



Effect of mat and swiss ball based pilates exercises in students with chronic non specific low back pain

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ABSTRACT

Background

Non-Specific Low Back Pain is a major health problem worldwide. Interventions based on exercises have been the most commonly used treatments for students with this condition. Over the past few years, the Pilates method has been one of the most popular exercise programmes used in clinical practice.

Objective

To compare the effectiveness of Mat and Swiss Ball Based Pilates Exercise on functional disability in terms of Modified Oswestry Disability Index (MODI) and Endurance in terms of Ito Test in Students with Chronic Non Specific Low Back Pain (CNSLBP).

Methodology

40 participants between the age of 18 to 25 years with the clinical diagnosis of CNSLBP were selected. Participants were randomly divided into Group (A), which received Mat Pilates exercise and Group (B) received Swiss Ball Pilates exercise for 4 weeks of duration under the guidance of therapist. Pre and post intervention assessments were done.

Result

There was a significant difference seen on comparison between the individuals pre and post interventional statistics of both Groups, nevertheless, when comparison was made between the Post results, there was a significant difference in Group A as compared to Group B.

Conclusion

The current study concluded that Mat based Pilates exercises showed more improvement in both the variables.

Keywords: Pilates Exercises, Chronic Non Specific Low Back Pain, Mat, Swiss Ball, Ito Test, MODI

INTRODUCTION

The Lumbo-Sacral area of the back is also known as lower back. It is made up by the muscles that are attached and surrounds the spine. The spine

is made up of many bones called vertebrae and between each vertebra is a disc. The discs are a combination of a strong fibrous outer layer and a softer, gel-like centre called as nucleus pulposus, is present between the vertebrae. Inter vertebral disc

act as shock absorber, allow the spine to be flexible. To give extra support and strength to the spine ligaments are attached to nearby vertebrae. [1] Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. [2] Low back pain is the second most common cause of disability in adults. [3] The low back pain can be categorized on the basis of the duration and etiology. On the basis of duration low back pain can be classified as acute, sub-acute and chronic. Acute low back pain is in between 0 and 6 weeks, Sub-acute low back pain is in between 6 and 12 weeks and chronic low back pain is more than 12 weeks. [4] On the basis of etiology the incidence or progression of low back pain includes the mechanical aspects of the system (i.e., compression, tension, shear, torsion, rate of loading) along with physiological, psychological, socioeconomic, and psychosocial factors. [5] Non specific low back pain; Non specific low back pain is the most common type of back pain; it can develop for no apparent reason. The severity of the pain can range from mild to severe. Sometimes a pain may develop immediately after you lift something heavy, or after an awkward twisting movement. [6] Chronic non specific low back pain can be treated by various methods like modalities, William's flexion exercises, McKenzie exercises but it has been shown that Pilates exercise have more beneficial effect on chronic non specific low back pain. Pilates exercises mainly involve isometric contractions (i.e. contraction without joint movement) of the core muscles, which make up the muscular centre responsible for the stabilization of the body, both while it is moving or at rest [1].

METHODOLOGY

The participants were selected as per the inclusion criteria and participants were explained about the intervention. 40 subjects were selected and allocated into 2 groups; 20 for mat and 20 for swissball [2]

- Group A: Pilates exercises given on mat
- Group B: Pilates exercises given on swissball

Scales used to assess pain and disability and core strength are

1. Modified Oswestry pain and disability index - The Oswestry Low Back Pain Disability Questionnaire can be used to assess patients with low back pain by determining its impact on the activities of daily living.
2. Ito-test-
 - ✓ For evaluating flexor endurance, subjects were asked to lie in a supine position and to raise the lower extremities with 90° flexion of the hip and knee joints.
 - ✓ For evaluating extensor endurance, subjects were asked to lie in a prone position while holding the sternum off the floor. A small pillow was placed under the lower abdomen to decrease the lumbar lordosis.

During both procedures, subjects were asked to maintain their maximum flexion of cervical spine, with pelvic stabilization through gluteal muscle contraction. Participants were instructed to perform stretching of obliques, transverse abdominis rectus abdominis and spot jogging for 10 minutes before and after the pilates exercise. Pre and post pain can be evaluated by using Modified Oswestry low back pain and disability questionnaire and core strength can be evaluated by Ito-test. Both groups were asked to perform 4 types of core stability exercises for relieving chronic non specific low back pain while focusing on five key elements which are neutral spine, core centering, shoulder blade placement, rib cage placement, head and neck placement. Common Pilates based exercises on swiss ball and mat in this study are: Bridging, Curl up, The hundred prep, Front plank Exercise for mat Group [3].

Bridging on mat

Participant was positioned in crook lying with hands at the side of the body, palm facing downwards. Hips were slowly raised off the ground so that only forearms and heels are in contact with the ground with weight supported across the shoulder area. Avoid pressing the cervical spine into the floor. Lumbar and cervical spine was in neutral position throughout.



Fig 1.1: Bridging on Mat

Curl-up on mat Participant was in crook lying with arms over the head then shoulders and upper back were lifted off the ground. The trunk was slowly

curled and returned to the starting position. Avoid pulling on the head or neck. Neutral posture was maintained between each repetition [4].



Fig 1.2: Curl-up on Mat

The hundred prep: Participant was positioned in supine position, the movement was initiated from the core with elbow under the shoulder and upper arm parallel to the ground. The head was flexed then the leg was lifted to 90-90 and the arm was

pumped till 5 counts. Participant was instructed to inhale during the initiation of movement and exhale during the head flexion and lifting the leg to 90-90 [5].



Fig 1.3: The Hundred Prep

Front plank on mat: Participant was in front plank position with elbow under the shoulder and upper arm perpendicular to the ground. Shoulder and pelvis were raised slowly off the ground;

supporting points were elbow and feet. Balancing the forearm under the shoulder, the spine was kept in neutral and the lower abdomen was drawn in [7].



Fig 1.4: Front Plank on Mat

Exercise for swiss ball group

Bridging on Swiss ball: Participant was positioned in supine position by placing the arms outwards. The feet were placed on the ball, toes pointing forward. The abdominal muscles were drawn in towards the

spine. The abdominals and gluteus were contracted and hips were raised off the floor. Ensure that toe should be in neutral position. Avoid the outward rotation of the toes.



Fig 1.5: Bridging on Swiss Ball

Curl-up on Swiss ball: Participant was in supine position with lower back supported on the ball. Hands were clasped behind the head and feet were shoulder width apart then the lower abdominal

muscles were drawn in towards the spine. The spine was slowly flexed with the abdominal muscles drawn in and the cervical spine was kept in neutral with the chin tucked.



Fig 1.6: Curl-up on Swiss Ball

The hundred prep: Participant was in supine position with elbow under the shoulder and upper arm perpendicular to the ground and leg bent to 90-90 on swiss ball. The head was slowly flexed then

the arm was pumped till 5 counts. Participant was instructed to inhale during the initiation of the movement and exhale during the head flexion.



Fig 1.7: The Hundred Prep on Swiss Ball

Front plank on Swiss ball: Participant was in front plank position on the Swiss ball with elbow under the shoulder and upper arm perpendicular to the ground. Shoulder and pelvis were slowly raised

off the ground; supporting points were elbow and feet. Balancing the forearm under the shoulder, the spine was kept in neutral and the lower abdomen was drawn in.



Fig 1.8: Front Plank on Swiss Ball

This protocol was given for 5 days for 4 weeks with 8-10 repetitions of all the exercises per session, baseline characters were Ito test and

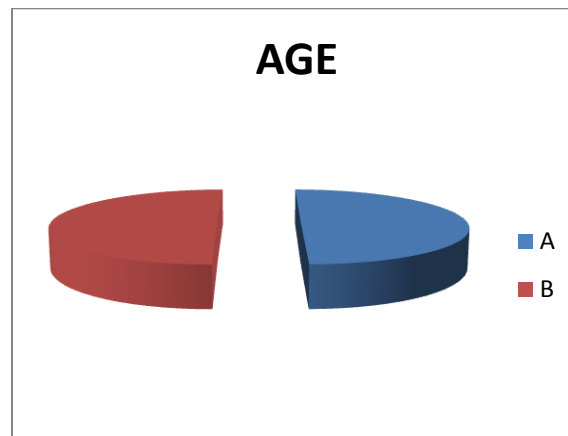
Modified Oswestry Disability Index was taken on first and last day of treatment and then results were tabulated.

RESULTS AND DISCUSSION

Age distribution of participants in group A and group B

Table 1.1: Age Distribution

GROUPS	MEAN OF AGE IN YEARS	SD OF AGE IN YEARS
GROUP A	20.2	2.215
GROUP B	20.55	2.089



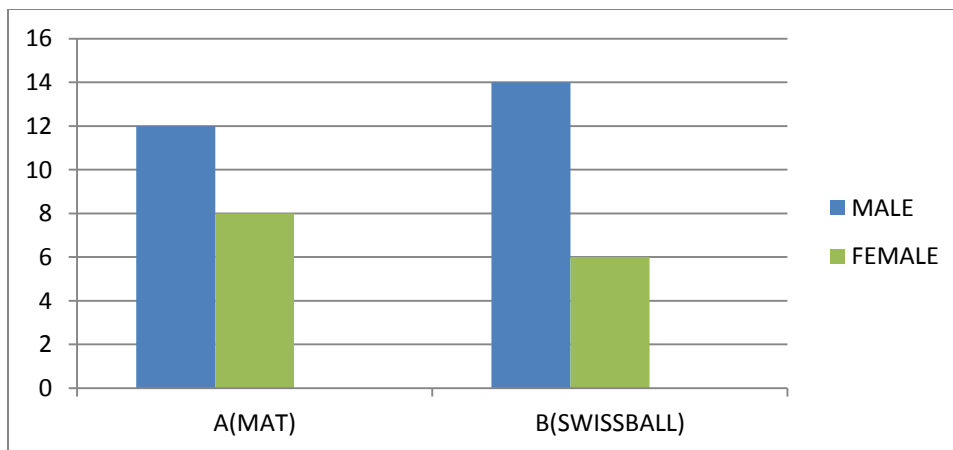
GRAPH 1.1: Mean of Age in Group A and Group B

The average age of Group A was 20.2 +_ 2.215 years and in Group B was 20.55+_2.089 years.

Comparison of Male and Female Ratio in percentage of group A and group B

Table 1.2 Male and Female Ratio in Percentage

GROUPS	MALE	PERCENTAGE	FEMALE	PERCENTAGE
GROUP A	12	60%	8	40%
GROUP B	14	70%	6	30%



GRAPH 1.2: Male and Female in Group A and Group B

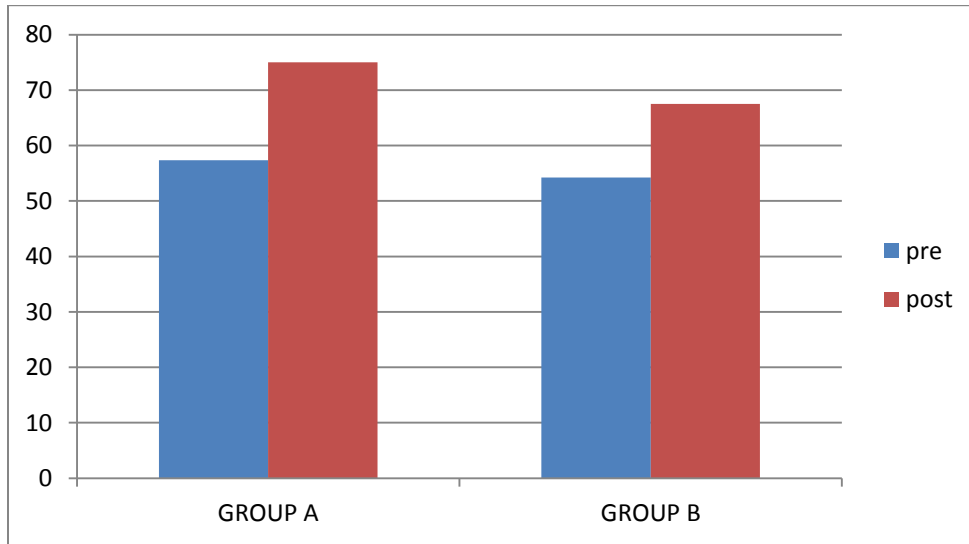
There were 12 (60%) male and 8 (40%) female in Group A receiving Mat Based Pilates. There were 14 (70%) male and 6 (30%) female in Group B

receiving SwissBall Based Pilates. The duration of treatment in both the Groups was for 4 weeks.

Comparison of Pre and Post ITO test for Flexor Endurance in Group A and Group B

Table no. 1.3: Pre and Post Ito Test for Flexor Endurance in Group A and Group B

GROUPS	INTERVENTION	MEAN	SD	t value	p value	RESULTS
GROUP A	PRE	57.35	14.985	10.467	<0.0001	EXTREMELY SIGNIFICANT
	POST	75	18.567			
GROUP B	PRE	54.25	20.601	12.698	<0.0001	EXTREMELY SIGNIFICANT
	POST	67.5	21.975			

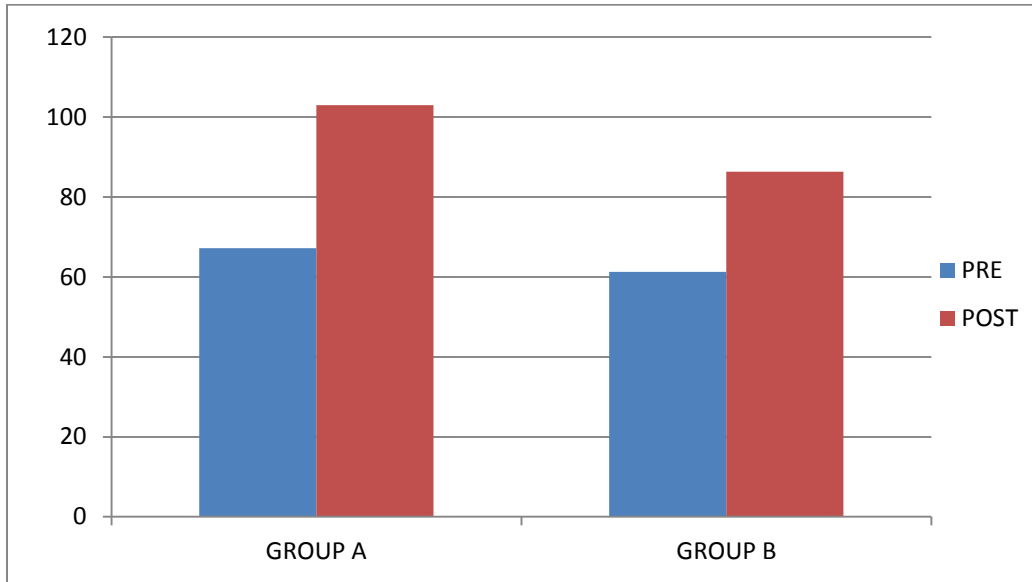


GRAPH 1.3: Comparison of Pre and post Ito Test for Flexor Endurance in Group A and Group B by using paired t test in which p value for mat is <0.0001 and t value is 10.67 it is considered extremely significant and for swissball p value is 0.0001 and t=10.467 it is considered extremely significant.

Comparison of Pre and Post Ito test for Extensor Endurance in Group A and Group B

Table no. 1.4: Pre and Post Ito Test for Extensor Endurance in Group A and Group B

GROUPS	INTERVENTION	MEAN	SD	t value	p value	RESULTS
GROUP A	PRE	67.2	12.755	10.467	<0.0001	EXTREMELY SIGNIFICANT



GRAPH 1.4: Comparison of pre and post ITO test for extensor endurance in Group A and Group B using paired t test in which p value for mat is <0.0001 and t value is 10.467 it is considered extremely significant and for swissball p value is <0.0001 and t=7.611 it is considered extremely significant.

Comparison of Post ITO test for Flexor Endurance in Group A and Group B

Table no. 1.5: Post Ito Test for Flexor Endurance in Group A and Group B

GROUPS	INTERVENTION	MEAN	SD	t value	p value	RESULTS
GROUP A	POST	17.65	77.969	2.131	0.0396	CONSIDERED SIGNIFICANT
GROUP B	POST	13.25	4.667			

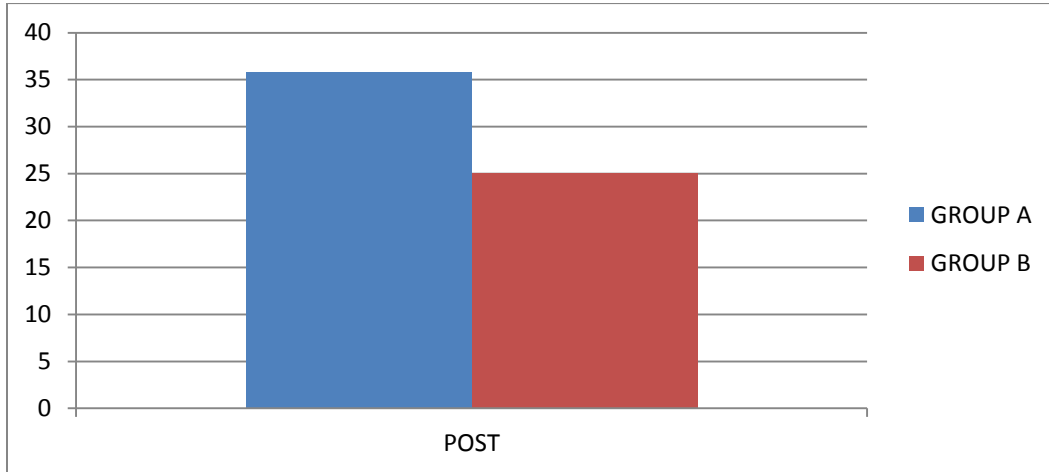


GRAPH 1.5: Comparison of post Intervention Ito score for flexor endurance in Group A and Group B using unpaired t test in which p value is p value is 0.0396 and t value is 2.131; it is considered significant

Comparison of Post Ito test for Extensor Endurance in Group A and Group B

Table no. 1.6: Post Ito Test for Extensor Endurance in Group A and Group B

GROUPS	INTERVENTION	MEAN	SD	t value	p value	RESULTS
GROUP A	POST	35.8	15.296	2.777	0.0285	CONSIDERED SIGNIFICANT
GROUP B	POST	25	14.690			

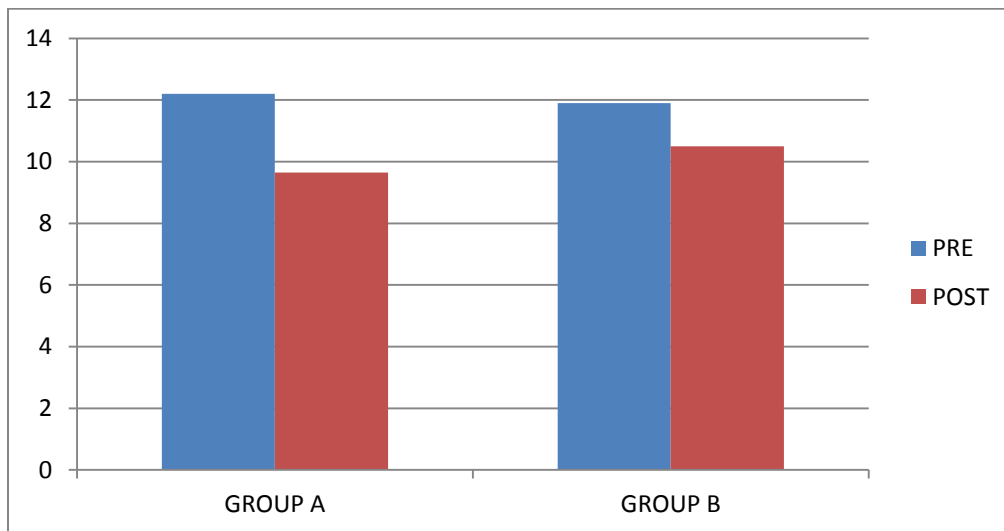


GRAPH 1.6: Comparison of post Intervention Ito score for extensor endurance in Group A and Group B using unpaired t test in which p value is p value is 0.0285 and t value is 2.777; it is considered significant

Comparison of Pre-Intervention and Post- Intervention MODI scoring in both the Groups:

Table 1.7 Pre-Post MODI score in Group A and Group B

GROUPS	INTERVENTION	MEAN	SD	t value	p value	Results
GROUP A	PRE	12.2	1.642	5.156	<0.001	EXTREMELY SIGNIFICANT
	POST	9.65	1.755			
GROUP B	PRE	11.9	1.997	2.268	0.0291	SIGNIFICANT
	POST	10.5	1.906			

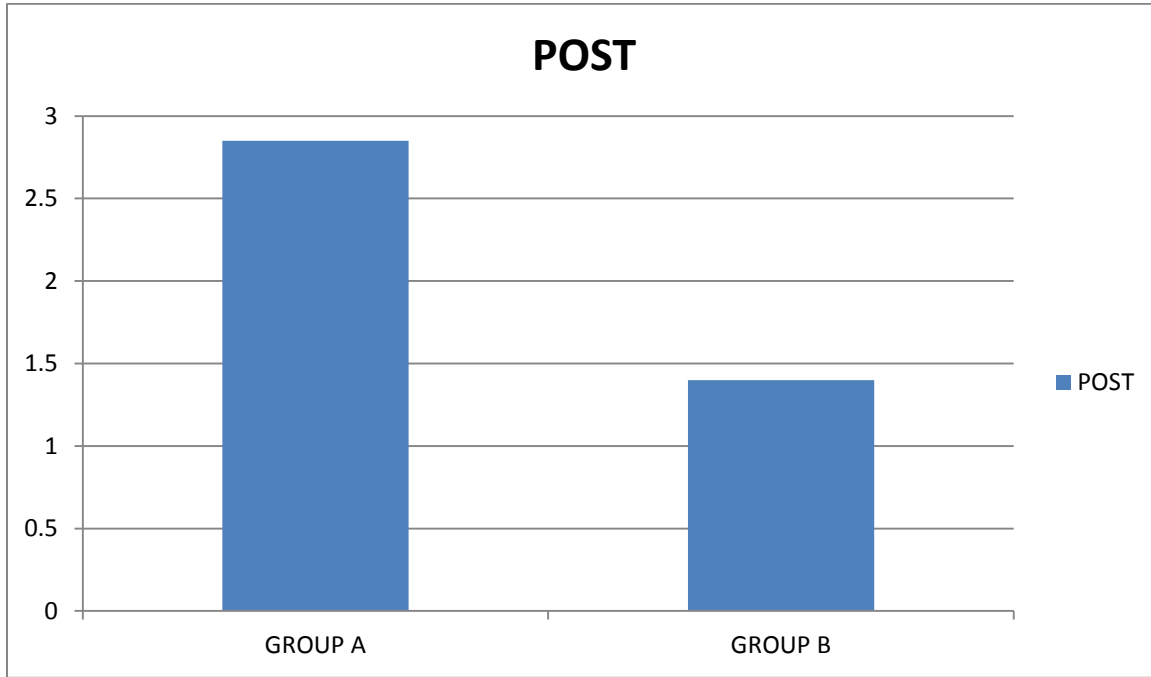


Graph 1.7: Comparison of pre and post Intervention MODI score in Group A and Group B using paired t test in which p value is p value is 0.0291 and t value is 2.268 ; it is considered significant

Comparison of Post- Intervention MODI scores in Group A and Group B

Table 1.8 POST MODI score in Group A and Group B

GROUPS	INTERVENTION	MEAN	SD	t value	p value	RESULTS
GROUP A	POST	2.85	1.785	3.444	0.0014	CONSIDERED SIGNIFICANT
GROUP B	POST	1.4	0.5982			



Graph 1.8: Comparison of Post Intervention MODI score in Group A and Group B using unpaired t test in which p value is 0.0014 and t value is 3.444; it is considered significant.

DISCUSSION

Low back pain is a condition which can be treated by wide variety of physiotherapy interventions. Present study was undertaken to find out effectiveness of mat and swissball based Pilate’s exercise, by using ITO test for core strength and endurance and modified Oswestry pain and disability scale. The intervention included 4 Pilate’s exercises given to all the participants in Group A and Group B on mat and swiss ball respectively for 3 weeks. The four Pilates exercises which are used to relieve low back pain are: bridging, curl up, hundred prep exercises, front plank. Bridging, a body weight strength training exercise, helps muscles in the back and hips (erector spinae, gluteus maximus, hamstring) to work together to coordinate the lifting of the hips and also improves the strength of core muscles. Curl ups are an effective way to strengthen the muscles of your abdomen specifically the rectus

abdominis, external and internal oblique. During hundred prep exercise, breathing and percussive pumping of arms not only increases oxygen exchange and blood circulation but also activates pelvic floor muscles and abdominal muscles. During front plank body weight borne on forearm, elbows, and toes strengthens erector spinae, rectus abdominis, transverse abdominis, trapezius, rhomboids, deltoid, pectorals, gluteus maximus, quadriceps, and gastrocnemius. The results of the present study are such that, intervention given on mat and swiss ball showed significant changes in the strength of muscles but when the effects of the intervention on mat and swiss ball were compared no significant changes were seen according to ITO test whereas according to MODI, pain and disability index were reduced more when participants were trained on swiss ball than on mat. As per our knowledge this is the first study which compares the effect of mat and swissball based pilates exercises in students with chronic non

specific low back pain with 4 weeks of intervention.

MAT

Mat Pilates concentrates mainly on Mat Based Pilates Exercises, is a gentle form of exercise which makes it more suitable for the patients with back pain and those recovering from injury. Pilates can also help to prevent the recurrence of low back pain. Uses of Mat based Pilates Exercises; it eases back pain, Strengthen the core, Increases your flexibility, It makes a great cross training workout, Improves posture, It builds cardiovascular endurance mat has a stable surface which provides sufficient stability to the spine preventing injury that occurs from uneven stress patterns on back and discs. It also improves the mobility of the hip and shoulder joints, balancing the sides of the body, aiding in creating postural symmetry which may trickle into the individual's daily awareness of how they hold their body during daily activities.

Swiss ball

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 part of a rehabilitation programme. Uses of Swiss Ball Based Pilates Exercises; Improve muscle tone and endurance, improve posture, improve balance, increase flexibility, experience greater self confidence and the body responds naturally and automatically to this instability to keep balanced on the exercise ball. Over time, the muscle used to keep in balance on the Swiss Ball become stronger. In essence, individuals build strength in important back muscles and abdominal muscles without knowing it. SwissBall has a dynamic surface in which the level of muscle activity increases and in order to stabilize the spine, muscles co-activation takes place, suggesting a higher demand on the motor control system. More muscle activity is seen when exercises are performed in mid range.⁷The biggest benefit to training using Swiss Ball Exercises is that they are very effective at targeting core

muscles, those muscles that are essential for stability and good posture but are often overlooked when exercising in fixed position.

CONCLUSION

From the above analysis, it is clear that both core stabilisation exercise on Mat and SwissBall have an effect on improving the endurance by Ito Test and reducing the pain and disability among Chronic Non Specific Low Back Pain on MODI. There is significant difference on core stabilisation exercise on Mat compared to core stabilisation exercise on SwissBall between 2 Groups. Hence our Null Hypothesis is rejected and Alternate Hypothesis is accepted. This result suggests that the core stabilisation exercise with Mat is more effective than the core stabilisation exercise on SwissBall in improving endurance and reducing pain and disability among Chronic Non Specific Low Back Pain participants in a very short period of time.

Acknowledgement

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