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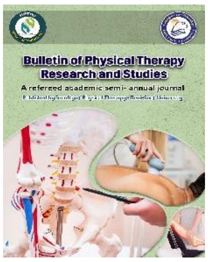

Effect of lumbar Stabilization Exercises Combined with Ball and Balloon Exercise in Treatment of Chronic Non-specific Low Back Pain: Randomized Clinical Trial

Ahmed Samir Abdelhamid[1], Faten Ali[2], Mahmoud Sabry Ahmed Asal[3], Shymaa Salem[4]

[1] Department of Physical Therapy for orthopedics and Its Surgeries, Faculty of Physical Therapy, Delta University for Science and Technology.
[2] Department of Physical Therapy for Internal medicine and geriatrics, Faculty of Physical Therapy, Delta University for Science and Technology, Gamasa, Mansoura, Egypt
[3] Department of Basic science for physical therapy department, faculty of physical therapy, South Valley University, Quena, Egypt.
[4] Department of Physical Therapy for neuromuscular disorders and its surgery, Faculty of Physical Therapy, Sphinx University, Assuit, Egypt

Corresponding author:

Ahmed Samir Abdelhamid

Department of Physical Therapy for orthopedics and Its Surgeries, Faculty of Physical Therapy, Delta University for Science and Technology.

Email: **ahmedsamir1977@gmail.com**

Tel: +201100330791

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Abstract

[Purpose] This study was conducted to investigate the impact of combining core stability exercises with ball and balloon exercises on chronic non-specific low back pain (CNLBP). [Subjects and Methods] Sixty participants were randomly allocated to Group A (core stability exercises with ball and balloon exercises) and Group B (core stability exercises alone), engaging in sessions three times weekly for four weeks. Pain intensity was evaluated using a visual analogue scale (VAS), while spinal function was assessed using the Arabic Oswestry Disability Index (AODI), and pulmonary function was measured via pulmonary function tests before and after the study. [Results] Group A demonstrated statistically significant reductions in pain intensity, improvements in functional ability (AODI scores), and enhanced pulmonary function compared to Group B. [Conclusion] it was concluded that combining ball and balloon exercises with core stability exercises is better than core stability exercises only in treatment of (CNLBP).

Keywords: Core Stability Exercises, Ball and Balloon Exercises, Chronic Non-Specific Low Back Pain

Introduction

Lower back pain (LBP) is common muscular and skeletal problem, it has a 60–90% prevalence percentage. The majority of people—more than 80%—will at least once in their lives suffer from low back discomfort. Approximately fifteen percent of them have chronic low back pain..[1)] Poor life style is the main result of lower back pain (LBP) as it weakens the muscles in the lumber region and puts undue strain and tension on them. Enhancing trunk muscular weakness is a crucial part of LBP sufferers' recovery. [2)] There is no known reason for the most common kind of LBP. Imaging tests are not able to accurately determine the patho-anatomical diagnosis for this type of pain, nor are they able to provide any meaningful information for treatment. [3)] Many studies found that individuals with chronic, non-specific lower back pain had different breathing patterns, including changes to their lung function and diaphragmatic kinematics. [4,5)]It was found a strong correlation between NSLBP and impaired respiratory function, according to a cross-sectional study that examined changes in respiration, respiratory muscle strength, endurance, core stabilization, diaphragmatic movement, and chest expansion in NSLBP patients. [6)] The European guidelines and other clinical practice recommendations for the management of chronic non-specific low back pain (NSLBP) advocate supervised exercise therapy as the initial course of treatment. [7,8)] In order to restore adequate kinetic function and treat non-specific low back pain, core stability exercises are becoming more and more popular. [8)] Core stability exercises are highly effective for patients with non-specific LBP than traditional physiotherapy regimens. [9)] Strong rhythmic contractions are required in patients with lower back discomfort who have unstable lumbar areas in order to support spinal stability. Spinal stability can be achieved through trunk muscular exercise. [10,11] Less movement in the vertebral joints results in overstress or greater joint mobility. If the spinal muscles are unable to adequately control this excessive motion, the risk of lower back discomfort rises, potentially affecting the function of the spinal column. [(12)] Trunk muscles that support the spine include the diaphragm, internal oblique, abdominals, back muscles, and spinal multifidus. Spinal stability is impacted by the abdominal pressure created when the trunk and pelvic floor muscles work together. One of the most crucial spinal stabilizers while breathing is the transversus abdominis muscle. [13, 14)] The interaction of respiratory muscles with trunk muscular stabilizers results in increase the pressure in the abdomen, which affects lumbar stability and protects the trunk muscles. [15)] Furthermore, diaphragm-activating breathing techniques increase pressure in the abdomen, which tightens muscles of pelvic floor. Therefore, when the abdominal muscles flex during breathing, the deep stabilizing muscles might be easily activated. [16)] Therefore, the goal of this study was to ascertain whether lumbar stabilization exercises plus ball and balloon exercises improve pain in the lower back, respiratory function, and spinal function in individuals with persistent, nonspecific lower back pain more effectively than stabilization exercises alone.

Subjects and Methods

This randomized controlled trial double blinded study (assessor and therapist) was conducted between April 2023 and October 2023 at the physiotherapy outpatient clinic on Delta University for Science and Technology. Each patient was informed of the study's goals and procedures before consenting to participate. All patients provided their informed consent before their involvement within this trial. Before starting therapy, each patient underwent a comprehensive physical assessment and history.

This study was accepted by the local ethics commission (Ethics committee F.P.T 2307017, Delta University for Science and Technology, Faculty of Physical Therapy).

This study was recorded on clinical trials by number (NCT06265090)

Subjects:

All of the participants gave their written informed consent prior to starting the study and following a thorough description of its goals and methodology.

One hundred forty physiotherapy students, including male and female, experience long-term, non-specific LBP were chosen and assessed for eligibility to the study from Delta University for Science and Technology's Faculty of Physical Therapy.

Criteria for inclusion: 1- Physiotherapy students, male and female, aged 18 to 25; 2- Patients suffering from low back pain, either referring leg pain or otherwise; and 3- Patients with LBP lasting longer than six months.

Exclusion criteria: 1- individuals with lumbar disc prolapse, 2-acute low back pain patients, 3. those with T.B. or systemic disease 4. A history of spinal operations or fractures, 5- people diagnosed with spondylolisthesis. 6- patients have sacroiliac dysfunctional functioning, 7- patients suffer from osteoporosis, 8- patients have spinal anomalies 9- Patients with respiratory disorders; 10-Those patients who had received physiotherapy for LBP in the preceding six months.

Sample size:

When calculating the sample size (using the G*power tool 3.1.0 for two tails, paired test). To get the estimated sample size (power of 60% and an alpha level of 95%), sixty people were needed in total considered significant). Therefore, there needed to be a minimum of 30 people in each group who were diagnosed with NS-LBP. However, 10 additional patients were included in the sample to allow for potential drop-outs. As a result, there were a minimum of 35 individuals in each study group. With the aid of a computer program, the patients were randomly split into two groups. Seventy individuals have been distributed at random to a software application. Exercises combining ball and balloon exercises with core stability were performed by Group [A], the first group). Group [B], the second group, was given only core stability exercises.

Instruments used for assessment:

The Arabic Oswestry Disability Index (AODI) for functional evaluation (17), for assessing pain visual analogue scale [18] and the pulmonary function test [19].

Arabic Oswestry Disability Index (AODI) for functional assessment:

Prior to and following sessions, patients filled out answers to questions that yielded a score in percentages indicating how successfully they completed daily tasks. Ten daily living activities are evaluated in this survey to determine daily function. Six distinct categories were available, with scores ranging from 0 to 5. If all ten sectors were finished, the outcome would be as follows: a final score of 40 percent, or 20 out of a possible 50 times 100. Results:1. Mild disability is defined as 0–20%. 2. From 21% to 40% are regarded as moderate. Incapacity.3. 41% to 60% are regarded as severely disabled. 4. 61%–80%: disabled. 5. 81%.

Visual Analogue Scale (VAS):

It had been implemented for assessing the level of discomfort as it is a reliable and efficient method that can detect changes in pain brought influenced by medical disorders. A zero on the leftmost side of the pain index indicates not experiencing pain at all, while a 10 indicates the worst conceivable agony. In terms of clinical significance, even a slight improvement in 1.1–1.2 centimeters is significant. [18)]

Tests for pulmonary function:

Peak expiratory flow (PEF), maximum voluntary ventilation (MVV), forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and forced vital capacity/FEV1 were all assessed with a Spirometry Medisoft ergo cart professional, power 230V AC 50Hz, serial number: 161121-05-0018, Belgium. [19]. Patients were given these following instructions on how to complete the PFT: (1) it was vital to clearly and succinctly explains the purpose and methodology of the test to the patient in order to get them ready. (2) The patient was provided with a sterile mouthpiece that is connected toward the spirometer tube's end valve. (3) This participant had been comfortably seated with both feet down on the floor, sporting a nose clip ;(4) the proper chin-neck posture had been demonstrated to the patient. During forced expiratory maneuvers, the patient should maintain an elevated chin and a slightly stretched neck, rather than bending their chin toward their chest. (5) After a mouthpiece was put in their mouth, the patient received instructions to never biting against it. Additionally, it was instructed to keep the lips securely sealed and to avoid sticking the tongue into the mouthpiece. (6) Then he / she received guidance inhale fully (it had to be full), then to quickly and firmly exhale via the mouthpiece. (7) Performing a minimum of three technically sound maneuvers was advised, with a preferred difference in FEV1 (and FVC) of less than 0.15 liters (achieve the maximum score of three). If a test meets the conditions for acceptability and reproducibility, it is deemed legitimate. To evaluate his or her ventilatory reserve, MVV had been employed by demonstrating the MVV measurement technique, which entailed breathing rapidly for ten to fifteen seconds after repeating steps one through five.[19)]

Interventions

Core stability exercises (CSE):

Targeted on the deep abdominal musculature were the core stability exercises. This comprised a range of activities and a TENS and ultrasonic therapy baseline management. These activities were overseen by a physiotherapist. For a duration of a month, all groups engaged core stability exercises for thirty minutes a total of three per week. Regarding every training session, for seven to eight seconds, an isometric contraction was sustained. Ten repetitions of each exercise were performed, separated by a three-second rest period. Between each activity, patients had a one-minute rest. [(20)] The level of therapist help was gradually reduced as the patient's achievement was taken into account, and the intensity of the individual training rose. Patients were told to squeeze their abdominal muscles and maintain the contraction while continuing to breathe regularly during every repetition of the exercise.[21)] every patient used a personalized workout regimen created by their therapist, recording their progress in a journal. Among core stability exercises were Abdominal hollowing, supine extension Bridging, Side Bridging, straight leg raising from prone, alternating arm and leg raising from quadruped, and prone bridging. Various CSE strategies have been developed, as Table 1 illustrates.

Hemi bridge exercises with ball and balloon

The second group performed hemi bridge exercises using balls and balloons in along with core stability exercises using the following protocol:

Over a course of three sessions per week, the participants received the hemi bridge exercise using a ball and balloon.

Instructions:

1) Lay flat on your back, lean with your feet on a wall, and flex your knees and hips to a 90-degree angle.

2) In the space between your thighs and knees, hold a ball with a diameter of four to six inches.

3) With your left hand holding a balloon, raise your right hand above the level of your head.

4) Tilt the pelvis so that your lower back is very barely raised of the supporting surface as you breathe in through your nose and out through your lips. Try to maintain as flat a low back as you can on the mattress. Push the heels into the wall rather than placing your feet flattened.

5) Without shifting your feet, lower your knee on the left down to meet the right one. The contraction of the muscle in your left inner thigh.

6) Lift your right foot off the ground while bending your left knee. This will cause Your left leg's back muscle to contract. Hold this posture throughout the duration of exercising.

7) Inhale via the nostrils, and then gently exhale into the balloon.

8) To prevent the balloon from losing air, press the back of your tongue against the upper part of the mouth for 3 seconds.

9) Breathe in through your nose again, making sure a tongue stays on the top of the mouth and not squeezing the balloon's neck.

10) Using your free hand to secure the balloon, gently release the air.

11) Refrain from striking with your neck or cheeks.

12) Hold the balloon by its collar and take it out of your mouth following your 4th breath. Release the balloon's air.

13)Unwind and keep doing this process four multiple times. [22)]

Figure (1a): starting position of hemi bridge with ball and balloon exercise

Figure (1b): ending position of hemi bridge with ball and balloon exercise

TABLE 1. Specifications for the exercises for core stabilization

Exercise Type	**Description**
Hollowing of the abdomen	The therapist stood at the patient's waist and placed her thumbs anteriorly and inferiorly to the ASIS, spreading her fingers laterally toward the rectus abdominis muscles. The patient assumed their customary lying position. The patient's lower back had to be compressed downward while her abdominal muscles were contracted. (Figure 2)
Supine extension bridge	In a hook-lying position, the person places both of their feet below the knees. The person transfers the body's weight from the neck to the shoulders by progressively raising the hips as long as either his / her knees and shoulders are in alignment. The person holds this posture for a while before lowering their hips gradually to the ground. (figure 3a & b)
Straight leg rise from prone	With their head resting on their arms, the participant lies on their back. Then, contracts the hamstring along with gluteus musculature in his or her right leg to raise it as high as he/she can toward the roof. Afterwards maintaining Such motionless posture, the individual progressively letting down one leg. Continue the exercise on the left side. (figure 4a & b)

Figure (2): abdominal hollowing exercise

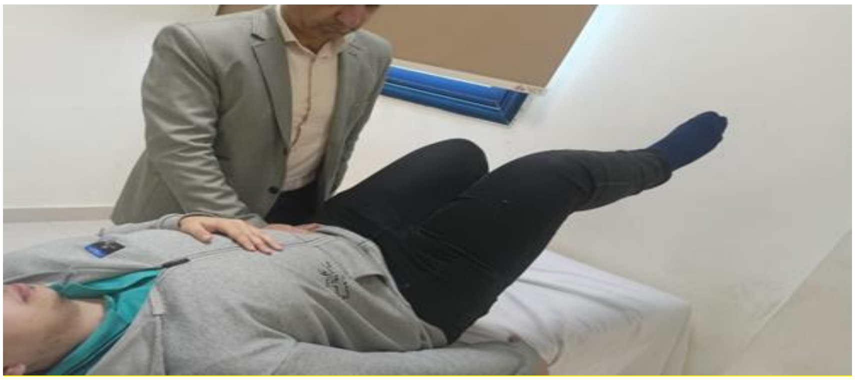


Figure (3a): starting position of supine extension bridge

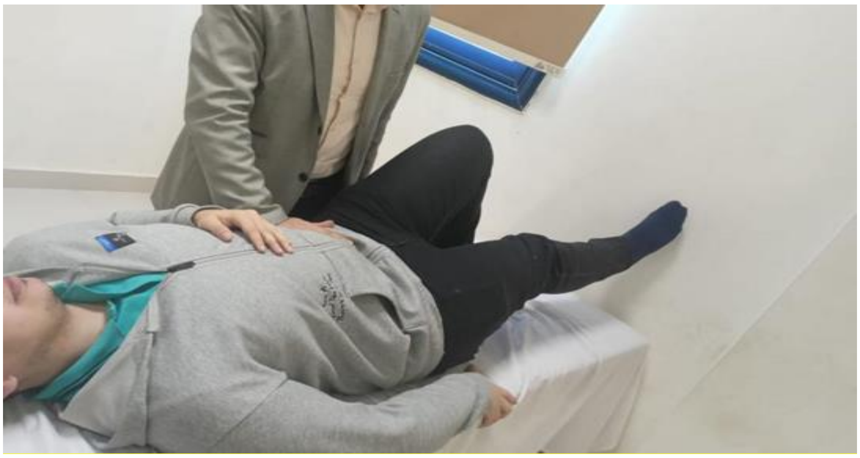
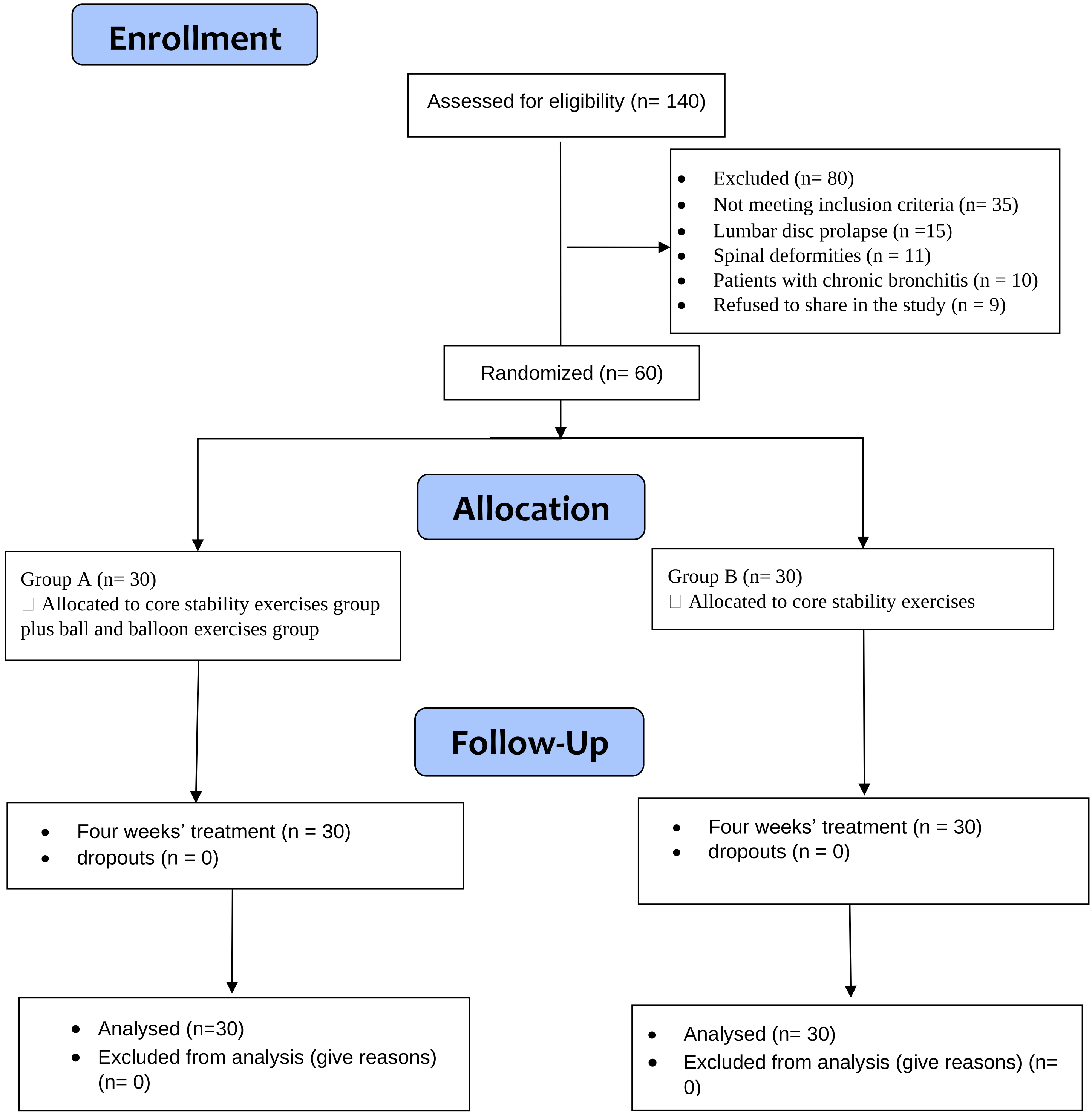


Figure (3b): ending position of supine extension bridge

Figure (4a): starting position of Straight leg rise from prone

Figure (4b): ending position of Straight leg rise from prone


Enrollment
Assessed for eligibility (n= 140)
Excluded (n= 80)
Not meeting inclusion criteria (n= 35)
Lumbar disc prolapse (n =15)
Spinal deformities (n = 11)
Patients with chronic bronchitis (n = 10)
Refused to share in the study (n = 9)
Randomized (n= 60)
Allocation
Group A (n= 30)
Allocated to core stability exercises group plus ball and balloon exercises group
Group B (n= 30)
Allocated to core stability exercises
Follow-Up
Four weeks' treatment (n = 30)
dropouts (n = 0)
Four weeks' treatment (n = 30)
dropouts (n = 0)
Analysed (n=30)
Excluded from analysis (give reasons) (n= 0)
Analysed (n= 30)
Excluded from analysis (give reasons) (n= 0)

Data Analysis

Before doing the final analysis, the data were first examined for compliance with the assumption of normality, variance homogeneity, and the presence of elevated values using a p-value threshold < 0.05. This study was conducted in preparation for a parametric test of the analysis of differences. The repeated measure MANOVA test was used to compare the means of the various parameters in the two groups and identify any significant variations between them at the two testing intervals (pre & post). The independent sample t-test was used to evaluate the significant discrepancies between groups in the demographic data, with the exception of the sex distribution, which was evaluated using the Chi-square test. An independent sample t-test was employed to evaluate the difference between groups, and a paired sample t-test was used to evaluate the difference within groups.

Results

First, we screened 140 patients were diagnosed as chronic non-specific lower back pain, then we excluded 80 patients and we found 60 eligible patients for the study, and 60 of them accepted to sign the consent form statement, then they were randomly assigned to core stability exercises group and exercises using ball and balloon combined with core stabilizing exercises group. (Figure 1) The distribution of males and females in group A was 53.3 % (16) and 46.7 % (14) respectively, while in group B, it was 50 % (15) and 50 % (15) respectively. There were no significant differences between groups (p = 0.796) when the sex distributions of all patients in groups A and B were compared using the Chi-square test. There were no significant differences in age (p = 0.39), height (p = 0.219), or weight (p = 0.115) between the patients in the two groups when the independent sample t-test was carried out to compare the mean values of these three parameters for all of the patients in each group. **(Table 2)**.

Table 2: Descriptive statistics for the demographic data

Variable	Mean ± SD		t-value	*P*-value	Sig.
	Group A N = 30	Group B N = 30			
Age (years)	21.43± 2.16	21.30± 2.45	0.2235	0.39	NS
Height (cm)	165.50± 5.10	164.53± 4.46	0.781	0.219	NS
Weight (kg)	76.93± 3.93	78.07± 3.28	-1.213	0.115	NS

*SD= Standard deviation, *t-value=t-statistic, *P-value=probability, *Sig. =Significance, *NS=non-significant

Within group comparison

Regarding (AODI)

With a p-value of less than 0.001, group (A) experienced a significant difference before and after the study (18.17±1.31) and (15.17±1.29), respectively. For group (B), there was a statistically significant difference in spinal function pre- and post-study (18.17±1.31, 10.80±0.847, respectively, with a p-value of less than 0.00). **(Table 3)**

Table 3: Comparisons of the mean, within, and between groups regarding (AODI)

		Group A N= 30	**Group B N = 30**	**Comparison between groups**	
		$\bar{X}$ ± SD	**$\bar{X}$ ± SD**	**MD**	**p-value**
AODI	**Pre**	18.17±1.31	18.17±1.31	0.000	0.500
	post	15.17±1.29	10.80±0.847	4.367	<0.001*
	MD	3	7.367		
	p-value	<0.001*	<0.001*		

x̄: Mean **SD:** standard deviation **MD:** mean difference **t value:** unpaired t value **p-value:** probability value ***:** Significant

Regarding (VAS)

Pre- and post-study differences in group (A) were significantly different (7.49±1.08) and (5.63±1.05), respectively, with p values less than 0.001. Pain was significantly reduced in both groups (B) as there was a significant difference between pre and post study (7.49±1.08) and 1.88±0.41) with a p-value of less than 0.001. **(Table 4)**

Table 4: Comparisons of the mean, within, and between groups regarding visual analogue scale (VAS)

		Group A N= 30	**Group B N = 30**	**Comparison between groups**	
		$\bar{X}$ ± SD	**$\bar{X}$ ± SD**	**MD**	**p-value**
VAS	**Pre**	7.49±1.08	7.49±1.08	0.000	0.500
	post	5.63±1.05	1.88±0.41	3.753	<0.001*
	MD	1.86	5.61		

x̄: Mean **SD:** standard deviation **MD:** mean difference **t value:** unpaired t value **p-value:** probability value ***:** Significant

Regarding pulmonary function test

The results showed a significant difference in group (A) FEV1 prior to and post the study, with p values less than 0.001, at 55.30±8.58 and 66.10±7.97, respectively. There was a significant difference in group (B) with a p value <0.001 between pre and post study values of 56.93±4.59 and 76.70±2.74, respectively. Group (A) experienced a substantial difference in FVC pre and post the study, with p values <0.001 (55.93±7.37) and 66.07±6.87, respectively. There was a significant difference in group (B) with a p value <0.001 between pre and post study measurements, 60.10±5.96 and 84.77±3.997, respectively. There was a non-significant variance in the FEV/FVC ratio in group (A) before and after the trial (.9885±0.08) and (1.0020±0.086), respectively, with a p value of 0.132. With a p-value of less than 0.001, group (B) experienced a significant difference before and after the study (.9525±0.08) and (.9058±0.03), respectively. With a p value <0.001, there was a significant difference in MVV in group (A) before and after the study (61.17± 6.92) and (69.50± 6.76), respectively with p value less than 0.001.

A substantial difference (p <0.001) was seen in group (B) before and after the study (61.67± 4.999) and (80.23± 4.63), respectively. PEF in group (A) showed a significant difference with a p value <0.001 between pre and post study values (58.53± 7.68) and 73.53± 7.75), respectively. Both groups' pulmonary function had improved, as evidenced by the significant difference in group (B) between pre- and post-study values (57.90± 5.66 and 80.90± 5.33, respectively, with a p value <0.001). **(Table 5)**

Table 5: Comparisons of the mean, within, and between groups regarding pulmonary function test

		Group A N= 30	Group B N = 30	Comparison between-group	
		$\bar{X}$ ± SD	$\bar{X}$ ± SD	MD	p-value
FEV 1	Pre	56.93±4.59	55.30±8.58	-1.683	0.181
	post	76.70±2.74	66.10±7.97	-10.600	<0.001*
	MD	-19.767	-10.800		
	p-value	<0.001*	<0.001*		
FVC	Pre	60.10±5.96	55.93±7.37	-4.167	0.010
	post	84.77±3.997	66.07±6.87	-18.700	<0.001*

	MD	-24.667	-10.133		
	p-value	<0.001*	<0.001*		
FEV/FVC	**Pre**	.9525±0.08	.9885±0.08	0.03599	0.048
	post	.9058±0.03	1.0020±0.086	0.09624	<0.001*
	MD	0.0466	-0.013		
	p-value	0.132	<0.001*		
MVV	**Pre**	61.67± 4.999	61.17± 6.92	-0.500	0.375
	post	80.23± 4.63	69.50± 6.76	-10.73	<0.001*
	MD	-8.333	-18.567		
	p-value	<0.001*	<0.001*		
PEF	**Pre**	57.90± 5.66	58.53± 7.68	0.633	0.359
	post	80.90± 5.33	73.53± 7.75	-7.367	<0.001*
	MD	-23.00	-15.00		
	p-value	<0.001*	<0.001*		

$\bar{x}$: Mean **SD:** standard deviation **MD:** mean difference **t value:** unpaired t value **p-value:** probability value ***:** Significant

Discussion

This 4-week randomized clinical investigation aimed to evaluate the impact of core stabilization alone versus ball and balloon exercises combined with stabilization exercises on people with persistent, nonspecific lower back pain. The study's findings indicate that both groups significantly improved on the AODI, the pulmonary function test, and the VAS. But following therapy, there was a noticeable difference between the two groups. With the ball and balloon exercise group showing greater improvement.

Regarding VAS results

The findings showed that pain decreased in both groups. It was determined that the result was a difference that is statistically significant at a p-value of less than 0.001. There was a statistically significant improvement within group A (ball and balloon exercises) when compared to group B (core stabilization exercises). The hemi bridge with ball and balloon exercise helps rectify posture by engaging the diaphragm and realigning the lumbar spine. Shetty, 2020 carried out a study to assess the impact Exercises using a ball and balloon on a 90/90 bridging for lower back pain and function disability. This study demonstrated the exercises' greater impact on pain and respiratory function. 23) However, as just eighteen patients were included in this investigation, we were unable to contribute to a larger patient sample size study. Hemi bridge using ball and balloon exercise: impacts on forced expiratory volume, aches and pains and functioning capabilities in individuals with persistent lower back pain were assessed by (Boyle, 2010) using forced expiratory volume, visual analogue scale, and Modified Oswestry Disability questionnaires (MODQ). The findings of this investigation showed that the exercise had a direct effect on discomfort, Forced Expiratory Volume, and functional abilities in patients with persistent lower back pain. Lumbar lordosis and painful posture might have been addressed if these muscles had been more engaged. [24)] Enhanced transverse abdominis muscle activation, as in group (A), is responsible for the significant pain reduction in the core stability group, enhanced stabilization, safeguard of the spine, and reduced pressure on the lower lumbar spine. [25)]

Regarding the functional assessment

The study found that both groups' functional disabilities had significantly improved, however group (A) performed better than group (B). This could be because blowing up a balloon causes the paraspinal muscles to weaken and the stomach muscles to contract. [26)] In a study on the impact of diaphragmatic respiratory exercises on pain and function, Shah (2020) found that combining diaphragmatic respiratory exercises in addition to stabilization exercises was better than using stabilization exercises alone in order to lower pain and increasing functional abilities in patients with non-specific lower back pain. Furthermore, this aids in the participant's lumbar lordosis correction, enhancing their functional capacity. It is also known that the spine requires "relative stiffness" and control to carry out functional activities, and this is provided by a rise in the pressure inside the abdomen. This means that isolated diaphragm contraction has been demonstrated to help spinal control by raising pressure in the abdomen, despite the lack of back and abdominal muscle firing. [26)]

Yu (2023) carried out a study to examine the effects of respiratory exercises in conjunction with stabilization exercises on the discomfort and functionality of persistent non-specific lower back pain. The results showed considerable improvement in both pain and function. [27)]

Regarding the respiratory function test

With the exception of the ratio between FEV1 and FVC, which was determined to be insignificant in group A only ($p = 0.132$), this study revealed substantial variations between pre and post-measures related respiratory functioning in both teams (p less than 0.001). Additionally, a notable distinction discovered between the two groups within the post-treatment evaluation of pulmonary function test values, with group B outperforming group A ($p < 0.001$).

In studies of people with persistent LBP, differences in lung capacity[25,26)] and diaphragm mechanics[26,28)] have been discovered. These findings suggest that there may be a connection between function of lungs, pattern of breathing, spinal stabilization, and lower back pain. The reviewed literature indicated that several breathing exercise programs were helpful for improving respiratory function, lowering chronic, non-specific LBP, and improving quality of life. [29,31)] Mehling et al. found that breathing exercises that emphasize sense of respiration, breathing patterns, breathing rate, and breathing volume, and they are performed regularly over the course of four weeks, are effective as conventional physiotherapy exercises for people with persistent lower back pain. The study investigated the difference between respiratory exercises and conventional physiotherapy. [(30)]

Janssens and colleagues investigated. The outcome of an intensive regimen for inspiratory muscle training on function and persistent, non-specific lower back pain. After engaging in a twice-daily an intensive regimen for inspiratory muscle for 8 weeks, patients with persistent, non-specific lower back pain report notable improvements in pain in addition to respiratory function. [(32)] When compared to a control group, exercises including deep breathing conducted one time a day for one-month improved breathing abilities and spinal stability in people with good health with reduced rib cage movement and reduced volume of tidal flow. During breathing, there were noticeable changes in both core muscle activity and respiratory performance. [(33)]

Similar to what we found, Fernandes et al. conducted an experimental investigation to assess the effects of hemi bridge with balloon and ball exercise on functional abilities, pain, and forced expiratory volume in individuals with persistent low back pain. They discovered that in patients with persistent LBP, hemi bridge with ball and balloon exercise had an instant effect on pain, FEV6, and functional abilities. [25)] The fact that the diaphragm's zone of apposition (ZOA) is essential for preserving regular breathing and trunk stability, which lowers low blood pressure, is one likely explanation for this improvement. The exercise used in this study was intended to realign the ZOA and spine, which would enable the diaphragm to function normally for breathing and maintaining posture. These exercises are believed to lower resting muscle tone, relax the neuromuscular system, and induce calm breathing. Lower back pain has been linked to impaired breathing ability. [24)] A study of correlation indicates that thoracic spine mobility restriction is linked to persistent lower back pain, and that this link may have an impact on pulmonary function tests. To guarantee that you can breathe and stay stable during the workout, the diaphragm and transversus abdominis must cooperate. During inhalation, the diaphragm and transverse abdominis contract concentrically, but during exhalation, the transverse abdominis contracts eccentrically. One must inhale deeply and then eject violently in order to inflate the balloon. Improved respiratory function may result from stronger diaphragm and transversus abdominis muscles as well as optimal ZOA during inhalation and exhalation. (24)

Conclusion

When treating persistent non-specific lower back discomfort, the ball and balloon exercise combined with spinal stabilization exercises significantly improved pain, functional impairment, and respiratory function compared to core stability exercises alone.

Implications on Physiotherapy Practice

Current knowledge

- Core stability exercises are helpful and very effective in treating persistent lower back pain that is not specific.
- Ball and balloon exercises are an excellent method for relieving persistent, all-over lower back discomfort.
- Ball with balloon exercises can be used with exercises for spinal stabilization. to help with persistent, generalized lower-back discomfort.

What this paper contributes to our knowledge

- When treating chronic non-specific lower back discomfort, exercises integrating stabilizing the core with ball and balloon exercises are more effective than stabilization exercises alone.
- Ball and balloon exercises along with stabilization exercises are more useful than core stability exercises alone when it relates to treating chronic non-specific lower back pain in terms of function.
- Ball with balloon exercises along with stabilization exercises are more useful than stabilization exercises alone for treating persistent non-specific lumbar pain with regard to respiratory function.

Conflict of interest: None

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