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## ORIGINAL ARTICLE

### COMPARATIVE EFFECT OF TRUNK BALANCE EXERCISES OVER STRENGTHENING EXERCISES IN CHRONIC LOW BACK PAIN AMONG WORKING WOMEN

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#### ABSTRACT

**Background of the study:** Chronic low back pain is the clinical condition affecting the lower portion of the spine and it is caused by the injury to the muscle (strain) and ligament (sprain). The main object was to compare the effect on chronic low back pain between trunk balance exercises and strengthening exercises among working women. **Methodology:** A total of 30 patients were selected with age group between 30-50 years. Working women were included after specific selection criteria for the study. Visual analog scale and Quebec back pain disability questionnaire is used to measure the chronic low back pain before and after the study. The trunk balance exercises and strengthening exercises were given to all the participants. Both group A and B were independently prescribed exercise performed for alternate days in a week for 30 minutes per day and this would have been followed for 8 weeks. Paired t-test analysis was used to find the significant difference between pre and post-test measurements. **Results:** After the analysis, when comparing the trunk balance exercises and the strengthening exercises, the results revealed that there is the significant difference improvement on chronic low back pain in both the groups trunk balance exercises and strengthening exercises. Trunk balance exercises is more efficient to reduce the chronic low back pain (P value > 0.0001). **Conclusion:** The study showed beneficial results in both the groups, the results reflected that the trunk balancing exercises had better improvement than the strengthening exercise group on chronic low back pain among working women.

**Keywords:** Chronic low back pain, strengthening exercises, trunk balance exercises.

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## INTRODUCTION

Back pain is an extremely common human phenomenon, a price mankind should pay for their upright posture. Low back pain is a clinical condition affecting the lower portion of the spine and it is caused by the injury to the muscle (strain) and ligament (sprain). Low back pain is usually categorized in 3 subtypes: acute, Sub acute and chronic low back pain. Acute low back pain takes less than 6 weeks, Sub acute pain is less than 6 to 12 weeks, low back pain present more than 3 months is considered to be chronic low back pain<sup>1,2</sup>.

Chronic pain lends itself to behavioral and emotional interpretations and it is a multifaceted problem. Chronic low back pain is a most common major public health problem. The Symptom of the low back pain is the most common after Common cold. The etiology of the low back pain is unknown<sup>3</sup>. On review of the global prevalence of low back pain shows that it is the major problem throughout the world and it is most prevalent among females and elder people ages 40-80 years. Report shows that there is an increase in a life time of lower back pain in 82% and the prevalence of chronic low back pain which reached 23% and an increase in disability in population to 11 to 12%<sup>4</sup>.

Low back pain is the most frequent reason for the referral to outpatient physical therapy. Most patients with low back pain have one or more of four symptoms: back pain, leg pain, neurological symptoms and spinal deformity. Social class is also one of the main reasons for the low back pain to occur as it is related to heavy manual labor and in part to social disadvantage like poor medical care<sup>5</sup>. Many patients with chronic low back pain have a psychological profile that predisposes them to develop chronic pain additionally, people aged between 50 to 60

years are more likely to become disabled due to the chronic low back pain<sup>6,7</sup>.

In India, the occurrence of low back pain is alarmingly high, nearly 60% of people have significant back pain at some point or other in their lives. Majority will have acute low back pain that resolve within 4 weeks' time. Chronic low back pain reduces the muscle strength, endurance, flexibility, and balance<sup>8</sup>. Physiotherapy interventions include stretching, strengthening, mobilization, core stabilization, and manipulation along with electrotherapy modalities like shortwave diathermy, ultrasound, TENS, IFT, traction and low-level laser therapy can decrease pain and disability but has limitations in increasing balance and motivation for exercise programs<sup>9</sup>.

The back-pain abnormalities can be found by the MRI and CT scan. X ray examination is necessary for the back pain lasting more than 3 weeks. There is insufficient research evidence for any improvement in clinical outcomes in favor of conditioning exercise for the trunk balancing exercises, aerobic conditioning, acupuncture, shoe lifts, corsets, biofeedback, physical modalities, which include ice and heat massage ultrasound therapy<sup>10-13</sup>.

Balance is a complex motor control task involving the detection and integrity of sensory information to access the position and motion of the body in execution of appropriate musculoskeletal responses to control body position within the context of environment and the task. Very few literatures are present in the chronic low back pain with the trunk balancing exercises and strengthening exercises in managing the pain the disability among working women, thus the study is planned<sup>14-16</sup>.

**Aim of the study:** The main aim of the study is to compare the effectiveness of the study

between trunk balancing exercises over strengthening exercises in Chronic low back pain among working women. The study also aimed to investigate the trunk balance exercises and strengthening exercises on improving chronic low back pain among working women.

## METHODOLOGY

**Study Design:** An Experimental study was done to compare the effectiveness of trunk balance exercise and strengthening exercises on chronic low back pain among working women. This is a pre and post comparative study type. The comparison was made before and after giving the exercises to chronic low back pain participants. Participants from ACS medical college and hospital has been selected by the random sampling method. The study was setted at the faculty of physiotherapy Dr. MGR Educational and Research Institute. In this study totally 30 working women were selected as participants from Dr. MGR Educational and Research Institute.

**Sampling Method:** In this study, lottery sampling methods were chosen to separate the groups in a clue card with 1 to 30 numbers printed in cards, the cards were shuffled well and a card was drawn out by the subjects. If drawn cards contain odd number means, the subjects assigned for Group A- trunk balance exercises. If the drawn card contains even numbers, it means the subject assigned for Group B- strengthening exercises. Informed consent was obtained from the subjects.

**Intervention Duration:** Intervention made for this study was about 8 weeks along with alternate days about 30 minutes per day. The total study duration was about 4 months from February 2021 to May 2021.

Only female patients will be included Age group: 30 to 50 Patients who are suffering from chronic low back pain. Study samples with free from corona symptoms were Included for the study. Contraindications to exercise, Recent injury, Recent surgery, Presence of any disease, Indication for surgical intervention were excluded from the study.

**Outcome Measures and Measurement Tool:** Pain, trunk flexibility and disability was an outcome measures of this study. Visual analog scale (VAS), Quebec back pain disability questionnaire (QBPDQ) were the measurement tools used for the study.

**Materials Required in The Study:** Client consent form, Treadmill, Pillows, Weight bars, Shoulder exerciser with pulleys and weights, string couch with pulleys and weights, Quadriceps table with pulleys and weights, Couch.

### Intervention:

**Group A:** This group consists of 15 chronic low back pain patients and trunk balancing exercises were given. In group A exercises were given for 30 minutes per day and alternate days.

**Group B:** This group consists of 15 chronic low back patients and strengthening exercises were given. In Group B exercises were given for 30 minutes per day and alternate days.

**Procedure:** This experimental study was conducted for a period of 4 months with 30 working women having chronic low back pain at the age group of 30 -50 years and have been selected based on inclusion and exclusion criteria. They are grouped into Group A and Group B randomly by lottery method.

The Group A participants are trained with trunk balance exercises and Group B participants are

trained with strengthening exercises in order to analyze the effectiveness of trunk balance and strengthening exercises among working women. The participants are informed and signed with consent form in order to participate in this study.

**Group A (Trunk Balance Exercises):** trunk balance exercises is a system of exercises designed to strengthen the muscles that help keep you upright, including your legs and core. These kinds of exercises can improve stability and help prevent falls.

### 1.Trunk, head and upper limbs rotation from kneeling:



**Figure 1** Trunk, head and upper limb rotation from kneeling

Step 1: The subjects were positioned kneeling on a pillow with arms abducted to 90 degrees.  
 Step 2: The subject was asked to rotate the trunk, head and upper limbs to one direction.  
 Step 3: The position was maintained for 30 seconds in each direction, and repeated 2 times per direction. The exercise was more challenged by adding first eye closure and then head extension.

Muscles involved: Rectus abdominus, lumbar multifidus, external and internal oblique.



**Figure 2** Upper Limb Flexion and Extension with Simultaneous Head Movement from Kneeling (A&B)

### 2.Upper Limb Flexion and Extension with Simultaneous Head Movement from Kneeling

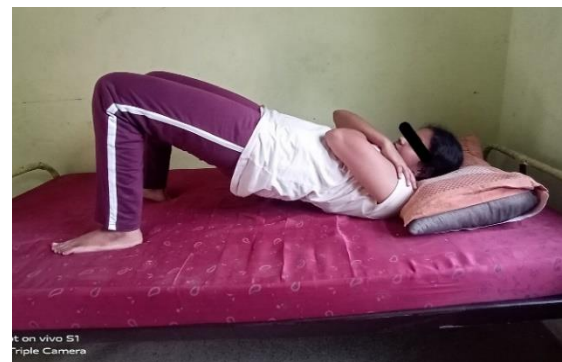
Step 1: The subject was positioned kneeling on the pillow, and the subject was instructed to look upward while moving her arms above the shoulder.

Step 2: The position was maintained for 3 minutes, performing 6 repetitions of upper limb movement.

Step 3: The exercise was made more challenging by adding eye closure.

Muscles involved: posterior deltoid, latissimus dorsi, anterior deltoid and biceps brachii.

### 3.Pelvic Bridging Followed by Raising One Lower Limb and Extending Knee



**Figure3A** Pelvic bridging followed by raising



**Figure3B** Pelvic bridging followed by raising

Step 1: supine with feet resting on the couch. The subject was instructed to lift her pelvis up and after reaching maximum hip extension she was asked to raise one lower limb from the couch and extend the knee.

Step 2: the position was maintained for 30 seconds, and repeated twice for each lower extremity.

Step 3: the exercise was made more challenging by adding first eye closure and then a ball under the foot resting on the couch.

Muscles involved: gluteus maximus, gluteus Minimus, Gluteus Medius and hamstrings.

#### 4. Lifting Opposite Upper and Lower Limbs from Quadruped Position



**Figure.4** Lifting opposite upper and lower limbs from quadruped position

Step 1: the participant was placed in quadruped position. And the subject was instructed to lift her opposite lower limbs.

Step 2: The position was maintained for 1 minute for each combination of limbs.

Step 3: The exercise was made more challenging by adding first eye closure and then a pillow under the lower limb.

Muscles involved: gluteus maximus, gluteus minimus and hamstrings.

#### 5 Sitting on The Side of The Couch with Unilateral Support



**Figure.5** Sitting on the side of the couch with unilateral support

Step 1: sitting on the side of the couch with unilateral support, and the subject was instructed to maintain this for 1 minute.

Step 2: The position was maintained for 1 minute each side.

Step 3: the exercise was made more challenging by adding eye closure, crossing the upper arms across the chest and the putting a pillow under the lower limb.

Muscles involved: rectus abdominus, hamstrings, gluteus maximus and Gluteus Medius external oblique.

## 6 Single Limb Kneeling on The Edge of The Couch:



**Figure.6** Single limb kneeling on the edge of the couch

Step 1: single limb kneeling on the edge of the couch with a pillow under the knee.

Step 2: the subject was instructed to maintain the position for 30 seconds. And the position was maintained for 30 seconds, two repetitions for each limb.

Step 3: The exercise was made more challenging by adding first eye closure, then head extension and then finally crossing the upper arms.

Muscles involved: gluteus maximus, gluteus medius, gluteus minimus, hamstrings.

### Group B (Strengthening Exercises):

Strengthening exercises are the exercises that are performed to improve the flexibility, stability and disability of the body to the great extent.

#### 1.Abdominal Curl Ups:

Step 1: The participant is placed in the supine with feet resting on the couch.

Step 2: the subject was instructed to lift her head and shoulders off the couch contracting the abdominal muscles



**Figure.7** Abdominal curl ups

Step 3: The position was maintained for 3 seconds, 3 sets of 6 repetitions were performed.

Muscles involved: rectus abdominus, external oblique, internal oblique and transverse abdominus.

#### 2. Latissimus Dorsi Shoulder Extensions Against Resistance

Step 1: The participant was asked to stand with the elbows extended.

Step 2: The subject was instructed to extend her shoulders at maximum voluntary contraction.



**Figure.8** Latissimus dorsi shoulder extension against resistance

Step 3: It was repeated with 3 sets of 8 repetitions at 50% maximum voluntary contraction.

Muscles involved: teres major, teres minor and posterior deltoid muscles.

**3.Hamstrings Prone Knee Extension Against Resistance:**

Step 1: the participant is placed in the prone position on the hamstrings table.

Step 2: And the subject was instructed to lift both the knees against the 50% maximum voluntary contraction.

Step 3: The subject was given 3 sets of 8 repetitions at 50% maximum voluntary contraction.

Muscles involved: hamstrings, gluteus maximus.



**Figure.9** Hamstrings prone knee extension against resistance

**4.Quadriceps in Seated Knee Extension**



**Figure.10** Quadriceps in seated knee extensions

Step 1: The participant was asked to sit in the quadriceps table.

Step 2: And the subject was instructed to extend both the knees against the resistance at the 50% maximum voluntary contraction.

Step 3: The subject was asked to do 8 repetitions of 3 sets at 50% maximum voluntary contraction.

Muscles involved: rectus femoris, vastus lateralis, vastus medialis, vastus intermedius.

**Visual Analog Scale (VAS):**

VAS is a self-reported measurement consisting of horizontal line with extreme anchors of no pain to worst pain. The line represents the pain intensity and it is 10 cm long.

**Procedure:** In the pre-test the subjects was asked to mark on the line at a point which represents their current level of pain, and the distance in the centimeters from the lower end of VAS to the subject’s mark was used as an index to identify the severity of pain.

In the post-test, the same process is repeated and the patient was again asked to mark on the line which represents their current level of pain and again their scores was recorded.

**Quebec back pain disability Questionnaire:**

The Quebec back pain disability scale (QBPD) is a condition-specific questionnaire developed to measure the level of functional disability for patients with chronic low back pain.

The Quebec back pain disability scale consists of 20 daily activities that can be categorized into 6 types of activities:

- Bed/rest items 1–3
- Sitting/standing items 4–6

- Ambulation items 7–9
- Movement items 10–12
- Bending/stooping items 13–16
- Handling of large/heavy objects items 17–20.

The scale exists of one central question: “Do you have trouble today with...?” followed by 20 activities of daily life. Some examples of daily activity: taking something out of the fridge, getting out of bed... In every activity, there are 6 answer categories, measured by using a Likert scale from 0-5 (0 = no effort, 5 = not able to). If the patient suffers a lot that day, he scores that activity with a 5, if it gives no problems a 0. The final outcome is obtained by the sum of the scoring of the degree of difficulty in performing the 20 daily activities. These outcomes score within the range of 0 and 100, determines the level of functional disability, with higher numbers representing greater levels of disability.

**Procedure:** The Quebec back pain disability questionnaire was given to patients and clearly explained about the items in the questionnaire. They were asked to mark the points with their

current level of pain and disability. The patient was asked to mark next to each appropriate statement and the scores was recorded.

In the post-test, again the patients were asked to mark the same set of questions with their current level of pain intensity and disability. Each of their statements was recorded.

**Descriptive Data Analysis:** In this comparative study, 30 chronic low back pain patients were selected randomly and segregated by lottery method for Group A-15 participation and Group B-15 participation. Selected people were working women were between 30-50 years and only female members were taken for this study. In Group A-15 these working women were given trunk balance exercise training for 30 minutes per day and alternate days for 8 weeks and Group B-15 were given strengthening exercises training for 30 minutes per day and alternate days for 8 weeks.

**Group A:** Effects of Trunk Balance Exercise on Chronic Back Pain among Working Women

Group A	Number of Pairs	Mean Difference	SD SEM	95% CI	df	t	P value	Sig. different (P < 0.05)
VAS	15	2.933	0.258 0.067	3.076 to 2.790	14	44.00	<0.0001	****
QBPDQ	15	15.33	1.839 0.474	16.35 to 14.32	14	32.30	<0.0001	****

**Table 1:** Paired t Test for VAS, and Quebec Back Pain Disability Questionnaire within the Group A



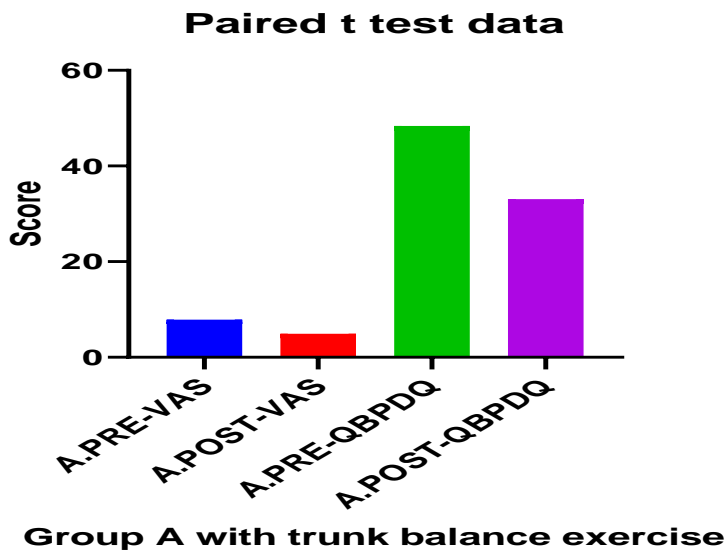
The above table 1 shows significant difference in VAS, and Quebec Back Pain Disability Questionnaire within the Group A  $P < 0.0001$

**Group B: Effects of strengthening Exercise on Chronic Back Pain among Working Women**

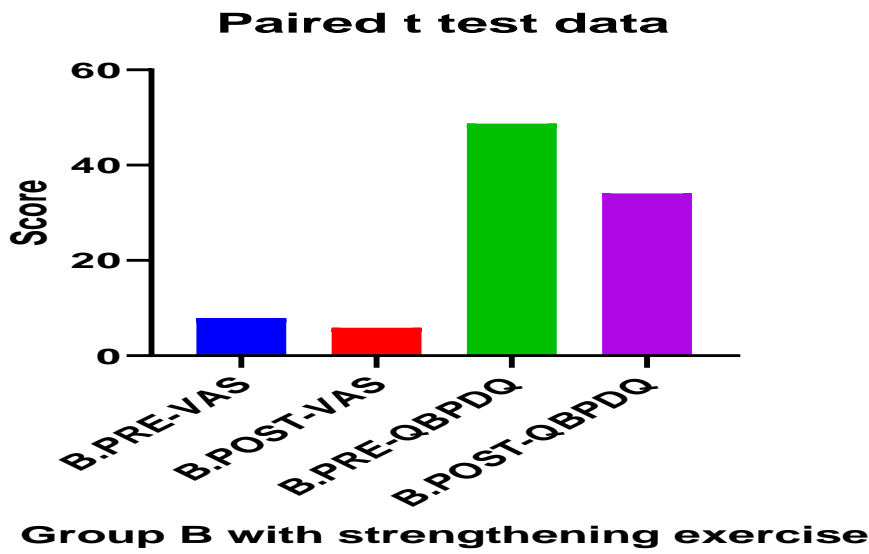
**Table 2:** Paired t Test for VAS, and Quebec Back Pain Disability Questionnaire within the Group B

Group B	Number of Pairs	Mean Difference	SD SEM	95% CI	df	t	P value	Sig. different (P < 0.05)
VAS	15	2.067	0.258 0.066	-2.210 to 1.924	14	31.00	<0.0001	****
QBPDQ	15	14.67	0.817 0.210	-15.12 to 14.21	14	69.57	<0.0001	****

The above table 2 shows significant difference in VAS, and Quebec Back Pain Disability Questionnaire within the Group A  $P < 0.0001$



**Graph 1:** Graphical representation of difference in VAS, and Quebec Back Pain Disability Questionnaire within the Group A



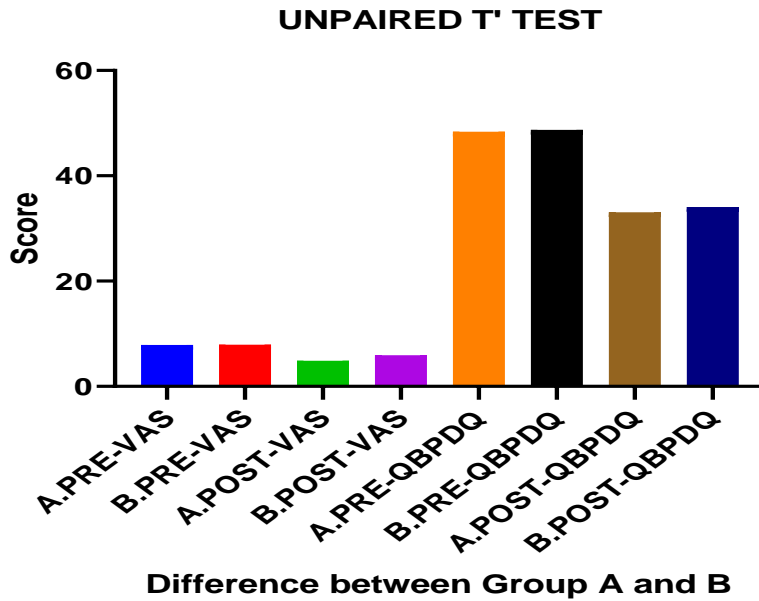
**Graph 2:** Graphical representation of pre-post Test VAS, and Quebec Back Pain Disability Questionnaire within the Group B.

**Comparative unpaired t Test for VAS, and Quebec Back Pain Disability Questionnaire between the Group A and B**

**Table 3:** Comparative effects of Trunk Balance Exercise over strengthening Exercise on Chronic Back Pain among Working Women

Variables	Test	Group A Mean	Group B Mean	Df	T Value	P value	Sig. different (P < 0.05)
VAS	Pre-Test	7.867	7.933	28	0.236	0.815	No
	Post-Test	4.867	5.933	28	3.786	0.0007	***
QBPDQ	Pre-Test	48.40	48.73	28	0.135	0.894	No
	Post-Test	33.07	34.07	28	0.458	0.651	No

The above table 3 shows significant difference in VAS, and No significant difference in Quebec Back Pain Disability Questionnaire between the Groups A and B.



**Graph 3:** Graphical representation of VAS, and Quebec Back Pain Disability Questionnaire between the Group A and B.

**RESULT**

Total 30 participants of patients with chronic low back pain within the age group of 30-50 years have been taken and only females were included in this study. All these women were working women having chronic low back pain were included in the study base on specific selection criteria.

In Group A, VAS, and Quebec Back Pain Disability Questionnaire has increased with mean difference of 2.933, 15.33 by trunk balance exercise along with conventional therapy with P value >0.0001, Chronic Back Pain among Working Women.

In Group B, VAS, and Quebec Back Pain Disability Questionnaire has increased with mean difference of 2.067, 14.67 respectively by strengthening exercise along with conventional

therapy with P value >0.0001, Chronic Back Pain among Working Women.

Comparative study between Group A and Group B showed significant difference in effectiveness on VAS, with P value 0.0007, and no significant difference found in Quebec Back Pain Disability Questionnaire with P value 0.6506 among Chronic Back Pain among Working Women.

Group A with Trunk Balance Exercise found more effective than Group B with strengthening Exercise on VAS, and Quebec Back Pain Disability Questionnaire with mean difference of 2.933, and 15.33 respectively.

**DISCUSSION**

This study is a comparative experimental study done to compare the effects of trunk balance exercises and strengthening exercises in chronic low back pain among working women. In this

study, 30 participants were taken and divided into group A trunk balance exercises and Group B strengthening exercises. The study shows there is significant difference in pain and disability following trunk balance exercises and strengthening exercises among chronic low back pain subjects. The study shows there is significant improvement in trunk balance exercises Group A than the strengthening exercises Group B in pain and disability score in chronic low back pain subjects.

Low back pain is a major public health problem all over the world. Numbers of different therapeutic interventions are used in managing the low back pain. Individuals with acute and chronic low back pain (CLBP) show changes in trunk muscle activity, particularly in the transverse abdominis and multifidi, which during functional activities ensures the mobility and stability of the lumbo-pelvic region<sup>1,2</sup>. Clinicians understand patients with CLBP have difficulty maintaining balance, especially under challenging condition and poor balance is also a frequent concern reported by patients with Chronic low back pain<sup>9</sup>.

The findings of the present study supported the findings of earlier studies of Kannabiran et al. and Hosseinifar et al. where the trunk balance exercises would promote the recruitment of the trunk musculature which might be lost in the patients with chronic low back pain.<sup>[6]</sup> The Wii Fit™ balance exercises are relatively new in practice. Not much reference is available regarding this protocol. It was learnt that it could be a biopsychosocial intervention as it encourages the participants to enjoy the exercises and require mental and cognitive functions<sup>17-20</sup>.

The limitations of the present study were the small sample size. More extensive the present

study supported the findings of earlier studies of Kannabiran et al and Hosseinifar et al. where the trunk balance exercises along with flexibility were reported to be effective enough in reducing pain and improving disability among chronic low back pain subjects. In fact, trunk balance exercises would promote the recruitment of the trunk musculature which might be lost in the patients with chronic low back pain<sup>11,12</sup>. The Wii Fit™ balance exercises are relatively new in practice. Not much reference is available regarding this protocol. It was learnt that it could be a biopsychosocial intervention as it encourages the participants to enjoy the exercises and require mental and cognitive functions. The limitations of the present study were the small sample size. More extensive study is required to validate the data study is required to validate the data<sup>21</sup>.

Hodges et al. found that activation and function in the Transverses abdominis (TrA) changes (delayed and more phasic) in patients with LBP, possibly indicating less effective stabilizing action. Hides et AL. also documented that training these muscles for postural control and stability improved the long-term outcome. Danneels et al. had supported the idea that training with specific exercises increased the function of the multifidi as well as the erector spine in general<sup>15</sup>.

Nourbakhsh and Arab found poor muscular endurance in the back extensor muscles had the greatest association with LBP. Anderson et al. conducted an EMG study to find out abdominal and hip flexor muscle activation during various training exercises. They found that curl up recruited primarily the rectus abdominis, with low activity in the oblique, transverses abdominis, and psoas major muscles<sup>6,7</sup>. Takemasa et al. conducted a study on trunk muscle strength in and effect of trunk muscle

exercises for patients with chronic low back pain. They concluded that strengthening the extensor muscles and an improved extensor/flexor ratio had been found to be important in decreasing symptoms in patients with CLBP. Hodges et al. explained the mechanism of deep muscles (TrA and MF) as core stabilizers. These deep muscles have segmental attachments in the lumbar spine and are therefore able to provide segmental control and stiffness<sup>8</sup>.

The idea of training the trunk musculature is not new. Exercises to induce transverse abdominis and multifidi muscle activation to stabilize the spine are often proposed for the treatment of CLBP. Evidence from randomized clinical trials shows that treatment programs aimed at improving trunk muscle control through stabilization exercises lead to significant improvements in pain and disability and quality of life in patients with CLBP. There are many new studies comparing some exercise programs to others trying to find the best possible protocol for these patients<sup>21</sup>.

DuFour et al. compared group-based multidisciplinary biopsychosocial rehabilitation and intensive individual therapist-assisted back muscle strengthening exercises. Both programs were very effective and could be used in combination in order to achieve the best possible results. Unsgaard-Tondel et al. compared motor control exercises (similar to stabilization) and sling exercises with general exercises for CLBP and found no evidence that first two were better in any way than traditional general exercise regimen<sup>22,23</sup>.

Rasmussen-Barr et al. found that graded exercise intervention, emphasizing stabilizing exercises, for patients with Recurrent LBP were more effective in improving disability and overall health parameters than other exercise

regimens, but with no positive results regarding pain. Further studies should analyze the characteristics of the recruitment of the trunk and spine muscles during trunk balance exercises and to determine if this type of treatment decreases the spinal reflex deficit and, consequently, the delayed response time of the spinal muscles<sup>24-27</sup>.

## CONCLUSION

On comparing both the groups, Group A (trunk balance exercises) showed better improvement than the Group B (strengthening exercise) in improvising the chronic low back pain among working women. Group A trunk balance exercises showed a beneficial improvement in post-test values when compared with Group B strengthening exercises post values. Hence the null hypotheses were rejected and accepted alternative hypothesis of the study.

The present study concluded that there was showing improvement in both the groups trunk balance exercises and the strengthening exercises on improving the chronic low back pain among working women.

**Ethical Clearance:** Ethical clearance has obtained from Faculty of Physiotherapy, Dr. MGR. Educational and Research Institute, Chennai, Tamil Nadu, Reference number: No: A-27/PHYSIO/IRB/2020-2021 Dated: 07/01/2020.

**Conflict of interest:** There was no conflict of interest to conduct and publish this study.

**Fund for the study:** It was a self-financed study.

## REFERENCE

1. Leibenson CS. Pathogenesis of chronic back Pain. J Manipulative Physiol Therapy 1992; 15: 299-308.

2. Frymoyer JW. Back pain and Sciatica. *N Engl J Med* 1988; 18: 291-300.
3. Frymoyer JW. Can low back pain disability Be prevented? *Baillieres Clin Rheumatol* 1992; 6: 595-606.
4. Nachemson AL. Prevention of chronic back Pain. *Bull Hosp Jt Dis* 1984; 44: 1-15.
5. McElligott J, Miscovich SJ, Fielding LP. Low back injury in industry. *Conn Med* 1989; 53: 711-715.
6. Nodrin M, Welser S, Halpern N. Education: The prevention and treatment of low back Disorders. In: Frymoyer JW. (ed), 1991. *The Adult Spin and Practice*. New York, NY: Raven Press 1991; pp 1641-1654.
7. Deyo RA, Loeser JD, Bigos SJ. Herniated Lumbar intervertebral disk. *Ann Intern Med* 1990; 112: 598-603.
8. Anderson GBJ, Pope MH, Frymoyer JW, Snook S. Epidemiology and cost. In Pope MH, Anderson GBJ, Frymoyer JW, Chaffin DB. Eds, *Occupational Low Back Pain*. St Louis, Mo: Mosby Year Book 1991; pp. 95-113.
9. Koley S, Singh G, Sandhu R. Severity of Disability in elderly patients with low back pain in Amritsar, Punjab. *Anthropologist* 2008; 10(4): 265-268.
10. Sullivan P. Diagnosis and classification of Chronic low back pain disorders: Maladaptive movement and motor control Impairments as underlying mechanics. *Manual Therapy* 2005; 10: 242-255.
11. Ferreira ML, Ferreira PH, Hodges PW. Comparison of general exercise, motor control exercise and spinal manipulative therapy for chronic low back pain: A randomized trial. *Pain* 2007; 131: 31-37.
12. Aure OF, Nilsen JH, Vasseljen O. Manual Therapy and exercise therapy in patients with Chronic low back pain. *Spine* 2003; 28: 525-532.
13. Ahmed MS, Shakoor MA, Khan AA. Evaluation of the effects of shortwave Diathermy in patients with chronic low back Pain. *Bangladesh Med Res Council Bull* 2009; 35: 18-20.
14. Facci L M, Nowotny J P. Effects of Transcutaneous electrical nerve stimulation (TENS) and interferential currents (IFC) in patients with nonspecific chronic low back Pain: Randomized clinical trial. *Sao Paulo Medical Journal* 2011; 129(4): 206-216.
15. Soriano F, Rios R. Gallium arsenide laser Treatment of chronic low back pain: A Prospective, randomized and double-blind Study. *Laser Therapy* 1998; 10: 175-180.
16. Gatti R, Faccendini S, Testament A, Barbera M, Balestri A, Calori G. Efficacy of Trunk balance exercises for individuals with Chronic low back pain. *JOSPT* 2011; 41(8): 542-552.
17. Mientjes MI, Frank JS. Balance in chronic Low back pain patients compared to healthy People under various conditions in upright Standing. *Clin Biomech* 1999; 14(10): 710-716.
18. Sullivan S, Schmitz TJ (2007) *Physical rehabilitation*. (5th edn), Jaypee brothers, Medical Publishers.
19. Chang WD, Lin HY, Lai PT (2015) Core strength training for patients with chronic low back pain. *J Phys Ther Sci* 27: 619-622.
20. Danneels LA, Vanderstraeten GG, Cambier DC, Witvrouw EE, Bourgeois J, et Al. (2001) Effects of three different training modalities on the cross-sectional area of the lumbar multifidus muscle in patients with chronic low back pain *Br J Sports Med* 35: 186-191.
21. Lee JH, Hoshino Y, Nakamura K, Kariya Y, Saita K, et al. (1999) Trunk muscle weakness as a risk factor for low back pain. A 5-year prospective study. *Spine* 24: 54-57.
22. Hayden JA, van Tulder MW, Malmivaara AV, Koes BW. Meta-analysis: exercise therapy for nonspecific low back pain. *Ann Intern Med* 2005; 142:765-75.
23. Richardson CA, Jull GA, Hides JA. *Therapeutic exercise for low back pain: scientific bases and clinical approach*, 1<sup>st</sup> ed. UK: Churchill Livingstone 1999;9-20.
24. McGill SM, Grenier S, Kavcic N, Cho Lewicki J. Coordination of muscle activity to assure stability of the lumbar spine. *J Electromyogr Kinesiol* 2003; 13:353-9.
25. Cairns MC, Foster NE, Wright C. Randomized controlled trial of specific spinal stabilization

- exercises and conventional physiotherapy for recurrent low back pain. *Spine (Phila Pa 1976)* 2006; 31:670-81.
26. Koumantakis GA, Watson PJ, Oldham JA. Trunk muscle stabilization training plus general exercise versus general exercise only: randomized controlled trial of patients with recurrent low back. *Phys Ther* 2005; 85:209-25.
27. Rohini K, Gaurav T, Singh SJ. Comparison of effects of specific stabilization exercises and conventional back extension exercises in management of chronic disc prolapse. *Indian J Physiother Occup Ther* 2007; 1:2007-9.

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