

# Effectiveness of Muscle Energy Technique as Compared to Proprioceptive Neuromuscular Facilitation in Non-Specific Low Back Pain: RCT

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## ABSTRACT

**Background:** Approximately 80% of peoples experience LBP during their lifetime. While a specific cause of low back pain can seldom be identified, the most prevalent type is mechanical & non-specific low back pain. This study was designed to evaluate the two manual techniques i.e., MET & PNF in participants with non-specific low back pain. MET is used to decrease pain & the PNF goal is the facilitation of the agonist's muscle.

**Objectives:** A Study to find the effectiveness of MET as compared to PNF to reduce pain and improve strength and function in participants with LBP to get the best results & greater benefits for the population.

**Methods:** In a 6-weeks intervention study, 45 participants with features of low back pain were studied. They were divided into 3 groups by simple random sampling; Group A received MET, Group B received PNF, and Group C is the control group. Pre and post-treatment data were collected and analyzed using SPSS 22.0. Paired t-test and One Way ANOVA were used to find out the significance of the treatment.

**Results:** A significant improvement in pain, disability through the NPRS, RMDQ scale ( $p < 0.05$ ), and PWB after the treatment was found. A greater statistically significant difference was seen in Group A as compared to Group B & Group C.

**Conclusion:** The study concluded that the MET is more effective compared to the PNF & control group treating participants with LBP.

**Keywords:** Non-Specific LBP, Muscle Energy Technique, Proprioceptive Neuromuscular Facilitation, NPRS, RMDQ

**Clinical Trial Registration Number:**

CTRI/2021/11/038248

## INTRODUCTION

For many years, low back pain has been both the leading cause of days lost from work and the leading indication for medical rehabilitation.<sup>[1]</sup> Low back pain (LBP), which is defined as pain and discomfort, localized below the costal margin and above the inferior gluteal folds, with or without leg pain can be highlighted.<sup>[2]</sup> Non-specific low back pain has become a major public health problem worldwide. The lifetime prevalence of low back pain is reported to be as high as 84%, and the prevalence of chronic low back pain is about 23%, with 11–12% of the population being disabled by low back pain.<sup>[3]</sup>

Many studies are done on low back pain because, according to the 2019 Global Burden of Disease (GBD) study, LBP is currently the sixth highest burden on a list of 291 conditions and is the cause of more years lived with disability globally than any other disease.<sup>[4]</sup> Other commonly reported risk factors include low educational status, stress, anxiety, job dissatisfaction, and whole-body vibration. Low back pain has an

enormous impact on individuals, families, communities, governments, and businesses throughout the world.

Nonspecific low back pain refers to a condition without a distinct etiology to explain its associated symptom. Along with medication treatment, Physiotherapy is also very useful in low back pain. Consider the addition of non-pharmacological therapy with proven benefits-for acute, chronic, or sub-acute low back pain like intensive interdisciplinary rehabilitation, exercise therapy, acupuncture, massage therapy, spinal manipulation, or progressive relaxation. Specific advanced physical activities include core strengthening, stretching, mobilization, Muscle energy technique, PNF technique, some electric modalities, etc.<sup>[5]</sup>

Muscle energy technique (MET) was originally developed by two osteopathic physicians, Fred Mitchell, Sr. and Fred Mitchell, Jr. to treat soft tissue, mobilize joints, stretch tight muscles and fascia, reduce pain, and improve circulation and lymphatic drainage.<sup>[6,7,8]</sup>

MET is defined as, the Procedure that involves voluntary contraction of patients' muscles in a precisely controlled direction, at varying levels of intensity.<sup>[9]</sup> MET is a commonly useful method for achieving tonus release (inhibition) in a muscle. The approach involves the isometric contraction of the affected muscle producing post isometric relaxation through the influence of the Golgi tendon.<sup>[10]</sup> MET is used to decrease pain, stretch tight structures muscle and fascia, reduce muscle tone, improve local circulation, strengthen weak musculature and mobilize joint restriction.<sup>[11]</sup>

Proprioceptive Neuromuscular Facilitation (PNF) involves stretching, resisted movement, traction, and approximation to ameliorate muscle decline, disharmony, atrophy, and joint movement limitation.<sup>[12]</sup> It is very effective in improving flexibility, strength, and ROM in a damaged or stiff muscle.<sup>[13]</sup> PNF Technique is based on movement patterns to

facilitate and correct sensory-motor function. It has been suggested that PNF corrects the impaired impulses emerging from proprioceptive receptors in the muscle. Therefore, it decreases pain and desires to improve the strength of muscles.<sup>[14]</sup>

Recently, it has been used in orthopaedic diseases of bones and joints (like lower back, neck, and shoulder pain), sports-related trauma, and CNS diseases such as stroke, and its usefulness has been reported in other medical fields.<sup>[15,16,17]</sup> When PNF exercises are performed correctly, the patient will eventually adopt them into their everyday movements, and habits putting chronic strain on the muscles, causing soreness, stress and eventually leading to injury will be corrected and their muscle spasm and pain will decrease greatly.<sup>[18,19]</sup>

There are different forms of PNF exercises. Two commonly used forms are Rhythmic stabilization training (RST) and a Combination of Isotonic exercises (COI). The RST technique uses isometric contraction of antagonistic patterns and results in co-contraction of the antagonists if, the isometric contraction is not broken by the Physiotherapist. It is used mainly to manage conditions in which weakness is a primary factor.<sup>[20]</sup>

The COI technique is used to evaluate and develop the ability to perform controlled purposeful movements. It involves the performance of alternating concentric, eccentric, and isometric contractions and is used to treat deficiencies in strength and ROM.<sup>[21]</sup>

It could be advocated that MET are similar to PNF, however, the execution of MET is usually performed with lower forces compared to those of PNF to recruit tonic muscle fibers that are associated with tonic motor units. These latter are activated during PNF and typically occur at forces greater than 25% of the person's maximal force.<sup>[22,23]</sup>

Another difference between MET and PNF is that the contraction during MET is performed at the initial barrier of tissue

resistance, rather than at the end of the ROM of a joint.<sup>[24]</sup>

Based on the above said concepts MET and PNF has been practiced worldwide in the treatment of low back pain and were found effective individually, but these two were not compared to find out which is better in reducing pain and improving the functional ability of the low back pain patients.

According to previous research, this kind of study was done on Neck pain, Osteoarthritis & Adhesive Capsulitis but to date, not a single study has been done for non-specific low back pain.

So, the study aims and Need is to determine the effectiveness of the Muscle Energy Technique as compared to Proprioceptive Neuromuscular Facilitation in participants with non-specific low back pain to get the best results & greater benefits for the population.

The objectives of the study are to find out whether there is any significant difference between Muscle energy techniques as compared to Proprioceptive neuromuscular facilitation for reducing pain, increasing strength, improvement in function in participants with low back pain.

Two Hypothesis were formulated: [H<sub>0</sub>]There is no significant effect of Muscle energy technique as compared to Proprioceptive neuromuscular facilitation in reducing pain, increasing the strength of back muscle & improving function in participants with non-specific low back pain. [H<sub>1</sub>]There is a significant effect of Muscle energy technique as compared to Proprioceptive neuromuscular facilitation in reducing pain, increasing the strength of back muscle & improving function in participants with non-specific low back pain.

## **MATERIALS AND METHODS**

This study was a Randomized controlled trial. It was conducted in Nootan College of Physiotherapy from September 2021 to February 2022. This study was done in 6 months with 6 weeks of treatment

duration. This study was approved by the Institutional Committee of Nootan College of Physiotherapy. Written informed consent was obtained from all individual participants included in the study.

### **Participants:**

The participant with Non-specific low back pain, aged between 35 - 55 years, both male and female, Participants who are willing to be a part of the study, Low back pain with non-specific nature i.e., without identifying specific anatomical or neurophysiological causative factors, Symptomatic back pain due to overuse, overload & overstretch were included into the study. The Participants were excluded if they had Acute or traumatic conditions, Spondylolisthesis with radiculopathy, Spinal stenosis, Infective conditions like Osteomyelitis, Systemic disorders like tuberculosis of the spine, Severe postural abnormality, Pain referred from viscera, nerve root pain signs, spinal surgery.<sup>[25]</sup> The pre-evaluation included the history, pain assessment, and functional scale of the participants. The pain was assessed by NPRS, functional disability was assessed by RMDQ scale, and strength was assessed by pressure bio-feedback unit.

### **Randomization:**

Participants were divided by Simple Random Sampling into A, B & C groups. Randomizations into three groups were achieved through the lottery method without replacement of chit and only participants were blinded in this study.

**PROCEDURE:** Group- A (Muscle energy technique +Conventional Treatment), Group-B (Proprioceptive neuromuscular facilitation technique +Conventional Treatment), and Group -C (Conventional Treatment) by simple random sampling method consisting of 15 participants in each group. Then interventions were given five days in a week (total=30 sessions), 1 session/day for six weeks. (Table 1)Participants received MET exercise for

40-45 minutes with 10sec.hold, 30sec.rest, 3 rep. for each muscle in 1 set. MET exercises were given for Iliacus, Psoas major, Quadratus lumborum, Erector spinae, and Hamstring muscles. Participants received

PNF for 30-45 minutes with 10sec.hold, 30sec.rest, 15 rep. in 1 set. The rest intervals between repetitions and sets will be 30 seconds and 60 seconds, respectively.

**Table No.1: MET & PNF TECHNIQUES Protocol**

	<b>MET + Conventional Treatment</b>	<b>PNF + Conventional Treatment</b>
<b>Week 1</b>	MET 1 set/Day, {5 Days} + (Conventional Treatment) [10 sec. hold, 5 Rep./Day]	PNF [1 set/Day], {5 Days} + (Conventional Treatment) [10 sec. hold, 5 Rep./Day]
<b>Week 2</b>	MET 1 set/Day, {5 Days} + (Conventional Treatment) [10 sec. hold, 5 Rep./Day]	PNF [1 set/Day], {5 Days} + (Conventional Treatment) [10 sec. hold, 5 Rep./Day]
<b>Week 3</b>	MET 2 set/Day, {5 Days} + (Conventional Treatment) [10 sec. hold, 5 Rep./Day]	PNF [2 set/Day], {5 Days} + (Conventional Treatment) [10 sec. hold, 5 Rep./Day]
<b>Week 4</b>	MET 2 set/Day, {5 Days} + (Conventional Treatment) [10 sec. hold, 5 Rep./Day]	PNF [2 set/Day], {5 Days} + (Conventional Treatment) [10 sec. hold, 5 Rep./Day]
<b>Week 5</b>	MET 3 set/Day, {5 Days} + (Conventional Treatment) [10 sec. hold, 5 Rep./Day]	PNF [3 set/Day], {5 Days} + (Conventional Treatment) [10 sec. hold, 5 Rep./Day]
<b>Week 6</b>	MET 3 set/Day, {5 Days} + (Conventional Treatment) [10 sec. hold, 5 Rep./Day]	PNF [3 set/Day], {5 Days} + (Conventional Treatment) [10 sec. hold, 5 Rep./Day]

**Table 2: Interventions of different groups**

<b>Therapy Type/ Intervention</b>	<b>Description</b>
<b>Group A[MET]</b>	<p><b>MET FOR ILIACUS:</b> The participant is asked to stand at the edge of the couch. Then, flex the one side hip and knee hold it. The fingers are crossed fold just anterior to the knee joint and then ask the participant to lie down straight on the couch and hold in a flexed position so, lordosis will be neutralized. On another side of the leg which hangs freely and from the restriction area we give MET. So, asked the patient to move the leg upward against resistance. Then, find the new barrier and apply the same procedure.</p> <p><b>MET FOR PSOAS MAJOR:</b> The participant is asked to stand at the edge of the couch. Then, flex the one side hip and knee hold it. The fingers are crossed fold just anterior to the knee joint and then ask the participant to lie down straight on the couch and hold in a flexed position so, lordosis will be neutralized. Another side of the leg that hangs freely is taken in the abduction and from the restriction area we give MET. So, asked the patient to move the leg upward against resistance. Then, find the new barrier and apply the same procedure.</p> <p><b>MET FOR QUADRATUS LUMBORUM:</b> Participant lying supine with the feet crossed at the ankle. Participant inside bend position and heels off the edge of the table (Banana Position). Therapist's stabilizing contact on the pelvis. Participant and therapist's hands interlocked in participant's axilla region. Instructed the participant to side bend towards the treated side and apply isometric contraction against resistance. Then, find the new barrier and apply the same procedure.</p> <p><b>MET FOR ERECTOR SPINAE:</b> To treat the erector spinae the participant should be placed on a fixed stool or chair, in a seated, slumped position, feet flat on the floor, and with the head approximating the knees. The therapist stands behind and to the side and passes an arm across the anterior upper chest from shoulder to shoulder, while the other hand maintains contact with the area of the back that is being treated. To treat the erector spinae, group a restriction barrier is engaged in which the patient is in an easy end-of-range position i.e., a combination of flexion, side bending, and rotation, with the paraspinal muscles close to their end-of-range. Then, very slight attempts to move further in the direction of the restriction barrier, pulsing against the firm and unyielding resistance of the therapist. After a series of mini-contractions and a brief rest, the barrier is reassessed and reengaged, and the process is repeated.</p> <p><b>MET FOR HAMSTRING:</b> Participant in supine lying position and therapist stands facing the head of the table. The therapist flexes one side of the hip fully and then extends the flexed knee with the back of the lower leg resting on the therapist's shoulder. Ask the participant to flex the knee, i.e., apply downward pressure against the therapist's shoulder with the back of the lower leg. At the same time, the therapist resists the participant's voluntary effort so developed an isometric contraction of the Hamstring. Then, find the new barrier and apply the same procedure.</p>



<i>Table 2 Continued...</i>	
<b>Group B[PNF]</b>	<p><b>Combination Of Isotonic Exercises (COI):</b> Resisted active concentric contraction for 5 seconds (trunk flexion), resisted eccentric contraction for 5 seconds (trunk extension), and resisted maintained contraction for 5 seconds (trunk flexion-extension). Three sets of 15 repetitions at maximal resistance were performed. Along with conventional treatment was also given.</p> <p>Exercises have been given into 3 stages:</p> <p><b>Stage 1:</b> -From the seated position, the participant flexes the trunk against manual resistance provided by the therapist. (5second)</p> <p><b>Stage 2:</b> -When maximum trunk flexion is achieved, the participant is instructed to maintain the position. (5second)</p> <p><b>Stage 3:</b> -Upon maintenance of static position, the participant returns to the starting position &amp; trunk extension have done with resistance provided by the therapist. (5second)</p>
<b>GROUP C [CONVENTIONAL TREATMENT]</b>	<p><b>Stretching exercises</b></p> <ol style="list-style-type: none"> <li>1. Quadriceps Stretch</li> <li>2. Hip Flexor Stretch</li> <li>3. Adductor Stretch</li> <li>4. Hamstring Stretch</li> <li>5. Prayer Cat &amp; Camel</li> </ol> <p><b>Isometric exercise</b></p> <ol style="list-style-type: none"> <li>1. Upper Back Extension</li> <li>2. The bridge</li> <li>3. Supine Twist</li> <li>4. Press Ups</li> <li>5. Quadruped Opposite arm/leg</li> </ol>



Photograph No:1 MET for Quadratus Lumborum



Photograph No:2 MET for Psoas Major



Photograph No:3: Stage-1 PNF in Trunk Neutral Position



Photograph No:4 Stage-2 PNF in Trunk Flexion Position



Photograph No:3: Stage-1 PNF in Trunk Extension Position

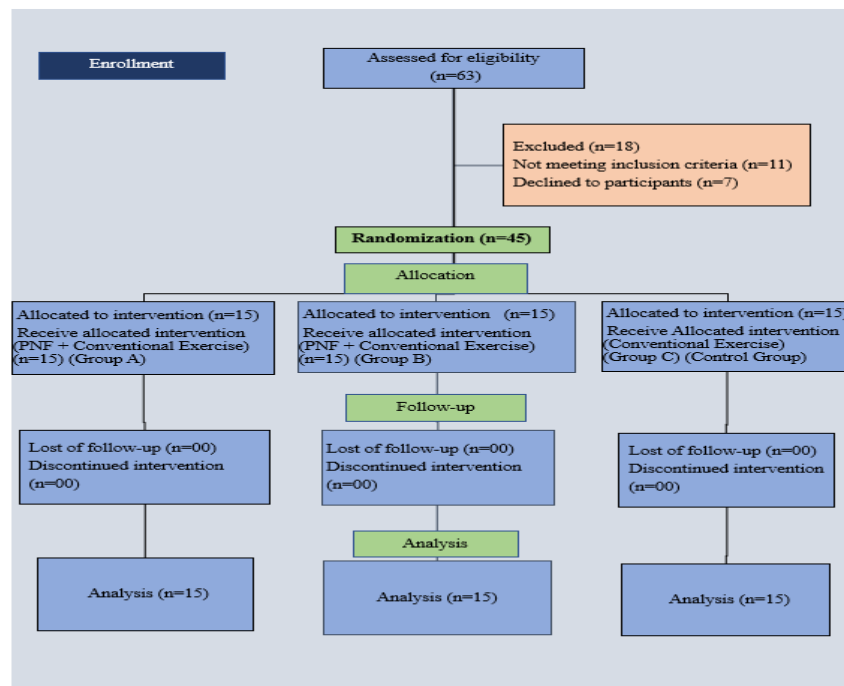
## STATISTICAL METHOD

All statistical analysis was done using SPSS 22.0 software for windows.

Descriptive analysis was obtained by mean & standard deviation. Intergroup comparison between Group A, B & C of pre

&post-treatment of NPRS, RMDQ & PWU was done using a One way ANOVA test. Intragroup comparison of pre & post-

treatment scores of NPRS, RMDQ & PWU within Group-A, B & C was done using paired t-test.



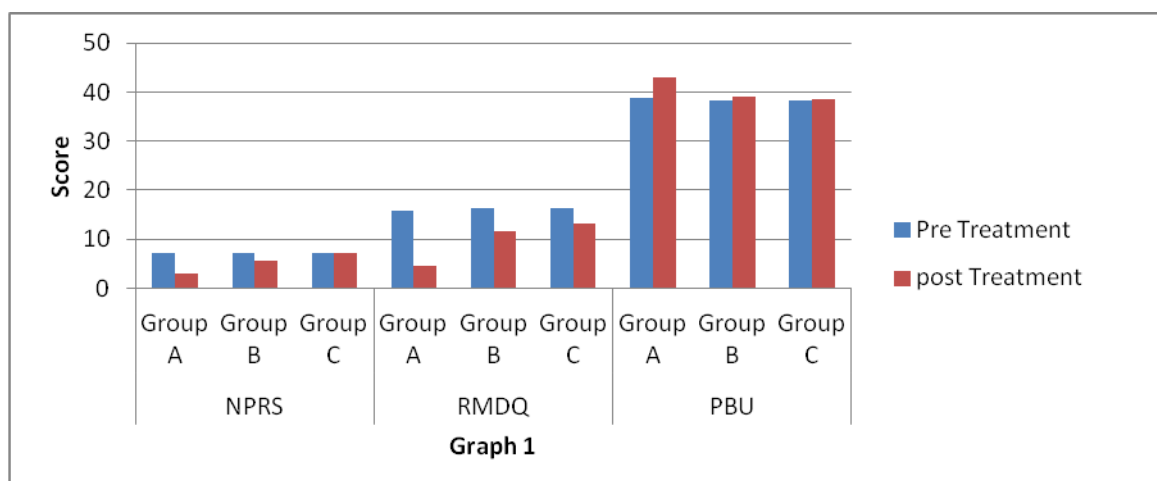
**A Flow Diagram Of The Study**

**Table 1**

Demographic Detailed		Group A	Group B	Group C
Age		34.73±5.700	36.53±6.139	46.80±6.270
gender	Male	60%	40%	40%
	Female	40%	60%	60%

**Table 2**

Outcome	Group A				Group B				Group C			
	Pre Treatment Mean±SD	post Treatment Mean±SD	T value	p value	Pre Treatment Mean±SD	post Treatment Mean±SD	F value	p value	Pre Treatment Mean±SD	post Treatment Mean±SD	F value	p value
NPRS	7.07±0.961	3.07±0.799	23.664	0	7.20±1.146	5.67±0.816	7.122	0	7.20±1.146	7.07±0.799	0.367	0.719
RMDQ	15.93±4.148	4.60±1.920	14.015	0	16.40±3.582	11.53±1.922	6.859	0	16.34±4.155	13.27±3.575	10.473	0
PBU	38.73±0.799	42.87±1.187	-15.101	0	38.27±1.033	39.13±0.743	-4.026	0.01	38.33±0.617	38.53±0.915	0.899	0.384



## RESULTS

As shown in Diagram 1, a total of 63 participants were selected. Among them, 11 participants didn't match the inclusion criteria and 07 participants decline to participate in the study due to their personal reason. So, 45 participants with Non-specific low back pain were selected. Table 3 shows the Demographic details of the participants in both groups.

The result found in this study disclosed that after 6 weeks treatment program. As shown in Table 4 and Graph 1, significant improvement in pain, disability through the RMDQ scale ( $p < 0.05$ ), and strength by PWU after the treatment was found. A greater statistically significant difference was seen in Group A as compared to Group B & C.

## DISCUSSION

Approximately 80% of people experience LBP during their lifetime. While a specific cause of low back pain can seldom be identified, the most prevalent type is mechanical & non-specific low back pain (NS-LBP). Most episodes of acute and subacute NS-LBP improve significantly within 6 weeks, and the average pain intensity is moderate by 12 months. Every year, 3-4% of the population is temporarily disabled, and 1% of the working-age population is disabled totally and permanently because of LBP. Despite its high prevalence, low back pain has a generally good prognosis. Non-specific low back pain is tension, soreness, and/or stiffness in the lower back region for which it isn't possible to identify a specific cause of the pain. Several structures in the back, including joints, discs, and connective tissues, may contribute to symptoms. The diagnosis of non-specific low back pain depends on the clinician being satisfied that there is no specific cause for their patient's low back pain and suspects that there should be relevant investigations.

This study was conducted on 45 participants with three groups of 15 each. Group-A was treated with muscle energy

technique, whereas Group-B was treated with Proprioceptive neuromuscular facilitation and Group-C (Control group) have conventional treatment (Home exercises). The output parameters i.e., pain by NPRS, strength by PWB, and functional scores using RMDQ is a self-administrated questionnaire that aims to measure disability before treatment, at 0 day, 2 weeks, 4 weeks, 6 weeks (follow up).

This study deliberated on the effectiveness of the Muscle energy technique as compared to Proprioceptive neuromuscular facilitation to reduce pain, improve strength and function in participants with non-specific low back pain. The results obtained in this study state that, after 6 weeks treatment program, among three groups Group-A (Experimental group), who received muscle energy technique attained a significant reduction in pain and improvement of strength and function, compared to Group-B (Experimental group) who received Proprioceptive neuromuscular facilitation and Group-C (Control group), who received conventional treatment (Home exercises) didn't found any significant changes.

MET is more effective because with the technique of MET there is a decrease in pain, via the production of joint movement, or stretching of the joint capsule, which may be capable of reducing pain by inhibiting the stronger diameter nociceptive neuronal input at the spinal cord level.<sup>[26]</sup>

The possible mechanism for the reduction in pain intensity in the MET group can be attributed to the hypoalgesia effect. This can be explained by the inhibitory Golgi tendon reflex, activated during the isometric contraction that leads to reflex relaxation of the muscle, and activation of the muscle and joint mechanoreceptors leads to sympathoexcitation evoked by somatic efferent and localized activation of periaqueductal gray matter that play a role in decreasing modulation of pain. Nociceptive inhibition then occurs at the dorsal horn of the spinal cord, as

simultaneous gating takes place of nociceptive impulses in the dorsal horn, due to mechano-receptor stimulation.<sup>[27,28]</sup>

MET improves the lumbar ROM which mainly works on reducing spasm or tightness of muscle by first resetting the muscle spindle and inhibiting the muscles by activating the Golgi tendon. The proposed mechanism by which passive manual stretch facilitates the laying down of collagen and regain of muscle length are direct viscoelasticity changes from the decreased actin-myosin cross bridging. The effect of MET for an increase in range of motion can be explained based on physiological mechanisms behind the changes in muscle extensibility- reflex relaxation, viscoelastic changes, and changes to stretch changes. A combination of contractions and stretches might be more effective for producing viscoelastic changes because the forces could produce increased viscoelastic change. Our result supports the study of H. Shaker et al<sup>[29]</sup> found that muscle energy technique was better in decreasing pain and functional disability in patients with chronic mechanical low back pain. Priyanka Dhargalkar et al<sup>[30]</sup> concluded that MET has got added beneficial effects for decreasing disability and improving function in patients with chronic nonspecific low back pain along with supervised exercises.

PNF is also effective because Nick Kofotolis & Eleftherios Kellies (2006) found that the COI (Combination Of Isotonic) group demonstrated greater lumbar mobility which could be attributed to the dynamic nature of the COI exercises, which used all muscle action types (eccentric, concentric, and isometric) through a progressively increased range of motion. According to (Alter 1996), PNF is a technique involving combinations of alternating contractions and stretches. Agonist facilitation leads to inhibition (a decrease in the excitability) of the antagonist (the stretched muscle) resulting in the relaxation of the inhibited muscle and muscular resistance in the facilitated muscle<sup>[31]</sup>.

From this study, it can be said that MET is better than PNF and can be used as a method of choice for the treatment of a patient with NS-LBP.

The limitations of this study were Small Sample Size & Long-term follow-up was not taken. So, in the future, further study can be done with long-term follow-up, with large sample size, with other outcome measures & with the use of electrical modalities.

## CONCLUSION

The study concluded that MET Group A shows greater improvement in reducing pain and improving lumbar muscle strength & functional ability compared to Group B [PNF] & control group Group C.

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**Conflict of Interest:** There are no conflicts of interest.

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**Ethical Approval:** Approved

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