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EFFECT OF NORDIC HAMSTRING EXERCISE VERSUS RETROWALKING ON HAMSTRING FLEXIBILITY AND FUNCTIONAL PERFORMANCE IN RECREATIONAL BADMINTON PLAYERS

Janak Rahul Shah[1], Dr. Shikha Paasi (PT)[2]
[1]*Intern, TMV's Indutai Tilak College of Physiotherapy, Pune*
[2]*Associate Professor, TMV's Indutai Tilak College of Physiotherapy, Pune*

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ABSTRACT

Background: *The hamstrings refer to a group of muscles positioned at the back of the thigh, namely the biceps femoris, semimembranosus and semitendinosus.[1] The Nordic hamstring exercise is a way of training the hamstrings by slowly controlling the muscle as it lengthens. Retrowalking is a locomotor activity performed by moving backwards which helps the body to get into right position to carry out different tasks, activities.*

Method: *Thirty individuals aged 18-30 years with hamstring flexibility >33^0 in males and >23^0 in females were divided into two groups. Nordic Hamstring Exercise and Retrowalking. Both interventions were performed thrice a week for four weeks.*

Results: The comparison of values of pre and post intervention of right AKET (Active knee extension test), left AKET (Active knee extension test) and LEFT (Lower extremity functional test) showed statistical significance of p< 0.001 i.e. increase in post intervention score in Group A as compared to Group B.

Conclusion: *The present study finds that Nordic hamstring exercise showed more improvement in hamstring flexibility and functional performance in recreational badminton players than Retrowalking.*

KEYWORDS: *Nordic Hamstring Exercise, Retrowalking, Hamstring Flexibility, Functional performance, Recreational Badminton players.*

INTRODUCTION

The hamstrings refer to a group of muscles positioned at the back of the thigh, namely the biceps femoris, semitendinosus and semimembranosus.[1] Hamstring involvement is unavoidable when engaging in daily activities, such as running, jumping, stair climbing.[1] A sedentary lifestyle and lack of exercise can impair the motor performance of hamstring and muscle wasting of lower limb. Long periods of sitting can cause muscles to shorten.[2] Men are more likely than women to have tight hamstring muscles.[3] Extended periods of sitting at work or college reduces the flexibility of soft tissues particularly in two joint muscles.[4]

Nordic hamstring exercise [NHE] is the eccentric hamstring training that can increase muscular flexibility and prevent hamstring injuries.[5] To conduct Nordic hamstring exercise, ask the subject to stand with his arms at his sides, his knees, hips, and back straight. The therapist holds onto the subject's ankles while seated behind them. The subject should progressively lower towards the ground.[6] There is hamstring activation as the subject starts to descends towards the ground. Additionally, muscles such as gluteus maximus, gastrocnemius and lower back extensors aid in holding the subject from falling to the ground.[7] Nordic Hamstring Exercise is an eccentric exercise method for hamstring muscle that improves muscular performance and hamstring strain.[8]

Retrowalking is essential to perform daily tasks. In Retrowalking, the toes touch the ground initially during the stance phase, followed by the heel being raised off the ground in early stance.[9] There is an increased activity of rectus femoris muscle. The normal eccentric contractions are replaced by concentric contractions, which causes the hamstring muscle to undergo eccentric stretch which could result in gaining of hamstring muscle length,[10] along with co activation of knee extensors and ankle plantar flexors.[9] Studies have shown effectiveness of Retrowalking in improving hamstring flexibility.[9]

OBJECTIVES

1. To examine the effect of Nordic Hamstring exercises on hamstring flexibility and functional performance using Active knee extension test and Lower extremity functional test in recreational Badminton players.
2. To examine the effect of Retrowalking on hamstring flexibility and functional performance using Active knee extension test and Lower extremity functional test in recreational Badminton players.

METHODOLOGY

This study was a comparative study with pre-post experimental study design. The total number of samples was 30 who were

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recreational badminton players. The inclusion criteria were, individuals should be aged 18-30 years with hamstring flexibility $>33^0$ in males and $>23^0$ in females,[11] none of them are currently taking any kind of lower limb strength training for last 6 months and the subject should be playing badminton for 2 years and more. The exclusion criteria were individual with history of any lower limb injury within 12 months. History of any previous hamstring strain throughout life. And any musculoskeletal and cardiorespiratory conditions. The outcome measure used for understanding the pre and post effect of the interventions on hamstring flexibility and functional performance was Active Knee Extension Test for hamstring flexibility (AKET) and Lower Extremity Functional Test for performance (LEFT). After ethical approval and consent, participants were divided into two groups. Group A performed Nordic Hamstring Exercise [12], and Group B performed Retrowalking.[13] Each session included warm-up (10 min), main exercise (10-22 min), and cool-down (5 min). The AKET and LEFT was recorded before and after four weeks of intervention.

SAMPLING DESIGN

Recreational Badminton players between the age of 18-30 years who lived in and around Pune city were included in the study using convenient sampling.

TREATMENT: GROUP A: NORDIC HAMSTRING EXERCISE [12]

The person starts in a kneeling position on the mat with the head and neck kept neutral, arms resting by the sides or held in front of the chest, back and hips straight, and knees bent at 90 degrees. The therapist supports the ankles firmly from behind to keep them stable. From this position, the person is asked to slowly lean forward at a consistent pace, trying to hold themselves up by engaging the hamstring muscles for as long as possible. Once they can no longer resist, they fall forward, landing on their arms with the chest touching the ground.[12]

PROTOCOL	EXERCISE	DURATION
WARM UP	High Knees, Butt Kicks, Leg Swings.	10 MINUTES
EXERCISE	Nordic Hamstring exercise	10 MINUTES
COOL DOWN	Stretches for hamstring and quadriceps.	5 MINUTES

GROUP B: RETRO-WALKING [13]

The participant begins the exercise by standing straight with feet positioned roughly at hip-width distance. The participant gradually begins to walk backward by lifting one foot and stepping back, then brings another foot. Head should be kept straight and the subject can use his arms for balance as he walks backward. The subject walks in backward direction for 10 minutes.[13]

PROTOCOL	EXERCISE	DURATION
WARM UP	High Knees, Butt Kicks, Leg Swings.	10 MINUTES
EXERCISE	Retrowalking	10 MINUTES
COOL DOWN	Stretches for hamstring and quadriceps.	5 MINUTES

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STATISTICAL DESIGN

Statistical analysis was performed after entering the data in MS Excel. The collected data was analyzed using SPSS version 26.0. Descriptive statistics including mean, median, standard deviation, and range were calculated for all variables. Shapiro-Wilk test was employed to assess normality of the data. Several variables violated the assumption of normality; appropriate non-parametric tests were used alongside parametric tests where assumptions were satisfied. Within-group comparisons of pre- and post-intervention values were analyzed using the paired samples t-test for normally distributed variables and the Wilcoxon signed-rank test for non-normally distributed data. Between-group differences in change scores were examined using the Mann-Whitney U test, as the normality assumption was not consistently met. Effect sizes for between-group comparisons were calculated using the rank biserial correlation, which allowed for interpretation of the magnitude of differences beyond p-values ($p < 0.001$) The obtained data from patient was organized in master chart along with graphs derived for statistical analysis for easy interpretation of results.

INTERPRETATION

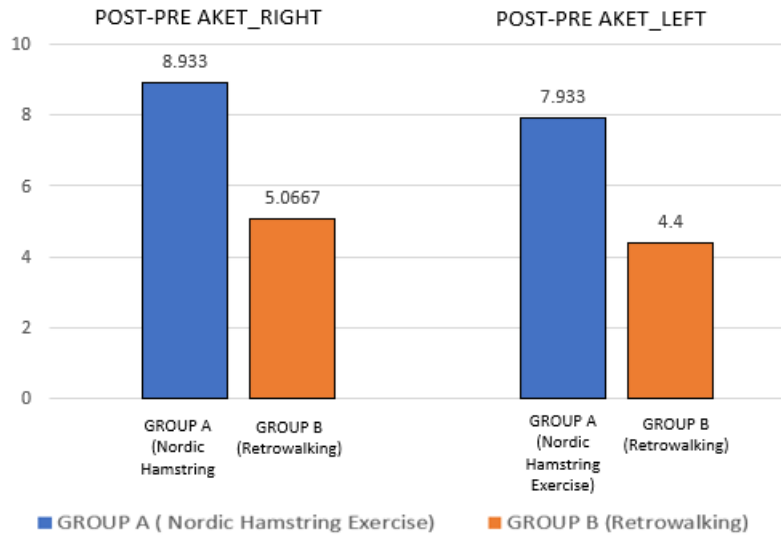
Variable	Group A (NHE, n=15)	Group B (RW, n=15)	Total (n=30)
Age (years), Mean ± SD	20.3 ± 1.8	20.8 ± 2.2	20.6 ± 2.0
Gender (M/F)	11 / 04	12 / 3	23 / 7

Table 1: Demographic Data

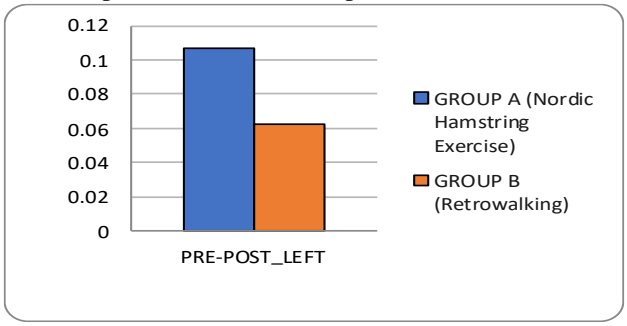
(Mann–Whitney U test)							
Outcome	**Mean Δ (NHE)**	**% Change (NHE)**	**Mean Δ (RW)**	**% Change (RW)**	**U statistic**	**p-value**	**Effect Size**
AKET Right (°)	8.93	0.066	5.07	0.038	1.5	<0.001	-0.987
AKET Left (°)	7.93	0.06	4.4	0.034	0	<0.001	-1
LEFT (sec ratio)	-0.107	-7.70%	-0.063	-4.70%	0.5	<0.001	-0.996

Table 2: Between-Group Comparisons of Nordic hamstring exercise and Retrowalking

Graph 1: Comparison of pre-intervention and post-intervention of Right AKET & Left AKET



Graph 2: Comparison of pre-intervention and post-intervention of LEFT in both groups



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GEOGRAPHICAL AREA

The study was conducted in Pune, Maharashtra, among recreational badminton players in and around Pune. The participants were young badminton players residing in nearby urban areas.

RESULTS

The comparison of values of pre and post intervention of right AKET showed statistical significance of $p< 0.001$ i.e. increase in post intervention score in Group A as compared to Group B.

The comparison of values of pre and post intervention of left AKET showed statistical significance of $p< 0.001$ i.e. increase in post intervention score in Group A as compared to Group B.

The comparison of values of pre and post intervention of LEFT showed statistical significance of $p< 0.001$ i.e. increase in post intervention score in Group A as compared to Group B.

DISCUSSION

The mean age of participants included were with an average of 20.6 ± 1.99.

Nordic Hamstring Exercises revealed significantly greater gains in the NHE group for right leg AKET ($U = 1.5$, $p < 0.001$), left leg AKET ($U = 0$, $p < 0.001$), and LEFT performance ($U = 0.5$, $p < 0.001$), all with very large effect sizes (rank biserial correlation > -0.98) after 4 weeks of intervention.

A study done by Worleichan A Shimray & Dr. L. Pungding, et al. states that muscle flexibility is crucial for smooth joint movement and proper execution of badminton strokes. In badminton, a fast-paced game where players constantly change direction, having good flexibility becomes even more important. It not only improves overall coordination and precision during play but also helps players manage muscle fatigue.[14]A study done by Maria Chawdi, Drashti Niket Shah, et al. refers that reduced hamstring flexibility usually leads to soreness after exercise. Musculoskeletal problems like decreased length, endurance and stability are due to tight hamstrings.[9] Both eccentric and concentric movements are noticeable while hamstring muscles are working. Muscles suddenly lengthen during eccentric movements. To withstand that strain it takes more power to endure that tension or it may lead to an injury.[15] Decreased hamstring flexibility develops risk factors like symptoms of muscle damage and hamstring strain.[16]

Nordic hamstring exercise [NHE] is the eccentric training of hamstring that can increase muscular flexibility and prevent hamstring injuries.[5] During the exercise there is eccentric activation of the hamstrings as the subject starts to descend towards the ground.[7]

In this study, within group analysis and between group analysis have proved that Nordic hamstring exercise to be superior than Retrowalking in improving hamstring flexibility. There was an improvement seen in right leg hamstring flexibility compared to left leg hamstring flexibility in both groups. Also, there was improvement seen in LEFT in both groups but highly significant in Nordic hamstring exercise group (Group A).

The drastic improvement in hamstring flexibility seen in the Nordic hamstring exercise tested using active knee extension test (AKET) could be attributed to the results found in the study done by Seethal K Babu, Anila Paul, et al. Their study states that young adults engaging in Nordic hamstring exercise demonstrates notable improvements in hamstring strength and flexibility. These enhancements are likely due to alterations in the optimal length of the muscle fibers and the repeated eccentric contractions involved in the exercise.[17] Morgan et al. reported that during eccentric movements, myofilaments undergo elongation, and certain sarcomeres may become overstretched while there is active lengthening of the muscle.[12]

Though not assessed independently, there is a possibility of the increased strength of the hamstrings as seen in previous studies related to Nordic hamstring exercise. These strength improvements occurred at the muscle along with thickening of the connective tissue around the muscle fiber. This could have led to more support to the fibres. Previous studies have claimed that contractile soft tissues tend to develop strength more exponentially with eccentric exercises.[18] All these factors could have contributed in the increase of the strength of the hamstrings which could have possibly led to improvement in the Lower extremity functional test performance.

The improvements in hamstring flexibility and lower extremity functional test performance in retrowalking group can be attributed to a study by Ciprani et al (1995) stated that during backward walking there is an increased activity of rectus femoris muscle. The normal eccentric contractions are replaced by concentric contractions, which causes the hamstring muscle to undergo eccentric stretch which could result in gaining of hamstring muscle length.[10] along with co activation of ankle plantar flexors and knee extensors.[9]

But the amount of improvement seen in the flexibility of hamstrings and LEFT performance in the Nordic hamstring exercise group is more as compared to Retrowalking group. This can be attributed to the possibility that there was more pronounced and stronger eccentric contraction of the hamstring muscle in the Nordic hamstring exercise group as compared to retrowalking. Though the repetitions and sessions of both the exercise groups were done equally.

CONCLUSION

The present study finds that both Nordic hamstring exercise showed more improvement in hamstring flexibility and functional performance in recreational badminton players than Retrowalking.

FUTURE SCOPE

Can be done on high contact sports such as football, sprinters and basketball players. Follow up can be done to see the performance level in future. Future study of more duration of intervention can be given.

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