

## Original Article

# EFFICACY OF ACTIVE STRETCHING IN IMPROVING THE HAMSTRING FLEXIBILITY

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## ABSTRACT

**Introduction:** Various stretching methods are available to improve the flexibility of the muscles which is proven to produce effects on the muscles. The purpose of this study was to find out the effectiveness of sum of the techniques used to improve the flexibility of the muscles. Both these stretching techniques are used to improve the flexibility. But the purpose of the study is to find the existing difference between these two stretching techniques (active stretching and passive stretching) in the improvement of flexibility in foot ball.

**Study design:** Experimental study design with pre and post test design.

**Procedure:** As per the selection criteria sixty subjects are selected, they are divided into two groups each group consists of thirty subjects, the tightness of the hamstring muscles are measured by using the Goniometer. Where in Group A administered the active stretching with with 30 seconds hold time and In the Group B administrated passive stretching with 30 seconds hold time. Both of stretches are given for five times per day. The post test measurements are taken after the successful course of six weeks of stretching.

**Statistical tools:** The paired t-test was used for the comparison within two groups. The comparison of both the Pre and Post test results of each groups are statistically analyzed.

**Result:** When comparing the pre test measurements in both the groups there is no significance, the value is 0.865 "p" value is greater than 0.05, so there is no significance. When comparing the post and pre test results of Group A and Group B, the values shows there is significance in the results, the value of 0.002 is less than that of the "p" value of 0.05 so there is significance. This results shows that the active stretching is more effective than the passive stretching

**Conclusion:** The present study helps to conclude that the patient treated with active stretching will have the better improvement in the flexibility of hamstring muscles, so while treating the football players either for training or for rehabilitation active stretching is more effective method for flexibility.

**KEYWORDS:** Active Stretching, Passive Stretching, Flexibility, Muscle, Hamstring Muscle, Football Players.

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## INTRODUCTION

Flexibility is the major component of physical fitness it is important to allow an adequate range of motion, to avoid sport injuries. Flexibility is the property of individual muscles and joint. Good muscle flexibility will allow muscle tissue to accommodate to imposed stress easily and

allow efficient and effective movement. More efficiency and effectiveness in movement a result of enhanced muscle flexibility will assist in preventing or minimizing injuries and may enhance performance.<sup>1</sup>

Adequate range of movement may be more important for long term injury prevention.

Individuals involved with physical activity with poor flexibility, the risks exceeding the extensibility limits of the muscle skeletal unit.<sup>2</sup> Once the flexibility is assessed and flexibility insufficiency is identified, a stretching programme can be customized, emphasizing those areas in need of important. Flexibility is a key component for injury prevention and rehabilitation. Stretching is important for reducing injury and improving performance in sports and for overall physical fitness. Athletes are often given stretching protocol to improve their flexibility. Adequate flexibility may help prevent muscle strain and such orthopedic problems such as backache<sup>3</sup>, good flexibility may bring about improved performance in athletes. Flexibility gains in the hamstrings have been demonstrated after a multiple day stretching programme. Active and passive stretching expand the range of motion by working in muscles tendons, capsules and ligaments; stretching of the muscles before an event is an extremely important factor in the achievement of optimal athletic performance.<sup>4</sup>

The peculiar characteristics of hamstring muscles is a biarthrodial, made predominantly of type two fibres and containing less amount of titin proteins may put the muscle group at higher risk of strains, so hamstring injuries are common on athletes.<sup>5</sup>

Studies have shown that muscle strains are common in sports injuries and represent 41% of all injuries reported in foot ball clubs. Hamstring injuries are account for to 11% of all injuries and 32% of all muscular strains. They are also common in football players. Injuries in hamstring are common during the eccentric phase of contraction, which occurs in the hamstrings while decelerating the swing phase leg or the leg after kicking a ball. Running by itself is known to produce tight weak hamstrings. Foot players are involved with more amount of running so they are prone to develop the hamstring tightness and player who have imbalance between the quadriceps and hamstrings also prone for hamstring strains.<sup>6</sup>

Purpose of the study was to find the effectiveness of both active and passive stretching. Both the active and passive stretching is used to improve the flexibility.

The resultant effects depend upon the technique and duration of stretch. But the aim of the study was to find the significance between the active and passive stretching in improving the hamstring flexibility in football players.

Hamstring tightness is defined as the inability to extend the knee to less than 20 degrees of knee flexion with the femur held at 90 degree of hip flexion while the person was positioned in supine.<sup>7</sup>

The double arm clear goniometries used to measure the tightness of hamstring. There are various studies shown that goniometric measurements are reliable and valid. The studies conducted by GogiaPP, Braatz JH on reliability and validity of goniometric measurements at knee prove that the goniometric measures are reliable and valie.<sup>8</sup>

**Need of the Study:** There are various stretching methods are available to improve the flexibility of the muscles which is proven to produce effects on the muscles. The purpose of this study was to find out the effectiveness of sum of the techniques used to improve the flexibility of the muscles. Both these stretching techniques are used to improve the flexibility. But the purpose of the study was to find the existing difference between these two stretching techniques (active stretching and passive stretching) in the improvement of flexibility in foot ball. The present study deals with the foot ball players this is why because the foot ball players are more prone to develop hamstring injuries, hamstring strains occur when strong concentric quadriceps contraction generate forces that the eccentric strength of hamstring cannot with stand, they are therefore prevalent in sports requiring sudden burst of speed. In soccer the forwards who take off more often with sudden bursts of speed had the highest relative risk of hamstring injury and the midfielders do more running they are also more prone to develop hamstring injuries.<sup>5</sup>

The study conducted in subjects at the duration of 30 seconds and 5 times per week for 6 weeks.<sup>9</sup> The same stretching duration was used for both the active and passive stretching to find out whether same stretch duration, will have any significant difference in the flexibility of the muscles between the two techniques.

## METHODOLOGY

Study has conducted as an experimental study design with pre and post test design and conducted at Sri Krishna Nagar Football club – Hyderabad, India for Six Weeks, for the study sixty subjects were selected by random sampling technique, further more sample has divided in two Groups i.e.

$N_1$  = Group A =30= Active stretching

$N_2$  = Group B=30 =passive stretching

**During random sampling technique, we have followed the following inclusion and exclusion criteria.**

**Inclusion criteria:** Subjects are professional football players under club level for the past one year. Adult male individual age between 18 and 30, Individuals with no history of knee and hip injury, Individual with hamstring tightness, Individual without history of neurological impairment and orthopedic condition affecting hamstring flexibility, Co operative subjects.

**Exclusion criteria:** Individuals with history of knee and hip injury, Individual with history of neurological complications, Individual with any systemic diseases, Individuals who are not fit into the Inclusion Criteria.

**Parameters used in this study is:** Range of motion and Hamstring muscle Flexibility

Materials /Tools included for this study is Goniometer, Stop clock, Frame to maintain hip at 90° flexion.

### Descriptions of tools

The tools used for this study are goniometer, stopwatch and a frame to maintain hip at 90 degrees.

**Goniometer:** Goniometer is the universally accepted tool to measure the range of motion in joints. There are numerous studies available to prove the reliability and validity of goniometric measurements.

**Stopwatch:** Stop watch is used to measure the time taken for each stretches of the hamstring muscle.

**A frame:** A wooden frame is used to maintain the hip at 90 degrees of flexion in order to measure the tightness of the hamstring muscle.

## PROCEDURE:

According to the selection criteria sixty subjects (60) were selected with consent letter, subjects are male adults.

The total number samples are divides into two groups. Each group consists of thirty (30) subjects, the tightness of the hamstring muscles are measured by using the Goniometer.

In group (A) active stretching was administered, the stretch must be hold for the duration of 30 seconds.

In group (B) passive stretching was administered, the stretch also holds for the duration of 30 seconds.

Each group is property instructed and demonstration of procedure has been given to the patients in order to find the exact measurement and to avoid the trick moments of the joints. A frame is used to maintain the hip at 90 degree of flexion. The frame consists of a horizontal bar in length, which is used to keep the upper thigh in contact during the stretching procedure.

Both of stretches are given at the duration of 30 seconds and five times per day.

The post test measurements are taken after the successful course of six weeks of stretching.

### Pre-stretching and post stretching measurements:

Both the pre-stretching and post stretching measurements are taken in order to find the effect of each stretching procedures.

Subjects in both the groups are positioned in supine lying. The hip joint is positioned in flexion at 90 degree and the anterior aspect of thigh contact the wedge in the frame, then the therapist passively move the leg in to the terminal position of the knee extension, which was defined as the point at which the subject report feeling of discomfort and the measurement is taken with the use of double arm goniometer<sup>14</sup>. Goniometer is placed over the lateral aspect of knee joint exactly at the point over the lateral condyle of femur. The moving arm of the goniometer has to be in parallel with tibia and the static arm should be aligned parallel to the femur.<sup>7</sup>

**Stretching Technique**

There are two different techniques used to stretch the hamstring muscles.

**Active stretching:** In group (A) active stretching for the hamstring muscle is administered. Subject sitting with leg to be stretched straight out in front of body with the knee full extended. While maintaining the neutral position of the spine and flexing at the hips, the subject reaches forward with both hands as far as possible down the leg until a mild tension is felt in the posterior thigh. Subjects should lean forward by bringing the chest forward. Flexion of the lumbar spine should be minimal. Subject must maintain position for 30 seconds to hold the stretch<sup>19</sup>.

**Passive stretching:** In group B the passive stretching group, the technique used to stretch the hamstring muscle is passive straight – leg raising technique. The straight-leg raising method is a comfortable method to stretch to stretch the hamstring muscle. The subjects are instructed to lie comfortably on the couch in supine lying position, and the knees are maintained in extended position with the ankle at 90 degree and the lower limb should in neutral position without any rotation. The lower limb is passively raised with hip flexed and knee extended until the subject feel a discomfort in the posterior aspect of thigh<sup>7</sup>. The therapist must hold the stretch for the duration of 30 seconds. Both the active and passive stretching are given at the duration of 30 seconds and given at a frequency of five times per day. The post stretch measurement is taken after the successful course of 5 times a week of stretching and measurement taken at the end of each week. This procedure is continued for six weeks and the measurement are taken<sup>10</sup>. The measured results are analyzed statistically.

**STATISTICS:**

**Statistical Tools:** The paired t-test was used for the comparison within two groups.

The comparison of both the Pre and Post test results of each groups are statistically analyzed:

**Formula for paired t –test:**

$$S = \sqrt{\frac{\sum d^2 - (\sum d)^2}{n-1}} \quad t = \frac{\bar{d} \sqrt{n}}{s}$$

d= Difference between the Pretest Vs Post test

d = Mean difference

n= Total number of subjects

S= Standard deviation

**Formula for Unpaired t-test:**

$$S = \sqrt{\frac{\sum(x1-x1)^2 + \sum(x2-x2)^2}{n1+n2-2}}$$

$$t = \frac{\bar{x1} - \bar{x2}}{s} \sqrt{\frac{n1 n2}{n1+n2}}$$

n<sub>1</sub>= Total number of subject in Group - A

n<sub>2</sub>= Total number of subject in Group -B

X<sub>1</sub>=Difference between Pretest Vs Post test of Group- A

X<sub>1</sub>=Mean difference between pretest Vs post test of Group -A

X<sub>2</sub>= Difference between Pretest Vs Post test of Group -B

X<sub>2</sub> = Mean difference between Pretest Vs Post Test of Group -B.

**STATISTICAL ANALYSIS**

**Table 1:** Comparison Of Pre And Post Test Results.

	GROUP	(A)	GROUP	(B)	't' test	Significance
	Mean	Standard Deviation	Mean	Standard Deviation		
Pretest	26.3	3.79	26.13	3.76	0.171	0.865
Posttest	8.07	3.83	10.13	3.73	2.117	0.039

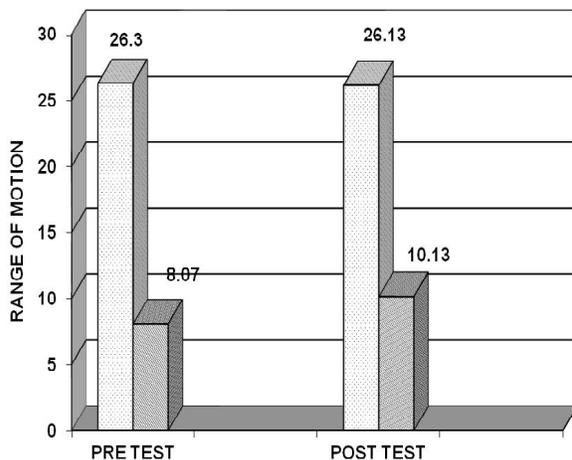
While comparing the pre and post test results of group (A) and group (B) suggest that the 'p' value of 0.039 is less than that of 0.05 so there is significance in the comparison.

**Table 2:** Comparison Of Post Test Results.

	GROUP	(A)	GROUP	(B)	't' test	Significance
	Mean	Standard Deviation	Mean	Standard Deviation		
Pretest	18.23	2.67	16	2.73	3.202	0.002

While comparing the post test results of both the group (A) and group (B) suggest that the 'p' value of 0.002 shows there is significance in the results.

**Graph 1:** Comparison Of Pre And Post Test In Group A and Group B.



**Table 3:** Comparison Of Improvement In Range Of Motion In First Week.

	GROUP	(A)	GROUP	(B)	't' test	Significance
	Mean	Standard Deviation	Mean	Standard Deviation		
WEEK1	3.8	1.1	3.3	1.09	1.774	0.081

When looking up the comparison of improvement in range of motion for the first week the 'p' value of 0.081, which is greater than 0.05 so there is no significance in the first week in range of motion.

**Table 4:** Comparison Of Improvement In Range Of Motion In Second Week.

	GROUP	(A)	GROUP	(B)	't' test	Significance
	Mean	Standard Deviation	Mean	Standard Deviation		
WEEK 2	4.07	1.01	3.5	0.78	2.429	0.018

When looking up the comparison of improvement in range of motion for the second week the 'p' value of 0.018, which is less than 0.05 so there is significance in the second week in range of motion.

**Table 5:** Comparison Of Improvement In Range Of Motion In Third Week.

	GROUP	(A)	GROUP	(B)	't' test	Significance
	Mean	Standard Deviation	Mean	Standard Deviation		
WEEK 3	3.63	0.81	3.23	0.73	2.014	0.049

When looking up the comparison of improvement in range of motion for the third week the 'p' value of 0.049, which is less than 0.05 so there is significance in the third week in range of motion.

**Table 6:** Comparison Of Improvement In Range Of Motion In Fourth Week.

	GROUP	(A)	GROUP	(B)	't' test	Significance
	Mean	Standard Deviation	Mean	Standard Deviation		
WEEK 4	3.27	0.79	2.8	0.66	2.486	0.016

When looking up the comparison of improvement in range of motion for the fourth week the 'p' value of 0.016, which is less than 0.05 so there is significance in the fourth week in range of motion.

**Table 7:** Comparison Of Improvement In Range Of Motion In Fifth Week.

	GROUP	(A)	GROUP	(B)	't' test	Significance
	Mean	Standard Deviation	Mean	Standard Deviation		
WEEK 5	2.4	0.72	2	0.79	2.048	0.045

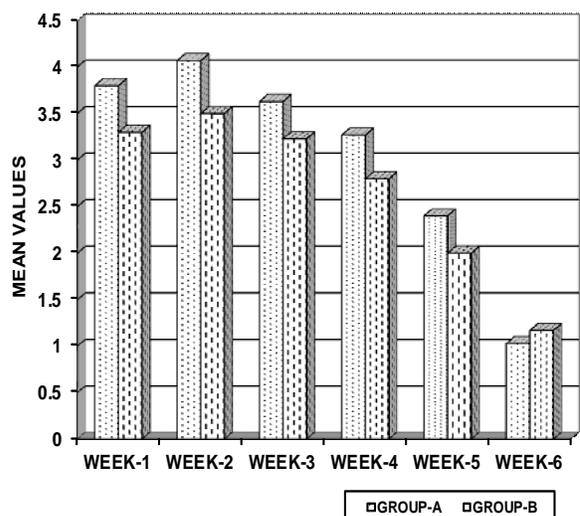
When looking up the comparison of improvement in range of motion for the fifth week the 'p' value of 0.045, which is less than 0.05 so there is significance in the fifth week in range of motion.

**Table 8:** Comparison Of Improvement In Range Of Motion In Sixth Week.

	GROUP	(A)	GROUP	(B)	't' test	Significance
	Mean	Standard Deviation	Mean	Standard Deviation		
WEEK 6	1.03	0.81	1.17	0.91	0.599	0.522

When looking up the comparison of improvement in range of motion for the sixth week the 'p' value of 0.522, which is less than 0.05 so there is significance in the sixth week in range of motion.

**COMPARISON OF GROUP-A AND GROUP-B IN ALL THE WEEKS**



**Table 9:** Comparison Of Pretest And Post Test Results In Group A.

	Pre test		Post test		't' test	Significance
	Mean	Standard Deviation	Mean	Standard Deviation		
Group A	26.3	3.79	8.07	3.83	37.347	0

While comparing the pre test and post test results in group (A) the 'p' value of 0.000 suggests that there is significance in the results.

**Table 10:** Comparison Of Pretest And Post Test Results In Group B.

	Pre test		Post test		't' test	Significance
	Mean	Standard Deviation	Mean	Standard Deviation		
Group B	26.13	3.76	10.13	3.73	32.111	0

While comparing the pre test and post test results in group (B) the 'p' value of 0.000 suggests that there is significance in the results.

## RESULTS

Present study was a comparative study. Two different stretching technique are used for experiment. This study was statistically known as the pre and post test- experimental study and the two tests are used for the statistical analysis. Independent "t" was used for the comparison between the two groups. Group (A) active stretching group, group (B) passive stretching group.

Paired "t" test was used for the comparison with the group<sup>20</sup>. The comparison is between the pre and post test measurements.

When the "p" value is less than 0.05 the significance is about 95% and the 'p' value of 0.001 suggest that there is 99% significance in the results.

When comparing the pre test measurements in both the groups there is no significance, the value is 0.865 "p" value is greater than 0.05, so there is no significance.

When comparing the post and pre test results of Group (A) and group (B), the values shows there is significance in the results, the value of 0.002 is less than that of the "p" value of 0.05 so there is significance. This results shows that the active stretching is more effective than the passive stretching. When looking up the comparison of improvement in range of motion for the first week ( $p > 0.05$ ). So there is no signifi-

-cant difference between two groups. In second week  $p < 0.01$ , so there is significant difference between two groups. In third week  $P < 0.05$ , there is 95% significance in the improvement in the range of motion. In the fourth week  $p < 0.01$  there is 99% significance in the improvement in the range of motion, in the fifth week  $p < 0.05$  there is 95% significance in the improvement in the range of motion. In the sixth week  $p > 0.05$ , so there is no significant difference in the improvement in the range of motion.

## DISCUSSION

There are various studies shown that both the active and passive stretching improves the flexibility and relieves the muscle tightness. But the focus of this study was relying on the comparison of these two techniques in improving the flexibility of the hamstring muscles in foot ball players.

This study was designed in order to obtain the effective of active and passive stretching method in improving the flexibility of hamstring muscle. The sample are selected according to the selection criteria, samples are professional foot ball players played under club level for the past one year.

The results was shown that active stretching given with 30 seconds duration and 30 seconds rest with a frequency of five times per week for the duration of six weeks found to produce a significant results in improving the flexibility of hamstring muscle.<sup>10</sup>

The present study results shows that the active stretching is more effective than the passive stretching, the studies conducted by safran, seaber and garnet in 1989 proves that the static stretching is probably the most effective method, with effects lasting up to 90 minutes.<sup>20</sup> So the results of the present study is supported by this study.

The 30 seconds duration is an effective amount of time to sustain a hamstring muscle. Stretch in order to increase the range of motion, no increase in flexibility occurred when the duration lasts more than 30 or 60 seconds (bandy.w.d. irioinj.m 1994). Comparing the results of present study with earlier studies showing the similar results and supports this study. In the present study the main tool used for measuring the

tightness of the hamstring muscle is double arm clear goniometer, the studies conducted by goggia pp, braatz in 1987 on the reliability and validity of goniometric measurements are reliable and valid.<sup>8</sup> The other tool used for this study is stop watch its measurements are also reliable and valid. Most of the other studies used the same duration for the purpose of stretching of the hamstring muscle. But they used a different technique for stretching the hamstring muscle. But he results shows the similar effects.

### RECOMMENDATION:

Present study has done on the effectiveness of two stretching techniques in the improvement of flexibility; we can also compare the effect by using stretching with the modalities like cryotherapy or heat therapy. In this study only male subjects were selected and in the right lower limb the measurements are taken for the evaluation. The present study can be compared with the males and females subjects and this study can be compared with the lower limbs. In this study the age groups of the subjects are 18-30, subjects are adults, and the study can be conducted in adolescent's population also.

### CONCLUSION

The present study was demonstrated that there is a significant difference in improving the flexibility of hamstring muscle by using the active stretching (static stretching) than the passive stretching though both the stretching techniques given at the same duration of 30 seconds. The active stretching group shows a better improvement in the flexibility of hamstring muscles.

The present study helps to conclude that the patient treated with active stretching will have the better improvement in the flexibility of hamstring muscles, so while treating the football players either for training or for rehabilitation active stretching is more effective method for flexibility.

**Conflicts of interest:** None

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