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EFFECTIVENESS OF CORE STABILITY EXERCISES ON AND OFF THE SWISS BALL ON PAIN, RANGE OF MOTION, AND DISABILITY AMONG SUBJECTS WITH NONSPECIFIC LOW BACK PAIN

Physiotherapy

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ABSTRACT

Background: Nonspecific low back pain (NSLBP) is among the most prevalent musculoskeletal disorders and a major cause of disability worldwide. Core stability exercises have proven efficacy, but the influence of exercise surface—unstable (Swiss ball) versus stable (floor)—is less explored. **Objective:** To determine and compare the effectiveness of core stability exercises on and off the Swiss ball on pain, range of motion, and functional disability in NSLBP patients. **Methods:** Thirty participants (aged 25–50 years) with NSLBP were randomized into Group A (Swiss ball, n=15) and Group B (floor, n=15). Both groups received interferential therapy followed by four progressive core exercises (pelvic tilts, bird-dog, bridging, dead bug) for four weeks. Pain was assessed using the Numerical Pain Rating Scale (NPRS), lumbar mobility by Modified Schober's Test (MST), and disability by Oswestry Disability Index (ODI). Data were analyzed using SPSS v21 with paired and independent t-tests. **Results:** Both groups showed significant improvement in pain, ROM, and disability ($p<0.05$). Group A demonstrated greater reductions in NPRS (6.93→3.07 vs. 7.00→4.40), greater gains in MST flexion (3.20→6.13 vs. 3.47→5.27) and extension (1.13→1.87 vs. 1.07→1.40), and a larger reduction in ODI scores (48.40→21.13 vs. 47.60→29.20). **Conclusion:** Core stability exercises effectively reduce pain and disability in NSLBP, with Swiss ball–based training providing superior benefits compared to floor-based exercises. These findings highlight the therapeutic value of instability-based training in rehabilitation.

KEYWORDS

Nonspecific Low Back Pain, Core Stability, Swiss Ball, Disability, Physiotherapy.

INTRODUCTION

Low back pain (LBP) remains the most common musculoskeletal disorder affecting up to 84% of adults at some point in life and is the leading cause of years lived with disability (1). Nearly 90% of cases are nonspecific low back pain (NSLBP), defined as lumbar pain not attributable to structural pathology (2). In India, lifetime prevalence is 60–70%, with high personal and socioeconomic impact due to absenteeism, reduced productivity, and treatment costs (3).

Risk factors for NSLBP include sedentary lifestyles, poor posture, core weakness, repetitive lifting, and psychosocial stress (4). Clinically, NSLBP presents as diffuse lumbar pain with stiffness and reduced range of motion but usually without neurological deficits (5). Physiotherapy is central to management, targeting pain relief, restoration of spinal function, and prevention of recurrence (6).

Core stability exercises specifically target deep stabilizing muscles such as transversus abdominis and multifidus, which are often delayed or inhibited in NSLBP (7). Improved activation enhances spinal support, reduces strain on passive structures, and restores lumbar control. Exercises may be performed on a stable surface (floor) or an unstable surface (Swiss ball). Swiss ball training demands greater neuromuscular activation and proprioceptive feedback, which may yield superior outcomes (8).

Despite growing use of Swiss ball exercises, limited comparative evidence exists on their effectiveness versus floor-based training. This study investigates whether performing identical core stability exercises on an unstable surface confers greater benefit in pain reduction, range of motion, and disability improvement among NSLBP patients.

Methodology

Design: Experimental two-group pre-test and post-test study.

Sample: Thirty patients (25–50 years) diagnosed with NSLBP were recruited from physiotherapy outpatient departments at SVIMS and BIRRD, Tirupati. Simple random sampling allocated 15 subjects each into Group A (Swiss ball) and Group B (floor). Ethical approval and informed consent were obtained.

Inclusion: Pain score 4–8 on NPRS, moderate to severe disability (ODI), symptom duration 3–6 weeks.

Exclusion: prior spine injury, surgery, disc pathology, systemic illness, or recent physiotherapy.

Intervention: All subjects received interferential therapy (IFT) for 10 minutes before exercise. Group A performed core stability exercises on a Swiss ball; Group B performed identical exercises on a floor mat. Exercises included pelvic tilts, bird-dog, bridging, and dead bug, conducted 3–5 sessions weekly for 4 weeks. Progression involved increasing repetitions and hold times.

Outcome Measures:

- Pain: Numerical Pain Rating Scale (0–10).
- Lumbar mobility: Modified Schober's Test (MST, flexion & extension).
- Disability: Oswestry Disability Index (ODI, % disability)

Treatment Protocol

A total of 30 subjects with nonspecific low back pain were randomly allocated into two groups:

- Group A (Experimental): Core stability exercises on Swiss ball
- Group B (Control): Core stability exercises on floor mat

All participants were assessed pre- and post-intervention using:

- Pain: Numerical Pain Rating Scale (NPRS)
- Mobility: Modified Schober Test (MST)
- Disability: Oswestry Disability Index (ODI)

Each session began with 10 minutes of Interferential Therapy (IFT) for pain relief and relaxation, followed by a 5-minute warm-up (spot jogging, free exercises, stretching).

Core Stability Exercises (4):

1. Pelvic Tilts
2. Bird-Dog
3. Bridging
4. Dead Bug

Group A performed exercises using a Swiss ball, while Group B performed the same exercises on the floor.

Exercises were supervised for correct posture, breathing, and engagement.

Progression (3–5 sessions/week):
- Week 1: 6 reps
- Week 2: 9 reps
- Week 3: 12 reps
- Week 4: 15 reps with 5–10 sec hold

Rest interval: 2–3 minutes with light stretching.

Each session lasted 20–35 minutes. At the end of each session, subjects performed cool-down exercises (light aerobic activity and stretching). Participants were monitored for discomfort, and modifications were made if needed.

At the end of 4 weeks, post-test scores (NPRS, MST, ODI) were recorded for statistical analysis to evaluate the effectiveness of Swiss ball vs. floor-based core stability training.

Fig1:- Pelvic Tilt on Swiss Ball

Fig:-2 Bird Dog on Swiss Ball

Fig:3 Bridging on Swiss Ball

Fig:- 4 Dead Bug on Swiss Ball

Fig:-5 Pelvic Tilting on the Floor

Fig:-6 Bird Dog on the Floor

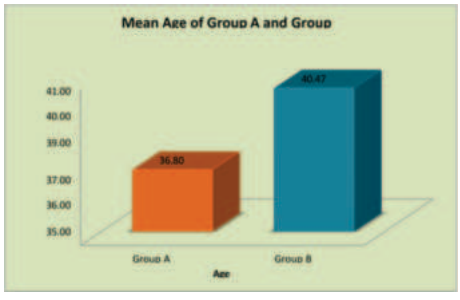
Fig:-7 Bridging on the Floor

Fig:-8 Dead Bug on the Floor

Statistical Analysis

Table1:- Mean Age of Participants in Group A and Group B

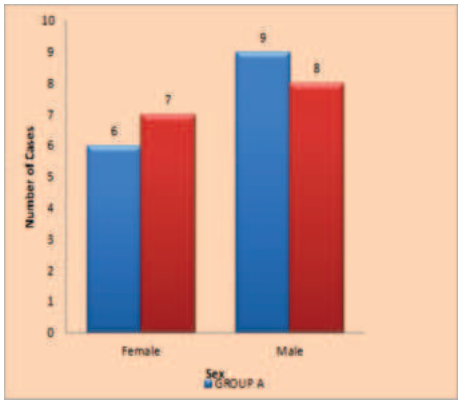
	Group	N	Mean	Std. Deviation
AGE	Group A	15	36.80	9.51
	Group B	15	40.47	7.38



Graph 1:- Mean age of Group A and Group B

Table 2: - Gender Wise Distribution in Group A and Group B

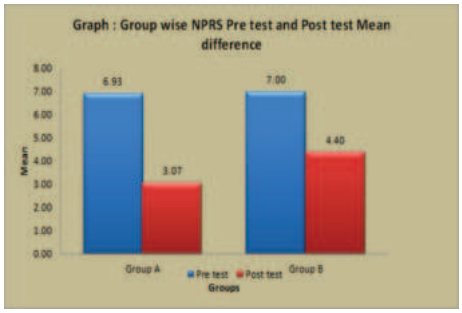
Groups	Sex		Total
	Female	Male	
GROUP A	6	9	15
GROUP B	7	8	15
Total	13	17	30



Graph 2: - Gender Wise Distribution in Group A and Group B

Table 3: - Mean of NPRS Pre and Post Values in Group A and B

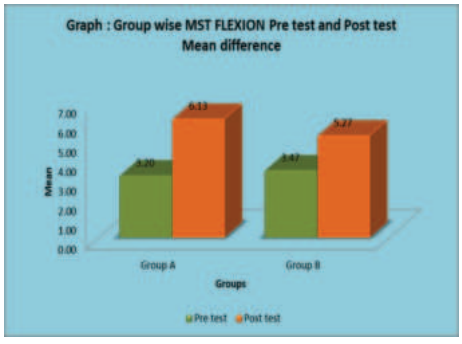
Variable	Groups	Pre test		Post test		p value
		Mean	S.D	Mean	S.D	
NPRS	Group A	6.93	0.799	3.07	0.884	0.000
	Group B	7.00	0.845	4.40	0.737	0.000



Graph 3:- Comparison of Mean Values of NPRS Between Pre and Post Test in Group A & B

Table 4:-Mean of MST [FLEXION] Pre and Post Test Scores in Group A and B

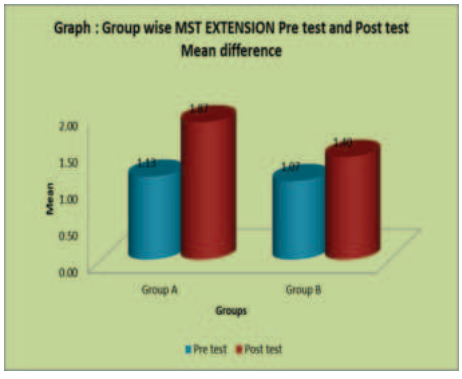
Variable	Groups	Pre test		Post test		p value
		Mean	S.D	Mean	S.D	
MST-FLEXION	Group A	3.20	0.414	6.13	0.516	0.000
	Group B	3.47	0.516	5.27	0.594	0.000



Graph4; Comparison of Mean Values of MST[FLEXION] Between Pre and Post Test in Group A and B

Table: 5 Mean of MST [EXTENSION] Pre and Post Test Scores in Group A and B

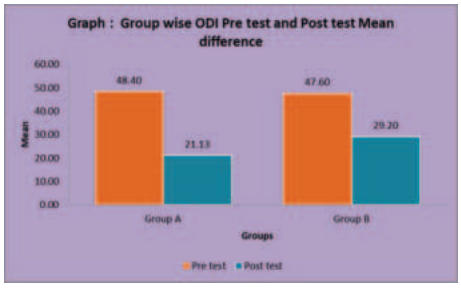
Variable	Groups	Pre test		Post test		p value
		Mean	S.D	Mean	S.D	
MST-EXTENSION	Group A	1.13	0.352	1.87	0.352	0.000
	Group B	1.07	0.258	1.40	0.507	0.019



Graph 5: Comparison of mean values of MST[EXTENSION] between Pre and Post test in Group A and B

Table:6 Mean of ODI Pre and Post Test Scores in Group A and Group B

Variable	Groups	Pre test		Post test		p value
		Mean	S.D	Mean	S.D	
ODI	Group A	48.40	7.642	21.13	3.907	0.000
	Group B	47.60	7.059	29.20	7.476	0.000



Graph:6 Comparison of Mean Values of ODI Between Pre and Post test in Group A and B

RESULTS

Both groups improved significantly in pain, ROM, and disability. However, Group A (Swiss ball) demonstrated greater benefits.

Pain (NPRS): Group A reduced from 6.93±0.79 to 3.07±0.88; Group B from 7.00±0.84 to 4.40±0.73 ($p<0.001$).

ROM (MST Flexion): Group A improved from 3.20±0.41 cm to 6.13±0.51 cm; Group B from 3.47±0.51 cm to 5.27±0.59 cm.

ROM (MST Extension): Group A improved from 1.13±0.35 cm to 1.87±0.35 cm; Group B from 1.07±0.25 cm to 1.40±0.50 cm.

Disability (ODI): Group A decreased from 48.40±7.64 to 21.13±3.90; Group B from 47.60±7.05 to 29.20±7.47.

Between-group comparisons confirmed superior improvement in Group A.

DISCUSSION

This study demonstrates that core stability exercises significantly reduce pain and disability and improve lumbar ROM in NSLBP. Findings align with prior studies showing the efficacy of core stability programs in spinal rehabilitation (4,7). Both groups improved, but Swiss ball–based training yielded superior outcomes across all measures.

Swiss ball training enhances proprioception and muscle activation due to surface instability. EMG studies confirm higher activation of abdominal stabilizers during Swiss ball exercises than on stable surfaces (6,8). Enhanced neuromuscular control may explain the greater reductions in NPRS and ODI observed. Improved ROM also reflects better spinal flexibility and functional restoration.

The findings support instability-based training for functional recovery. Similar results were reported by Behm et al. (2010), emphasizing the role of unstable training in improving trunk stabilization (9). Additionally, Kumar et al. (2015) highlighted improved outcomes from structured core strengthening, further corroborating present results.

Clinical Implications: Incorporating Swiss ball training may maximize rehabilitation outcomes in NSLBP by addressing proprioceptive deficits and muscle inhibition. Such interventions are simple, cost-effective, and adaptable in outpatient physiotherapy settings.

CONCLUSION

Core stability training effectively reduces pain, improves lumbar range of motion, and decreases disability in nonspecific low back pain. Swiss ball–based exercises produced greater benefits than floor-based training, highlighting the therapeutic value of instability in rehabilitation. These findings suggest Swiss ball exercises should be incorporated routinely in physiotherapy programs for NSLBP management.

Limitations

Limitations include small sample size, short 4-week duration, lack of long-term follow-up, and reliance on self-reported outcomes. Generalizability is limited by single-center setting and exclusion of older adults

Recommendations

Future studies should include larger, diverse samples with long-term follow-up and objective assessments (e.g., EMG, motion analysis).

Exploring integration of Swiss ball training with other evidence-based interventions may further enhance outcomes.

REFERENCES

1. Balagué F, Mannion AF, Pellisé F, Cedraschi C. Non-specific low back pain. Lancet. 2012;379(9814):482–91.
2. Koes BW, van Tulder M, Thomas S. Diagnosis and treatment of low back pain. BMJ. 2006;332(7555):1430–4.
3. Dagenais S, Caro J, Haldeman S. A systematic review of low back pain cost of illness. Spine J. 2008;8(1):8–20.
4. Hodges PW, Richardson CA. Inefficient muscular stabilization of the lumbar spine in low back pain. Spine. 1996;21(22):2640–50.
5. Vlaeyen JW, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain. Pain. 2000;85(3):317–32.
6. Marshall PWM, Murphy BA. Core stability exercises on and off a Swiss ball. Arch Phys Med Rehabil. 2005;86(2):242–9.
7. Macedo LG, Maher CG, Latimer J, McAuley JH. Motor control exercise for persistent NSLBP. Cochrane Database Syst Rev. 2009;(1):CD001254.
8. Gillani SA, Shah S, Shaikh R. Role of Swiss ball exercise on chronic nonspecific low back pain. Rawal Med J. 2015;40(4):456–60.
9. Behm DG, Drinkwater EJ, Willardson JM, Cowley PM. Instability to train the core. Appl Physiol Nutr Metab. 2010;35(1):109–12.
10. Kumar T, Kumar S, Nezamuddin M, Sharma VP. Efficacy of core muscle strengthening exercise in chronic low back pain. J Back Musculoskelet Rehabil. 2015;28(4):699–707.