Research Article

Exercises for Hamstring Tightness

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Abstract.
Hamstring tightness is a feeling that is often felt by futsal players, which can interfere with performance during playing. Previous studies suggest that stretching can solve it. However, feeling hamstring tightness is associated with weakness, so strengthening exercises are required to treat it. Strengthening exercises consist of concentric and eccentric exercises, which differ in the direction of muscle contraction. This study aimed to observe the effect of concentric, eccentric, and stretching exercises on muscle length, endurance, and power following hamstring tightness. 49 futsal players who experienced hamstring tightness participated in this study. Participants were divided into three groups consisting of Nordic Hamstring Exercise (NHE), Leg Curl Exercise (LCE), and control group (CTRL) - which only did stretching exercises. The exercises were carried out for 6 weeks, three times per week. The sit and reach test, Passive Knee extension test, Single leg bridge test, and Leg dynamometer tests were used to determine the changes in hamstring muscle before and after the exercises. One-way ANOVA was performed to compare changes between groups. All participants were found to be in the good category (28.78±5.53 cm) in sit and reach test and had low performance (39.13±16.77) in the leg dynamometer test before the intervention series. However, sit and reach test was shown not to be significantly different between groups ($p>0.05$) as well as ROM. Single-leg bridging test and leg dynamometer significantly differed between groups ($p<0.05$).This study suggests that feeling tight in the hamstring muscle is not correlated with muscle length. Concentric exercise increased strength more than eccentric and stretching. While concentric exercise increased the endurance of the hamstring muscle.

Keywords: Hamstring, Stretching, Strengthening, Eccentric, Concentric

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1. INTRODUCTION

Hamstring tightness leads to hamstring injuries, and hamstring injuries are the most common injuries in high-speed running-based sports (1). These injuries take a long time to heal, cost a lot of money to treat, and reduce the athlete's performance level (2). Muscle tightness is caused by a reduction in the muscle's capacity to deform, which reduces the range of motion at the joint. Hamstring tightness is defined as an inability to attain more than 160° of knee extension with the hip at 90° of flexion (3).

Stretching is commonly used to treat hamstring tightness (4). Several studies have also found that static and dynamic stretching can help relieve hamstring tightness (5). However, there is limited evidence that stretching has long-term impacts on hamstring flexibility (6). Hamstring tightness can cause lower back and leg pain (7), so it might lead to other issues in the long term.

Aquino et al, mention that strengthening in a stretched position may result in a long-term change in muscle length (8). Thus, strengthening is a possible long-term treatment for hamstring tightness. Moreover, low hamstring strength was associated with an increased risk of hamstring strain injury (1). It is debatable whether stretching or strengthening is the most effective for tight hamstring conditions.

In the isolated strengthening exercise, there are two types of muscle contraction, which are concentric and eccentric, that might affect hamstring tightness differently. Therefore, purpose of this study was to observe the differences of stretching, concentric, and eccentric exercise for hamstring tightness.

2. MATERIAL AND METHODS

2.1. Participants

Inclusion criteria were; males futsal players aged between 18-25 years old, with no physical limitations which may interfere with the testing protocol. Participants were excluded from the study if they reported a history of lower extremity surgery within a year prior to testing. Participants drop out from study when they did not complete the exercise sessions.

2.2. Procedures

Participants divided into three groups. consisting of Nordic Hamstring Exercise (NHE) represent eccentric exercise, Leg Curl Exercise (LCE) represent concentric exercise, and control group (CTRL) which only get stretching exercises. The intervention was carried out for 6 weeks, three times per week. Sit and reach test (9), Passive knee extension test (PKET) (10,11), Single leg bridge test (SLBT) (12,13), and Leg dynamometer (LD) were used to determine changes in hamstring muscle before and after the intervention series

2.3. Statistical Analysis

Mean and standard deviation was used to describe participant characteristics and baseline measurements. One way ANOVA was performed to compare the differences between groups

3. RESULTS

49 respondents participate in this study. All participants were right leg dominant. The age was 19.74±1.21 years old and BMI 21.78±2.83 kg/m^2. According to the sit and reach test results and PKET, individuals in this study demonstrated good hamstring flexibility and normal ROM. As a result of the leg dynamometer and SLBT, all subjects had low lower limb strength and moderate hamstring endurance, and all summarized in the Table 1.

Table 1: Characteristics of respondents.

n = 49	**Mean ±SD**	**Interpretation**
Age (years)	19.74 ± 1.21	
BMI (kg/m^2)	21.78 ± 2.83	Normal
Sit and Reach test (cm)	28.79 ± 5.53	Good
PKET (degree)	9.23 ± 7.12	Normal
Leg Dynamometer (kg)	39.12 ± 16.76	Poor
Single Leg Bridge Test (repetition)	21.0 ± 5.37	Average

SRT and PKET did not show sig improvement, in contrast LD and SLBT sig diff in all groups after 6 weeks of intervention (Table 2). All groups of intervention showed improvement in hamstring flexibility, however, no sig difference in PKET indicates that improvement was in the active mobility than passive treatment.

Table 2: pre and post differences of measurements.

Measurements	Groups			*p*-value
	NHE	LCE	CTRL	
Sit and Reach test (cm)	3.09 (0.97)	2.42 (1.77)	1.84 (1.02)	0.066
PKET (degree)	6.15 (5.45)	3.46 (3.15)	3.84 (2.99)	0.197
Leg Dynamometer (kg)	8.92 (5.67)	32.84 (46.10)	5.61 (13.67)	0.035*
Single Leg Bridge Test (repetition)	17.00 (5.38)	13.46 (5.76)	9.53 (3.28)	0.002*

*) Significant different (p<0.05)

All groups of intervention showed improvement in lower limb strength and hamstring endurance. SLBT indicates there was an improvement in hamstring muscle endurance,

and the improvement from strengthening was sig than stretching, moreover eccentric type has better improvement than concentric type of exercise. In contrast, concentric exercise type was significantly improved lower extremity strength than others groups.

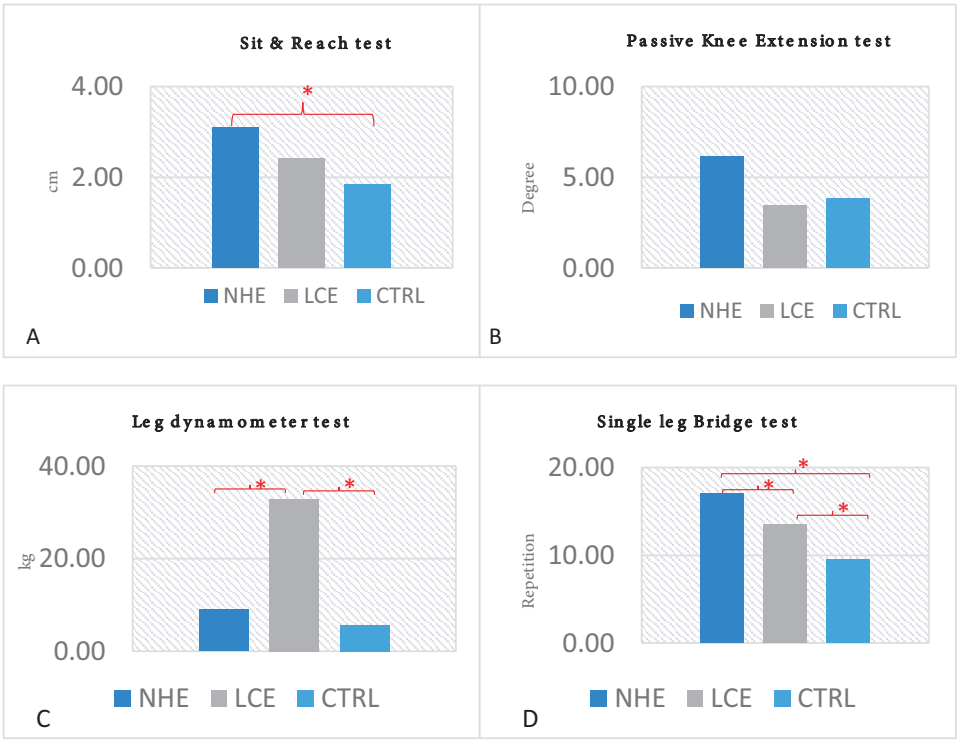

Figure 1: Pairwise comparison between group intervention; A. Sit and Reach test, B. Passive Knee Extension test, C. Leg Dynamometer test, D. Single Leg Bridge test. *) Significant different ($p<0.05$).

4. DISCUSSION

The result suggested that there was no correlation between feeling tight in the hamstring and hamstring flexibility. All of participants had feeling tightness, however the result of sit and reach test and PKET showed good and normal respectively. This study did not identify the specific tightness. The tightness might come from neurological and did not affect hamstring flexibility, however it might have some effect in the lower limb performance such as strength and endurance.

All groups of intervention showed improvement in hamstring flexibility. NHE shows significant improvement than CTRL. This suggested strengthening in eccentric type improving hamstring flexibility than stretching. The previous studies have demonstrated that stretching is more effective than a no-stretch control group, which was not included in our study (14). However, all groups did not show any significant differences in PKET. This also indicates that improvement was in the active mobility than passive.

All groups of intervention showed improvement in lower limb strength and hamstring endurance. SLBT indicates there was an improvement in hamstring muscle endurance, and the improvement from strengthening was sig than stretching, moreover eccentric type has better improvement than concentric type. In contrast, concentric exercise type was sig improve lower extremity strength than others groups. It was supported with previous study that demonstrated strengthening in lengthened position changed peak torque angle in the direction of knee extension (8).

5. CONCLUSION

Current study suggested that feeling tight in the hamstring was not correlated with muscle length. All strengthening and stretching could improve hamstring flexibility. Concentric exercise increase strength more than eccentric and stretching, while eccentric exercise increased endurance of hamstring muscles.

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