

**COMPARATIVE STUDY BETWEEN PNF TECHNIQUES AND SWISS BALL EXERCISES
FOR NON-SPECIFIC LOW BACK ACHE IN SOFTWARE PROFESSIONALS**

Dr. V. K. Jayaseelan*¹, Dr. Logeshwari Selvaraj^{2*}, Miss. Naynika Mridha³, DR. M.S. Sundaram⁴
& DR. P. Senthil selvam⁵

1. *MPT(Sports), (Ph.D), Assistant Professor, School of Physiotherapy, Vels Institute of Science, Technology and Advanced Sciences (VISTAS). jayaseelvkmp@gmail.com*
2. *M.P.T (Neuro), (Ph.D), Assistant Professor, School of Physiotherapy, Vels Institute of Science, Technology and Advanced Sciences (VISTAS). Lokeshwari.sp@velsuniv.ac.in*
3. *B.P.T, School of Physiotherapy, Vels Institute of Science, Technology and Advanced Sciences (VISTAS).*
4. *M.P.T (Sports), Ph. D, Professor, School of Physiotherapy, Vels Institute of Science, Technology and Advanced Sciences (VISTAS).*
5. *M.P.T (Ortho), Ph. D, HOD & Professor, School of Physiotherapy, Vels Institute of Science, Technology and Advanced Sciences (VISTAS).*

Corresponding Author:

* Dr. V. K. Jayaseelan, MPT, (Ph.D), jayaseelvkmp@gmail.com /
lokeshwari.sp@velsuniv.ac.in

Abstract:

Background: Low back pain has been a matter of concern affecting upto 90% of the population at some point in their lifetime, upto 50% have more than one episode. One of the factors leading to non-specific low back pain among software professionals is prolonged sitting. PNF techniques is used to treat non-specific low back pain cases. The purpose of this study was to compare the effect of proprioceptive neuromuscular facilitation program(PNF) and swiss ball exercises on non-specific low back ache patients among software professionals. **Materials and methods:** 40 subjects aged 18-35 years with non-specific low back pain among software professionals were included in the study and were divided into two groups group A (n=20) received PNF techniques and group B(n=20) received swiss ball exercises. The exercise program was given with a total period of 4 weeks. The outcome measures used were Numerical Pain Rating Scale, Modified Oswestry Low Back Pain Disability Questionnaire & Functional Reach Test. **Results:** Results showed that there is a significant improvement in pain, disability and flexibility in group A patients who received PNF techniques than group B. **Conclusion:** The present study concluded that the patients with non-specific low back pain are benefitted more by PNF techniques than swiss ball exercises. So, PNF technique training has more benefits and reduces the pain when compared to the other conventional physiotherapy in the management of non-specific low back ache patients.

KEYWORDS:

Non-specific low back pain, PNF techniques, Modified Oswestry Disability Questionnaire (MODQ) , Numerical Pain Rating Scale (NPRS), Functional Reach Test (FRT).

INTRODUCTION:

Low back pain is a significant health problem in all industrialized nations. It is associated with considerable disability, health care use and societal costs.^{1,2} Repetitive static bad body postures resulting from excessive bending and twisting will increase spinal stress and disproportionate loading to spinal structures.³ Pain in the lower back has been a matter of concern, affecting upto 90% of the population at some point of their lifetime, up to 50% have more than one episode (William and Shiel, 2012)⁴. Back pain has become not only a medical problem, but a social, legal and political one as well. In 1990, nearly 15 million office visits took place for mechanical low back pain, ranking this problem as the second most common symptom related reason for seeing a physician. Survey suggested that the life time incidence of low back pain ranges from 60% to 90% within 5% annual incidence⁵.

Pain and muscle weakness are the most common obstacles in carrying out activities of daily living. The main causative factor that can cause back pain is poor posture while sitting, standing, lifting heavy weights. Other factors that can cause low back pain include spinal disorders and systemic diseases (Cox and Trierk, 1987)⁶. Lack of sufficient coordination in core musculature can lead to decreased efficiency of movement and compensatory patterns, causing strain and overuse injuries. There is ample evidence that individuals with low back pain and sacroiliac pain lack proper recruitment of core muscles and exhibit core weakness. The biggest problem of low back pain is lumbar instability. Unbalanced mobilization order among stability and mobility muscles, as well as muscle length causes low back pain in spinal structures.

Non-Specific low back pain is an uncomfortable medical condition that causes frequent disability and absence from work⁷. Approximately 70% - 85% of individuals experience during their lifetime and over 80% of them report recurrent episodes. Recent inception cohort study demonstrated that 43% of patients with acute low back pain seen in primary care settings develop chronic low back pain and that nearly a third of them did not recover within one year⁵. It is estimated that 80% - 90% of subjects will recover within six weeks, regardless of the type of treatment. However, 5-15% will develop low back pain⁸. Non-Specific low back pain represents about 85% of low back pain patients seen in primary care and the clear majority of patients seen by physical therapists are classified under this label.⁹ In acute non-specific low back pain (0-4 weeks duration of pain) there is moderate to strong evidence that self-care with over-the-counter medication and maintaining activity as tolerated or treatment with a limited number of sessions with manipulative therapy is effective for pain relief.

In sub-acute non-specific low back pain (4-12 weeks duration of pain) there is moderate to strong evidence that a graded activity program including exercises and cognitive behavioural treatment in combination is more efficient than usual care about return to work. In cases of chronic non-specific low back pain (>12 weeks of pain duration) a variety of treatment are available with limited and similar efficacy on pain and disability reduction.¹⁰

Prolonged sitting is one of the factors causing musculoskeletal pain specifically the office staffs who suffered from having low back pain (LBP) which commonly reported. Symptoms of non-specific low back pain includes: cyclic episodes of pain, Low back pain is often referred to buttock and thigh, Morning stiffness or pain is common at morning, pain on forward bending activities and often also in returning position, Pain is often produced and aggravated by extension, side flexion, rotation, standing, walking, sitting, and exercise in general, Pain usually becomes worse over the course of the day, Pain is relieved by change in position.

Physiotherapy is the most widely used form of treatment adopted for gaining relief from low back pain. It is used in both modes, as single line of treatment including exercises or in a form of combination with electrotherapy modalities like short wave diathermy, interferential therapy etc. The exercises include stretching, strengthening, range of motion exercises, McKenzie therapy, core stability exercises and proprioceptive neuromuscular facilitation program (Kumar,2011).

Proprioceptive neuromuscular facilitation (PNF) exercises are designed to promote the neuromuscular response of the proprioceptors. Neuromuscular facilitation exercise is based on some movement patterns to facilitate and correct sensory motor function. It has been suggested that these exercises correct the impaired impulses emerging from the proprioceptive receptors in the muscles. Therefore, pain may be decreased, and strength of the muscles may be improved.¹¹ The four types of PNF techniques are: Hold-Relax, Contract-Relax with agonists, Rhythmic initiation and Rhythmic Stabilization, Combination of Isotonic exercises

The swiss ball is widely used in the recreational training environment to be a training device for core stability exercise. The swiss ball is a conservative treatment option for back pain sufferers and is designed to help prevent further episodes of low back pain as a part of a rehabilitation programme.¹² It helps in improving muscle tone and endurance, improves posture, balance, reduces pain & increase flexibility.

Researchers have demonstrated that significant difference exist in the proprioceptive function of the low back, between individuals with or without low back pain and researchers have suggested that interventions that address the PNF function must be investigated for their effects in low back pain population. It has been concluded in various studies that both swiss ball exercises and proprioceptive neuromuscular facilitation program are beneficial in low back pain patients. Comparison of their effects needs to be established to provide early and better relief from the disability and pain. Hence , this study was aimed to compare the effects of PNF techniques and Swiss ball exercises for non-specific low back ache in software professionals.

Methodology:

A pre-post experimental study was done for 40 subjects aged 18-35 years with non-specific low back pain among software professionals from Jothi Ladies Hostel, Navallur based on the inclusion criteria : Duration of pain for more than 4 weeks, Age 18-35 years of female subjects, Pain during or after activity and Exclusion criteria : Pregnancy, History of vertebral fracture during last 1 year, Neurological disorders, recent trauma, Presence of any cardiovascular disease. Then divided into two groups using convenient sampling method group A (n=20) received PNF techniques and group B(n=20) received swiss ball exercises. The exercise program was given with a total period of 4 weeks. The outcome measures used were Numerical Pain Rating Scale, Modified Oswestry Low Back Pain Disability Questionnaire & Functional Reach Test.

PROCEDURE:

40 samples of software professionals were taken for the study based on the inclusion and exclusion criteria. After taking the consent, the procedure was explained to the subjects. These patients were conveniently divided into two groups. Group A(N=20) PNF techniques was given & Group B (N=20) received Swiss ball exercises . Initially hot pack was given for 10-15 minutes. The treatment session was performed for 4 weeks.

GROUP A : PNF TECHNIQUES

The treatment to this group includes

1. COMBINATION OF ISOTONICS (COI):

The program consisted of alternating concentric and eccentric contractions of agonists without relaxation.

- Resisted active concentric contraction for 5 seconds(trunk flexion)
- Resisted eccentric contraction for 5 seconds.
- Resisted maintained contraction for 5 seconds(trunk flexion-extension).

Subjects performed 3 sets of 15 repetitions. Rest interval of 30,60 seconds were provided after the completion of 15 repetitions for each pattern and between sets respectively.

2. RHYTHMIC STABILIZATION TECHNIQUE(RST):

The RST program consist of alternating trunk flexion-extension isometric contractions of agonists against resistance for 10 seconds with no motions intended. Patients were asked to sit in couch in high sitting position.The patients were given isometric resistance alternatively in flexion and extension direction to the therapist. Therapists was standing facing the patients. Hands were placed in front or behind the shoulders as required for the need of resistance.

First the therapist places her hands on upper part of the thoracic area, just below the shoulder level. From this position, the subject is instructed to flex the trunk against resistance provided by the therapist. The resistance slowly increases as the subject gradually increases strength. When strength exertion is stabilized, the therapist slowly moves one hand to the upper part of the back, just below the shoulder level, aiming to provide resistance to the antagonists movement of the trunk(10sec). When the subject responds to the new position, the therapist moves the other hand to the upper part of the back and instructs the subject to extent the trunk against the resistance provided.

Subjects performed 3 sets of 15 repetitions at maximal resistance provided by the therapist and rest intervals of 30,60seconds were provided to the subjects after the completion of 15 repetitions for each pattern and between sets same as above technique.

GROUP B: SWISS BALL EXERCISES

1. Swiss ball pelvic bridging exercise
2. Single leg raise exercises with swiss ball
3. Alternative hand and leg raise with swiss ball

Swiss ball pelvic brigding exercises:

STEPS:

- Start in supine position with arms out to the side. Place feet on the ball toes pointed forward. Draw abdominal muscles in towards the spine.
- Contract the abs and glutes and lift hips off the floor.

Avoid rotating toes forward.

Single raise exercises with swiss ball:

STEPS:

- Lie face down on the swiss ball with the ball positioned under our stomach. Your body should be conformed to the ball. This is the starting position.
- Begin exercise by inhaling as you raise your right leg.
- Raise leg until they are in line with the spine.
- Pause, then exhale as you lower them back down. Repeat movement with opposite leg.

Avoid twisting. Raise leg straight up. Be sure head is in the line with the spine at the top position. Leg should be straight when at the top position. They should not be locked though.

Alternative hand and leg raise with swiss ball:

STEPS:

- Lie face down on the swiss ball with the ball positioned under our stomach. Your body should be conformed to the ball. This is the starting position.
- Begin exercise by inhaling as you raise your left leg, when simultaneously raise your right arm.
- Raise leg and arm until they are in line with the spine.
- Pause, then exhale as you lower them back down. Repeat movement with opposite leg and arm.

Avoid twisting. Raise arm and leg straight up. Be sure head is in the line with the spine at the top position. Leg and arm should be straight when at the top position. They should not be locked though.

STATISTICAL ANALYSIS:

Paired 't' test and Independent t-test was used to interpret the results. Paired 't' test was applied between pre and post values of numerical pain rating scale, Oswestry low back pain questionnaire and functional reach test. Mean, Paired 't' test were used to find out whether there is any significant difference on the magnitude on effect of both PNF techniques and swiss ball exercises. The statistical significance was set at 0.05 at 95% confidence interval. Independent t-test was applied to find out the comparison between the both groups A and B.

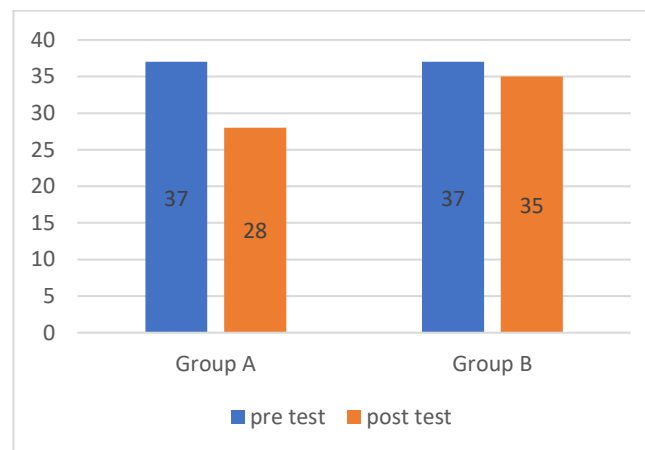
Table 1. Effect of PNF exercises on non-specific low back ache patients among software professionals in group A (PNF) in MODQ, NPRS and FRT.

| | Mean value | S.E | t-value | p-value |
|--------------------------------|------------|------|---------|---------|
| MODQ (pre- post test value) | 9.1 | 3.99 | 20.38 | 0.000 |
| NPRS (pre- post test value) | 2.35 | 0.66 | 12.93 | 0.000 |
| FRT (pre- post test value) | 9.22 | 0.65 | 55.16 | 0.000 |

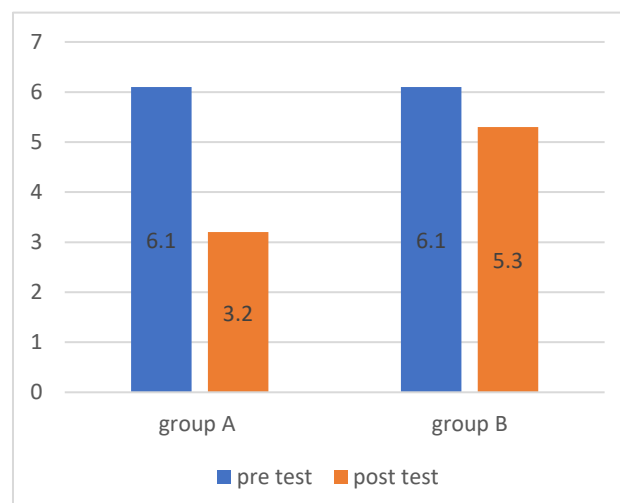
Table 2. Effect of swiss ball exercises on non-specific low back ache patients among software professionals in group B (Swiss ball) in MODQ, NPRS and FRT.

| | Mean value | S.E | t-value | p-value |
|--------------------------------|------------|------|---------|---------|
| MODQ (pre- post test value) | 1.6 | 0.62 | 10.78 | 0.000 |
| NPRS (pre- post test value) | 0.65 | 0.45 | 4.33 | 0.000 |
| FRT (pre- post test value) | 5.08 | 0.74 | 5.90 | 0.000 |

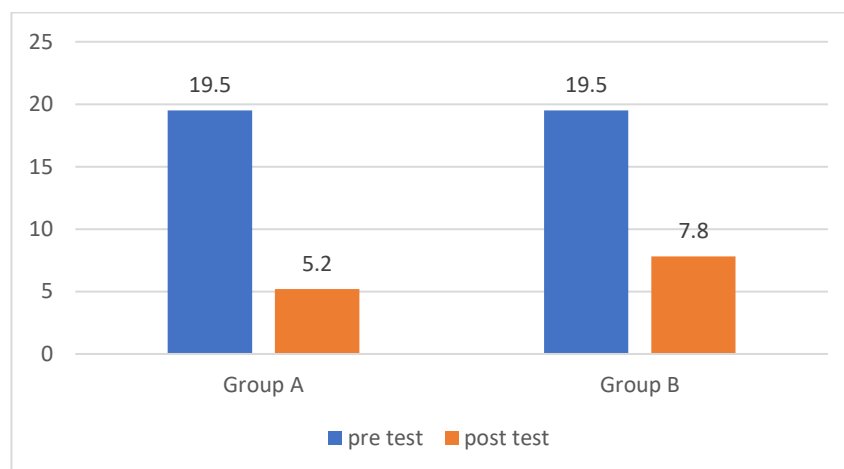
Graph 1: comparison of MODQ between Group A(PNF) vs Group B (swiss ball) exercises on non-specific low back ache patients among software professionals.



Graph 2: comparison of NPRS values between Group A(PNF) vs Group B (swiss ball) exercises on non-specific low back ache patients among software professionals.



Graph 3: Comparison of FRT values between Group A(PNF) vs Group B (swiss ball) exercises on non-specific low back ache patients among software professionals.



DISCUSSION:

Low back ache is an important health, social and economic problem. It is a common health condition in working population. The aim of our present study was to compare the effect of both the groups in the management of non-specific low back ache. There was a significant difference in the p-value of both the groups. Result showed that pain reduction was greater in the PNF combination pattern group than in the swiss ball exercise group after 4 weeks of training. The reasons for this are that the PNF combination patterns used a technique that uses the limbs to indirectly affect the pain area in a posture which did not cause pain to the patients with low back pain, in order to avoid direct stimulation of the pain area. The PNF techniques is the one that controls the proprioception and sensory-motor functions to reduce the further pain. PNF exercises maximize improvements in flexibility. Trunk proprioceptive neuromuscular facilitation training helped in promoting muscle sensitivity by enhancing the sensitivity of muscle spindle and golgi tendon organs which are responsible for proprioception. This enhanced control of movement helps in the reduction of local stress and thereby pain. In the present study core muscle strength increased after both RST and COI programs. The increased core strength is due to the dynamic nature of combination of isotonic exercise, which uses all muscle action types- eccentric, concentric and isometric through a progressively increased range of motion, and can be related to the static nature of rhythmic stabilization techniques.

PNF exercises are designed to enhance the response of neuromuscular mechanisms by stimulating proprioceptors. The patterns of PNF exercises have a spiral, diagonal direction, and the performance of these patterns is in line with the topographical arrangements of the muscles being used. These techniques have been often used to improve the range of motion of a joint and endurance.

KUMAR , ZUTSHI AND NARANG(2011) did a study to examine the efficacy of trunk proprioception facilitation(PNF) training on chronic low back pain. The results of the study suggest that the PNF programs are appropriate for improving trunk endurance, trunk mobility, pain and functional ability in people with chronic low back pain.

According to (ALTER 1996), PNF is a technique involving combinations of alternating contractions and stretches, whose goal is facilitation of the agonist muscle thereby increase the recruitment of additional motor neurons or increase the excitability of the motor neurons already in use. The facilitation of the agonist 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. PNF patterns can increase thickness of the abdominal muscles, which is a basic requirement for enhancing trunk stability, and they can improve physical functions by stimulating the proprioceptors of muscles and tendons. RST works to increase the patients ability to stabilize or hold a position as well. So this exercise also helps to improve stability of spine. PNF training also improves the trunk muscle endurance. PNF combination patterns mainly concentrates on sprinter and skater

patterns. It has always been recommended for sensory-motor control training, as well as for stimulating lumbar muscle proprioception. Among the PNF patterns, the motions of the sprinter and skater patterns were found to have the advantages of not only strengthening the muscle due to large scale movement, but also functional training due to active motor control, the strengthening of coordination, increases in the active range of motion, and the efficient control of movement.

NICK KOFOTOLIS(2015) studied on effects of two 4 weeks PNF programs on muscle endurance, flexibility and functional performance in women with chronic low back pain and concluded that the application of 4 week RST and COI PNF programs increased the muscle endurance of people with chronic low back pain by 23.6% to 81%.

HODGES and RICHARDSON reported that unbalanced trunk muscles in patients with chronic low back pain should be trained muscle strength to balance the trunk muscles interactively, and that the trunk muscle strength was an essential element for maintaining spinal stability, so that the muscle becomes a foundation support for maintaining balance. In that sense, the PNF combination pattern and ball exercises groups in our study significantly reduced low back pain through the balanced training of trunk muscles and training induced increase in muscle strength.

Thus, PNF techniques involves significant muscle work that result in muscle strength and endurance improvement. It thus improves the patient's trunk endurance and thereby helps in the reduction of pain.

Limitations of the study:

sample size was small, only female participants were selected for the study, study population were only software professionals, only non-specific low back pain patients.

Recommendations of the study:

Large sample size, both gender population, chronic low back pain patients, mechanical low back pain patients, further study can be conducted in other working professions like office workers, university students.

Conclusion:

From the above results we founded out that PNF technique has showed significant improvement in pain and disability. It also got an added effect in trunk extension endurance.

The conclusion of the present study is that the software professionals with non-specific low back ache are benefitted more by PNF techniques rather than swiss ball exercises. PNF group found to be more significant than swiss ball group. Therefore, PNF techniques should be practiced more in the management of non-specific low back ache in software professionals.

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