International Journal of Yoga, Physiotherapy and Physical Education
ISSN: 2456-5067
Impact Factor: RJIF 5.24
www.sportsjournal.in
Volume 3; Issue 5; September 2018; Page No. 57-61

To compare the effects of Pilates and Swiss ball exercise on chronic nonspecific low back pain and functional disability

Dr. Ankita Barad[1], Dr. Asmita Moharkar[2], Dr. Mahendra Shende[3]
[1] Maharashtra University of Health Sciences, P.E.S. Modern College of Physiotherapy, Pune, Maharashtra, India
[2] Associate professor, P.E.S Modern College of Physiotherapy Pune, Maharashtra, India
[3] Principal, P.E.S. Modern College of Physiotherapy Pune, Maharashtra, India

Abstract
The purpose of the study was to compare the effects of Pilate's exercises & Swiss ball exercises on pain and functional disability in patients with chronic nonspecific low back pain by the end of 6 weeks. 60 participants were divided into 2 groups, 30 in each group (including both males and females) ranging from 18-45 years old along with the inclusion criteria which were randomly selected. Pilates and Swiss ball exercises session were conducted for 3 times per week for about 6 weeks. The subjects were evaluated before and after 6 weeks. Numerical rating scale (NRS) and Oswestry disability index (ODI) was to assess the effects of Pilates and Swiss ball exercises. Statistical analysis of the data was done and significant improvement in numerical rating scale and Oswestry disability index ($p<0.05$) was noted in each group but Swiss Ball exercises prove to be more effective than Pilates. Hence, these result suggested that after 6 week Swiss ball exercises proved more effective on chronic nonspecific low back pain and functional disability than Pilate's exercises.

Keywords: Pilates, Swiss ball, pain, functional disability, numerical rating scale, Oswestry disability index

1. Introduction

Low back pain is an important health problem in all countries. It remains to be a leading cause of disability in population younger than 45 years [1]. Low back pain is defined as the pain localized between 12th rib to the inferior gluteal fold with or without leg pain. [2] Low back pain persisting for more than 12 weeks is considered as chronic.

Chronic non-specific low back pain is caused due to prolonged hours of standing, sitting with awkward posture, bending forward. [1]

The core muscles, which are the primary muscle group for maintaining spinal stability [4], can be divided into two groups according to their functions and attributes.

Local stailizing muscles - is composed of the deep core muscles. These muscles primarily include the transverus abdominis, lumbar multifidus, internal oblique muscle and quadratus lumborum [3]. These muscles provide precise motor control and are thus primarily responsible for spinal stability [6, 7].

Global stabilizing muscles - comprises the shallow core muscles, which includes the rectus abdominis, internal and external oblique muscles, erector spinae, quadratus lumborum, and hip muscle groups. These muscles are not directly attached to the spine, but connect the pelvis to the thoracic ribs or leg joints, thereby enabling additional spinal control [8]. Global stabilizing muscles produce high torque to counterbalance external forces impacting the spine; thus, this group of muscles is secondarily responsible for maintaining spinal stability [6, 7, 9].

When the core muscles function normally, they can maintain segmental stability, protect the spine, and reduce stress impacting the lumbar vertebrae and intervertebral disc [10]; hence, the core muscles are also called "the natural brace" in humans [9].

The causes of CLBP are complex, several of which are unknown [11]. One major cause involves the weakening of the shallow trunk and abdominal muscles. Mitigating CLBP and improving mobility typically involves strengthening these muscles [11] another cause of CLBP is the weakening of or insufficient motor control of the deep trunk muscles, such as the lumbar multifidus and transversus abdominis [1]. During physical activities, the trunk muscle tissues ensure the mobility and stability of the lumbo-pelvic region; thus, changes in trunk muscle activity (particularly in the lumbar multifidus and transversus abdominis) are typically observed in patients with low back pain [4]. Core strength training is directed at training the deep trunk muscles [13].

Pilates: All Pilates exercises flow from the "five essentials" – breathing, cervical alignment, rib and scapular stabilization, pelvic mobility and utilizing the transverses abdominis. Each exercise is initiated by stabilizing the core musculature, which includes the abdominal, gluteal, and paraspinal muscles in particular, and then proceeds through a controlled range of motion.

Pilate's exercises can be performed both on a mat and on specialized equipment called a Reformer [14]. Pilates is a mind-body exercise that targets core stability, strength, flexibility, posture, breathing, and muscle control. It has been recommended in the management of people with chronic

nonspecific low back pain, as this type of exercise may strengthen deep, stabilising muscles that support the lumbar spine, such as transverses abdomen. These muscles are inhibited in people with chronic nonspecific low back pain.

Swiss Ball Exercises: By performing exercise on a Swiss ball, there is decreased balance stability during exercise, thereby increasing muscle work in the core muscles. Swiss ball exercises are proven to facilitate spinal stability and balance. Many researchers have emphasized on using Swiss ball to develop and improve strength, endurance, flexibility and neuromuscular control [15].

2. Methodology

(a) Purpose

The intention of the study was to compare the effects of Pilate's exercises & Swiss ball exercises on chronic nonspecific low back pain and functional disability.

(b) Selection of the subjects

To achieve this purpose of the study 60 patients with chronic nonspecific low back pain between 18-45 years of age with the numerical rating scale score minimum 5 out of 10 and manual muscle testing grade 3 or more out of 5 were selected.

(c) Procedure

Subject were divided into two groups: group A received Pilate's exercises and group B received Swiss Ball exercises. Treatment was given thrice a week for 6 weeks.

Pilates Protocol

Week	Exercise
1	Side kick, one leg stretch.
2	As week 1 plus: the Hundered.
3	As week 2 plus: progression of exercises
4, 5, 6	As week 3 & exercises: swimming, Swan Dive, Roll up, spine twist, one leg circle

5 Key elements to be taught to the subjects before commencing the Pilates protocol.
Neutral spine
Centering
Shoulder blade placement
Rib cage placement
Head and neck placement

1. The modified side kick

Side lying. Underneath arm outstretched in alignment with trunk with head resting on arm, hips bent slightly knees bent up to 90 degrees, other top hand resting on the mat in front of the waist. LEVEL 1- inhale to prepare. Exhale and lift top leg to hip height then glide this top leg forward from the hip joint. Keeping knee bent and other leg at height. Inhale and glide this leg back into alignment with trunk. Repeat 8- 10 times on each side. LEVEL 2- Extend both legs and flex your ankles. Inhale to prepare. exhale and lift top leg, glide the leg forward from the hip joint. inhale to prepare. Exhale and lift top leg, glide the leg forward from the hip joint. Inhale and glide this leg back into alignment with trunk. Repeat 8-10 times.

2. The modified one leg stretch

(Start with crook lying position)
Level 1 – inhale to prepare. Exhale, slide the left heel forward along the floor. Inhale, slide the left heel back along the floor towards the sitting bone. Repeat 8-10 times alternating legs.
Level 2-inhale to prepare. Exhale, float the left leg into table top position. Inhale and hold this position. Exhale, extend the left leg forward and upward on a diagonal line (leg positioned in full knee extension and hip extension to 45 degree) then inhale, fold the left leg back into the table top position. Exhale, lower the left leg to the mat to resume starting position. Repeat 8-10 times alternating legs.

3. The Hundred

Crook lying position.
Level 1- inhale and hold position and focus on up to 10 breath cycles. Optional: Pulse arms up and down in a small arc of movement. Inhale for 5 arm movements and exhale for 5 arm movements.
Level 2- Inhale to prepare. Exhale and raise right knee over right hip. Hold position. Pulse arms up and down in a small arc of movements for up to 100 arm movements. On 5th breath out, lower the right leg to the mat. Repeat on left leg. Repeat 1-2 times on each leg. LEVEL 3- Exhale and raise left knee over left hip. Inhale to hold the position. Exhale, raise right knee over right hip and adducts hips. Hold leg position and restore neutral spine as required. Hold position. Pulse arms up and down in a small arc movement.

4. The Swimming

Quadripod position with neutral neck and spine position with legs in parallel alignment. Inhale to prepare. Exhale and reach the left arm and right leg away from the body, allowing them to hover one inch off the mat. Inhale and lower the arm and the leg to the mat Repeat 6-8 times alternating the opposite arm and leg.

5. The modified swan dive

Lie on your front, legs out straight, hip –distance apart, arms bent up beside the body, with the elbows, slightly below the level of the shoulders, forehead resting on a small cushion or a folded towel, neck long.
Inhale to prepare exhale and lift your breastbone to hover off the floor, allow the and head to follow the movement. Simultaneously, hover the arms one inch off the mat. Inhale and hold the position exhale and lower the breastbone to the mat, allow the neck and head to follow the movement. Simultaneously, lower the arms to the floor. Repeat 6-8 times keeping the neck long.

6. The modified roll up

Sit upright on top of the sitting bone, lumbar spine and pelvis neutral, spine lengthened and upright, shoulders stacked over his. Place one thumb in the belly button and place the other thumb at the base of the breastbone. Scapulae set, neck long. LEVEL 1-Inhale to prepare. Exhale, roll off the back of the sitting bones in a small range of motion to round the pelvis and lumbar spine. The ribcage and the upper quadrant remain still. There should be little change in the distance between

your two thumbs. Inhale, roll forward onto the sitting bone and as above there should be little change in the distance between your two thumbs. LEVEL 2- assuming level 1 starting position. lift both arms to shoulder height, keeping the arms long. complete the roll back as for level 1, aiming for a slightly larger range of motion. ensure that lumbo-pelvis flexion is maintained throughout the roll-back. Repeat 8-10 times.

7. Modified spine twist

sitting up tall on your sitting bones with the soles of the feet together and hips and knees turned outward. neutral spine position, arms folded into the 'cossak' position, neck long. Inhale to prepare. exhale and rotate your spine to the side around a vertical axis, keeping your hips facing forward inhale and hold the stretch. exhale, rotate your upper body back into the centre around a vertical axis, keeping your hips facing forward. Repeat 6-8 times in alternating sides.

8. One leg circle

Start with resting position. Inhale to prepare. Exhale, float the left leg into the tabletop position. inhale and hold the tabletop position. Exhale, circle outward and downward in clockwise direction in a small, controlled range of motion. inhale, complete the circle on this leg by circling inward and upward to finish where the circle started. NOTE: exhale as the leg circles away from the body, inhale as the leg circles inward towards the body. Repeat 6-8 clockwise and anticlockwise circles on both the legs.

Swiss ball exercises

1) Swiss-ball straight arm crunch: Lower back is placed on top of the ball with feet flat on the floor and thighs parallel to the floor. The arms are stretched back over the ball. Upper torso is lifted half way with arms extended to the front.
2) Swiss-ball alternate arm and leg extension: Lie face down with the ball under the pelvis and ribs with knees bent and your arms relaxed on the ball. While balancing on the tip of your toes and finger tips, stretch out the left arm and right leg and then alternate.
3) Swiss-ball wall squat: Start with the ball placed between the wall and your lower back. Stand leaning against the ball keeping your back straight with a natural arch. Stretch out your arms and bend your knees until your upper legs are horizontal to the ground. Maintain a natural arch in your lower back and avoid tilting your hips forward.
4) Swiss-ball Shoulder Bridge: Lie supine on the ground with your lower legs on the ball. Open your arms to the sides. Lift your hips off the ground until there is a straight line from your heels to your upper back.
5) Swiss-ball back extension: Lie face down with the ball under the pelvis and ribs with knees bent and your arms relaxed on the ball. Start slowly straightening your legs and arms as you lift your torso by pushing against the ball with your abdominals. Extend back until your torso is in line with your legs
6) Swiss-ball hamstring curl: Lie supine on the floor and place your lower legs on the ball. Open your arms to the sides. Lift your hips off the ground until there is a straight line from the heels to your upper back like a bridge. Start rolling the ball toward the buttocks until the soles of your feet meet with the ball, then roll back the ball forward. Maintain the bridge position throughout the exercise.
7) Swiss-ball leg raise: Lie supine on the floor with your knees slightly bent and hold the ball between your lower legs (calves). Lift your legs up until the upper thighs touches the lower abdominals while maintaining the same knee angle. Keep your feet off the ground through the exercise.

The exercises will be performed as 2 sets of 10 repetitions in the first 2 weeks and then increased to 3 sets of 12 repetitions…..

(d) Findings

Table 1: shows the gender distribution among 30 subjects. (GROUP A)

Gender	No of subjects
Male	10
Female	20

Table 2: shows the gender distribution among 30 subjects. (GROUP B)

Gender	No of subjects
Male	8
Female	22

Table 3: shows the age wise distribution among 30 subjects. (GROUP A)

Age (in years)	No of subjects
18-23	5
24-29	22
30-35	4

Table 4 shows the age wise distribution among 30 subjects.(GROUP B)

Age (in years)	No of subjects
18-23	4
24-29	22
30-35	5

Table 5: shows the effectiveness of pilates (group A) on all the outcome measure Pre and post analysis was done within group using paired t test which showed significant results.

		Mean ± SD	t value	P value	Significance
NRS	Pre	6.000±0.83	18.044	>0.05	Significant
	Post	3.633±0.83			
Oswestry Index	Pre	34.007±4.129	9.248	>0.05	Significant
	Post	27.995±4.759			

Table 6: shows the effectiveness of Swiss Ball exercises (group B) on all the outcome measure

		Mean ± SD	t value	P value	Significance
NRS	Pre	6.000±0.7878	19.229	>0.05	Significant
	Post	2.600±0.8944			
Oswestry Index	Pre	33.925±3.955	18.371	>0.05	Significant
	Post	19.925±3.715			

Table 7: Post analysis of comparison was done using unpaired t- test and the result showed that group B was more effective than group A in reducing pain and functional disability.

		Mean ± SD	t value	P value	Significance
NRS	Group 1	3.400±0.9685	4.694	<0.0001	Extremely Significant
	Group 2	2.367±0.7184			
Oswestry Index	Group1	14.000±4.171	6.714	<0.0001	Extremely Significant
	Group2	6.185±3.201			

3. Results

Post data analysis shows that group B (Swiss ball exercises) has shown extremely significant improvement in reducing chronic nonspecific low back pain and functional disability in young adult on numerical rating scale and Oswestry disability index as compared to group A (Pilates)

4. Discussion

This project was done to find out the effective approach while treating chronic non-specific low back pain and functional disability in adults. For this purpose Pilates and Swiss ball exercises were considered as treatment approaches. The study was done with the 60 subjects. Each group had 30 subjects. The subjects were assessed and diagnosed to have chronic non-specific low back pain. After the assessment if the subject met with the inclusion criteria then they were randomly distributed to their respective groups. The subjects were explained about the procedure. Before and after the treatment outcome measures were taken. The protocols were given twice a week for 6 weeks. The collected data was analyzed. When the values of pre and post treatment within each group (A and B) were compared by paired t test, both groups (A and B) showed significant difference. When comparision were done between Pilates and swiss ball exercise by using unpaired t test it shows that the Swiss ball exercises is more effective than Pilates.

Core contraction causes activation of the core muscles which causes motor unit recruitment of the muscle fibers causing an increases in the strength of the contractile muscles which help to counter balanced the load on the back, cause decrease in back pain.Hides *et al*., 2001 indicated that the Transverse abdominis and the multifidus play important roles in the stability of the trunk. The weakening of the lumbar extensor muscles is also dominant over the weakening of the lumbar flexor muscles in chronic low back pain patients, so that strengthening of the extensor muscles is important (Mayer *et al*., 1985; 1989). Exercises on unstable surfaces provide stability to the spine due to the co-activation of global and local muscles at the beginning of motor control (Carter *et al*., 2006).And (Cooke, 1980), the use of resistance to body mass in unstable surface without using external resistance increases the integration and recruitment of global and local muscles,which overall effects the increase in muscle activation and improvement in motor control, which ultimately leads to increased muscle strength (Cug *et al.*, 2012).

Also, there are additional benefits of Swiss ball exercises as it leads to a greater level of activation when compare with stable surface. On a unstable surface there is reduction in contact area, increase in perturbations, control of centre of gravity with in limited base of support. The subjects were highly motivated during the training, probably due to fun nature of this program and also their desire to tone up core muscles to improve their body shape.

The endurance of trunk muscles is low in patients with low back pain as compared to individual without low back pain and the poor endurance of trunk muscles may cause strain on structures which leads to low back pain. In the swiss ball exercises the local muscles which composed of type 1 (slow-twitch) muscle fibers allows them to improve trunk endurance

Therefore the approach of Swissball exercises is found to be more effective than Pilate's exercises in reducing chronic non-specific low back pain in adults.

5. Conclusion

Swiss Ball Exercises appeared to be more effective than Pilates in reducing chronic nonspecific low back pain and functional disability in adults.

6. References

1. Costa LO, Fukuda TY, de Freitas DG, Salomão EC, Monteiro RL, Costa Lda C. Efficacy of adding the Kinesio Taping method to guideline-endorsed conventional physiotherapy in patients with chronic nonspecific low back pain: a randomized controlled trial. BMC Musculoskelet Disord. 24 Oct 20131186/1471-2474-14-30M.
2. Krismer MD, M. van Tulder* PhD. The Low Back Pain Group of the Bone and Joint Health Strategies for Europe Project.
3. http://www.chiropractorsstaugustine.com/index.php?p=215948 EFFECT OF HYDROCOLLATOR PACKS
4. Aluko A, DeSouza L, Peacock J: The effect of core stability exercises on variations in acceleration of trunk movement, pain, and disability during an episode of acute nonspecific low back pain: a pilot clinical trial. J Manipulative PhysiolTher, 2013; 36:497-504, e1–e3.
5. Wong AY, Parent EC, Funabashi M, *et al.* Do various

baseline characteristics of transversus abdominis and lumbar multifidus predict clinical outcomes in nonspecific low back pain? A systematic review. Pain, 2013; 154:2589-2602.
6. Huang JT, Chen HY, Hong CZ, *et al*.: Lumbar facet injection for the treatment of chronic piriformis myofascial pain syndrome: 52 case studies. Patient Prefer Adherence, 2014; 8:1105-1111
7. Kumar SP: Efficacy of segmental stabilization exercise for lumbar segmental instability in patients with mechanical low back pain: a randomized placebo controlled crossover study. N Am J Med Sci, 2011; 3:456-461.
8. Ekstrom RA, Donatelli RA, Carp KC. Electromyography analysis of core trunk, hip, and thigh muscles during 9 rehabilitation exercises. J Orthop Sports Phys Ther, 2007; 37:754-762. 9.
9. Ekstrom RA, Donatelli RA, Carp KC: Electromyographic analysis of core trunk, hip, and thigh muscles during 9 rehabilitation exercises. J Orthop Sports Phys Ther, 2007; 37:754-762.
10. Ezechieli M, Siebert CH, Ettinger M, *et al*.: Muscle strength of the lumbar spine in different sports. Technol Health Care, 2013; 21:379-386
11. HuxelBliven KC, Anderson BE: Core stability training for injury prevention. Sports Health, 2013; 5:514-522.
12. Lee CW, Hwangbo K, Lee IS: The effects of combination patterns of proprioceptive neuromuscular facilitation and ball exercise on pain and muscle activity of chronic low back pain patients. J Phys TherSci, 2014; 26:93-96
13. Chang WD, Chang WY, Lee CL, *et al.* Validity and reliability of wii fit balance board for the assessment of balance of healthy young adults and the elderly. J Phys TherSci, 2013; 25:1251-1253
14. Schilling JF, Murphy JC, Bonney JR, *et al.* Effect of core strength and endurance training on performance in college students: randomized pilot study. J Bodyw Mov Ther, 2013; 17:278-290
15. Bethesda MD, National Center for Biotechnology Information, U.S. National Library of Medicine, 20894USA
16. BetulSekendiz, MutluCug, Feza Korkusuz the Journal of Strength and Conditioning Research · Effects of swiss – ball core strength, endurance, flexibility balance on sedentary women.