Advances in Bioresearch
Adv. Biores., Vol 15 (4) July 2024: 483-487

Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL:http://www.soeagra.com/abr.html
CODEN: ABRDC3
DOI: 10.15515/abr.0976-4585.15.4.483487

Advances in Bioresearch

SHORT COMMUNICATION

A Comparative Study of Static Stretching Vs Ballistic Stretching on The Flexibility of The Hamstring Muscles"

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ABSTRACT
Hamstring tightness is present in almost all population of the world. Poor hamstring flexibility in often associated with injuries to the lower back and lower extremities. A sedentary lifestyle often results in diminished flexibility. Stretching has been promoted for years as an integral part of fitness program to decrease the risk of injury. Static stretching and Ballistic stretching both helps in improving hamstring flexibility which in term increases range of motion of knee extension. So the main objectives of this study are to evaluate a comparative effectiveness between static stretching and ballistic stretching in improvement of hamstring flexibility. This will help to find out the most effective type of stretching, to improvement of hamstring flexibility in hamstring tight individuals. This study included 40 subjects randomly selected, hamstring tight individuals of both the sexes, between the age group of 20-40 years. Hamstring tightness was analyzed by active knee extension test in supine position with the help of standard double arm plastic goniometer. The result of this study has shown that there in a significant difference in both static stretching and ballistic stretching. After 6 weeks of stretching, the study shown that ballistic stretching is better than static stretching in improving hamstring flexibility, with a p value ≤0.05 significance. The study concluded that ballistic stretching in better than static stretching in improving hamstring flexibility in hamstring tight individual though it cannot be generalized to the whole population.
Keywords: *Flexibility, Hamstring tightness, Static stretching, Ballistic stretching, Active knee extension test.*

Received 24.03.2024 Revised 01.05.2024 Accepted 11.07.2024

How to cite this article:
Deeksha A, Neelu Kanwar R. Unveiling the Therapeutic Potential of *Ocimum Genus*: A Comprehensive Review. Adv. Biores. Vol 15 [4] July 2024. 483-487

INTRODUCTION

Hamstrings muscle tightness with respect to stretching has become one of the most researched topics in the field of orthopedics & sports medicine today. Hamstring muscle tightness is found in almost all over the world's populations [1]. Several conditions commonly seen by physiotherapist have been linked to hamstring muscle tightness [3]. Hamstring is one of the important muscles during walking [2]. Lack of hamstring flexibility is generally associated with injuries of the low back and lower limb [4]. Flexibility does not exist as general characteristics, but is rather specific to a particular joint action [5]. The specificity of flexibility is another example of how the body will adopt to the stresses placed on it [6]. Flexibility is an important component of fitness which is the ability to transfer a joint through a normal range of motion without producing stress to the musculotendinous unit [7]. Mainly hamstring flexibility may prevent acute and chronic musculoskeletal injuries, low backache problems, postural deviations, gait limitations and risk of fall [8]. Good muscle flexibility will allow muscle tissue to accommodate to imposed stress more easily and allow efficient and effective movements [9]. Stretching has been promoted for years as in integral part of fitness program to decrease the risk of injury [10]. Stretching in a general term used to describe any therapeutic maneuver designed to lengthen (elongate) pathologically shortened soft tissue structures and thereby to increase ROM [11]. Stretching is important because it contributes to various physical benefits including running economy, injury prevention, and promotion of healing etc [12]. Static stretching has been defined as elongation of the muscle to tolerance level and maintaining the position for a length of time [13]. Ballistic stretching is a bouncing, rhythmic motion & uses the momentum of a swinging body segment to vigorously lengthen the muscle [14]. Ballistic stretching is effective in increasing knee extension range of motion, an indirect method of measuring hamstring

flexibility. To date, limited information exists regarding a comparative study between static stretching ballistic stretching and it has not been extensively examined.

Human movements are not possible without a certain amount of the fitness component, commonly called flexibility [15]. To date hamstring muscle tightness is present in all most all the population of the world which in turn affects the flexibility. Loss of flexibility is defined as the poor ability of a muscle to deform [16]. The tight hamstring muscles in defined as the unable to extend the knee to less than 20° of knee flexion [20]. Several conditions commonly seen by physiotherapist have been linked to hamstring muscle tightness [19]. A sedentary lifestyle often results in diminished flexibility [8]. Physiological effects of stretching on the flexibility of muscles have been profusely reported in the literature [17]. Stretching has been in use for years as a vital exercise program of fitness to minimize the risk of injury [18]. Static stretching has the least associated injury risk & is believed to be the safest and most frequent methods of stretching [5]. Ballistic stretching is a bouncing type of stretching in which significant increase in ROM can be obtained but many arguments exist regarding the same[5]. According to the research that implies that the connective tissue conformity appears to be a distinct factor in musculoskeletal system flexibility. A comparative study between static stretching and ballistic stretching has not been extensively examined. The main purpose of the study is to compare static stretching and ballistic stretching techniques effects on hamstring muscles flexibility.

Hypothesis

Ballistic stretching is more effective than static stretching in improving flexibility of the hamstring muscles.

Null Hypothesis

Static stretching and Ballistic stretching are equally effective in improving flexibility of the hamstring muscles.

MATERIAL AND METHODS

Study Setting

The study was conducted in Care & Cure Clinic Beltola

Source Of Data

The 40 subjects for the study are randomly selected from the population of various colleges in Guwahati and other working individual in the age group of 20-40 years, those having hamstring tightness.

Design Of the Study

To analyze the effect of two different types of stretching on the hamstring flexibility, a different subject design was used.

Criteria For Selection

Inclusion Criteria

- Subjects having bilateral hamstring tightness have been taken.
  [Hamstring tightness is defined as 20° of knee extension deficit with the hip at 90°]
- **Age group**: 20-40 years.
- **Sex**: Both Male & Female included.

Exclusion Criteria

- Athletes
- OA
- RA
- Any pathologies of lower back, hip, thigh and knee

Measurement

Measurements were done with the help of standard double arm plastic goniometer for supine active knee extension test. The validity and reliability of knee extension range of motion in already mentioned in plenty of literature [12]. Each subject is measured twice with 15 minutes of separating time [21]. Measurements were taken before and after 6 weeks of stretching phase. To determine the residual effect of stretching measurement is taken once a week for 6 weeks of therapy period.

Data Analysis

Mean and SE are being calculated to perform the entire statistical test. The data used in the statistical analysis were the highest values obtained across the trials for the test. Paired't' test and unpaired't' test was performed on each dependent variable, to analyze the effect of stretching on range of motion. When Paired't' test was significant, then both the stretching methods are compared by using unpaired't' test, to analyze which stretching was better. A significant level of $P \leq 0.05$ was used throughout the statistical tests [11].

RESULT AND DISCUSSION

Group A and Group B got a ROM pretest mean value of 47.55 and 49.6 respectively. At the time of starting the therapy both groups are in baseline. After 6 weeks of stretching both groups showed a ROM mean score of 53.45 and 57.3 respectively. The test statistics for Paired't' test is 32.78 for Group A and 42.78 for Group B, is significant at P≤0.05. (Table 1, Fig 1)

TABLE 1- COMPARISON OF RANGE OF MOTION VALUES WITH IN THE GROUPS (Paired't' test)

Group	ROM Pre test mean score	ROM Post test mean score	Comparison test mean score	Inference P≤0.05
Group A	47.55	53.45	T=32.78	Significant
Group B	49.6	57.3	T=42.78	Significant

T values = $(a_2 = 0.05)^{t\,(19)} = 2.093$

$(a_2 = 0.01)^{t\,(19)} = 2.861$

Where, A_2 = two tailed test

TABLE 2: COMPARISON IN BETWEEN GROUPS (Unpaired 't' test)

Group	Post test ROM mean score	Unpaired 't' test value	Inference p≤0.05
Group A	53.45	3.13	Significant
Group B	57.3		

't' values = $(a_1 = 0.05)^{t\,(38)} = 1.684$

$(a_1 = 0.01)^{t\,(38)} = 2.423$

The mean ROM score of Group A & B were 53.45 and 57.3 respectively. The test statistic for unpaired't' test is 3.13, is significant at p≤0.05.(Table2, Fig 2).

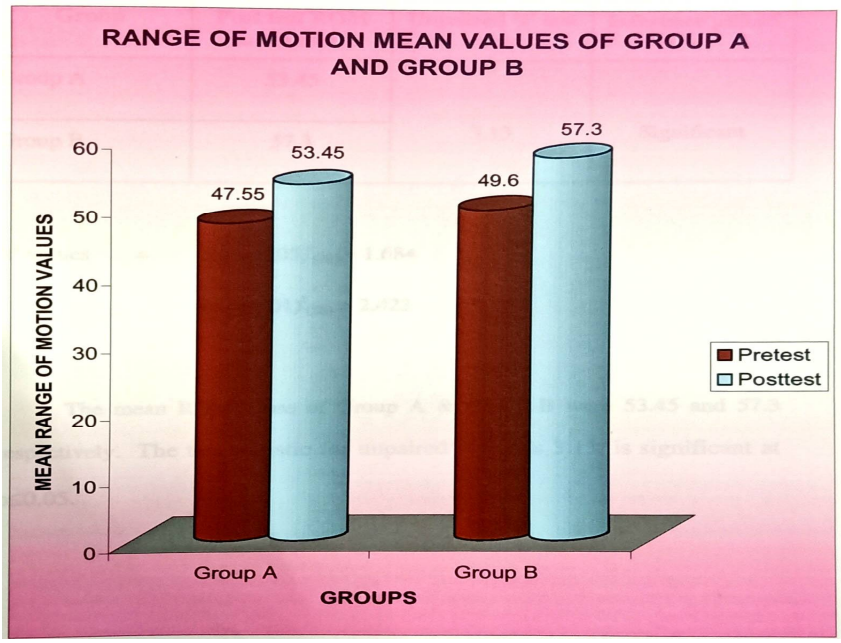

Fig 1: Comparison of ROM mean score between the groups

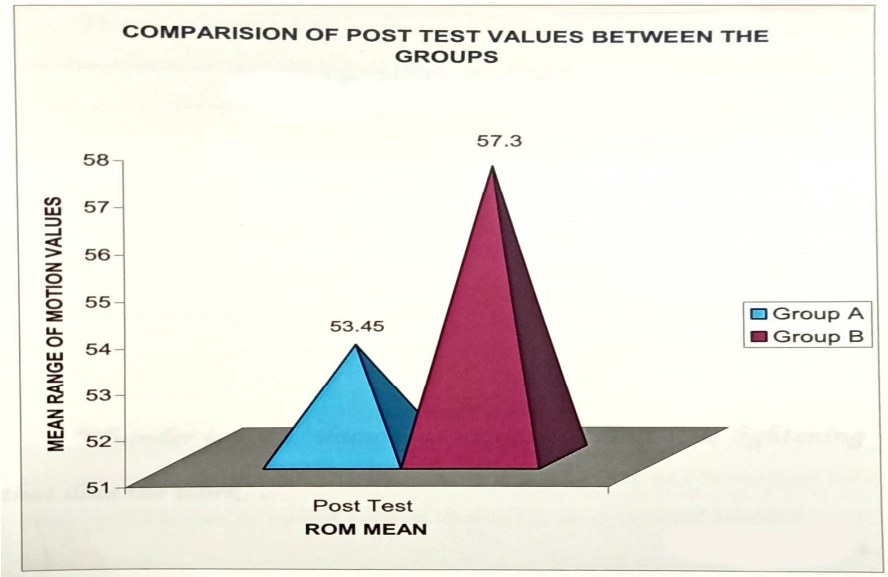

Fig 2: Comparison of ROM post test mean score in between the groups

The measurements were conducted using a standard goniometer, and to assess the flexibility of the hamstring muscles, an active knee extension test was administered. The comparison between static and ballistic stretching in normal individuals with hamstring tightness has not been thoroughly investigated. The results obtained from the statistical analysis in this study differ from those of previous research. This study's findings indicate that ballistic stretching is a more effective method for enhancing hamstring flexibility compared to static stretching. Given that this study focused solely on the impact of stretching on the hamstring muscle, further research is necessary to assess the effects of stretching on other muscle groups, such as the gastrocnemius, soleus, and iliotibial band. The findings of this study cannot be generalized to the entire population experiencing hamstring tightness. Additional research exploring the effects of stretching on individuals across different age groups would be valuable.

CONCLUSION

The results of this study suggest that ballistic stretching is more effective than static stretching in improving the flexibility of the hamstring muscles in individuals with tight hamstrings. It is crucial for physical therapists to have a thorough understanding of how stretching impacts muscles and joints in order to appropriately recommend these stretching methods, thereby maximizing benefits while reducing risks. A significant difference was noted in the efficacy of ballistic stretching compared to static stretching in improving hamstring muscle flexibility, as demonstrated by the supine active knee extension test, which supports the original hypothesis. Moreover, static stretching produces the least favorable outcomes and should be used sparingly to improve hamstring muscle flexibility.

CLINICAL IMPLICATION

Physical therapist should enroll them in applicating ballistic stretching in case of muscle tightness and should be aware of the disadvantages of the same, which may cause an unproductive result. The result of this study shows that ballistic stretching in better than static stretching in improving hamstring flexibility, which holds a high privilege in treating individuals with a tight hamstring.

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