Leg Bridging Test (SLBT);

The Single Leg Bridging Test (SLBT) is a functional performance test used to assess hamstring muscle endurance, strength, and lumbopelvic stability. It is commonly used in athletes to identify deficits in posterior chain muscle performance and evaluate improvements following rehabilitation or strengthening programs.

Interpretation:

Higher duration indicates better hamstring endurance and functional performance. Reduced performance may indicate hamstring weakness, poor endurance, or decreased lumbopelvic stability. Improvement in post-intervention scores reflects enhanced hamstring muscle endurance and functional capacity.

Intervention:

The participant received a combined Nordic Hamstring Curl exercise and Retro Walking training program for a duration of 5 weeks, with 4 sessions per week. The Nordic Hamstring Curl exercise was performed in kneeling position with the ankles stabilized and the hands crossed across the chest, where participants gradually lowered the trunk forward using eccentric hamstring control and returned to the starting position with support as needed. Each session included 3 sets of 8–10 repetitions with adequate rest intervals between sets.

Retro walking was performed on a flat floor surface under supervision for 10–15 minutes at a comfortable speed while maintaining proper posture and balance. Participant was closely monitored throughout the sessions to ensure correct technique, safety, and progression according to individual tolerance.

RESULT

The participant demonstrated improvement following the intervention program. HHD values showed increased hamstring muscle strength bilaterally which is pre-intervention gives value 10.3 kg in right leg and in left leg it is 10.0 kg. In post-intervention shows 11.3 kg in right leg and in left leg 10.9 kg, while SLBT scores also improved significantly, which is in pre-intervention 57 seconds in right leg and in left leg 54 seconds. In post-intervention shows 80 seconds in right leg and in left leg 77 seconds. Which indicating enhanced hamstring endurance and functional performance. Participant also reported reduced hamstring tightness and better sports performance following the 5-week training protocol. Greater improvements were observed in athlete who consistently adhered to the supervised exercise sessions.

DISCUSSION

The present study evaluated the effect of a 5-week combined intervention of Nordic Hamstring Curls and retro walking on hamstring strength and endurance in an athlete. The findings showed improvements in hamstring muscle strength measured using the Hand-Held Dynamometer (HHD) and increased endurance measured by the Single Leg Bridging Test (SLBT). The participant also reported reduced hamstring tightness and better sports performance after completing the training program. These findings suggest that combining eccentric strengthening with functional gait training can improve hamstring muscle performance in athletes.

The improvement in hamstring strength observed in this study may be explained by the eccentric loading provided by Nordic Hamstring Curls. This exercise increases hamstring muscle activation, improves muscle strength, and enhances neuromuscular control. Better eccentric strength helps athletes perform activities such as sprinting, jumping, and sudden changes in direction while reducing the risk of hamstring injuries.

Our findings are supported by the study conducted by Adigüzel et al. (2024), who investigated the effects of a Nordic Hamstring Curl training program in young football players. Their study demonstrated significant improvements in athletic performance, including increased hamstring strength, sprint performance, and lower-limb function following Nordic Hamstring training. The authors concluded that Nordic Hamstring Curls are an effective exercise for improving muscle performance and preventing sports-related hamstring injuries. These findings are consistent with the improvements in hamstring strength observed in the present study.¹⁰

The results of this study are also in agreement with the comparative study by Shah et al. (2026), which evaluated Nordic walking and retro walking in young-old individuals. They reported that retro walking significantly improved balance, physical fitness, and quality of life because backward walking increases muscle activation, neuromuscular coordination, and lower-limb control. Although their study involved older adults, the physiological benefits of retro walking may also explain the improvement in endurance and functional performance observed in our athlete. The increased muscle recruitment and better movement control during retro walking may have contributed to the higher Single Leg Bridging Test scores seen after the intervention.¹¹

The combination of Nordic Hamstring Curls and retro walking may provide greater benefits than using either intervention alone because both exercises target different aspects of muscle performance. Nordic Hamstring Curls mainly improve eccentric hamstring strength, whereas retro walking enhances muscular endurance, balance, coordination, and functional movement. Together, these exercises may produce better overall improvements in hamstring function and athletic performance.

However, this study has some limitations. It was conducted as a single case study with one participant and a short intervention period of five weeks. Therefore, the findings cannot be generalized to all athletes. Future studies should include a larger sample size, different sports populations, and longer follow-up periods to confirm the effectiveness of this combined intervention.

Overall, the findings of the present study indicate that a supervised program of Nordic Hamstring Curls combined with retro walking is a simple, safe, and effective physiotherapy intervention for improving hamstring strength and endurance in athletes. This approach may also contribute to enhanced athletic performance and help reduce the risk of future hamstring injuries.

CONCLUSION

The findings of this study concluded that the Nordic hamstring curls and retro walking on improves hamstring muscle strength, endurance in athlete following a 5 weeks intervention.

ACKNOWLEDGEMENT

The patient's co-operation in carefully adhering to the directions and consistently completing the task is appreciated by the writers. The institute's assistance and approval of this effort are also appreciated by the writers.

REFERENCE

1. Petersen J, Hölmich P. Evidence based prevention of hamstring injuries in sport. British journal of sports medicine. 2005 Jun 1;39(6):319-23.
2. Ekstrand J, Häggglund M, Waldén M. Epidemiology of muscle injuries in professional football (soccer). The American journal of sports medicine. 2011 Jun;39(6):1226-32.
3. Bourne MN, Opar DA, Williams MD, Shield AJ. Eccentric knee flexor strength and risk of hamstring injuries in rugby union: a prospective study. The American journal of sports medicine. 2015 Nov;43(11):2663-70.
4. Cuthbert M, Ripley N, McMahon JJ, et al. The effect of Nordic hamstring exercise intervention volume on eccentric strength and muscle architecture adaptations: A systematic review and meta-analysis. Sports Med. 2020;50(1):83-99.
5. Threlkeld AJ, Horn TS, Wojtowicz GM, Rooney JG, Shapiro R. Pilot study: Kinematics, ground reaction force, and muscle balance produced by backward running. Journal of Orthopaedic & Sports Physical Therapy. 1989 Aug;11(2):56-63.
6. FLYNN TW, Connery SM, Smutok MA, Zeballos RJ, Weisman IM. Comparison of cardiopulmonary responses to forward and backward walking and running. Medicine & science in sports & exercise. 1994 Jan;26(1):89-94.
7. Rd H. The football association medical research programme: an audit of injuries in professional football. Br J Sports Med. 2001;35:43-7.
8. Stark T, Walker B, Phillips JK, Fejer R, Beck R. Hand-held dynamometry correlation with the gold standard isokinetic dynamometry: a systematic review. Pm&r. 2011 May 1;3(5):4729.
9. Freckleton G, Cook J, Pizzari T. The predictive validity of a single leg bridge test for hamstring injuries in Australian Rules Football Players. British journal of sports medicine. 2014 Apr 1;48(8):713-7.
10. Adıgüzel NS, Koç M, Öztürk B, Engin H, Karaçam A, Canlı U, Orhan BE, Aldhahi MI. The effect of the nordic hamstring curl training program on athletic performance in young football players. Applied Sciences. 2024 Nov 7;14(22):10249.
11. Shah Y, Deshmukh MP, Rathi M. Effect of Nordic walking versus retro walking on balance, physical fitness, and quality of life in young-old individuals: A comparative study. Aging Medicine and Healthcare. 2026 Apr 1;17(2):103-10