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Effect of Nordic Strengthening and Hamstrings Muscles Protocol on Deadlifters

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ABSTRACT

Background and Objective: Hamstring injury is a prevalent condition among athletes, especially in exercises that require forceful contractions, such as deadlifts. It has been reported that eccentric exercise, particularly Nordic hamstring, significantly improves muscle strength and function, reducing the susceptibility to injury and potentially enhancing performance. This study sought to assess the efficacy of a hybrid training program that includes Nordic hamstring exercises and conventional hamstring strengthening exercises on improving lower extremity functional performance in deadlifters.
Method: Thirty participants were assigned to one of two groups: an experimental group (n=15) which performed a structured program of Nordic hamstring exercises, alongside Romanian deadlifts, leg curls, and good mornings, three times per week for 12 weeks; a control group (n=15) continuing with their regular training. Functional performance was evaluated by the Lower Extremity Functional Scale (LEFS) at preintervention and postintervention time points.
Results: The experimental group showed highly significant improvements in LEFS scores, with mean values increasing from 48.8 ± 4.60 to 74.73 ± 3.29 T-statistic = -17.86, $p < 0.001$. In contrast, the control group showed limited improvements, increasing from 53 ± 4.32 to 63 ± 1.44 T-statistic = -7.53, $p < 0.001$.
Conclusion: The findings suggest that Nordic hamstring exercises integrated into a strength training program significantly enhance lower extremity functional performance in deadlifters compared to traditional training alone. This study underscores the role of eccentric training in optimizing performance and reducing injury risks in athletic populations.

Key words: Nordic hamstring exercise, Hamstring strengthening, Deadlifter performance, Strength training

INTRODUCTION

The hamstring muscle group comprises three prominent muscles at the back of the thigh: the biceps femoris, semitendinosus, and semimembranosus. They run from the pelvis down the back of the thigh to the bones of the lower leg, and each of them plays an essential role in various movements of the lower extremities.(1) The hamstring muscles primarily help in flexion of the knee-essential functions during activities like running, cycling, and squatting, where the leg must be pulled back towards the body. These muscles also contribute to

extension of the hip, an action used during standing up, climbing stairs, and jumping actions and more important in athletic movements involving powerful thrusts of the leg.[2] These strong and flexible hamstrings are necessary for athletes competing in most sports, as they provide speed, agility, and general lower-body strength.[3,4] On the other hand, hamstring injuries are one of the most prevalent sports injuries and can vary in severity from slight strains to a complete tear; the symptoms for this type of injury include pain, swelling, and bruising behind the thigh.[5,6,7] Often rehabilitation of such injuries will involve a combination of rest, ice, compression, and the gradual return of movement and strengthening.[8,9,10] In this respect, avoiding these types of injuries would also include regular exercise that helps one to maintain appropriate flexibility and strength of the hamstrings, typically with deadlifts, leg curls, and lunges.[11] Overall, the hamstrings are essential not only for athletic performance but also for daily movements, and knowledge of their function and preservation can lead to better physical performance and a lower risk of injury.[12]

The hamstrings are one of the major movers in the deadlift, another staple strength training exercise for working multiple muscles. Here is how they involve themselves in executing the movement:

1. Hip Extension:

As one deadlifts, the dominant movement is an extension of the hips as he pulls the barbell off the floor. The hamstrings are quite effective in their role, particularly when synergizing with the gluteus maximus, during hip extension. As the lifter drives into his heels and lifts his torso, the hamstrings contract to assist in pulling the pelvis forward, maintaining correct position and mechanics.

2. Knee Stability:

As the lifter initiates the deadlift, the hamstrings also help stabilize the knee joint. Although the primary function of the quadriceps is to extend the knee, the hamstrings are there to assist in the control of movement and prevent the knees from extending or collapsing too much during the lift, thereby aiding in overall stability.

3. Engagement of the Posterior Chain:

The deadlift is a compound movement, heavily engaging the posterior chain-the hamstrings, glutes, and lower back muscles. Well-developed hamstrings are very important for holding an effective posture throughout the lift, allowing the lifter to keep his or her back straight and avoid placing undue stress on the spinal column.

4. Force Generation:

As the lifter stands up from the deadlift, the hamstrings help in force generation. When the bar is lifted, the hamstrings pull the torso toward the bar, creating a more efficient lifting motion. This synergy between the hamstrings, glutes, and other muscle groups results in a powerful upward movement.

5. Eccentric Control:

During the lowering phase of the deadlift, the hamstrings are also used eccentrically. This simply means that they would assist in controlling how fast the bar descends due to gravity. Eccentric strength in the hamstrings is necessary for injury prevention and proper control of movement, thus needing it to maintain an intact lifting technique overall. [13,14]

The hamstrings are vital for effective deadlifting, providing the necessary force, stability, and control throughout the lift. Strengthening the hamstrings through targeted exercises can enhance deadlift performance and reduce the risk of injury, making them an essential focus for anyone looking to improve their strength training regimen. Proper warm-up and conditioning of the hamstrings can also ensure optimal engagement during this foundational exercise. [15]

The Nordic hamstring exercise is one of the more effective strength training and rehabilitation exercises for the hamstring muscles. Specifically, this type of exercise enhances eccentric strength or the force developed by a muscle as it elongates. [16,17] One performs this exercise by being

positioned on your hands and knees at a hip width distance on a cushioned surface where your feet must be pinned beneath a solid support or fastened down with someone holding you. Keep your torso upright and your body in a straight line from your knees to your shoulders. Slowly lean forward from your knees while maintaining control, lowering your body toward the ground. Aim to lower yourself as far as possible without breaking form, ideally until your chest is approaching the floor. Once you attain your maximum controlled position, you can use your hands to push off the ground or pull yourself back up using your hamstrings and glutes. You should do 3 to 4 sets of 5 to 10 repetitions, depending on your level of fitness, and make sure you rest sufficiently between sets. [(18)] The Nordic hamstring exercise helps develop eccentric strength in the hamstrings, which is essential in the prevention of injury, particularly for sports requiring sprinting or changing direction rapidly. It's therefore an exercise beneficial for rehabilitation and athletic performance, but the execution should be appropriate to avoid straining, especially for the beginners. [(19)]

For deadlifters, strengthening the hamstrings is crucial for optimal performance, particularly in the squat and deadlift. Here are several effective hamstring strengthening exercises that can be beneficial for dead lifters. [(20)]

Romanian deadlifts

The Romanian deadlift is one of the best exercises that will definitely help target the hamstrings, glutes, and lower back in strength training, thus a basic movement to be included in this workout. Find a stance standing with feet hip-width apart, holding a barbell or dumbbells in front of the thighs. Bend at the hips, keeping a bit of bend in knees, and then swing the weights along the front of legs. Keep your back straight throughout the exercise. Lower the weights down to where you feel a stretch in your hamstrings, then push back up into the standing position by driving through your hips. This exercise is great for targeting the posterior chain and increasing mobility and strength through the hips.

Good Mornings

Good mornings are an excellent exercise for the strengthening of the hamstrings, glutes, and lower back. They entail mimicking a deadlift's hip hinge movement pattern by hinging at the hips, keeping your back straight as you lower your torso toward the ground with a slight bend in your knees. Stand with your feet shoulder-width apart, then place a barbell across your upper back. Lower until you feel you are stretching the hamstrings; then return back to the original position by glutes and hamstring contraction. Leg curls are quite helpful in strength development of posterior chain and will help in achieving overall athletic prowess.

Leg curls

Leg curls are a great way to isolate and strengthen the hamstrings using a leg curl machine. Start by adjusting the machine to ensure proper alignment, with your knees matching the pivot point and your ankles positioned securely under the padded lever. Sit with your back against the pad and curl the lever upward towards your glutes by contracting your hamstrings. Hold briefly at the top of the movement, then lower the lever back to the starting position in a controlled manner. This exercise is ideal for building targeted strength in the hamstrings, improving muscle balance and reducing the risk of injury. [(21,22,23)]

MATERIALS AND METHODS

The study was an experimental study and was approved by Institutional Research and Ethics Committee. The procedures followed during the study were in accordance with the Helsinki declaration of 1975, as received in 1983.The purpose and procedure of the study was explained to the participants before commencement of the study. All the individual participants in this study gave written informed consent before the commencement of the study

PARTICIPANTS –The study included male or female powerlifters aged between 18 and 35 years and with a minimum one year of strength training experience and prior experience in performing deadlifts. Additionally, participants were required to have had no lower limb injuries within the past six months.

Participants were excluded if they had any contraindications to exercise, including severe musculoskeletal disorders or cardiovascular issues. Individuals who were currently undergoing rehabilitation for injuries were also excluded. A total of 30 participants were recruited and randomly assigned to two groups: an experimental group (15 participants) and a control group (15 participants). Randomization was conducted using a computer-generated randomization schedule. Group assignments were concealed until the completion of recruitment and baseline assessments to minimize selection bias.

INTERVENTION

Experimental Group:

Participants in the experimental group performed a combined regimen of Nordic hamstring exercises and other hamstring strengthening exercises (such as Romanian deadlifts, leg curls, and good morning) three times per week for a duration of 12 weeks. Each training session included an appropriate warm-up prior to the Nordic hamstring exercises, followed by the supplementary hamstring exercises, and concluded with a cooldown period.

Control Group:

Participants in the control group continued their usual training programs without the addition of any specific hamstring-strengthening interventions.

Training Protocol:

Nordic hamstring exercise was performed for 3 sets of 12-15 repetitions, focus on a controlled movement and the eccentric phase. The supplementary hamstring exercises-including Romanian deadlifts, leg curls, and good mornings, were also performed for 3 sets of 12–15 repetitions, with varying loads adjusted according to each participant's individual strength and ability. Each training session lasted for approximately 60 to 75 minutes, including warm-up and cooldown periods.

OUTCOME MEASURE:

Lower Extremity Functional scale (LEFS)-were administered to all the individuals pre and post intervention to assess functional abilities related to lower extremities, in addition all participants completed a post-test assessment on **deadlift performance** following the 12-week intervention period.

STATISTICAL ANALYSIS

Statistical Analysis was done using SPSS 16.0 software and Microsoft and Excel was used to generate graphs, tables. Parametric tests were applied to analyse the data. Sample size was calculated to be 30 participants in total

RESULTS

Table 1: Age distribution in subjects

AGE DISTRIBUTION IN SUBJECTS					
S. No	**Age in years**	**GROUP A**		**GROUP B**	
		No	%	No	%
1	20-25	7	46.6	8	53.3
2	26-30	4	26.6	4	26.6
3	31-35	4	26.6	3	20.1
TOTAL		15	100%	15	100%
MEAN		5		5	
SD		1.414213562		2.160246899	

Table 2: Gender distribution in subjects

GENDER DISTRIBUTION IN SUBJECTS					
S. No	**Gender**	**GROUP A**		**GROUP B**	
		No	%	No	%
1	MALE	10		10	
2	FEMALE	5		5	

Table 3: Analysis of LEFS IN GROUP A (Pre to post test analysis)

GROUP A							
S. No	**OUTCOME MEASURES**	**PRE-TEST**		**POST-TEST**		**PAIRED T-TEST**	
		RANGE	**MEAN ± SD**	**RANGE**	**MEAN ± SD**	**T-STAST**	**P VALUE**
1	LEFS	41-50	48.8 ± 4.60	70-80	74.73±3.29	-17.86	4.97E-11

Table 4: Analysis of LEFS IN GROUP B (Pre to post test analysis)

GROUP b							
S. No	**OUTCOME MEASURES**	**PRE TEST**		**POST TEST**		**PAIRED T- TEST**	
		RANGE	**MEAN ± SD**	**RANGE**	**MEAN ± SD**	**T-STAST**	**P VALUE**
1	LEFS	53-60	53 ± 4.32	61-65	63 ± 1.44	-7.53	2.74E-06

The data shows that both Group A and Group B had significant improvements in their LEFS scores after the intervention. For Group A, the pre-test LEFS scores ranged from 41 to 50, with a mean of 48.8 ± 4.60, while the post-test scores ranged from 70 to 80, with a mean of 74.73 ± 3.29. A paired t-test showed a T-statistic of -17.86 and a p-value of 4.97 times 10^{-11}, which means that the improvement in functional performance was highly significant. Group B also showed statistically significant improvements in LEFS scores, with pre-test scores ranging from 53 to 60 (53 ± 4.32) and post-test scores ranging from 61 to 65 (63 ± 1.44). The paired t-test had a T-statistic of -7.53 and a p-value of (2.74 times 10^{-6}). Group A had more significant improvements in the LEFS score by showing greater mean score differences between the pre-test and the post-test as well as having a greater post-test range.

On the other hand, Group B had a smaller magnitude of change, with a narrower range and lower mean increase in post-test scores. This indicates that the intervention applied in Group A was more effective in enhancing lower extremity functional performance than that in Group B. Overall, both groups showed statistically significant improvements, but the degree of improvement was more pronounced in Group A.

DISCUSSION

The present investigation sought to establish whether Nordic hamstring exercises could complement traditional hamstring strengthening exercises to improve the performance of deadlifters. The study found that there was a greater improvement in lower extremity functional performance in Group A compared to Group B as shown by the results of the LEFS.

Group A had a great increase in their LEFS scores with a mean change from (48.8 ± 4.60) to (74.73 ± 3.29). The statistical analysis indicated a highly significant improvement (T-statistic = -17.86, $p < 0.001$), which indicates that the combined regimen of Nordic hamstring exercises and other strengthening exercises is effective in enhancing functional performance. On the other hand, Group B scores on the pre-test and post-test improved by a much more modest amount from (53 ± 4.32) to (63 ±1.44), T = -7.53, $p < 0.001$. This indicates that though both groups benefited from their usual training regimen, the gain was significantly less for Group B than it was for Group A.

These findings are in agreement with previous studies that highlighted the role of eccentric training in enhancing hamstring strength and preventing injuries. A study by Askling et al. showed that Nordic hamstring exercises significantly increased hamstring strength and reduced injury rates among athletes. [24] Similarly, Bourne et al. reported that the inclusion of eccentric exercises in training programs enhanced athletic performance and reduced the risk of injury, especially in sports that require explosive movements. [14]

Furthermore, the obtained results are supported by the literature of Mjølsnes et al. which reported not only strength increases but also functional enhancement in different athletes with the help of the Nordic hamstring exercise. [11] The significant alterations in Group A are due to its specific focus on eccentric training since it has the potential to boost muscle strength as well as muscular control during maximum load activities, such as the deadlift.

Implications of Training

From the significant effects seen in Group A, including improved strength measurements and a corresponding reduction in pain levels, is the implication for integrating Nordic hamstring exercises into strengthening programs for sports athletes. That is, even in activities that put quite a load through the hamstrings, these additional exercises could create a comprehensive tool for enhancing sport performance, for injury prevention and for overall better athletic capabilities.

While the study provided some valuable information, there is a need to recognize some of its limitations. The sample size was adequate enough for initial findings but may not be representative enough of the bigger population of deadlifters. Future research will be beneficial if larger samples and diverse backgrounds in athletics could be used in validating these results. It will also be valuable to explore such training regimens on long-term performance and the rates of injuries.

In summary, this study supports the hypothesis that combining Nordic hamstring exercises with traditional hamstring strengthening exercises greatly improves deadlifters' functional performance of the lower extremities. The findings indicate that specific training interventions may improve athletic performance and minimize the risks of injury. Future studies may investigate mechanisms responsible for such improvements and determine if such adaptations may be translated across various sports.

CONCLUSION

In general, this study shows that combining Nordic hamstring exercises with traditional hamstring strengthening exercises would greatly improve functional performance of the lower extremities among deadlifters. The experimental group, Group A, showed impressive improvements in their LEFS scores relative to the control group, Group B, thus confirming the effectiveness of this intervention on increasing strength, stability, and overall performance in deadlifting.

Other than the fact that their general purpose has been demonstrated, their benefits, as indicated in other studies, have been on muscle strength, injury prevention, and strength development. The more athletic activities continually demand on the hamstrings, the necessity of exercises like these could differ between athletes who are seeking to perform at best while lowering their injury risk. Long-term impacts of this training should be understood and its application in different athletic disciplines followed.

Declaration by Authors

Ethical Approval: Approved

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