

# The Role of the Nordic Hamstring Curl in the Rehabilitation of Hamstring Injuries: A Narrative Review

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## ABSTRACT

**Background:** Hamstring injuries are common in sports requiring high speed and power, such as soccer, football, and field. Prevention and rehabilitation strategies are essential to address the economic and performance-related consequences of hamstring injuries in sports. A state-of-the-art review provides a comprehensive and up-to-date summary of knowledge on hamstring muscle injuries in athletes.

**Purpose:** To review the literature to verify the effectiveness of Nordic hamstring curls exercise in managing and preventing hamstring injuries during sports activity.

**Method:** Electronic databases used for relevant trials: Google Scholar, Pubmed, Cochrane, NCBI, Science Direct, and CINAHLI. All the articles are taken from 2017 to 2022. On Nordic hamstring curls in sports, players were kept as inclusion criteria. One hundred forty articles were searched, which includes NHE in sports players. After screening, 39 studies were finally included in the review.

**Result:** A total of 39 studies were finally included in the review, of which 17 were Randomized controlled trials, 16 were Systemic Reviews, 2 were Quasi-experimental Studies, and 4 were Observational studies. The hamstring injury rate was substantially lower in groups that included the Nordic Hamstring curl exercise in their daily regime. NHE significantly increases eccentric strength, eccentric peak torque, H: Q ratio, muscle fascicle length, and muscle architecture.

**Conclusion:** There was a significant relation between hamstring injuries and Nordic hamstring curl exercise. NHE is found to be effective in the prevention and rehabilitation of hamstring injuries in athletes. Clinicians should be encouraged to incorporate NHE into their prevention strategies, and players and coaches should be more aware of and encourage the use of NHE.

**Keywords:** Hamstring Injuries, Nordic hamstring exercise, Nordic curl, eccentric strength, injury prevention.

## BACKGROUND

Hamstring injuries are common in sports requiring high speed and power, such as soccer, football, and field sports. These injuries can disrupt training and competition, decrease athletic performance, and increase the risk of future injuries. Strategies for prevention and rehabilitation are crucial in addressing the economic and performance-related fallout from hamstring injuries sustained in sports[1]. It is essential to understand the complex mechanisms

underlying hamstring muscle injuries, which can involve a combination of extrinsic and intrinsic factors such as training errors, fatigue, and inadequate warm-up can contribute to injury occurrence, while intrinsic factors such as muscle imbalances, reduced flexibility, and previous injury can increase the risk of hamstring injuries. It is essential to consider factors such as individualization, age, gender, and previous injury history when implementing injury prevention programs. [1] [2].

Previous injury and age significantly predict hamstring injury risk in elite male soccer players[3]. Also, Exercise program selection and intensity can impact the architectural adaptations of the hamstring muscles, which may affect injury risk[4]. Modifying the training load, implementing a gradual return-to-play protocol, and using protective equipment are other prevention strategies that can also be employed to prevent injury[4]. Numerous preventive strategies have been evaluated, including the Nordic hamstring exercise. Even with low-volume training programs, the Biceps Femoris long-head muscle fascicles actively lengthen during the

NHE, which may add to the exercise's effectiveness.[17] Additionally, even an 11% increase in fascicle length can reduce the likelihood of HSI by roughly 21% [28]. It was identified that NHE is a key exercise for hamstring rehabilitation in elite track and field athletes, as they are effective in improving eccentric strength and preventing reinjury[31].

In a study, they compared NHE with Stiff-Leg Deadlift (SLD) on muscle architecture and eccentric strength in well-trained rugby athletes and found that the NHE exercise is more effective than SLD in improving hamstring eccentric strength and BF LH fascicle length, which are important risk factors for HIS. NHE training increased BF LH fascicle length by 14%, more than double the increase generated by SLD training[30].

NHE as a standalone intervention may be limiting the development of more comprehensive injury prevention strategies and suggests that incorporating a combination of interventions, including exercise-based interventions, neuromuscular training, and education on injury prevention strategies, may prove more effective in reducing the incidence of hamstring injuries in substantially[27].

This review provides valuable recommendations for Physical Therapists, trainers, and coaches regarding implementing the NHE in hamstring injury prevention and rehabilitation programs. Moreover, this review aims to contribute to the development of evidence-based guidelines for the prevention and management of hamstring injuries in sports that demand high levels of speed and power, such as soccer and football field sports, by increasing awareness among athletes, coaches, and sports organizations about the importance of injury prevention strategies, including exercise-based programs like the Nordic hamstring curl.

## **NEED OF STUDY**

1. How well can the NHE be adjusted or modified to meet the demands of various sports and athletes, and what influence does this have on acceptance and efficacy?
2. To know the effective method to rehabilitate the hamstring injuries in athletes.
3. To know the efficacy of NHE in preventing and rehabilitating hamstring injuries.

## **Aim of Study:**

1. To provide valuable recommendations for Physical Therapists, trainers, and coaches

regarding implementing the Nordic hamstring curl exercise in hamstring injury prevention and rehabilitation programs.

2. To contribute to the development of evidence-based guidelines for the prevention and management of hamstring injuries in sports that demand high levels of speed and power, such as soccer, football, and track and field sports.

### Objective of the Study

1. To determine the effect of Nordic hamstring exercise on the rehabilitation & prevention of hamstring injuries.
2. To determine the relationship between the prevalence of hamstring injuries and eccentric strength of hamstring muscles.
3. To provide valuable recommendations for physiotherapists, trainers, and coaches regarding implementing the Nordic hamstring curl exercise in hamstring injury prevention and rehabilitation programs.

## METHODOLOGY

This was a narrative review of literature about the Role of the Nordic Hamstring Curl in rehabilitating Hamstring Injuries: A Narrative Review. The literature search was done using various search engines.

The inclusion criteria of the article were on the Nordic hamstring curl used in sports populations below the age of 35 years. Studies that investigated the effect of including the Nordic hamstring exercise (NHE) in injury prevention programs on the incidence of hamstring injuries in athletes, Studies that report on the outcomes of interest, such as incidence of hamstring injuries, muscle function, strength, and architecture, Athletes Free of lower limb injuries for at least three months prior to the study without any medical condition such as cardiovascular disease or musculoskeletal disorders.

Search engines used were Google Scholar, Pubmed, Cochrane, NCBI, Science Direct, and CINAHLI. All the articles are taken from 2017 to 2022. On Nordic hamstring curls in sports, players were kept as inclusion criteria. One hundred forty articles were searched, which includes NHE in sports players. After screening, 39 studies were finally included in the review.

The articles published in the English language and published in 2017 were included in the study. The articles were screened in the review based on our inclusion criteria.

With the help of search strategies, 140 studies were identified; following the removal of duplicates and the screening of titles and abstracts, a total of 60 potentially relevant studies remained; after these studies were reviewed with the inclusion criteria to determine if they should be reviewed, 39 studies remained, other – were excluded from the review.

## RESULT

**Identification:** Search using keywords hamstring injury,” “Nordic hamstring curl,” “prevention,” “rehabilitation,” “athletes,” “sports,” and “muscle function.”

## DISCUSSION

In Nordic hamstrings exercise, Subjects are instructed to let themselves fall forward and then resist the fall against the ground as long as possible using their hamstrings[39]. In both professional and amateur athletes, hamstring injuries cause severe damage and disability, and hence, it's a major problem that needs to be addressed. It is well known that HSI occurs frequently in various sports, including baseball, track and field, American football, Australian rules football, cricket, handball, Gaelic football, and football. They are more prevalent in training for competitive games. Patients with acute HSI frequently complain of pain in their posterior thighs, which they believe was caused by overstretching or high-speed jogging [1].

Nordic hamstring exercise, which focuses on eccentric training, has been found to lower the risk of hamstring injuries [1,2] in trials.



**Fig. 2:** Showing the procedure.

Previous hamstring injury was a strong predictor of future injury, emphasizing the need to prevent re-injury in players with a history of hamstring injury. Reduced flexibility, femoris fascicle length (a measure of the length of the muscle fibers) in the hamstring muscle was also found to be a major predictor of hamstring injury in the study, implying that stretching and other flexibility exercises should be incorporated in injury prevention program. Activities that increase biceps femoris muscle length, such as eccentric exercises, may be useful in lowering the risk of hamstring injury.[3] and hence NHE results in significant architectural adaptations in the hamstring muscles, including increases in fascicle length, muscle thickness, and pennation angle.[4] so it is found to be more effective in preventing HSI [5].

NHE is the only exercise that has been well-validated for the prevention of HIS[20]. The exercise's success is partly attributed to detecting net BF muscle fascicle lengthening and a positive mean fascicle velocity from approximately 85 to 100% of peak force during the NHE by various ultrasound tracking techniques. [17] Shorter biceps femoris long head fascicles increase the risk of hamstring strain injury (HSI) in professional soccer players by more than four times. Even with low-volume training programs, NHE training is an efficient way to enhance the length of the biceps femoris long head fascicles. An increase in fascicle length of just 11% can reduce the chance of HSI by about 21% [28].

The introduction of NHE in a 10-week duration prevention program reduced the incidence of

hamstring injuries by as much as 70% in a randomized controlled. NHE's interest lies mainly in the fact that it gets a high hamstring activation, especially in the final part of the movement, which emphasizes the importance of carrying out the NHE through the complete range of motion [38].

After the two-week NHE program, improvement in the flexor strength, hamstring eccentric and concentric peak torque, and H:Q functional ratio was observed [34]. Both high and low-volume prescriptions of NHE can significantly improve strength and muscle architecture over a minimum of 6 weeks[25]. Eccentric strength is the ability of a muscle to resist lengthening under load, which is important for activities like decelerating or changing direction. Hamstring flexibility is also essential for reducing the risk of injury, as tight hamstrings can increase the risk of strains and tears. NHE shows more significant improvements in eccentric strength and hamstring flexibility than the stiff-leg deadlift [30].

The Nordic hamstring exercise significantly improves sprint performance over short distances (0-20m) and over long distances (20-40m). The exercise may improve sprint performance through this route, given the benefits in sprint performance were only weakly correlated with the increases in eccentric knee flexor strength [33].

NHE helps address strength and muscular imbalances and get athletes ready for the demands of high-speed running [20]. Significant improvement in change of direction speed in the athlete's training with NHE and reduction 50m running time was observed than the control group, and the hamstring injury rate in the NHE group was 1.14 times lower than in the control group; thus, the incorporation of NHE interventions into the training programs of elite youth soccer players may be an effective strategy for reducing the risk of hamstring injury and enhancing agility [11].

NHC intervention may be particularly effective in improving complex movements and neuromuscular control [13], and is more effective for eliciting peak muscle activity in the hamstring muscles [15].

A four-week training program with the Nordic hamstring exercise during preseason increases eccentric strength of male soccer players." Incorporating the Nordic Hamstring Exercise (NHE) into a preseason training program can significantly increase eccentric strength in the hamstrings of male soccer players. The training group that performed the NHE twice a week for four weeks saw a 13% increase in eccentric strength, while the control group saw only a 3% increase. This finding is important because eccentric strength is a critical component of injury prevention in soccer, as it is associated with a reduced risk of hamstring injuries [23].

Eccentric training at long muscle lengths increases fascicle length, pennation angle, and muscle thickness of the biceps femoris long-head muscle. These changes were accompanied by improvements in muscle strength, maximal eccentric hamstring strength, and knee flexion angle during the Nordic hamstring exercise [35].

NHE alone cannot wholly prevent hamstring injuries, and it needs to be combined with other exercises to correct this deficiency [3]. It's important to note that the effectiveness of any training program may depend on various factors, such as individual characteristics, training history, and the specifics of the training program. Coaches and athletes should carefully consider their training program's specific needs and goals and adjust training accordingly [22].

A study by Hickey et al. (2019) found that while Nordic hamstring exercises reduced the risk of hamstring injuries in elite Gaelic footballers, they did not significantly reduce the incidence of these injuries in amateur players.

These findings suggest that Nordic hamstring exercises may effectively prevent hamstring injuries in some populations but may not be universally applicable. The implementation of Nordic hamstring exercises as a preventive measure should, therefore, be tailored to the specific needs of the athlete and the sport they are participating in. Nordic hamstring exercises may effectively reduce the incidence of hamstring injuries, but they should not be relied upon as the sole preventive measure. Other preventative measures, such as proper warm-up, stretching routines, and proper technique during play, should also be employed [27].

**Applications and implications.** A multidisciplinary approach to preventing and treating hamstring injuries, including the involvement of sports medicine physicians, physical therapists, and athletic trainers. Such an approach can help ensure athletes receive the most appropriate and effective care for their injuries. Hamstring eccentric strengthening (Low- and high-volume) programs can effectively improve hamstring strength, muscle architecture, and functional performance in elite soccer players. The choice between the two may depend on practical considerations such as time and resources and individual preferences and goals. It's essential for coaches and athletes to carefully consider the specific needs and characteristics of their training program and adjust training volume accordingly. Coaches and medical staff working with elite male soccer players should focus on injury prevention strategies incorporating previous injury history, flexibility exercises, and exercises targeting biceps femoris fascicle length. Longer and more frequent prevention programs may be more effective, so teams should consider investing more time and resources into prevention programs. It is important to note that prevention programs alone may not eliminate the risk of acute hamstring injuries completely, and other factors such as proper warm-up, adequate rest and recovery, and good nutrition should also be considered in injury prevention [5]. The difficulty of NHE can be increased progressively by adopting a slight overload, such as a ballasted jacket or an external push made by the mate. Multicomponent prevention programs based on multiple complementary prevention exercises, including NHE and a stretching program, can significantly reduce hamstring injuries in soccer players. However, the exercises should always be performed under the supervision of a qualified trainer [38].

Nordic hamstring exercises can be a helpful training tool for improving sprint performance and eccentric knee flexor strength in team sports players [33]. and incorporating the NHE into preseason training programs for male soccer players to improve the eccentric strength of the hamstrings. However, it is essential to note that the NHE should be performed with proper technique and progression to avoid overuse injuries [23]. It's an effective method for improving muscle strength, power, and endurance and reducing the risk of injury. The findings may be useful for coaches, trainers, and healthcare professionals working with athletes and individuals looking to improve their muscle function and performance [35].

The Nordic hamstring program is an effective injury prevention protocol, but compliance among athletes may be a significant barrier to its effectiveness [37].

## CONCLUSION

After reviewing the literature, this article concludes that the Nordic Hamstring exercise

(NHE) successfully lowers the risk of hamstring injuries and improves athletic performance. While it still has a low adaptation rate in professional athletes, studies have shown it can improve strength and injury incidence. Hence, increasing awareness of and adoption of the NHE among players and coaches worldwide should be a priority for clinicians and authorities in sports medicine. The NHE should be regarded as a necessary workout for all athletes to decrease the likelihood of hamstring injuries and enhance athletic performance.

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