

# A Study to Compare the Effectiveness of L4/L5 Zygoapophyseal Joint Mobilization versus Sub Occipital Muscle Inhibition Technique on Hamstring Extensibility in Athletes

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**Abstract:** *Background:* Hamstring tightness is a major contributing factor for lumbar spine disorders and sports related injuries. Mobilize L4/L5 zygoapophyseal joint used to induce sympathetic nervous system changes in lower limb and decrease the stress on spinal soft tissues. Suboccipital muscle inhibition technique (SMI) describes the steady pressure to soft tissues to effect relaxation and normalize reflex activity. This study was aimed to compare the effect of L4/L5 zygoapophyseal joint mobilization and SMI technique on hamstring extensibility in athletes. *Methodology:* 40 subjects were selected randomly and divided into two equal groups. Group A were given L4/L5 zygoapophyseal joint mobilization technique and Group B was given SMI technique for 4 weeks with 4 days a week. Outcome measures of this study were NPRS & AKE. *Results:* The data was analyzed using paired and unpaired 't' test after statically analyzed it has been shown that Group A shows much significant than Group B with the p value of (p<0.001). *Conclusion:* In this study it has been concluded that L4/L5 zygoapophyseal joint mobilization showed better improvement in hamstring extensibility which is superior than SMI technique.

**Keywords:** L4/L5 zygoapophyseal joint mobilization technique, SMI technique, hamstring extensibility, athlete

## 1. Introduction

Muscular flexibility is an important aspect of normal human function. Lack of flexibility has been shown to predispose to several musculoskeletal overuse injury and significantly affect person's level of function (J W Orchard, et. al., 2004). and difficulty in executing and sustaining motor activities in daily life. Hamstring is one of the commonest muscles that often get tight (Peter Brukner et. al., 2013). Muscle tightness in caused by a decrease in the ability of the muscle to deform resulting in a decrease in ROM at joint (Akinpelu et. al., 2005) Males are more predominantly affected than the females. Most commonly affected age group between 18 to 25 (PramodK. Jagtap et. al., 2015).

Tight hamstring muscle will increase the patellofemoral compressive force because of passive resistance during swing phase of ambulation and running (Akinpelu et. al., 2005). Hamstring tightness has been reported to be the cause of posterior pelvic tilt, reduced lumbarlordosis and exacerbation of existing pain in patients with LBA (Peter Brukner et. al., 2013). The L4/L5 and L5/S1 levels are the most common areas for spinal degeneration and athletes are susceptible to degenerative changes at an earlier age than the normal population (Akinpelu et. al., 2005).

A significant number of acute injuries in the sporting population are associated with hamstring muscle. Ekest and et. al., (2011) found to be increase in professional soccer player with the incidence rate of 11 - 15.9% (Pramod K. Jagtap et. al., 2015).

Various studies suggest that hamstring tightness is a factor that is responsible for pathological condition of knee and spine even in non - athletic individuals. Mostly stretching techniques used increased joint ROM and enhance flexibility of the muscles.

In this study according to the Szlecek et. al., (2011) found that the unilateral zygoapophyseal mobilization on posterior neurodynamic chain. Grade III zygoapophyseal joint mobilization (larger amplitude into resistance) at L4/L5 have been shown to induce sympathetic nervous system changes in lower limb (PramodK. Jagtap et. al., 2015).

SMI technique is another technique to normalize reflex activity (Peter Brukner et. al., 2013). and also produce effect relaxation in soft tissues. Erika Quintana Aparicio et. al., studied the effectiveness of sub - occipital muscle inhibition technique for treating hamstring tightness, the study suggested that the possible hypothesis for hamstring muscle act as postural control of Sub - occipital muscle (Peter Brukner et. al., 2013). Superficial back line (SBL) is a continuing line of fascia and muscle from head to heel which includes both the Sub - occipital and hamstring (Yolanda Castellote - Caballero et. al., 2014).

Connection of sub occipital muscles with duramater and presence of myofascial chains that links the connective tissue fascia and muscle along specific lines in the body (Peter Brukner et. al., 2013). Various treatment technique are available to treat hamstring tightness such as Muscle energy technique, Positional release technique, Myofascial release technique and different stretching technique (Peter

Brukner et. al., 2013) Indirect approach is very beneficial when the hamstring are injured and sensitive or just have not responded direct massage and Stretching technique (Yolanda Castellote – Caballero et. al., 2014)

According to Gajdosik & Lusian, the AKE test is more reliable tool used than the SLR test for assessing Hamstring tightness and NPRS for pain level. This study is designed to compare the effectiveness of L4/L5 zygapophyseal joint mobilization and SMI technique for individuals with hamstring tightness.

## 2. Need of the study

Hamstring tightness common causes of several musculoskeletal overuse injury and significantly affect person's level of function. Etiology of this tightness is caused by decrease in the ability the muscle to deforms resulting in a decrease in ROM at joint (Akinpelu et. al., 2005). . Many treatment options exits like, MET, PRT, MRT and different stretching technique (Peter Brukner et. al., 2013)

Literature indicates that hamstring tightness may be successfully treat using L4/L5 zygapophyseal joint mobilize and scriptura muscle inhibition technique. Purpose of this study to improve hamstring extensibility and improve joint ROM. Even though both mobilization and MET there is no evident to prove the comparative effect between this two. Thus there is an effort to taken to analyze the comparative effect of mobilization and MET in Athletes with hamstring tightness.

### Aim and Objectives of the Study

- Aim of the study is to compare the effect of L4 - L5 Zygapophyseal joint mobilization and sub occipitalmuscle inhibition on Hamstring extensibility in athletes.
- To find out the effects of mobilizing L4/L5 zygapophyseal joint on hamstring extensibility.
- To find out the effects of sub occipital muscle inhibition technique on hamstring extensibility.
- To compare the effect of mobilizing L4/L5 zygapophyseal joint v/s SMI technique on hamstring extensibility in Athletes.

## 3. Methodology

This study was conducted at Sri Venkateshwaraa College of Engineering & Indirani College of nursing. A total of 40 athletes with both gender were participated in this Comparative study and they were randomly divided into 2 Groups (A& B). Group A Athletes were given with L4/L5 zygapophyseal joint mobilization & Group B were given with Suboccipital Muscle Inhibition Technique and the duration of treatment was about 4weeks.

### Inclusion Criteria

- Clinically diagnosed cases and symptoms of hamstring tightness. (Unilateral)
- Age group between 18 - 25
- patient of both gender

- Those who willing to participate in this study and willing to take treatment for 4 weeks.
- Normal healthy individual with Active knee extension (popliteal angle <125°)
- At least 15° loss of AKE (extension lag.)

### Exclusion Criteria

- Current symptomatic low back pain
- Hamstring or Hip pathology
- Diagnosed with neurologic disorders.
- Previous lumbar surgery
- Contraindication to spinal mobilization.
- Individuals with neck pain
- Individuals with history of neck trauma
- Individuals with fracture of lower limb
- Individuals with cervical ligament instability
- Individuals with vertebra basilar artery syndrome.

### Outcome Measure

- Numerical Pain Rating Scale
- Active Knee Extension Test

## 4. Procedure

### Group (A) (Mobilizing the lumbar L4/L5 Zygapophyseal joint)

- Position of patient: prone lying
- Application: Lumbar mobilization of the unilateral Zygapophyseal L4/L5 joint to the ipsilateral side as the dominant limb (Louis 1981). Grade III posterior - anterior (PA) mobilization were applied to the group for 1 minute, 3 times at the 14/15verrtical level. Grade III Zygapophyseal PA mobilizations (large amplitude into resistance) with high velocity at L4/L5 have been shown to induce sympathetic nervous system changes in the lower limb were applied to group 3 times for 2 minutes. For each subject 1 minute of mobilization is done at L4/L5 level transversely 3 times. This was done for alternative days for 4 week the end of 4<sup>th</sup> week post assessment was done.



Figure 1

### Group (B) Sub - occipital Muscle Inhibition Technique (SMI)

- Position of patient: supine lying
- Application: Therapist stands at the head of the table and placethe palms under the subjects head. Pads of therapist fingers are placed on the projection of the posterior arch of the atlas which is palpated between the external

occipital protuberance and spinous process of axis vertebra.

Therapist located with the middle and ring fingers of both hands the space between occipital condyles and spinal process of 2<sup>nd</sup> cervical vertebra. Then with MCP joint in 90 flex, therapist rests the base of the skull on hands. Pressure was maintained for 2mints until tissue relaxation. Treatment was continued alternatively for 5 days for 4 week. At the end of 4<sup>th</sup> week post assessment was done.



Figure 2

### 5. Statistical Analysis

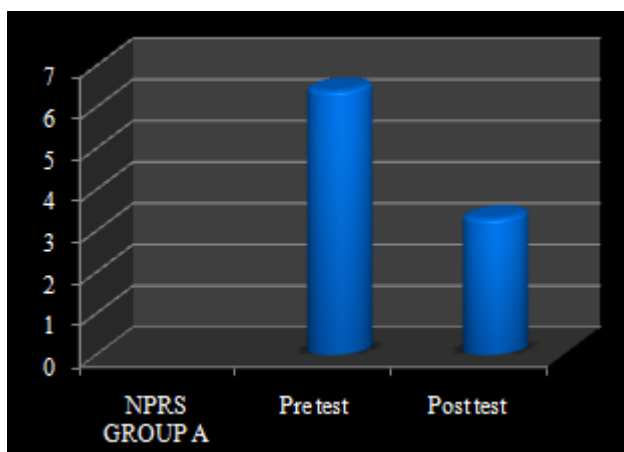
Statistical comparisons within the group and between the groups for NPRS and ROM were analyzed using paired' test and unpaired 't' test respectively. Baseline characteristics of all the subjects were given as Mean ± SD. The outcome values obtained were manually tabulate in Microsoft Excel '07 spreadsheet, and were exported to "Graph pad prism 5" for windows version 5.03 for statistical analysis.

Table 1: Comparison of pre - test and post - test level of NPRS group A

NPRS	Mean	SD	t - value	p value
Pre test	6.40	1.536	10.394	at P <0.0001
Post test	3.30	0.865		

SD = 0.865 Calculate 't' value is 10.394 at the 0.0001 level of significance

#### NPRS Group A Pre And Post Value



Graphical Representation 1

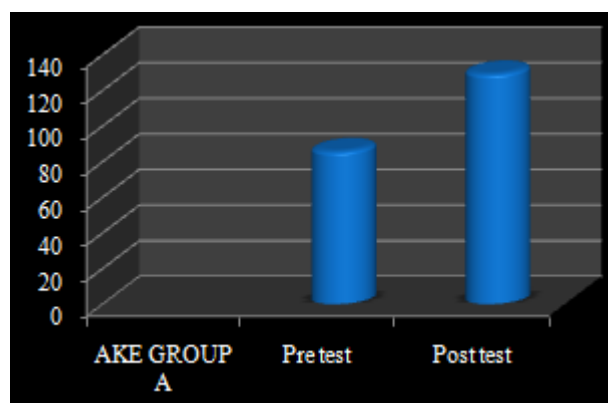
Table No - 1. The pain intensity score using NPRS for group A is given. the NPRS score was taken before and after 4 week treatments follow up. The table gives the mean± SD of the NPRS scores on these weeks. The mean ± SD score was 6.40, 1.536 as compared to 3.30, 0.865 on 4<sup>th</sup> week. the score assessed on patients in group A for pain intensity using NPRS had significant effect (t=10.394., p<0.0001)

Table 2: Comparison of pre - test and post - test level of AKE group A

AKE	Mean	SD	t - value	p value
Pre test	85.75	10.295	17.857	at P <0.0001
Post test	129.25	5.20		

SD =5.20 Calculate 't' value 17.857 is at the 0.0001 level of significance

#### AKE Group A Pre and Post Value



Graphical Representation 2

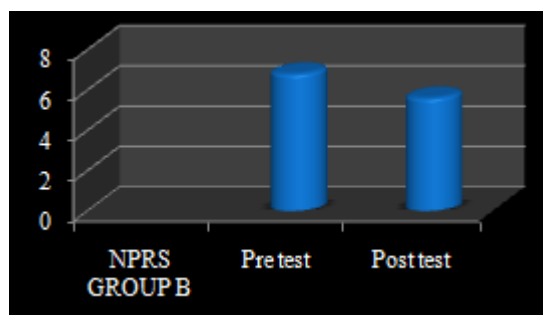
Table No - 2: The Muscle extensibility score using AKE for group A is given. the AKE score was taken before and after 4 week treatments follow up. The table gives the mean± SD of the AKE scores on these weeks. The mean± SD score was 85.75, 10.295 as compared to 129.25, 5.20 on 4<sup>th</sup> week. The score assessed on patients in group A for pain intensity using NPRS had significant effect (t=17.857., p<0.0001)

Table 3: Comparison of pre - test and post - test level of NPRS group B

NPRS	Mean	SD	t - value	p value
Pre test	6.80	1.542	7.228	at P <0.0001
Post test	4.60	1.429		

SD =1.429 Calculate 't' value is at the 0.0001 level of significance

#### NPRS Group B Pre and Post value



Graphical Representation: 3

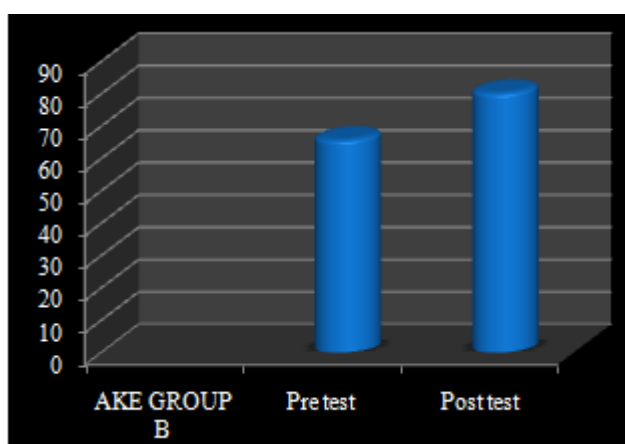
**Table No - 3.** The pain intensity score using NPRS for group A is given. The NPRS score was taken before and after 4 week treatments follow up. The table gives the mean± SD of the NPRS scores on these weeks. The mean± SD score was 6.80, 1.542 as compared to 4.60, 1.429 on 4<sup>th</sup> week. The score assessed on patients in group A for pain intensity using NPRS had significant effect (t=7.228., p<0.0001)

**Table 4:** Comparison of pre - test and post - test level of AKE group B

AKE	Mean	SD	t - value	p value
Pre test	88	10.687	3.23	0.004
Post test	102.25	22.622		

SD =22.622 Calculate 't' value is at the 0.0001 level of significance

**Ake Group B Pre Value and Post Value**



**Graphical Representation 4**

**Table No - 4:** The Muscle extensibility score using AKE for group A is given. The AKE score was taken before and after 4 week treatments follow up. The table gives the mean± SD of the AKE scores on these weeks. The mean± SD score was 88, 10.687 as compared to 102.25, and 22.622 on 4<sup>th</sup> week. The score assessed on patients in group A for pain intensity using NPRS had significant effect (t=3.23., p<0.0001)

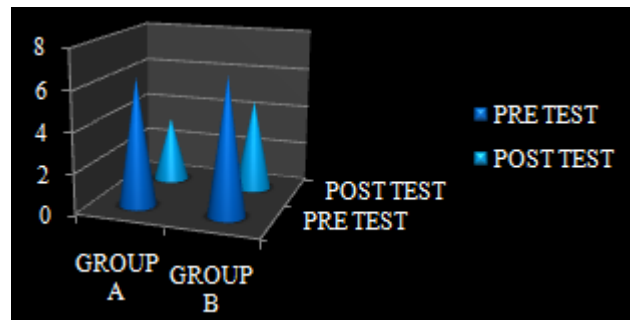
**Table 5:** Comparison of group A and B of NPRS

NPRS	Mean	SD	t - value	p value
Group A	3.1	1.334	2.112	0.041
Group B	2.2	1.361		

Calculate 't' value is 2.112 at the 0.0001 level of significance

**Assessment of pain intensity using NPRS for Group A and Group B**

**NPRS (Numerical pain rating scale)**



**Graphical Representation 5**

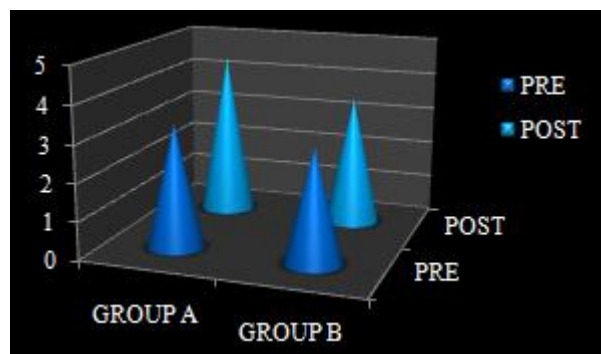
**Table no - 5:** showing mean difference of pre and post for group 1 and group 2 with NPRS score Result The t - value is found to be 2.112 and 0.041 it is greater than the table value of 1.729. Hence it is significant. Therefore the stated null hypothesis is rejected and alternate hypothesis is accepted. So it is concluded that there is a significant difference in NPRS value between group 1 and group 2.

**Table 6:** Comparison of group A and B of AKE

AKE	Mean	SD	t - value	p value
Pre test	43.5	10.894	5.80	P <0.0001
Post test	14.25	19.753		

SD =19.753, Calculate 't' value is 5.80 at the 0.0001 level of significance

**Assessment of Hamstring Muscle Extensibility using AKE for Group A and B AKE (active knee extension)**



**Graphical Representation 6**

**Table - 6:** showing mean difference of pre and post for group 1 and group 2 with AKE score Result The t - value is found to be 5.80 and 0.0001 it is greater than the table value of 1.729. Hence it is significant. Therefore the stated null hypothesis is rejected and alternate hypothesis is accepted. So it is concluded that there is a significant difference in AKE value between group 1 and group 2

**6. Result**

The data were analyzed using measures of paired 't' test to find the significance of the interventions used among the groups. The analytical test showed significance for both the groups L4/L5 Zygapophyseal joint mobilization (Group A) and Sub Occipital Muscle Inhibition technique (Group B) were both effective in reducing the pain intensity and improve the hamstring muscle extensibility among groups. Group A showed improvements after 4 week measurements showed more significance than group B which showed

decrease in pain intensity and improve in Hamstring muscle extensibility after 4 week measurements. Hence, group A showed more significance than group B. The results were found to be significant at  $p < 0.0001$  for pain intensity and Muscle extensibility, stating that there is a significant effect using L4/L5 Zygapophyseal joint mobilization than Sub Occipital Muscle Inhibition technique in reducing pain intensity and improve muscle extensibility.

## 7. Discussion

The chief objective of this study was to compare the efficacy of L4/L5 Zygoapophyseal joint mobilization technique over Sub occipital muscle inhibition technique for hamstring tightness in athletes, reducing the pain intensity and improving the hamstring muscle extensibility assessed by NPRS and AKE respectively. The study was detailed and tailored to find which mode of treatment was better in the two groups after 4 weeks follow up.

The result of this study also has got strong evidence from the study done by in those study assess the effectiveness **SZleck et al 2011** of mobilizing L4/L5 Zygoapophyseal joint technique, a effective technique used for hamstring tightness. this study was the first to examine the effects of lumbar mobilization on both neural and muscle components of the hamstring region. this study developed the work of **S Zlezak et 2011** who found multilevel facet mobilization increased neurodynamics of the posterior lower limb tested via the SLR

According to Pramod K. Jagtop2015 SMI technique is effective in improving the flexibility of hamstring muscle

Over all 40 subjects who met with the inclusion criteria were randomly allocated into two groups. The subjects, who fell into age groups of 18 - 26years of both the sexes and who were selected.20 subjects from group1A were treated with 14/15 Lumbar mobilization technique and while 20 subjects from groupB were treated with SMI Technique. Pre treatment values of pain intensity using NPRS and hamstring muscle extensibility using AKE on baseline, before and after 4 week treatment were assessed these values were statically analyzed using repeated measures of paired't' test. The statically analysis done for both the groups showed in pain intensity and Improve in muscle extensibility.

It also showed that subjects from group A showed more improvements in hamstring muscle extensibility and pain reduction from baseline to day 10 treatment maintained the improvements till after 4 week of treatment. Based on this data accept the alternate hypothesis and reject the null hypothesis. this result was significance at  $p < 0.0001$

It strongly support the earlier findings of **K Pagare et al 2014**. The purpose of those study was to compare the effects of neurodynamic sliding technique with static stretching on hamstring flexibility with short hamstring syndrome and conclusion of those study was, both the technique are equally effective to improve hamstring g flexibility in football players with short hamstring g syndrome

The result of this study also has got strong evidence from study done by **DrewTylorBsc, M. H. SC osteo et al 2003**. The purpose of those study was to investigate the effect of cervical isometric contract relax technique on hamstring extensibility and it concluded that there is no significant effect to the extensibility of hamstring. those study does not support the use of cervical technique to alter hamstring extensibility

The findings in our Group A L4/L5 mobilizing technique are similar to those reported in a case series by **Chesterton, P, Pyton S. et al, 2016** they all demonstrated significant increase hamstring extensibility and decrease pain level and concluded that receiving L4/L5 had greater improvement in function and reduce pain as well as compared to SMI technique.

During the study, at that time, i have been used pelvic strap to stabilize the hip joint alone with the lumbar spine. This prevents posterior pelvic tilt while measuring Active knee extension with using goniometer it isolates the joint from the interference of other joint without affecting final outcome of measuring the length of other muscle groups<sup>4</sup>. In SMI group some low back pain present after treatment because the myofascial chain level from the suboccipital region relaxes the connective tissue, so there will be increase soft tissue extensibility. but in L4/L5 mobilizing technique decrease the LBP due to the neurodynamic chain connection from the lumbar to hamstring so this group shows decrease NPRS level after treatment along with hamstring muscle extensibility. This study implies that both L4/L5 mobilization and SMI technique used or treat hamstring tightness but lumbar mobilization significantly higher than SMI technique

## 8. Conclusion

This study concluded that both L4/L5 zygoapophyseal joint mobilization, SMI technique have got beneficial effect in reducing pain intensity and improving hamstring muscle extensibility in hamstring tightness athletes. When both the treatment regimens were taken into consideration for significances showed effectiveness in hamstring extensibility and pain level but lumbar mobilization showed superior hand over than SMI technique.

## 9. Limitations of the Study

- Small sample subjects were taken
- The study was limited to assess only the two outcome measures (AKE and NPRS)
- Randomized study group were taken

## 10. Suggestions and Further Recommendation

- In this study, subjects were tested for pain and Hamstring Muscle extensibility, similar studies could also be done to detect the endurance and power of hamstring muscle
- Further studies should be conducted in larger sample size
- This study could be done with control group for whom intervention will not be given so that there will be a

chance to know the outcome of L4/L5 Zygoapophyseal joint mobilization technique is more significant.

## References

- [1] **AkinpeluAO, Bakare U, Adegoke BOA.** 'Influence of Age On Hamstring Tightness In Apparently Healthy Nigerians'. *Journal of the Nigeria Of The Society Of Physiotherapy* - 15, 2005
- [2] **J W Orchard, P Farhart, C Leopold,** 'Lumbar spine region pathology and hamstring and calf injuries in athletes; is there a connection?' *Br J ports Med* 2004, 38; 502 - 504
- [3] **PramodK. Jagtap, Shubhangi D, Mandale.** 'The Effect of Suboccipital Muscle Inhibition Technique On Hamstring Tightness Patients'. *journal of Evolution of medical and dental science* 2015, 23; 5682 - 5689
- [4] **Peter Brukner, Andrew Neelson, Christopher Morgan, Darren Burges,** 'Recurrent hamstring muscle injury; applying the limited evidence in the professional football setting with a seven - point programme' 2013 *bjsports* - 2012 - 091400
- [5] **YolandaCastellote - Caballero, Marie C. Valenza, Emilio J. Puentedura,** 'Immediate Effects Of Neurodynamic Sliding Versus Muscle Stretching On Hamstring Flexibility In Subjects With Short Hamstring Syndrome' *Journal of Sports Medicine* Vol 2014
- [6] **BakirtzoglouPanteleimon, IoannouPanagiotis and BakirtzoglouFotis,** 'Evaluation of Hamstring Flexibility By Using Two Different Measuring Instruments, *SHORT SCIENTIFIC ARTICLE UDC*; 616, 796.012.23
- [7] **Cheserton P, Payton, S. J. Stephant,** 'Effects of spinal mobilizations on lumbar and hamstring ROM and Semg; A Randomised Control Trail' *Teesside University's Research Repository* 2016, 1`7 - 25
- [8] **Daniel Mayorga - Vega, Rafael Meino - marban, Jesus Viciana,** 'Criterion - Related Validity of sit - and - Reach tests for Estimatin g Hamstring and Lumbar Extensibility; a Meta - Analysis' *J Sports Sci Med* 2014 Jan 13 - 14
- [9] **Dipesh Thakur, Sumi Rose** 'A Study To Find Out The Correlation Between The Right And Left Hamstring Length In Both Genders To Determine The Prevalence Of Hmstring Tightness Among College Students' *NUJHS* Vol6, December 2016, 2249 - 7110
- [10] **Erika Quintana Aparicio, DO, Luis BorralloQuirante, PT, Cleofas Rodriguez Blanco, DO, et al'**Immediate Effects Of The Suboccipital Muscle Inhibition Technique In Subjects With Short Hamstringb Syndrome; *National university of health sciences* 2009
- [11] **Felipe Jose Jandre Reis, Adriana RibeiroMacedo.** 'Influence of Hamstring Tightness in Pelvic, Lumbar and Trunk Range of Motion in Low Back Pain and Asymptomatic VolunTERS during Forward Bending' 2015, 9, 535 - 540
- [12] **Gajdosik R, LusinG.** 'Hamstring muscle tightness. Reliability of an active -knee - extension test.1983 jul, 63, 1085 - 90
- [13] **T Neto et al.** 'Reliability of the Active - Knee - Extension and Straight - Leg - Raise tests in subjects with flexibility deficits' *J Sports Rehabil Technical Notes* 17, 2014 - 0220, 2015
- [14] **Paul chesterton, Matthew Weston, Myles Butler.** 'The Effect of Moblizing the Lumbar 4/5 Zygaopophyseal joint on Hamstring Extensibility in Elite Soccer Players'. *International Journal of Physiotherapy and Rehabilitation*, April 2016
- [15] **MC Partland JM, BrodeurRR,** 'How Upper Neck Muscles Influence HamstringLength' *journal of bodywork and movement therapies*, January 1996
- [16] **SUNG - HAK CHO, Phd, PT, Soo - HAN KIM, Phd, PT et al'**The comparison of the immediate effects of application of the suboccipitalmuscleinhibition and self - myofascial release techniques in the suboccipital region on short hamstring' Aug.3, 2014
- [17] **Stanley Hui, Pak Y. Yuen,** 'Validity of the modified back - saver sit - and - reach test; A C comparison with other protocols' *medicineand science in sports and exercise* 32; 1655 - 9. September 2000