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Comparative Analysis of Immediate Effects of Static Stretch and Muscle Energy Technique in Hamstring Flexibility in Collegiate of Ziro (Arunachal Pradesh)

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Abstract:-

Introduction: Mechanical back pain is one of the major problem facing by youngster. There are several causes as bad posture, lack of physical activities and so on. According to previous studies our of several causes one of the cause is Hamstring tightness. The shortened Hamstring muscle causes a posterior pelvic tilt that leads to a flat back, which causes back pain. Though there are several effective physiotherapeutic exercises available to resolve this problem, but it's still in dilemma about the immediate effects. In this study the researchers aimed to compare the effect of static stretching and MET on hamstring flexibility in the normal collegiate of Ziro (Arunachal Pradesh).

Methods: An Experimental research study has been conducted to find the tightness of hamstring muscle in the collegiate of Ziro (Arunachal Pradesh). The method used to measure the hamstring length/tightness in this study is the Passive Knee Extension Test. The knee and hip angle is measured using universal goniometry. The data for this study was collected from colleges situated at Ziro,. The subjects were grouped into two groups. Pre test data were taken and assigned randomly into two group. One group was given static stretch for hamstring were as other group was given muscle energy technique stretch. Immediately after stretch again measurement were taken as post test data.

Results: Fifty-Six collegiate responded to the study. Most of them were young female collegiate. The female-male ratio is 5:2.Two groups were made with 28 participants each. As a result, There was a significant improvement in hamstring flexibility in both the groups following the application of MET and Passive static stretching.

Conclusion: From the present study we can conclude that both MET and passive stretching techniques have an immediate effect on reducing hamstring muscle tightness. From the mean difference values, it is visible that MET is slightly more effective than passive stretching although statistically significant difference is not seen.

Keywords:-*Hamstring muscle tightness, Muscle energy technique, static stretching, Passive knee extension test (PKET).*

I. INTRODUCTION

The gift of mobility and being able to move is a blessing to a healthy life. Movement gives us healthy joints, strong bones, physical fitness, strength, good circulation, good coordination, reflex activity, and flexibility; without it, we would deteriorate.[1] Flexibility is capability in movement performance in the body joints with suitable range of motions which contributes largely in doing any movement.[2] Decreased flexibility can cause inefficiency in the workplace and is also a risk factor for conditions such as low back pain, plantar fasciitis, any muscle imbalances, muscle tightness, more prone to injuries, affects the health of cartilage around the joints etc which will affects a person's static and dynamic balance[3]. The flexibility of muscles helps in maintaining a good balance while performing activity of daily life like walking, sitting, running, bending etc. It has been seen that flexibility has a positive impact on some parameters of muscular performance.[4] And one of the examples of muscle group that needs flexibility to increase performance or to avoid injuries are hamstring group of muscle. The Hamstring muscles are a group of muscles present in the posterior thigh to collectively perform hip extension and knee flexion. There are three muscles in the Hamstrings group[5] (Semimembranosus, biceps femoris &*semitendinosis*)

Due to the fact that many people in functional positions are more in positions where the knee is bent, the hamstring muscle tends to shorten. Aging as well as lack of proper exercise tends to increase the process of shortening and the shortness of this muscle directly affects the function of the knee and indirectly affects the function of the low back, hip and ankle joint[6]. Modern sedentary style of living is one of the main reasons for postural abnormalities evident in modern society. The prolonged sitting hours required in most of the jobs, and educational setups can affect the flexibility of soft tissues,[7,8]. These can also lead to hamstring tightness and a tight hamstring can lead to a reduction in hip and knee ROM (Range of motion). The

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causes of hamstring injuries have been attributed to a lack of strength in the hamstrings, lack of hamstring flexibility as well as imbalance between lower extremities muscle[6].Tightness and Decreased flexibility in hamstring muscles leads to hamstring muscle injury so to reduce the number of injuries preventive programs are highly recommended. Stretching is important for reducing injuries and improving performance in sports and overall fitness[9,10].

Dr. Fred Mitchell has been titled the father of Muscle Energy Technique (MET)[11].Muscle energy technique is a manual therapy intervention in which the patient actively contracts a targeted muscle against a precise, clinician-controlled counterforce, followed by relaxation and a passive stretch. This technique is commonly used to strengthen and lengthen muscles, reduce edema, improve circulation, and mobilize restricted articulations. MET has been demonstrated to be more effective in improving the extensibility of shortened muscles than static stretching[12].MET may be used to decrease pain, stretch tight muscles and fascia, reduce muscle tonus, improve local circulation, strengthen weak musculature, and mobilize joint restrictions. This method employs muscle contraction by the patient followed by relaxation and stretch of an antagonist or agonist. It is essentially a mobilization technique using muscular facilitation and inhibition. MET works on two basic principles i.e. post isometric relaxation and reciprocal inhibition[13]. Muscle energy technique (MET) is a procedure that involves voluntary contraction of a patient's muscle in a precisely controlled direction, at varying levels of intensity. It is unique in its application as the client provides the initial effort while the practitioner facilitates the process[9,10].

Passive stretching is the most widely used method to extend the length of muscles, and is the most used intervention to enhance the flexibility of muscles and increase the range of motion; however, there have been reports that question the beneficial effect of stretching on exercise performance because extension of muscle length may lead to decreased strength (Marek et al., 2005; You and Lee, 2010)[14]. Clinically, hamstring length can be measured indirectly which is carried out by measuring hip's range of motion (ROM) during the passive straight leg raise (SLR) or active knee extension (AKET) tests.

According to Lusin and Gajdosik, to measure the length of the hamstring, the AKE test is recommended which is a better choice than the passive SLR. AKE test has very high reliability[15,16]. This test is remarked safe, as the participant dictates his/her end of range[17].The purpose of the Passive Knee Extension Test (PKET) is to examine the joint range and its quality of movement; in particular, the 'end feel' of the joint. The test can also measure tightness of the hamstringmuscle[18]. Hamstring flexibility measurements are of clinical relevance for the prognosis of a hamstring injury and for monitoring recovery after such injury. The active knee extension test (AKET) and passive knee extension test (PKET) are proven to be reliable in healthy subjects.[19]

The Passive Knee Extension Test has good intra-tester reliability [ICC: 0.97-0.98].[20]The purpose of this study is to compare the effect of passive static stretching and MET on hamstring flexibility in normal Indian collegiate by using AKET and PKET tests and doing a pretest-posttest analysis. The patient is positioned in supine with the hip of the tested leg in 90 degrees of flexion.The contralateral leg stays flat on the examination table. The clinician extends the knee until reaching the maximal tolerable stretch of the hamstring muscle as indicated by the patient with the ipsilateral hip remaining in 90 of flexion. The knee angle is then measured with a goniometer.[21]Thus the aim of this study is to compare the effect of static stretching and MET on hamstring flexibility in normal Indian collegiate. The objectives of these studies are to find out the effect of muscle energy technique and static stretch on flexibility of hamstring in order to reduce tightness, with least time consumption. The significance of this study is to re-discover more efficient intervention/ method to improve hamstring flexibility, within minimal time.

II. METHOD AND MATERIALS

For this experimental study 60 college going students from three educational institution, viz: Indira Gandhi Technological and Medical Sciences University, Mudo Tamo B'ed college, St. Claret college Ziro, Arunachal Pradesh, India. different colleges of Ziro, , participated voluntary. The inclusive criteria were aged between 18-30 years with no history of hamstring injury for at least 2 years, and an individual with 0^o of knee extension and less than 110^o hip flexion.[20]. The exclusion criteria were recent complain of Low back pain/ lower extremities pain. hamstring injury and other Soft tissue injury around the knee. (at least for 2 years) and Range of motion of Hip flexion and knee extension beyond normal. For this study Muscle Energy Technique & Static Stretching are independent variable and Hamstring Flexibility is dependent variable. Tools and materials were 360^o goniometer/ long scale, Bed, Yoga mat, Passive Knee Extension Test.

III. PROCEDURE

STEP-I: The subjects were grouped into 2 with 30participants. They were divided by following random controlled trial method.

STEP-II: All the groups were informed about the whole procedure of the program and a written consent form was obtained from them.

STEP III: The subject was tested for Hamstring Tightness with the help of PKET. The measurement will be recorded to see the pretest-posttest result.

The patient is positioned supine with the hip of the tested leg in 90 degrees of flexion. The contralateral leg stays flat on the examination table. The clinician extends the knee until reaching the maximal tolerable stretch of the hamstring muscle as indicated by the patient with the ipsilateral hip remaining in 90 of flexion. The knee angle is then measured with a goniometer.[21]

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Goniometer Placement: The Axis of the goniometer should be placed at the lateral epicondyle of the femur. The moving arm should point toward the lateral malleolus and the stationary should point toward the greater trochanter.[22][23]

Photo 1: Starting point for PKET

Photo 2: After passive extension of knee

STEP-IV:"Group A" was facilitated by the Passive Static Stretching[24]-
Subject Position: Supine lying.
Therapist Position: Standing beside the bed.

Technique: The subject was asked to lie down on a bed and to relax his whole body. The therapist himself flexed the subject's hip and extend their knee until the point of tolerance of hamstring muscle stretching. The therapist held this position for at least 30 seconds and then place the tested leg back on the bed, while the other leg was fully extended on the bed while the test was going on another leg.Frequency of treatment: 3 times x 30 seconds in a day.Treatment duration: 1 session.

Photo 3: Static Stretching

STEP-VI: At the same time "Group B" was facilitated with Muscle Energy Techniques[24]-
The technique used: Autogenic inhibition; "POST ISOMETRIC RELAXATION"
Therapist Position: Standing beside the bed.

- Subject Position: Supine lying
  Technique: The therapist flexed the hip fully and then extend the flexed knee of the testing leg with the back of the lower leg resting on the shoulder of the therapist who stands facing the head of the table. The therapist uses their shoulder as resistance against the individual's active contraction. The therapist asked the individual to flex the knee and extend the hip, it causes a downward pressure against the therapist resistance, so there was an isometric contraction of hamstring muscle due to the therapist's resistance and then the therapist asked the subject to hold it for 5- 10 seconds and during this movement subject was asked to inhale air and hold it in for 5- 10 seconds too. After this effort, the therapist asked the individual to relax the leg and exhale while doing so a gentle stretch was applied to take up the slack till the new barrier and then the therapist maintain this new barrier, and starting from this new barrier the same procedure was repeated for 5 more times. Frequency of Treatment: 5 times X 5 second hold X 25 percentage of patient strength, Duration: 1 session

Photo 4: MET first 25 percent

Photo 5: MET second 25 percent

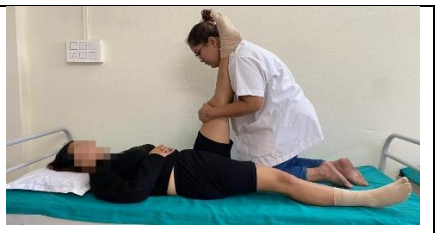

Photo 6: MET fourth 25 percent

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STEP-VIII: After that reassessment was done to check the hamstring muscle flexibilityby assessing Hip Flexion ROM and Knee Extension ROM and the changes was recorded according to

- Comparison between pretest-posttest results in a group.
- Comparison between the pretest-posttest results of two groups.

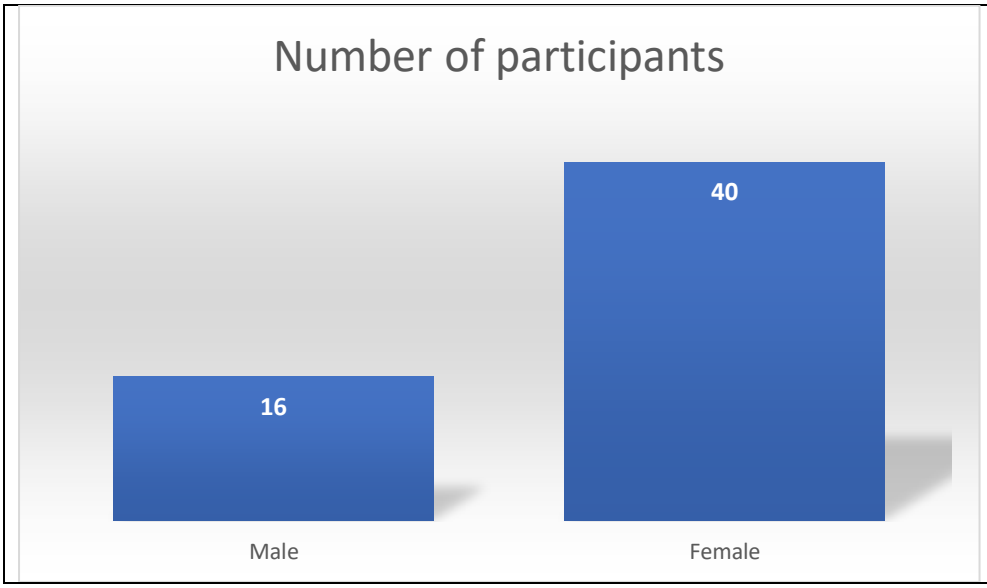
Photo7: HIP RANGE OF MOTION ASSESSMENT

Photo8: KNEE RANGE OF MOTION ASSESSMENT

IV. DATA ANALYSIS

A. DEMOGRAPHIC DATA:

GRAPH 1



Overall 62 participants were selected for the study from three colleges of Ziro of which 56 students were selected (40 females & 16 males) as per the set inclusive and exclusive criteria

Graph 1: The 56 participants were equally distributed in two groups. Each group having 28 participants (20 girls and 8 boys)

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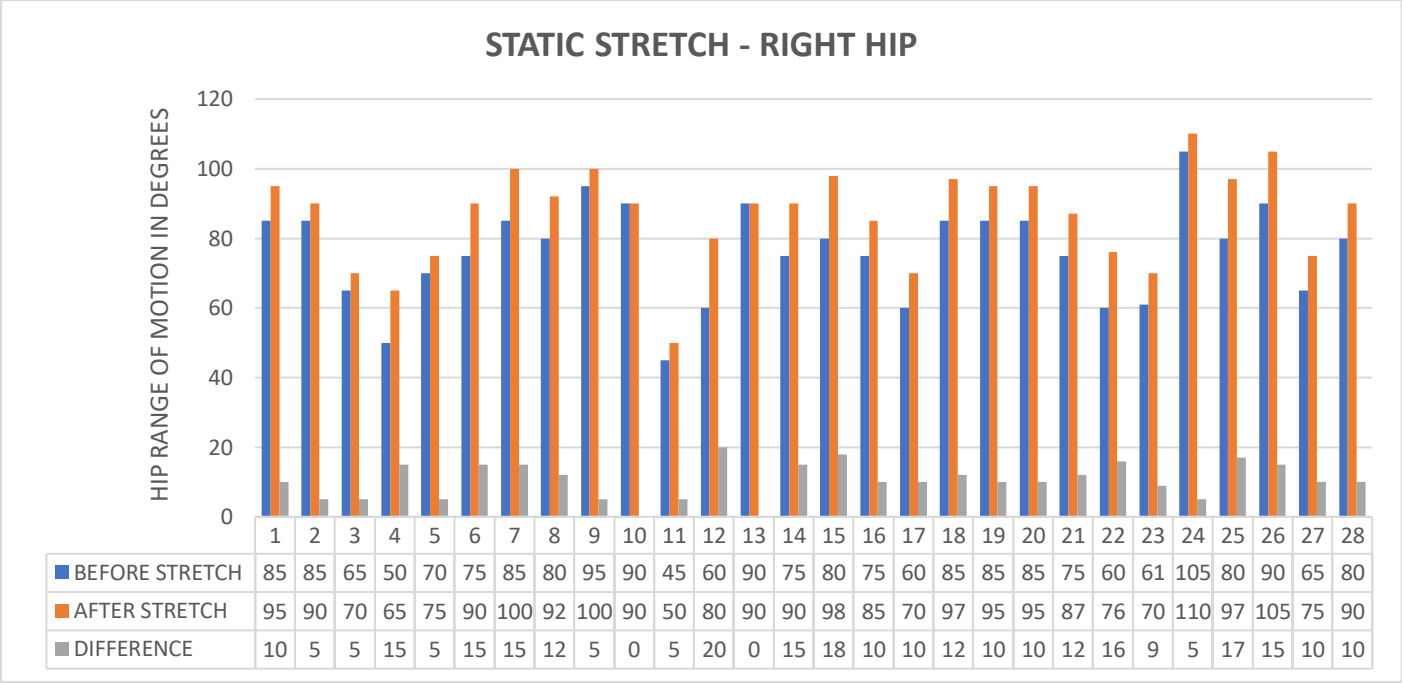
B. GROUP 1: STATIC STRETCHING

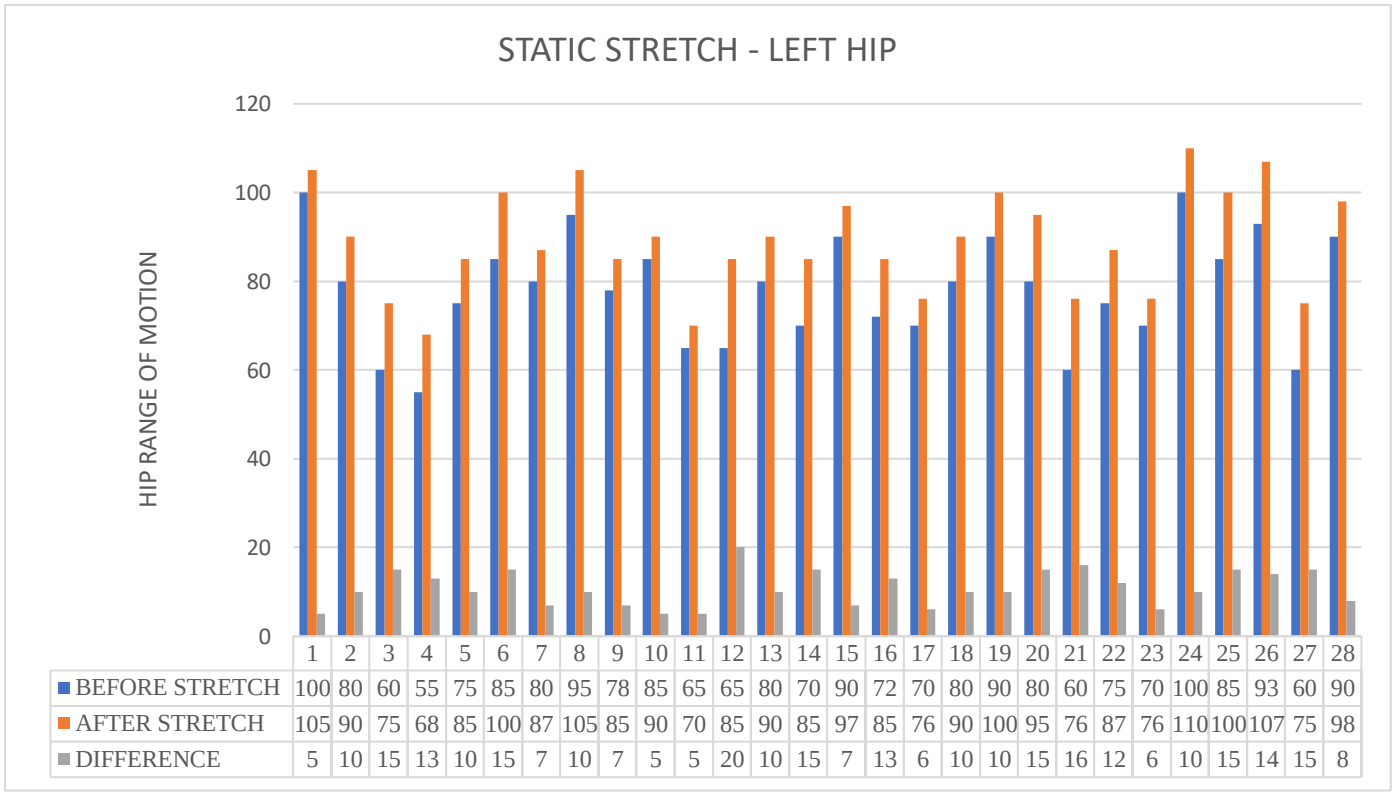
GRAPH 2



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
BEFORE STRETCH	85	85	65	50	70	75	85	80	95	90	45	60	90	75	80	75	60	85	85	85	75	60	61	105	80	90	65	80
AFTER STRETCH	95	90	70	65	75	90	100	92	100	90	50	80	90	90	98	85	70	97	95	95	87	76	70	110	97	105	75	90
DIFFERENCE	10	5	5	15	5	15	15	12	5	0	5	20	0	15	18	10	10	12	10	10	12	16	9	5	17	15	10	10

Graph 2: States that range of motion of right hip before static stretch was 76.28 ±13.96 degrees wehre as after static stretch it was 86.67±13.31 degrees. There was improvement of 10.39±5.11 degrees.

GRAPH 3



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
BEFORE STRETCH	100	80	60	55	75	85	80	95	78	85	65	65	80	70	90	72	70	80	90	80	60	75	70	100	85	93	60	90
AFTER STRETCH	105	90	75	68	85	100	87	105	85	90	70	85	90	85	97	85	76	90	100	95	76	87	76	110	100	107	75	98
DIFFERENCE	5	10	15	13	10	15	7	10	7	5	5	20	10	15	7	13	6	10	10	15	16	12	6	10	15	14	15	8

Graph 3: States that range of motion of left hip before static stretch was 78.14 ±12.42 degrees wehre as after static stretch it was 89±11.36 degrees. There was improvement of 10.85±3.97 degrees.

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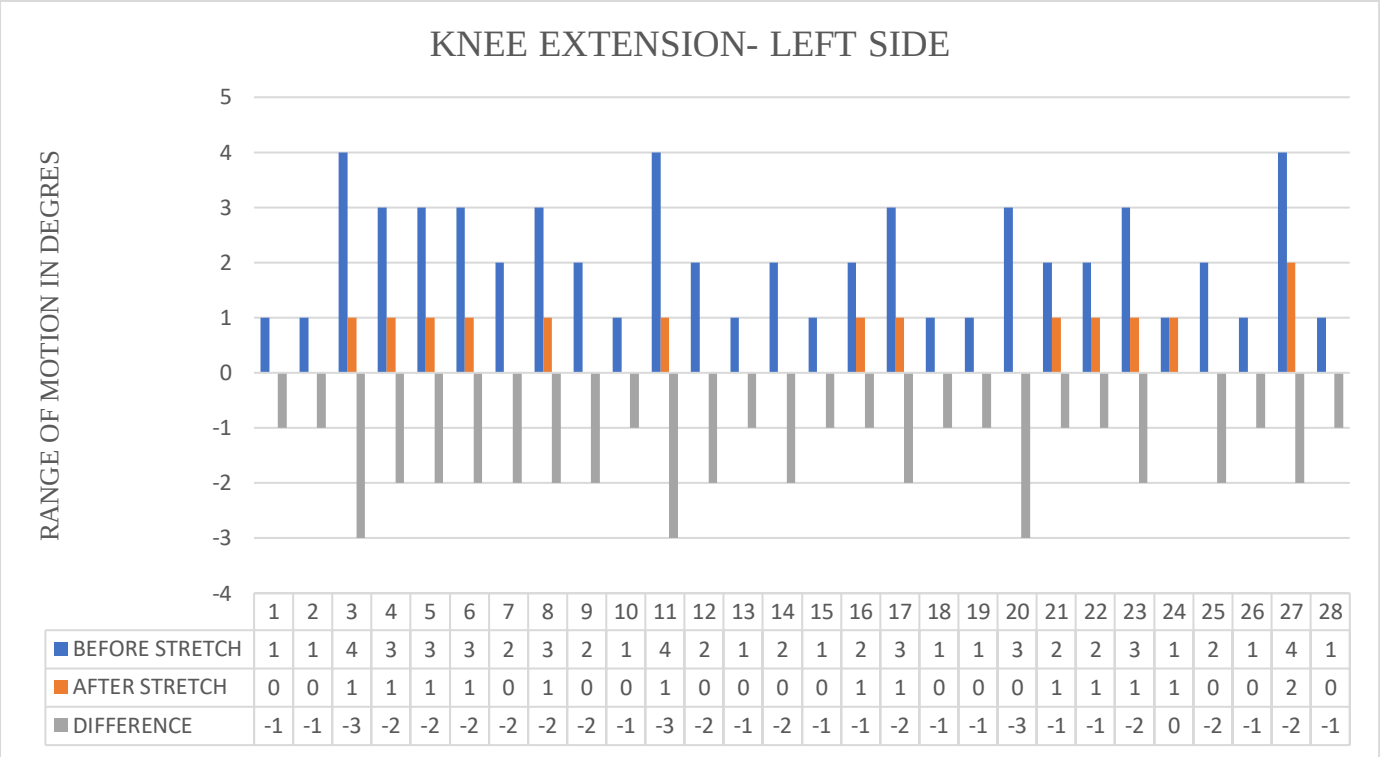
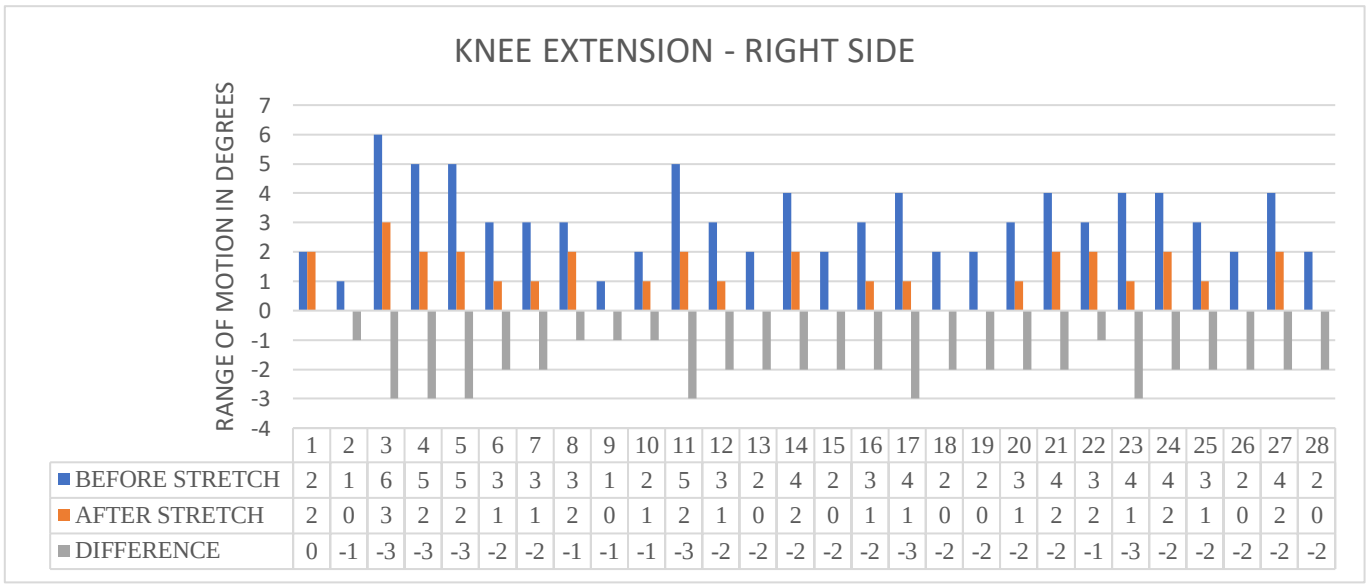
GRAPH 4



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
BEFORE STRETCH	1	1	4	3	3	3	2	3	2	1	4	2	1	2	1	2	3	1	1	3	2	2	3	1	2	1	4	1
AFTER STRETCH	0	0	1	1	1	1	0	1	0	0	1	0	0	0	0	1	1	0	0	0	1	1	1	1	0	0	2	0
DIFFERENCE	-1	-1	-3	-2	-2	-2	-2	-2	-2	-1	-3	-2	-1	-2	-1	-1	-2	-1	-1	-3	-1	-1	-2	0	-2	-1	-2	-1

Graph 4: States that range of motion of left knee before static stretch was 2.10 ±1.01 degrees wehre as after static stretch it reduced up to0.5±0.56 degrees. There was decrease in range of 1.61±0.72 degrees.

GRAPH 5:

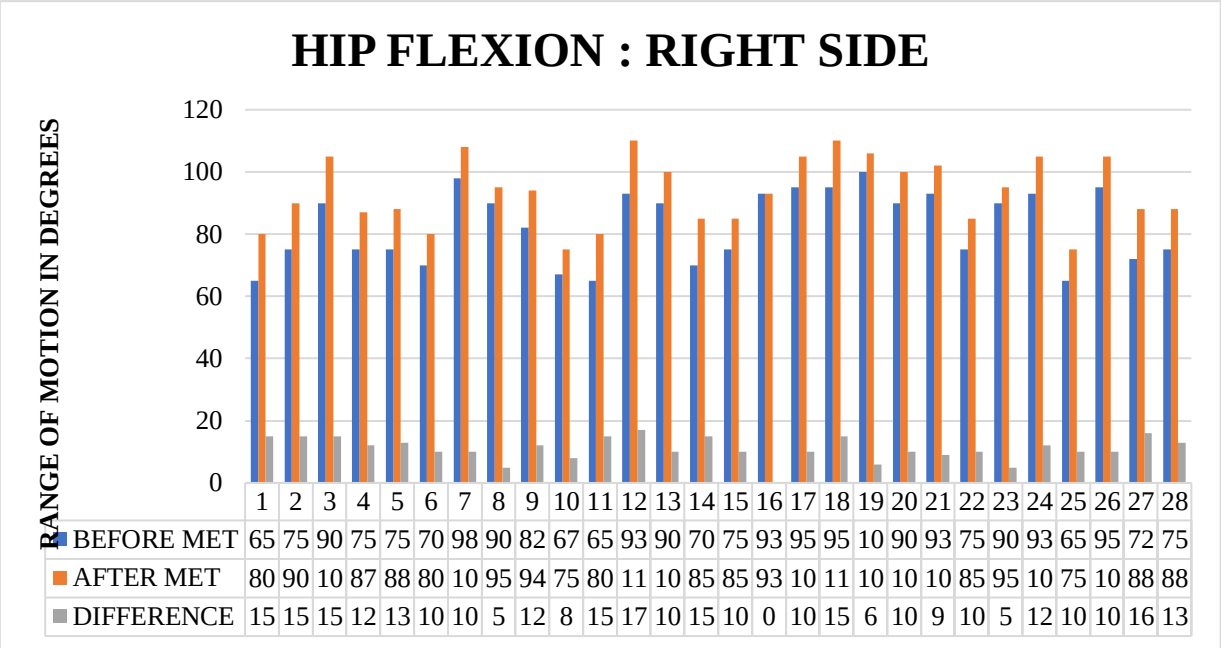


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
BEFORE STRETCH	2	1	6	5	5	3	3	3	1	2	5	3	2	4	2	3	4	2	2	3	4	3	4	4	3	2	4	2
AFTER STRETCH	2	0	3	2	2	1	1	2	0	1	2	1	0	2	0	1	1	0	0	1	2	2	1	2	1	0	2	0
DIFFERENCE	0	-1	-3	-3	-3	-2	-2	-1	-1	-1	-3	-2	-2	-2	-2	-2	-3	-2	-2	-2	-2	-1	-3	-2	-2	-2	-2	-2

Graph 5: States that range of motion of right knee before static stretch was 3.1 ±1.23 degrees wehre as after static stretch it reduced up to 1.14±0.87 degrees. There was decrease in range of 1.96±0.73 degrees.

C. MUSCLE ENERGY TECHNIQUE

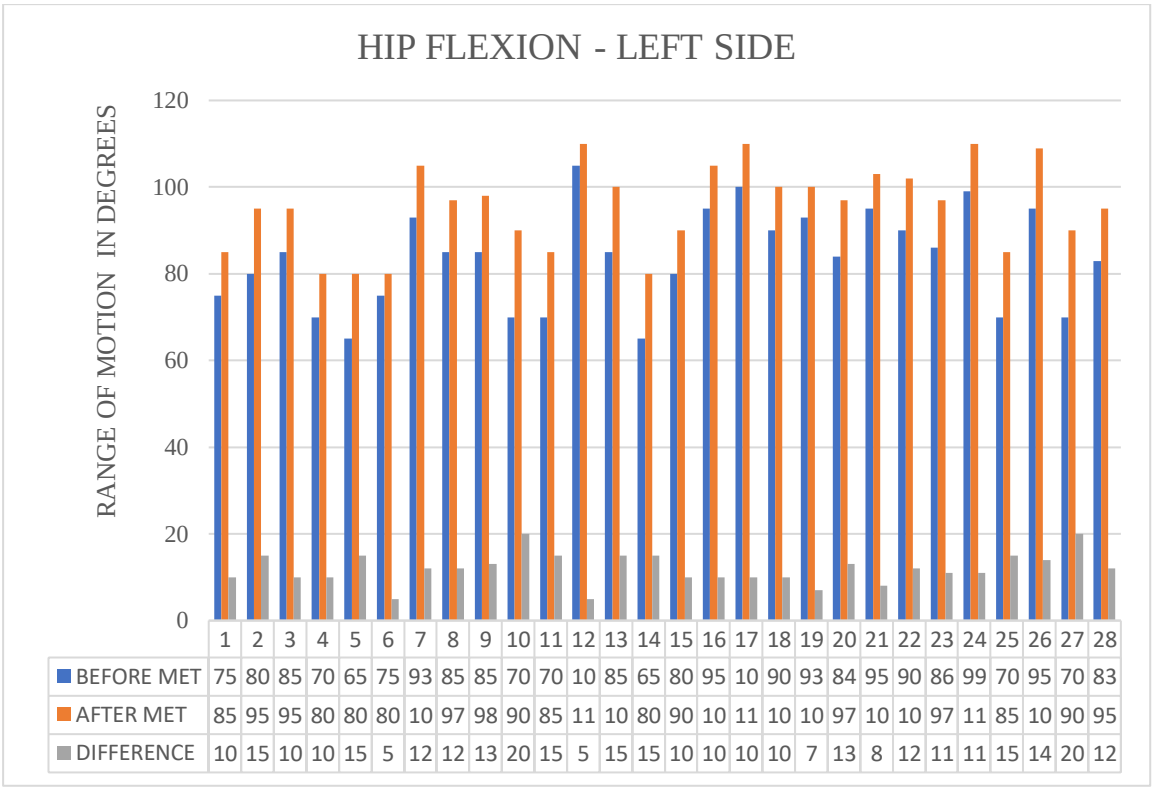
GRAPH 6



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
BEFORE MET	65	75	90	75	75	70	98	90	82	67	65	93	90	70	75	93	95	95	10	90	93	75	90	93	65	95	72	75
AFTER MET	80	90	10	87	88	80	10	95	94	75	80	11	10	85	85	93	10	11	10	10	10	85	95	10	75	10	88	88
DIFFERENCE	15	15	15	12	13	10	10	5	12	8	15	17	10	15	10	0	10	15	6	10	9	10	5	12	10	10	16	13

Graph 6: States that range of motion of right hip before MET was 82.53 ±11.42 degrees wehre as after static stretch it was 93.53±10.68 degrees. There was improvement of 11±3.82 degrees

GRAPH 7



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
BEFORE MET	75	80	85	70	65	75	93	85	85	70	70	10	85	65	80	95	10	90	93	84	95	90	86	99	70	95	70	83
AFTER MET	85	95	95	80	80	80	10	97	98	90	85	11	10	80	90	10	11	10	10	97	10	10	97	11	85	10	90	95
DIFFERENCE	10	15	10	10	15	5	12	12	13	20	15	5	15	15	10	10	10	10	7	13	8	12	11	11	15	14	20	12

Graph 7: States that range of motion of right hip before MET was 83.5 ±11.04 degrees wehre as after static stretch it was 95.46±9.54 degrees. There was improvement of 11.96±3.57 degrees

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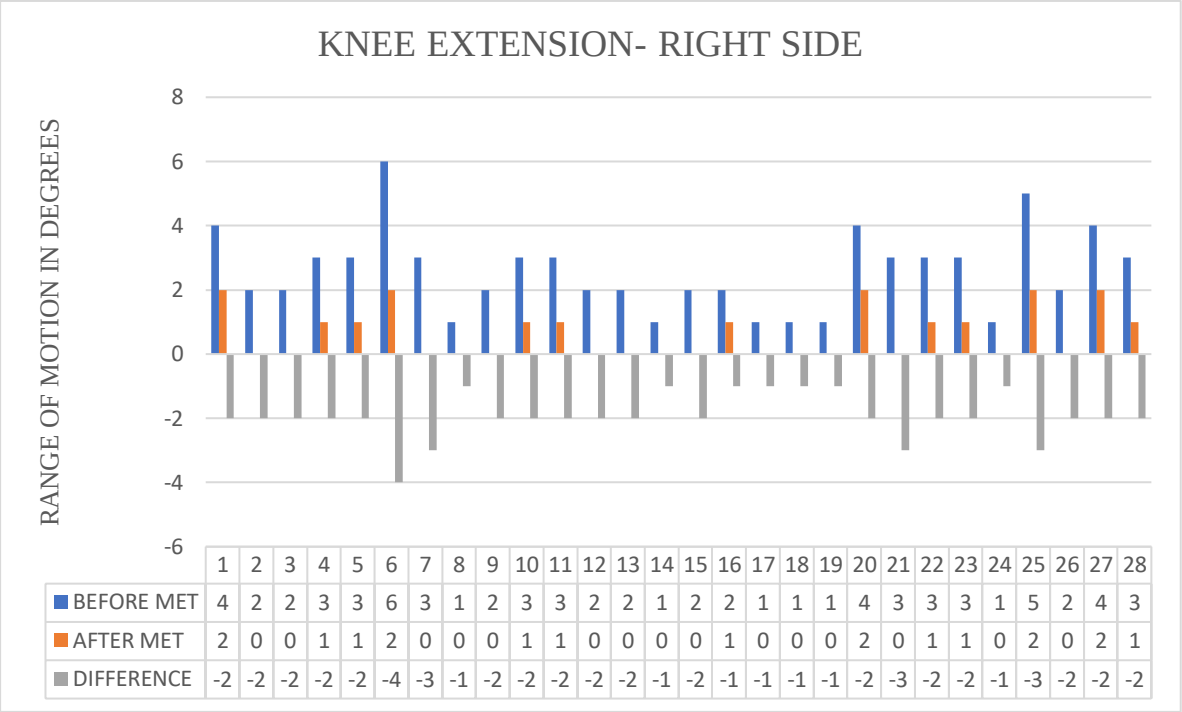
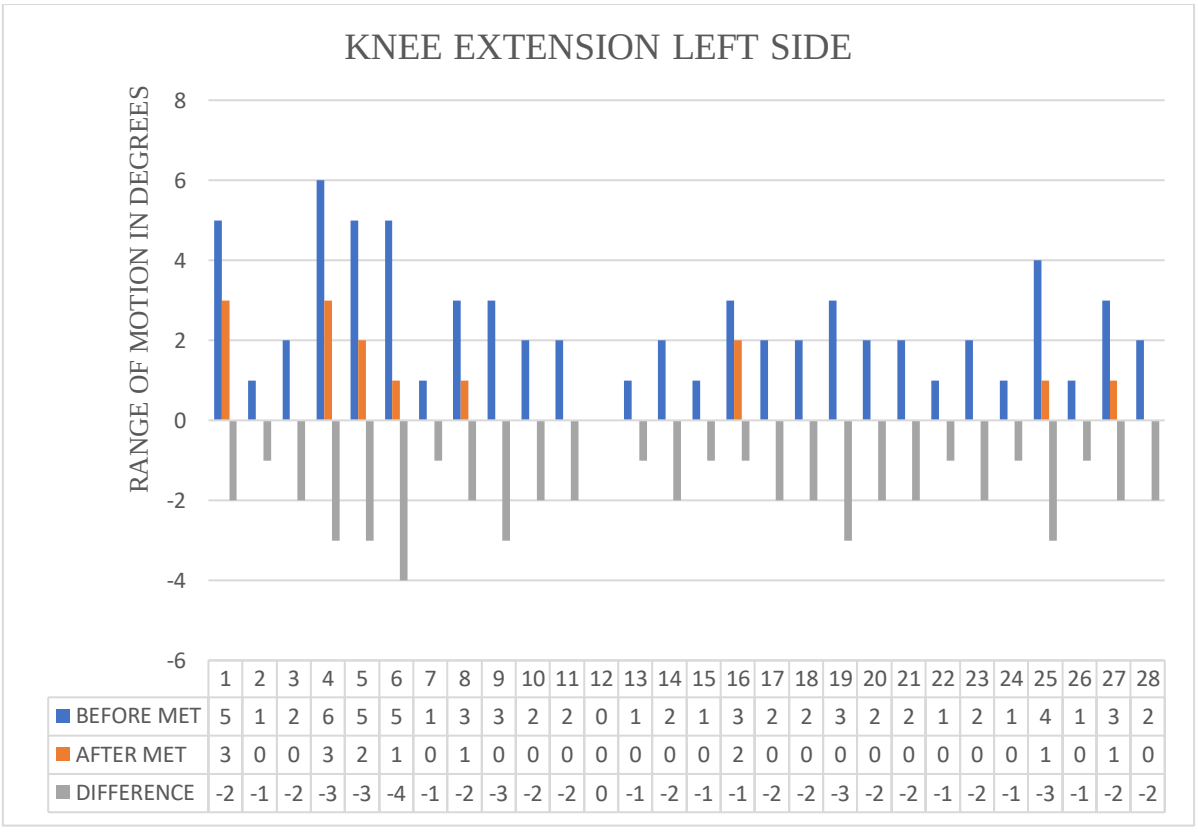
GRAPH 8



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
BEFORE MET	4	2	2	3	3	6	3	1	2	3	3	2	2	1	2	2	1	1	1	4	3	3	3	1	5	2	4	3
AFTER MET	2	0	0	1	1	2	0	0	0	1	1	0	0	0	0	1	0	0	0	2	0	1	1	0	2	0	2	1
DIFFERENCE	-2	-2	-2	-2	-2	-4	-3	-1	-2	-2	-2	-2	-2	-1	-2	-1	-1	-1	-1	-2	-3	-2	-2	-1	-3	-2	-2	-2

Graph 8: States that range of motion of right knee before MET was 2.57 ±1.23 degrees wehre as after static stretch it reduced up to 00.64±0.77 degrees. There was decrease in range of 1.92±1.1 degrees.

GRAPH 9



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
BEFORE MET	5	1	2	6	5	5	1	3	3	2	2	0	1	2	1	3	2	2	3	2	2	1	2	1	4	1	3	2
AFTER MET	3	0	0	3	2	1	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	1	0
DIFFERENCE	-2	-1	-2	-3	-3	-4	-1	-2	-3	-2	-2	0	-1	-2	-1	-1	-2	-2	-3	-2	-2	-1	-2	-1	-3	-1	-2	-2

Graph 9: States that range of motion of left knee before MET was 2.39 ±1.9 degrees wehre as after static stretch it reduced up to 0.5±1.95 degrees. There was decrease in range of 1.89±1.86 degrees

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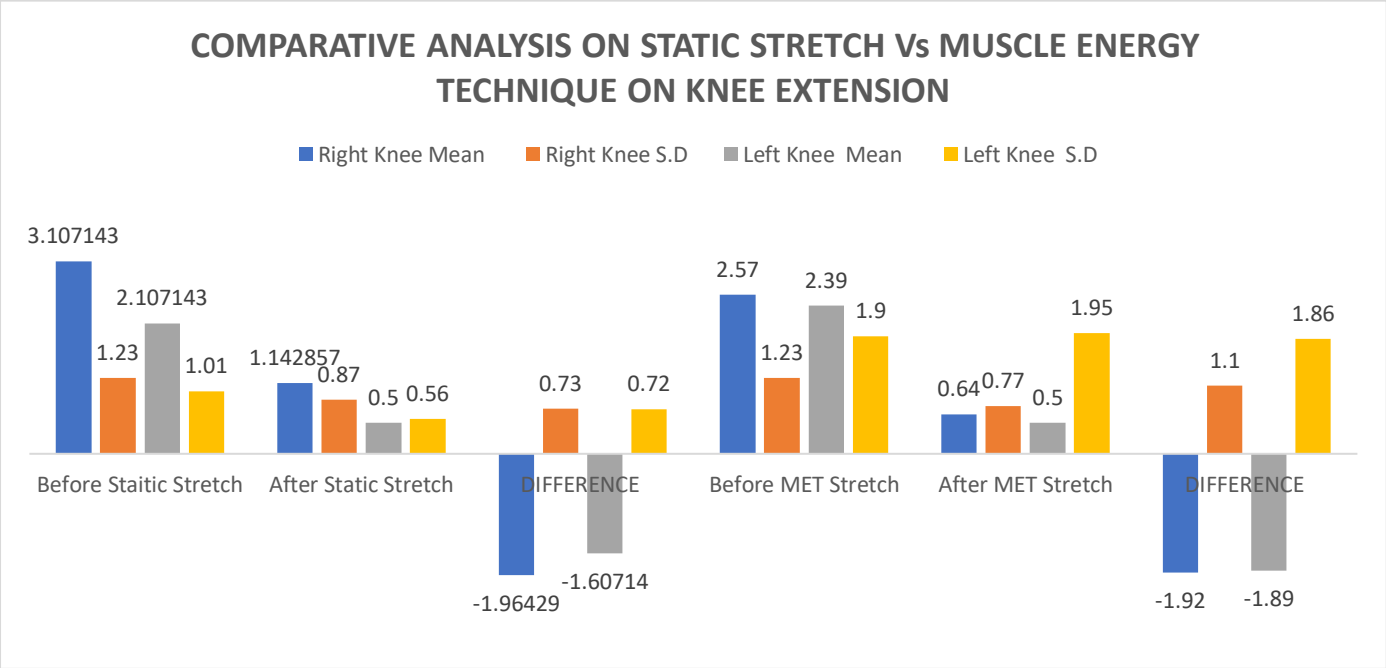
V. RESULT

This study shows an interseting result when it is compared static stretch verses muscle energy technique. The details are as follow:

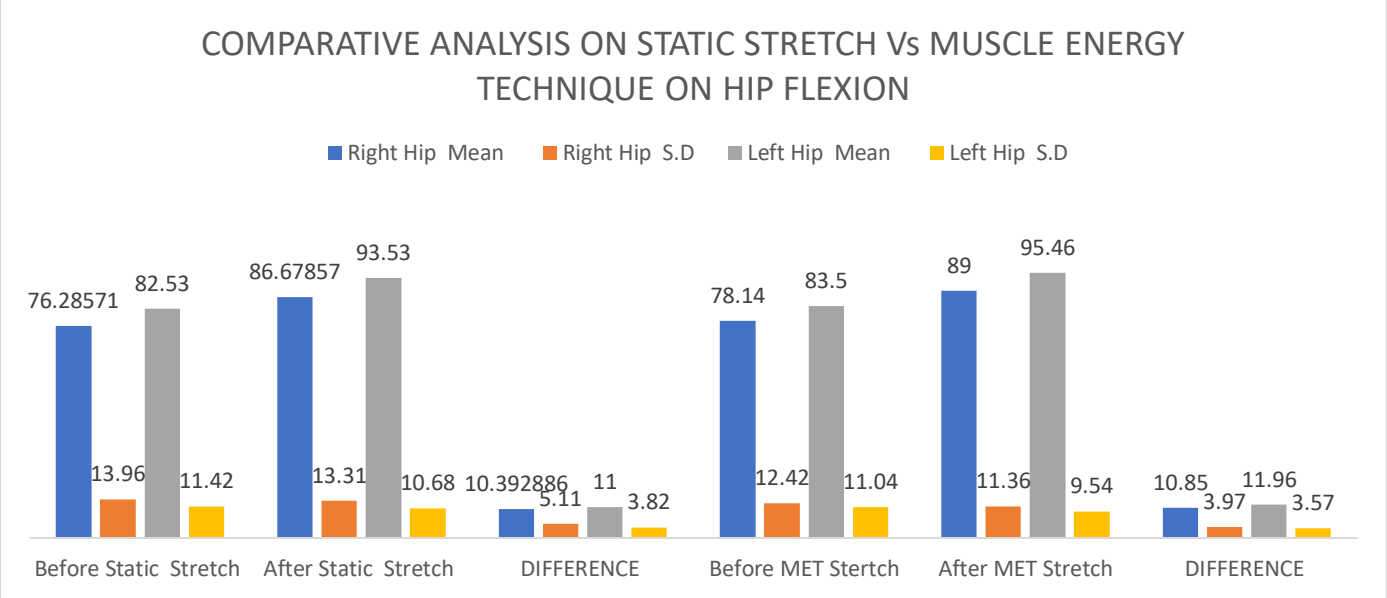
- **Knee Range of Motion**

GRAPH 10



Graph 10: It represents that before statics stretch the left side knee range of motion was 2.10±1.01 degrees where as after static stretch it was reduce 0.5±0.56 degrees, which was reduced upto 1.61±0.72 degrees. On other side before MET the mean value of range of motion was 2.39±1.9 degrees where as after MET stretch it was reduced upto 0.5±1.95 degrees. The net reduction of 1.83±1.86 degree of left knee range of motion was found. When we analysis the right side of knee, before ststic stretch over hamstring it was recoded 3.107±1.23 degrees where as after stretch it was found 1.14±0.87 degrees. The net decrease of 1.96±0.73 degrees of range was recorded. On other side it was recorded that before MET the mean range of motion was 2.57±1.23 degrees where as after MET stretch it was recorded 0.64±0.77 degrees, the net fall in range of motion of right knee was 1.92±1.1 degrees. The exach cause of decrease in range of motion is not clear. Thus further through biomechanical analysis needed in future.

GRAPH 11



Graph 11: It represents that before statics stretch the left side Hip range of motion was 82.53±11.42 degrees where as after static stretch it was recorded 93.53±10.68 degrees, which was improved by11±3.82 degrees. On other side before MET the mean value of range of motion was 83.53±11.04 degrees where as after MET stretch it was recorded 95.46±9.54 degrees. The net improvement of 11.96±3.57 degree of left knee range of motion was found. When we analysis the right side of hip, before stastic stretch over hamstring it was recoded 76.83±13.96 degrees where as after static stretchover hamstring it was found 86.68±13.31 degrees. The net improvement was 10.39±5.11 degrees of range was recorded. On other side it was recorded that before MET the mean range of motion was 78.14±12.42 degrees where as after MET stretch it was recorded 89±11.36 degrees, the net improvement in range of motion of right hip was 10.85±3.97 degrees.

VI. DISCUSSION

In our study we found out that there was an immediate positive effect on hamstring tightness with both the intervention. Though it was not clear about improvement in hip range flexion range of motion where there is decrease in knee extension range of motion. The researcher suggest that further biomechanical analysis needed which was our limitation.Desai Sonali et al conducted a study to compare the effectiveness of Muscle Energy Technique (MET) & Static Stretching on hamstring tightness in healthy young individuals and found that both MET and static stretching showed significant improvement in reducing Hamstring Tightness in agreement to our study.[33]

Bandy et al in their research have stated, the optimal duration for an effective stretch as a duration of 30 seconds.[34] During MET, muscle elongation is maintained for this duration thus leading to increased muscle length with a combined effect of creep and plastic changes occurring in the connective tissue.35,36

Holuskova et al stated that the variations in the connective tissue show mechanical properties associated with both elastic and viscous constituents. Creep is the temporary lengthening of the connective tissue during the stretch period (viscoelastic property). Fryer et al in their study have explained that the reasons of increased flexibility after MET may be the result of biomechanical or neuro-physiological changes or increased stretch tolerance.[35]

Ivan et al affirmed MET as an effective and non-traumatic manipulative technique. MET is said to have an inhibitory effect on motor activity acting through the muscle spindles or the Golgi tendon organs.[37]Post isometric relaxation technique reduces of the tone of the muscles. The afferent nerve impulses entering the dorsal route links up with the inhibitory motor neuron, stopping the efferent motor neurons impulse discharge, thus preventing further contraction and decreasing the muscle tone. This in turn relaxes the agonist muscle. [38]

June-Su Yua et al, analysed on 51 healthy individuals with tight hamstrings compared the immediate effect of hamstring stretching techniques and found that static stretching and PNF-hold relax showed a significant effect on ROM measured by active knee extension (AKE) test.[39] Phil Page in clinical commentary on current concepts in muscle stretching for exercise and rehabilitation has also stated that Static passive stretching is effective at increasing ROM. A static stretch of 15-30 seconds applied 2 to 4 times showed increase in ROM not because of increased length (decreased tension) of the muscle but simply due to an increased tolerance of the individual to stretching.Patrick G De Deyne in his perspective on Application of Passive Stretch and Its Implications for Muscle Fibers explained that the increase in the range of motion immediately after application of static passive stretch can be because of the viscoelastic behaviour of muscle and short-term changes in muscle extensibility. Passive stretching

leading to positive changes in range of motion often may involve biomechanical, neurological, and molecular mechanisms.[40] Static stretching leading to increased range of motion might be due to increase in the number of sarcomeres in series (muscle length) due to prolonged exposure to the stress. In addition, stretching causes increase in viscoelasticity and decrease in stiffness of muscular and connective tissues that results in improved muscular extensibility.[41]

Maryam Azizi et al in their pilot study concluded that a single session of MET (3 repetitions) resulted in significant immediate improvement in flexibility and reduction in stiffness of hamstring.[42]

Yuichi Nishikawa et al in their study on Immediate effect of passive and active stretching on hamstrings flexibility found that both active and passive static stretching had significant effect on improving hamstring flexibility immediately however, passive stretching elicited greater improvements in hamstring flexibility than active stretching.[43]

Shadmehr et al. in their study related to passive stretch and MET on hamstring flexibility concluded that both techniques relatively had the same effect on increasing the flexibility in healthy young females which is similar to our results aswell. Thus the results of our study corroborates the previous findings about a significant immediate effect of single session of MET and passive static stretching (3 repetitions each) on improving flexibility of hamstring.

VII. CONCLUSION

From the present study we can conclude that both MET and passive stretching techniques have an immediate effect on reducing hamstring muscle tightness.The two intervention were performed on two groups; Group – A(Passive Static Stretching) 10 males and 18 females, Group – B (Muscle Energy Technique) 5 males and 23 females. From the mean difference values, it is visible that MET is slightly more effective than passive stretching although a statistically significant difference is not seen.It may be due to limited time for the intervention to be effective.

VIII. LIMITATION

Due to limited resources and financial constrain, there were lacuna in this research such as numbers of participant/ respondent are minimal, unable to get spacious place and updated equipments such as electronic goniometer to perform the experiment, limited resources for collecting secondary data, time duration for survey was limited, number of colleges were few, participants being afraidas experiment is unknown from them.

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