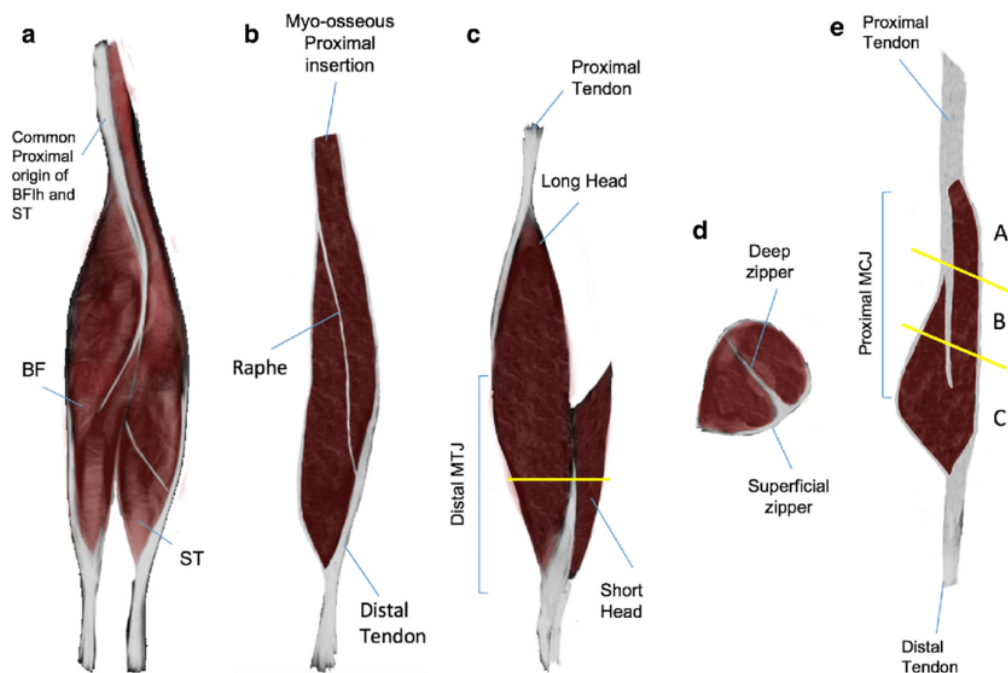


# To compare the effectiveness between Kinesio Taping versus Ballistic Stretching for improving hamstring flexibility in collegiate athletes

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## INTRODUCTION

Hamstring muscles are reported to be the most commonly injured multi-joint muscle group in the body.<sup>1</sup> Sprain, most common muscle injury can occur due to hamstring tightness. Tight hamstrings can cause postural problems and back problems such as sacroiliac joint pain, lower back pain. It is the main contributing factor leading to the risk of pathological conditions of the knee and spine. Tight hamstrings can cause the hips and pelvis to rotate back which leads to flattening the lower back muscle and increased patellofemoral compressive force, which may eventually, lead to patellofemoral pain syndrome <sup>2</sup>.



hamstring tightness is often an indicator of muscle weakness elsewhere.<sup>3</sup> People who assume prolonged sitting position are prone to tight hip flexors, hamstrings and calves. Thus, sedentary individuals are susceptible to inflexible or reconditioned hamstrings, while athletes and very physically active individuals have healthy, well-conditioned hamstrings.<sup>4</sup>

Maintaining normal muscle length requires regular stretching to prevent muscle stiffness and benefit from the decreased risk of musculoskeletal injuries and enhanced physical performance<sup>36</sup>. Stretching techniques are the treatments used to improve muscular extensibility to improve ROM, and can help prevent damage in daily life or sports, reduce muscle pain, and improve muscle capability, and athletic performance<sup>5</sup>

Hamstring extensibility is frequently analyzed in the clinical setting and sport training, and it is considered a basic component of physical fitness. hamstring muscle shortness has been related with lower limb injuries <sup>36,37,38</sup>, low back pain and changes in lumbopelvic rhythm<sup>39</sup>. Decreased hamstring extensibility has been associated to increased thoracic kyphosis and more posterior pelvic tilt when maximal trunk flexion with knees extended is performed <sup>35</sup>. Short hamstring muscle is common in physically active people, sedentary subjects and athletes<sup>10</sup>.

Studies that have analyzed hamstring extensibility in athletes of different sport disciplines have found a high percentage with low extensibility, except in those sports where hamstring extensibility plays a very important role in the performance and posture, such as rhythmic gymnastics and dancing<sup>10</sup>.

In an attempt to improve hamstring extensibility, several studies have analyzed and compared the effectiveness of different techniques. The effects of several stretching techniques in hamstring extensibility have been extensively analyzed<sup>1,11-14</sup>. Hamstring stretching is considered an appropriate intervention in both the prevention and treatment of hamstring injuries.

A few studies have also analyzed other techniques. The effects of the Bowen technique <sup>15</sup>, dynamic soft tissue mobilizations<sup>16</sup>, sub occipital muscle inhibition technique <sup>17</sup>, muscle energy technique <sup>18</sup>and neurodynamic sliding technique <sup>19</sup> have shown their effectiveness in increasing hamstring muscle extensibility. In recent years, kinesio tape <sup>20, 21</sup> and electrical muscle elongation<sup>22</sup> have been proposed as alternatives to improve muscle extensibility.

Kinesio tape (KT) is being widely used to prevent injuries to athletes, for rehabilitation and also to treat several musculoskeletal disorders <sup>28,29</sup>. Kinesio tape was developed in 1970s by Dr. Kenzo Kase. This alternative taping technique, theorized by Kase, had been suggested to introduce the beneficial effects of the tapes including effects on strength, control and performance, as well as reduction in pain, prevention of injury, inhabitation and facilitation of motor activity, improvement of a variety of physiological problems, including the range of motion, based on the functions of the tape <sup>24,25,27</sup> KT mechanism, by which KT exerts its hypothesized effects, has not clearly demonstrated the effectiveness of its methodology yet.

KT has been show to support muscle movement, relieve abnormal feeling or pain on the skin. Mori et al suggested that KT normalizes muscle function <sup>26</sup>. Kase et al believed that the stretch rate and width of the KT affected the facia and flow of lymph fluid<sup>25</sup>. Kinesio taping reduced cervical pain and increased range of motion (ROM) 24 hours following whiplash injury <sup>23</sup>. Slupik et al showed a preliminary effect on quadriceps peak torque and electromyographic activity in healthy subjects<sup>28</sup>.

Some authors advocate that ballistic stretching is more functional than other stretching techniques for individuals who participate in activities that require high velocity movements.<sup>31,32,35</sup> However, there are differing opinions about the safety of ballistic stretching with some authors expressing concern over the risk of musculoskeletal injury, particularly as it relates to muscle strain.<sup>32,33,34</sup>

The most frequently cited reason for this belief is that ballistic stretching involves repeated rapid stretching of the muscle. <sup>34,39</sup> This rapid stretch may activate the muscle spindle, thus preventing adequate muscle relaxation before the subsequent stretch. Some have hypothesized that this may cause micro trauma to the muscle.<sup>35,34</sup>

## NEED OF THE STUDY

Nathan R. Blackhurst, Static Stretching (SS) and Combined static and ballistic stretching (**COMBINED STATIC AND BALLISTIC STRETCHING (CSBS)**) are equally effective for improving active knee ROM. A trend indicating **COMBINED STATIC AND BALLISTIC STRETCHING (CSBS)** showing only slightly greater differences may be due to limited time allowed to master the **COMBINED STATIC AND BALLISTIC STRETCHING (CSBS)** method, with no supervision during stretching sessions<sup>41</sup>.

Dr. Abhijit Dutta suggested that modified hold-relax and ballistic stretching both were statistically significant in improving hamstring flexibility. But modified hold-relax technique showed better results compared to ballistic stretching<sup>43</sup>.

Adel Rashad Ahmed concluded that neurodynamic and static stretching are effective in increasing hamstring flexibility in healthy male individuals, but neurodynamic stretching showed a more significant effect as compared to static stretching<sup>44</sup>.

Marc A. Sherry, a rehabilitation program consisting of progressive agility and trunk stabilization exercises is more effective than a program emphasizing isolated hamstring stretching and strengthening in promoting return to sports and preventing injury recurrence in athletes suffering an acute hamstring strain<sup>45</sup>.

Nele Nathalie Mahieu, provides evidence that static and ballistic stretching have different effects on passive resistive torque and tendon stiffness and both types of stretching should be considered for training and rehabilitation programmes<sup>46</sup>. Sezen Cimen Polat, ballistic suggested that warm-up protocol can be more effective in many parameters, especially strength compared to ordinary warm-up<sup>47</sup>.

Samuel López, concluded that ballistic and passive static stretching did not cause, under these circumstances, any effect in the assessed variables related to soccer performance (linear sprint, CMJ, and Abalakov). This has to be considered by coaches when devising soccer-related warm-ups<sup>48</sup>.

hen-Yu Huang, the findings may implicate benefits for medial gastrocnemius muscle strength and push-off force when using Kinesio tape<sup>49</sup>. Sara Fereydounnia, concluded that Kinesio taping had immediate effects on improving strength, performance and balance. However, there were no differences on the method of application<sup>50</sup>. Justyna Karwacińska, the application of Kinesio Tapes is effective for hypertrophic scars, keloids and contracture scars<sup>51</sup>.

Claire Farquharson, has modelled the temporal changes in active knee extension to contrast the efficacy of kinesiology tape, static stretching, and PNF. The choice of intervention should consider the temporal context of the scenario.

For an immediate improvement in hamstring extensibility PNF is preferable, but for advantages over a longer duration (up to 30 minutes in this study) kinesiology tape is advantageous. The optimum timing of kinesiology tape application was 24 minutes prior to assessment of hamstring extensibility<sup>52</sup>.

Jung-Hoon Lee, it is essential to find and eliminate the origin of the problem. If these fundamental conditions of tape's application are satisfied, the treatment by kinesiology tapes may bring us far more better results<sup>53</sup>.

Prof. Andrzej Szulc, A) Kinesiotaping is an effective method in pain reduction in soft tissue injuries. It can assist practitioners as a complementary method in rehabilitation treatment of soft tissue injuries in adolescent athletes. B) Faster post-injury pain reduction implies earlier return to full athletic activity. C) The applied kinesiotaping techniques (muscle and lymphatic correction) do not effect improvement of proprioception in injured athletes<sup>54</sup>.

Jacqueline Gracia, it is inconclusive whether or not ballistic stretching in addition to a basketball conditioning program has an effect on hamstring flexibility or vertical jump height<sup>55</sup>

No literature have found to Compare the kinesio taping versus ballistic stretching for improving hamstring flexibility in collegiate athletes So this study is designed.

## **AIM OF THE STUDY**

The aim of the study is:

To compare the effectiveness between Kinesio Taping versus Ballistic Stretching for improving hamstring flexibility in collegiate athletes

## **OBJECTIVES OF THE STUDY**

The main objectives of the study are:

1. To evaluate the effectiveness of Kinesio Taping for improving hamstring flexibility in collegiate athletes.
2. To evaluate the effectiveness of Ballistic Stretching for improving hamstring flexibility in collegiate athletes.
3. To compare the effectiveness between Kinesio Taping Versus Ballistic Stretching for improving hamstring flexibility in collegiate athletes.
4. To find out the limitations and recommendations of the study.

## **HYPOTHESIS**

### **ALTERNATE HYPOTHESIS:**

It states that there is significant difference between the effectiveness of Kinesio Taping versus Ballistic stretching for improving hamstring flexibility in collegiate athletes.

### **NULL HYPOTHESIS:**

It states that there is no significant difference between the effectiveness of Kinesio Taping versus Ballistic stretching for improving hamstring flexibility in collegiate athletes.

## **METHODOLOGY**

**STUDY DESIGN:** Comparative study .

**SAMPLING DESIGN:** Randomized

**SAMPLE SIZE :**40 Collegiate athletes were taken for improving hamstring flexibility.

**STUDY CENTRE:**PMCH UDAIPUR

**DURATION OF THE STUDY:** 30 minutes per day, 4days in a week, Total 12 Weeks.

### **OUTCOME MEASURES**

1. SIT AND REACH TEST.
2. ACTIVE KNEE BENDING TEST

### **STUDY MATERIALS**

1. Written consent form.
2. General assessment form.
3. Treatment couch
4. Paper and Pencil.
5. Chair.
6. Goniometer
7. Kinesio Tape
8. Table
9. Examination couch

## **INCLUSION CRITERIA**

1. Both male and female.
2. Collegiate athletes.
3. Age between 18-28Years.

## **EXCLUSION CRITERIA:**

1. Neurological disorders.
2. Cardiovascular disorders.
3. Any skin allergy
4. Open wounds.
5. Presence of any malignancy.
6. Recent fracture of lower limb.
7. Any surgery in lower limb.
8. Mentally retard persons.
9. Presence of any malignancy



## PROCEDURE

After collecting the written consent form patients were selected by inclusion and exclusion criteria and equally divided into 2 groups - Group A and Group B

### **Group A: Kinesio Tape applied on this group.**

5 cm wide kinesio tape was applied to the hamstrings using the X-shaped taping technique. The base of the tape was placed unstretched with the patient in a neutral body position, just distal to the insertion of the muscle in order to achieve a relaxing effect. Then functional strips were applied on the stretched muscle belly, maintaining the original 10% tape pre stretching. Afterward, the anchorage was applied without stretching, just proximal to the insertion of muscle in neutral body position.

**First step.** Application of the midpoint “X” in the neutral position just above the popliteal fosse and placing the short strips both medially and laterally to the popliteal fosse.

**Second step.** Hip flexion and knee extension and then application of the medial strip on semimembranosus and semitendinosus muscles and the lateral strip on the biceps femoris.

**Third step:** Joining the anchorages in a neutral position on the ischial tuberosity. To use the correct length of the tape for each person, they were measured in a stretched position from the medial or lateral condyle of the tibia to the ischial tuberosity.



**Fig: Kinesio taping**



**Fig: application of kinesio tapping**

**Group B: Ballistic Stretching given on this group.**

**Patient position-** Supine lying position.

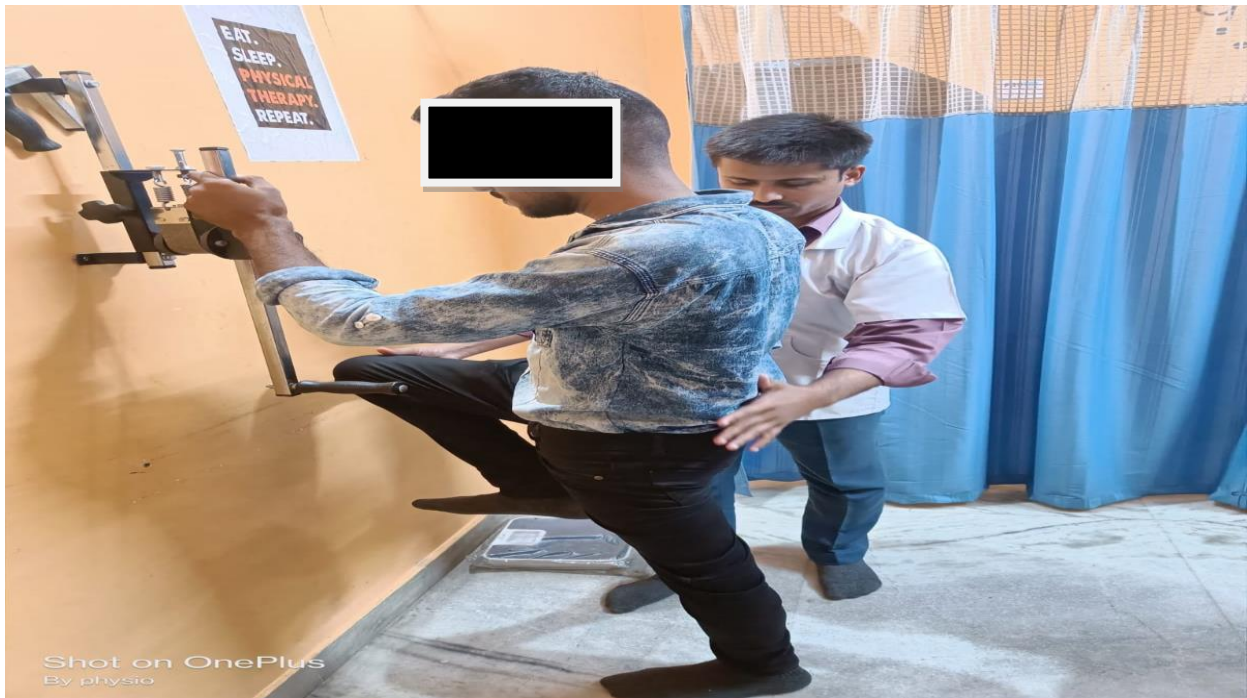
**Therapist position -** Stand by the side of the patient Flexion extension movements of the hip with knee kept in full extension, with the fastest speed as possible, respecting the limit, 5 cycles of 20 repetitions with 30 seconds interval between them.



**Fig: ballistic stretching (Modified straddle stretch)**



**Fig: Ballistic stretching**



**Fig: Ballistic stretching**

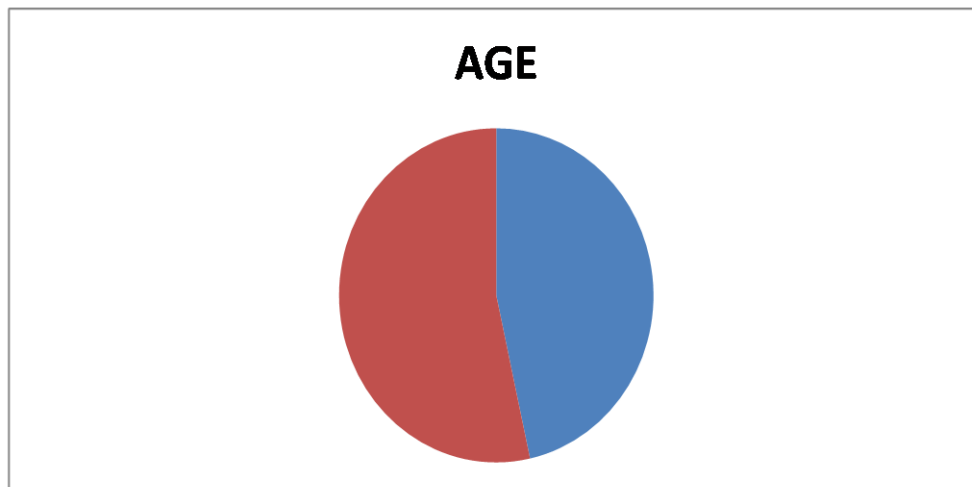
## RESULTS & DATA INTERPRETATION

Analyses of pre and post test scores within and between the groups are tabulated with intervention of the result of the study.

**TABLE:1**

Group	Number	Mean	S.D
GroupA	20	20.9	2.48
GroupB	20	24	2.31
Total	40	44.9	4.80

**CHART 1**



Interpretation:

Demographic data of mean value of age of participants

**TABLE 2**

**A. WITHIN GROUPS:**

**GROUP A SIT TO REACH TEST**

<b>SIT TO REACH</b>	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Std. Error Mean</b>	<b>Mean Diff</b>	<b>df</b>	<b>t</b>	<b>P</b>
Pre-test	20	4.1	0.78	0.17	6.1	29	4.75	<0.0001**
Post-test	20	10.2	1.43	0.32				

**CHART 2**



Interpretation:

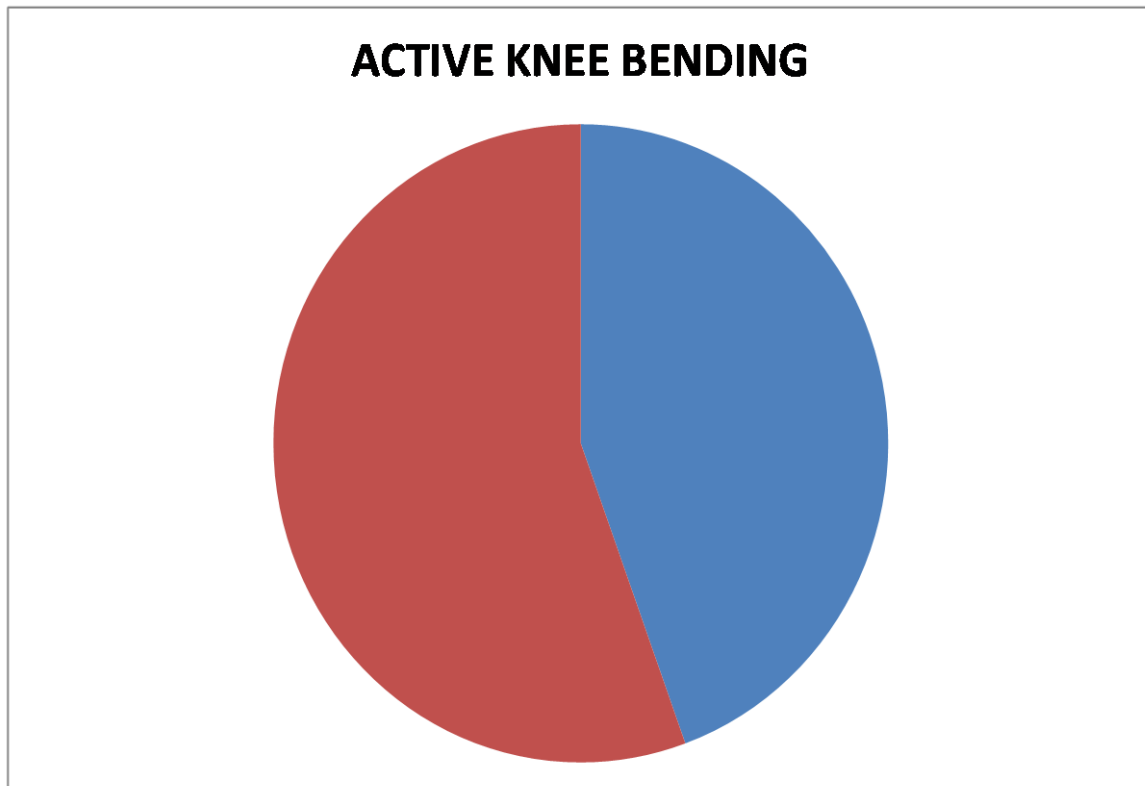
The above table and chart shows the mean value, mean difference, t value and p value of sit and reach test for group A.  $p < 0.0001$  was significant.

**TABLE 3**

GROUP A Active Knee Bending Test

<b>Active knee bending test</b>	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Std. Error Mean</b>	<b>Mean Diff</b>	<b>Df</b>	<b>t</b>	<b>P</b>
Pre-test	20	84.5	5.59	1.25	21	19	6.29	<0.0001**
Post-test	20	105.5	5.10	1.14				

**CHART 3**



Interpretation:

The above table and chart shows the mean value, mean difference, t value and p value of active knee bending for group A.  $p < 0.0001$  was significant.

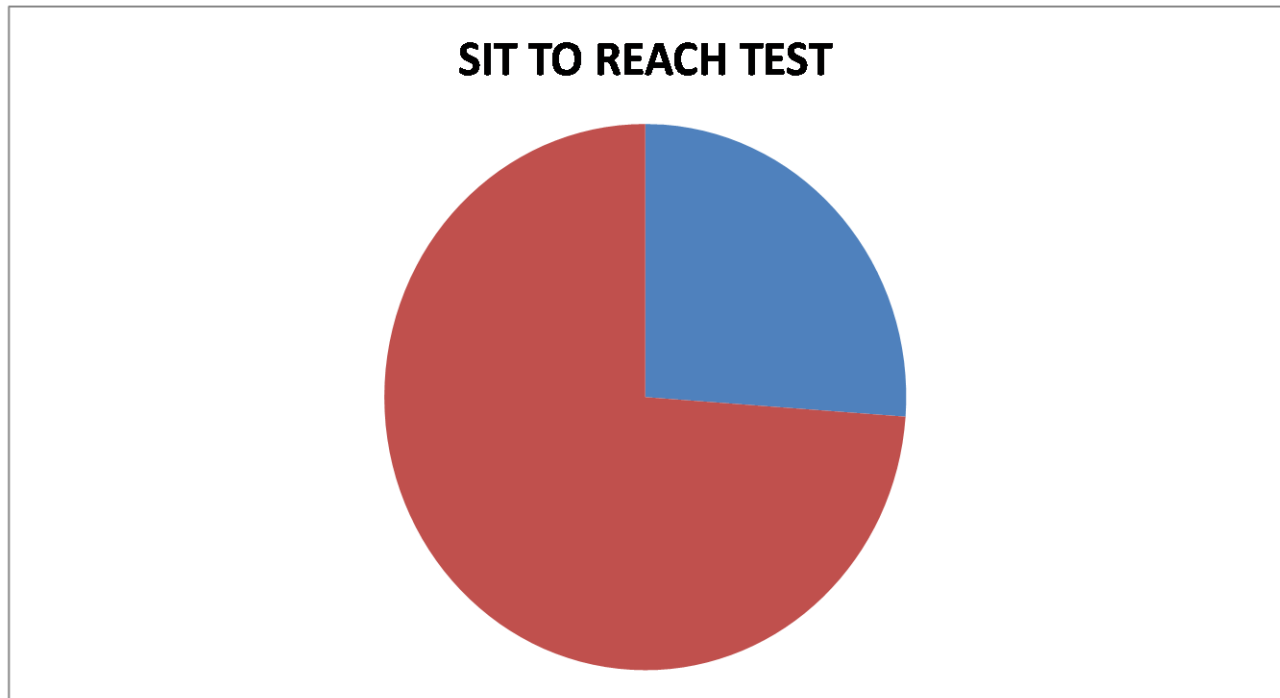
**TABLE 4**

**GROUP B Sit To Reach Test**

<b>SIT TO REACH TEST</b>	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Std. Error Mean</b>	<b>Mean Diff</b>	<b>df</b>	<b>t</b>	<b>P</b>
Pre-test	20	4	0.79	0.17	7.3	19	9.54	<0.0001**
Post-test	20	11.3	0.97	0.21				

\*\*Significant

**CHART 4**



Interpretation:

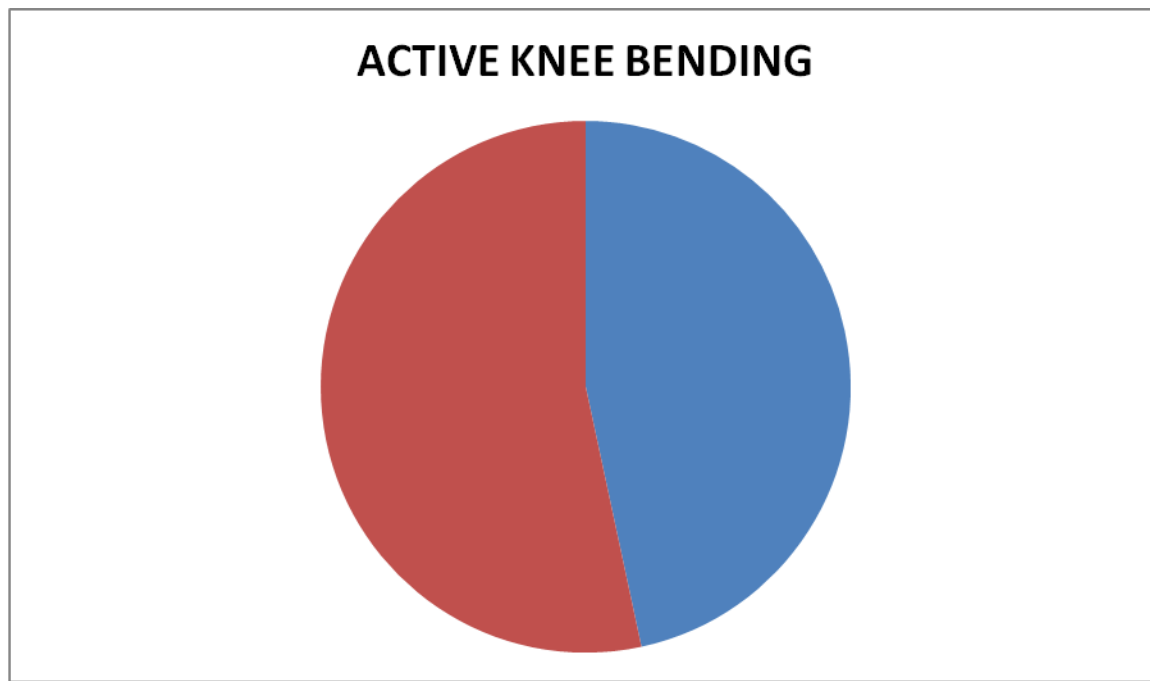
The above table and chart shows the mean value, mean difference, t value and p value of sit and reach test within group B.  $p < 0.0001$  was significant.

**TABLE 5**

**GROUP B** Active Knee Bending Test

<b>ACTIVE KNEE BENDING</b>	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Std. Error Mean</b>	<b>Mean Diff</b>	<b>df</b>	<b>t</b>	<b>P</b>
Pre-test	20	83.9	6.52	1.45	12.1	19	2.56	<0.0001**
Post-test	20	96	4.16	0.93				

**CHART 5**



Interpretation: The above table and chart shows the mean value, mean difference, t value and p value of active knee bending within group B.  $p < 0.0001$  was significant.



**BETWEEN GROUP**

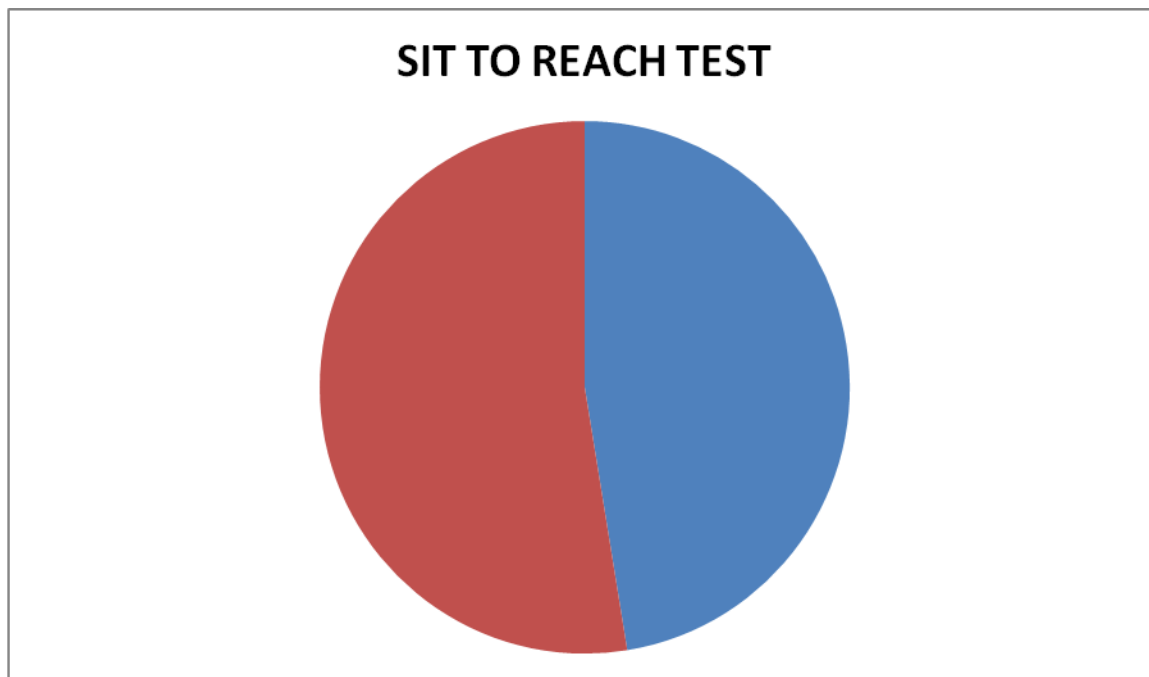
**TABLE 6**

**GROUP A AND B (SIT TO REACH)**

<b>SIT TO REACH TEST</b>	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Std. Error Mean</b>	<b>Mean Diff</b>	<b>df</b>	<b>t</b>	<b>P</b>
<b>GROUP A</b>	20	10.2	1.43	0.32	1.1	19	2.39	<0.0001**
<b>GROUP B</b>	20	11.3	0.97	0.21				

\*\*Significant

**CHART 6**



Interpretation:

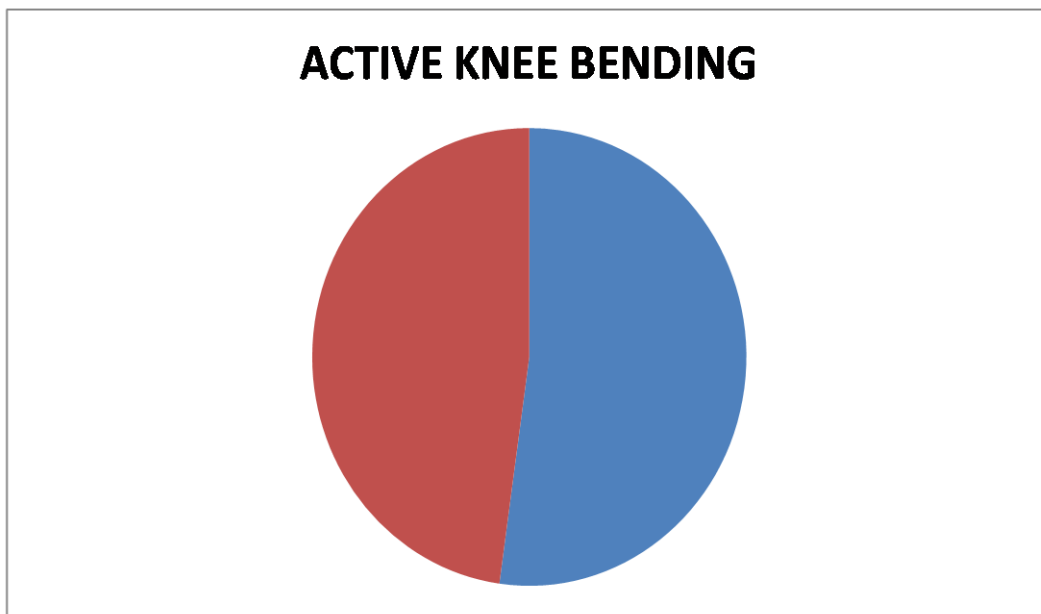
The above table and chart shows the mean value, mean difference, t value and p value of sit and reach test between group A and group B.  $p < 0.0001$  was significant.

**TABLE 7**

**GROUP A AND GROUP B**

<b>ACTIVE KNEE BENDING</b>	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Std. Error Mean</b>	<b>Mean Diff</b>	<b>df</b>	<b>t</b>	<b>P</b>
GROUP A	20	105.5	5.10	1.14	9.5	19	1.95	<0.0001**
GROUP B	20	96	4.16	0.93				

**GRAPH 7**



Interpretation:

The above table and chart shows the mean value, mean difference, t value and p value of active knee bending between group A and group B.  $p < 0.0001$  was significant.

## DISCUSSIONS

The purpose of this research project was to identify the effects of Kinesio Tape and ballistic stretching and compare the effect on hamstring flexibility.

There are three muscles in the back of the thigh that are collectively known as the hamstrings--the semimembranosus, the semitendinosus and the biceps femoris. One of their major characteristics is that they cross two major joints, the hip and the knee. The hamstring muscles are the major flexors of the knee and also aid hip extension. Individuals who sit for prolonged periods of time are predisposed to developing tightness in the hamstrings, as are athletes who compete in sports that require bursts of speed, such as sprinters. Tight hamstrings can be a serious problem for both athletes and non-athletes alike. Tight hamstrings increase the risk of lower back pain and knee pain, conditions that can hamper one's performance in sport and exercise.

One of the main treatments for people with tight hamstrings is stretching. Its effectiveness has been questioned and some studies report that it may actually increase the incidence of injury prior to an event. This may be true because the stretch prior to the activity injures the muscle and the muscle tears at that injury site when it is load with more force.

According to Mori A, Takasaki M, "Activation of Cerebral Cortex in Various Regions After Using Kinesio Tape Nihon University, kinesiotaping.com; July 2011" Kinesio Tape (KT) has been used and proven to increase somatosensory recognition and proprioception from the periphery to the cortex. It has also been speculated to help promote posture and walking in the elderly.

During a study of ankle sprains performed by Jayson M. Goo, it was found that the athletes who did not receive the Kinesio Tape as part of their post injury rehab had increased joint effusion and increased time to recovery and return to sport.

"The major four major effects of Kinesio Taping is to relieve pain or abnormal feeling on the skin and fascia, supports the muscle in movement (with expanding effects), removes congestion of lymphatic fluid or hemorrhages under the skin, and corrects misalignment of the muscle, fascia, and joint." (K Kase. Adjunctive Therapy to Increase the Effects of Kinesio Taping; 2005).

A study was performed on dancers associated with muscle disorders and fatigue. Kinesio Tape was used to correct biomechanical movements/habits, thus allowing them to create more power throughout their movements and effectively improve their performance. (A Futakawa. Treatment for the Disorders of Dancers Analysis of the Effects of Kinesio Taping on the movement of dancers; 2005)

Dr. Heather Murray researched the effects of Kinesio Tape used as postural therapy and the results were that the tape helped improve posture of scapular disorders and significantly relieve posterior and anterior musculature pain. (HM Murray. Effects of Kinesio Taping on Posture and Presence of Upper Extremity Pain; 2001)

Kinesio Tape has also been proven to help stroke victims due to the fact that “restoring trunk and scapular alignment after the stroke is critical in an effective treatment program for the upper extremity in hemiplegia”. (E Jaraczewska, C Long. Kinesio Taping in Stroke: Improving Functional Use of the Upper extremity in hemiplegia. *Topics in Stroke Rehabilitation*; 2006; vol 13.3 pg 31-42.)

The ballistic stretching is characterized by the use of vigorous and rhythmic movements of a body segment throughout this range of motion in order to lengthen a muscle or muscle groups.

McMillian et al. found increased T-drill, medicine ball throw, and five-step-jump performance after dynamic stretching but not after static stretching. Similar results were obtained by Little and Williams who found that dynamic stretching was most effective to prepare for high-speed activities (10-m sprint, flying 20-m sprint, and agility) and that static stretching was not detrimental to performance.

Research often reports ballistic stretching to be less effective at improving flexibility than other types of stretching. One of the reasons for the lower effectiveness of ballistic stretching for improving static flexibility is inhibitory effect of the stretch reflex. Ballistic stretching is associated with increased potential of injury to the musculotendinous unit because of

involvement of higher functions. The musculotendinous units of untrained and sedentary individuals may not be able to withstand this vigorous type of stretching without sustaining muscle damage.

Of those examined, only one evaluated the effects of a ballistic stretching routine on maximum vertical jump height. The finding of the current investigation is consistent with results from Unick et al. They found no significant difference in maximum vertical jump height after completing three sets of a ballistic stretching routine as part of a warm-up.

In this study both the group showed improvement in hamstring flexibility but the group treated with Kinesio taping showed significantly more effective than the ballistic stretching group.

Ballistic stretching traditionally is used less often than static stretching, except when considering the similarities between this method and dynamic stretching. Dynamic stretching, which is widely used by collegiate athletes, is performed by repeating forceful sport-specific movements, whereas ballistic stretching is thought of as repeated bouncing maneuvers, not necessarily as a sport-specific motion. However, both methods contain ballistic traits.

Ballistic stretching has been negatively labeled by fitness professionals as potentially harmful when not performed correctly, most likely due to the incidence of injuries received by the less-trained general public. Despite this perception, Kumar and Chakrabarty have shown ballistic stretching to be more effective than static stretching, when performed properly, for increasing ROM.

## **CONCLUSIONS**

The study was performed to compare the effectiveness between Kinesio taping versus Ballistic Stretching for improving hamstring flexibility in collegiate athletes. This study concludes that both the interventions having significant effect within the groups. While comparing Kinesio taping showed statistically more effective than ballistic stretching for improving hamstring flexibility for collegiate athletes.

## **LIMITATIONS AND RECOMMENDATIONS**

### **Limitation of the Study**

- Shorter Duration.
- Small number of sample
- The Study was performed for collegiate athletes only

### **Recommendations for further study**

- Further study could be done with large number of sample
- Further study could be done on professional players also.
- Study could be done on different age group.
- Different interventions could be added for improving hamstring flexibility.
- Different type of professionals may be use in further study.

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