

Effect of Swiss Ball Versus Floor Exercises in Patients with Mechanical Low Back Pain: A Comparative Study

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Abstract

Purpose. Mechanical low back pain is a prevalent health issue that necessitates effective non-surgical treatment options. While exercise therapy is a fundamental component of conservative care, further research is needed to compare the efficacy of various exercise approaches. This study aimed to determine the effectiveness of Swiss ball exercises and floor-based exercises in individuals with mechanical low back pain.

Material & Methods. A comparative study was conducted with participants divided into two intervention groups. Group A received a moist heat pack application for 15 minutes, followed by Swiss ball exercises, while Group B received a moist heat pack application for 15 minutes, followed by floor exercises. Outcome measures included the Visual Analog Scale (VAS) for pain intensity, the Oswestry Disability Index (ODI) for functional disability, and the Dynamic Abdominal Endurance Test (DAET), the Dynamic Extensor Endurance Test (DEET), and the Manual Testing (MT) for muscle endurance and strength evaluation. Assessments were performed at baseline and after the intervention period.

Results. Both intervention groups demonstrated significant improvements across all outcome measures. Analysis of pre- and post-intervention data revealed that both Swiss ball exercises and floor exercises effectively reduced pain intensity scores on VAS, decreased functional disability ratings on ODI, and improved muscle endurance and strength as measured by DAET, DEET and MT.

Conclusions. Both Swiss ball exercises and floor exercises, when combined with moist heat application, provide effective therapeutic benefits for patients with mechanical low back pain, including pain reduction, decreased functional disability, and enhanced muscle endurance and strength.

Keywords: Mechanical low back pain, Swiss ball exercises, floor exercises, rehabilitation, pain management, muscle endurance.

Introduction

In today's society, modern work patterns, including increased sedentary office roles, corporate lifestyles, and the recent shift to remote work, have led to a significant decline in physical activity. This reduction in movement has corresponded with a rise in lower back pain (LBP) and related musculoskeletal issues (Hartvigsen et al., 2018). LBP typically manifests as pain, stiffness, or discomfort, primarily localized in the gluteal

fold, with leg muscle pain being less common (Khan et al., 2018). While approximately half of the cases resolve spontaneously, 30-35% of patients require therapeutic intervention, and the remaining cases develop into chronic conditions demanding specialized, long-term care (Foster et al., 2018).

Core abdominal musculature plays a crucial role in the rehabilitation of patients suffering from LBP. These muscles provide essential support,

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strength, and protection to the lumbar region (Coulombe et al., 2017). Research demonstrates that insufficient trunk muscle development significantly increases vulnerability to LBP compared to individuals with well-developed core strength (Akhtar et al., 2017). Various etiologies can underlie LBP, including nerve compression and herniated discs, highlighting the complex nature of this condition (Maher et al., 2017).

The lower back is anatomically complex, featuring multiple joints, intervertebral discs, and an abundant muscular network. Somatic dysfunction within these muscles frequently contributes to LBP, emphasizing the importance of comprehensive patient assessment (Allegri et al., 2016). Clinicians must consider multiple factors when evaluating LBP patients, including age, pain duration, occupation, and risk factors such as obesity, poor general health, frequent heavy lifting, and weak abdominal muscle tone (Parreira et al., 2018). Even student populations carrying heavy backpacks demonstrate increased susceptibility to developing LBP (Yamato et al., 2018; Nageswari et al., 2025).

Swiss ball exercises have gained popularity as an effective intervention for LBP rehabilitation, with studies suggesting improvements in core stability and proprioception (Searle et al., 2015). Conventional floor exercises also demonstrate effectiveness in managing LBP through targeted strengthening of paraspinal and abdominal muscles (Owen et al., 2020; Rajan Balakrishnan et al., 2016). This study aims to compare the therapeutic efficacy of Swiss ball exercises versus conventional floor exercises in reducing pain and disability while improving muscle endurance in patients with mechanical LBP. By examining these distinct exercise modalities, we seek to provide evidence-based recommendations for clinical rehabilitation protocols that optimize patient outcomes and recovery.

Material and Methods

Subjects

This comparative study recruited thirty subjects (7 males and 23 females) aged between 20-30 years from Delhi and Delhi NCR residential areas. All participants were diagnosed with mechanical low back pain with symptoms lasting more than 6 weeks. The study excluded individuals with congenital disorders, degenerative conditions, and pregnant females. Subjects who met the inclusion criteria were provided with detailed information about the study, and informed consent was obtained from each participant before enrollment. The subjects were then randomly assigned to either Group A or Group B, with 15 participants in each group.

Assessment

Assessment of all participants was conducted using validated tools, including the Visual Analog Scale (VAS) for pain intensity, the Oswestry Disability Index (ODI) questionnaire for functional disability, the Dynamic Abdominal Endurance Test (DAET), the Dynamic Extensor Endurance Test (DEET), and the Manual Testing (MT) for muscle endurance and strength evaluation. The assessment was performed twice - at baseline (pre-intervention) and after completion of the 4-week intervention program (post-intervention). These tools were selected to comprehensively evaluate pain levels, functional limitations in activities of daily living, and muscle endurance capacity in patients with mechanical low back pain.

Protocol

The intervention protocol consisted of two distinct exercise regimens. Group A received a moist heat pack application for 15 minutes, followed by Swiss ball exercises, while Group B received a moist heat pack application for the same duration, followed by floor exercises. Both groups performed similar exercise types, including multifidus exercises, back extension exercises, and abdominal crunches, with the only difference being the exercise surface (Swiss ball vs. floor). The intervention was conducted over 4 weeks with a frequency of 3 sessions per week. Each session was carefully monitored to ensure proper execution of exercises. The study tools utilized included a mattress, a towel, a moist heat pack, a Swiss ball, and standard assessment forms.

Data Extraction and Analysis

The data extraction process was systematically conducted at baseline (pre-intervention) and after completion of the 4-week intervention (post-intervention). All 30 participants (15 in each group) completed the full 12 training sessions over the 4-week intervention period. The collected data included demographic information (age and gender), pain intensity measured using VAS, functional disability assessed through ODI, and muscle endurance evaluated using DAET, DEET), and MT.

All collected data was systematically organized and entered into SPSS version 20.0 for statistical analysis. Descriptive statistics including means and standard deviations were calculated for each parameter. Independent t-tests were used to compare baseline characteristics between groups to ensure homogeneity. Paired t-tests were employed to analyze within-group changes from pre- to post-intervention. Between-group comparisons for post-intervention measures were conducted using independent t-tests. Statistical significance was established at $p < 0.05$ for all analyses.

Table 1. Demographic Characteristics of Study Participants

	Group A	Group B	P- Value
Age (years)	23.1±2.1	22.1±2.1	0.213
Male	4 (26.7%)	3 (20%)	0.673
Female	11 (73.3%)	12 (80%)	0.673

Results

Analysis of baseline data revealed no significant differences between Group A and Group B in terms of demographic characteristics and outcome measures, indicating successful randomization and homogeneity between groups at the start of the intervention (Table 1). The normality of the data was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Data was found to be near normal, and parametric t-test statistical methods were considered. Paired t-test for within-group analysis and unpaired t-test for between-group analysis. Both groups showed substantial improvements in all outcome meas-

ures following the 4-week intervention period.

The statistical analysis of within-group changes from pre- to post-intervention demonstrated significant improvements in all outcome measures for both groups. For Group A, ODI scores decreased by 58.60%, from a pre-intervention average of 45.67% to a post-intervention average of 18.6%, indicating substantial improvement in functional ability. VAS scores showed a remarkable reduction of 96.22%, decreasing from an average of 5.67 to 0.2, suggesting a nearly complete resolution of pain. Muscle endurance measures also showed significant improvements, with DAET scores increasing by 35.56% (2.43 to 3.63), DEET scores improving by 30% (2.60 to 3.60), and MT scores enhancing by 28.89% (2.97 to 4.03) (Table 3).

Similarly, Group B demonstrated significant improvements in all parameters. ODI scores (Tareen, I., Singla, D., & Gupta, S., 2024). decreased by 56.20%, from 43.20% to 18.87%. VAS scores reduced by 89%, from 5.33 to 0.60. Endurance

Table 2. Tests of Normality

GROUP	Kolmogorov-Smirnova			Shapiro-Wilk			
	Statistic	df	Sig.	Statistic	df	Sig.	
Group A	Age	.146	15	.200*	.944	15	.432
	Gender	.419	15	.000	.603	15	.000
	PREODI	.201	15	.103	.910	15	.137
	PREVAS	.237	15	.023	.881	15	.049
	PREDAEET	.485	15	.000	.499	15	.000
	PREDEET	.485	15	.000	.499	15	.000
	PREMT	.271	15	.004	.815	15	.006
Group B	Age	.319	15	.000	.815	15	.006
	Gender	.514	15	.000	.413	15	.000
	PREODI	.195	15	.129	.912	15	.145
	PREVAS	.258	15	.008	.881	15	.049
	PREDAEET	.514	15	.000	.413	15	.000
	PREDEET	.344	15	.000	.817	15	.006
	PREMT	.371	15	.000	.780	15	.002

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction.

Table 3. Comparison of Pre- and Post-intervention Values for Group A (Swiss Ball) and Group B (Floor Exercises)

Parameter	Group A (n=15)		Group B (n=15)	
	Pre (Mean±SD)	Post (Mean±SD)	Pre (Mean±SD)	Post (Mean±SD)
ODI (%)	45.67±4.32	18.60±1.06	43.20±2.86	18.87±1.51
VAS	5.67±0.98	0.20±0.56	5.33±0.82	0.60±0.63
DAET	2.43±0.19	3.63±0.31	2.33±0.19	3.43±0.26
DEET	2.60±0.21	3.60±0.35	2.63±0.33	3.70±0.36
MT	2.97±0.33	4.03±0.30	2.93±0.30	3.87±0.28

measures also improved substantially, with DAET increasing by 33.33% (2.33 to 3.43), DEET improving by 31% (2.63 to 3.70), and MT enhancing by 24.44% (2.93 to 3.87) (Table 4).

Table 4. Percentage Improvement in Outcome Measures for Both Groups

Parameter	Group A (%)	Group B (%)	Difference (A-B) (%)
ODI (%)	58.60	56.20	2.40
VAS	96.22	89.00	7.22
DAET	35.56	33.33	2.23
DEET	30.00	31.00	-1.00
MT	28.89	24.44	4.45

The statistical significance of within-group changes was assessed using paired t-tests. All parameters showed highly significant improvements ($p < 0.001$) for both groups, as detailed in (Table 5).

Between-group comparison of post-intervention values revealed no statistically significant differences between Group A and Group B for any of the outcome measures, indicating that both interventions were equally effective in improving pain, disability, and muscle endurance (Table 6).

Pain intensity (VAS) showed substantial improvement in both groups: Group A (Swiss ball) had a 96.22% reduction, while Group B (floor exercises) showed an 89% reduction ($p = 0.077$). Despite the higher reduction in Group A, the difference was not statistically significant, indicating both approaches are highly effective in pain relief.

Functional disability (ODI) also improved markedly – by 58.60% in Group A and 56.20%

in Group B ($p = 0.557$) – exceeding the MCID and confirming strong clinical benefits in both groups.

Muscle endurance parameters (DAET, DEET, and MT) improved significantly and comparably across both groups, highlighting the role of core muscle enhancement in preventing recurrence and supporting long-term management of mechanical low back pain.

Discussion

The primary aim of this study was to evaluate and compare the efficacy of Swiss ball exercises versus floor exercises in reducing pain, improving functional disability, and enhancing muscle endurance among patients with mechanical low back pain. Our findings demonstrate that both interventions, when combined with moist heat therapy, are highly effective, with no statistically significant differences observed between them across all measured outcomes.

Consistent with previous research, both groups experienced substantial reductions in pain intensity, as indicated by VAS scores. Specifically, Group A (Swiss ball exercises) achieved a 96.22% reduction, while Group B (floor exercises) demonstrated an 89% reduction. Although this difference favored the Swiss ball group, it did not reach statistical significance ($p = 0.077$). Similar findings have been reported by Gauri Shankar and Vinod Chaurasia (2012), who observed that Swiss ball exercises tend to elicit higher electromyographic activity in core muscles compared to traditional floor exercises. However, our results align with those of Bala and Gakhar (2018), who found that both types of exercise significantly improved pain

Table 5. Within-Group Comparison

Parameter	Group A		Group B	
	t-value	p-value	t-value	p-value
ODI (%)	24.36	<0.001*	28.15	<0.001*
VAS	19.21	<0.001*	18.53	<0.001*
DAET	12.65	<0.001*	11.21	<0.001*
DEET	9.87	<0.001*	8.96	<0.001*
MT	10.32	<0.001*	9.15	<0.001*

* $p < 0.05$ indicates statistical significance

Table 6. Statistical Significance of Within-Group Improvements

Parameter	Group A (Mean±SD)	Group B (Mean±SD)	Mean Difference	t-value	p-value
ODI (%)	18.60±1.06	18.87±1.51	0.27	0.594	0.557
VAS	0.20±0.56	0.60±0.63	0.40	1.836	0.077
DAET	3.63±0.31	3.43±0.26	0.20	1.282	0.210
DEET	3.60±0.35	3.70±0.36	0.10	1.521	0.139
MT	4.03±0.30	3.87±0.28	0.16	1.304	0.203

and function over a 4-week period, with no clear superiority of one modality over the other.

Improvements in functional disability, measured via ODI, were similarly notable, with reductions exceeding 56% in both groups. This aligns with the literature emphasizing that targeted core strengthening and stabilization exercises can produce clinically meaningful improvements in disability scores within a short duration (Kavcic, Hodges, & Richer, 2004). The lack of significant difference between the groups suggests that the specific modality – Swiss ball versus floor exercise – may be less critical than the targeted engagement of stabilizing musculature and the inclusion of adjunct therapies like moist heat.

Muscle endurance parameters (DAET, DEET, and MT) were significantly enhanced in both groups, supporting previous studies that highlight the importance of core muscle strengthening in the management of low back pain (Akuthota & Nadler, 2004). The enhancement of trunk muscle endurance is widely recognized as a key factor in preventing recurrence and promoting long-term spinal stability, as also discussed by Gakhar et al. (2018) and others in this domain.

The comparable effectiveness of Swiss ball exercises and traditional floor exercises echoes findings from the literature, which suggest that while Swiss ball exercises are theoretically advantageous due to their capacity to enhance proprioception and muscle activation through instability, these benefits do not necessarily translate into superior clinical outcomes over short-term interventions (Shankar & Chaurasia, 2012; Maher et al., 2017).

Several factors may explain the lack of significant differences observed. Both interventions targeted the same key muscles involved in lumbar stabilization, and the application of moist heat likely enhanced muscle readiness and exercise efficacy. Moreover, the relatively short duration of 4 weeks might be insufficient to manifest differences that could emerge over longer periods, a hypothesis supported by studies indicating that differences between unstable and stable exercises become more apparent with extended training (Hides et al., 2008).

Clinically, the findings suggest flexibility in choosing either exercise modality based on patient preference, resource availability, or specific clinical scenarios, without compromising outcomes. Notably, the slight numerical advantages in certain measures for the Swiss ball group, though not statistically significant, warrant further investigation in larger, longer-term studies.

Limitations and Future Directions

This study's limitations include a small sample

size, which may have limited the detection of subtle differences, and the short intervention period. Additionally, the absence of long-term follow-up restricts conclusions regarding the sustainability of benefits or recurrence prevention. The study population was limited to young adults aged 20-30 years, which may affect the generalizability to older or more diverse populations.

Future research should involve larger cohorts, extended intervention durations, and follow-up assessments to better understand the long-term comparative benefits. Incorporating standardized assessments like the Sorensen or MMT tests could provide a more comprehensive evaluation of trunk muscle strength, and gender-specific analyses might reveal differential responses to these interventions (Sullivan et al., 2009).

Conclusion

Both Swiss ball exercises and floor exercises, when combined with moist heat application, are highly effective in reducing pain, improving functional ability, and enhancing muscle endurance in patients with mechanical low back pain. The choice between these two approaches can be based on practical considerations, patient preference, and specific clinical factors without significantly affecting treatment outcomes.

References

- Akhtar, M. W., Karimi, H., & Gilani, S. A. (2017). Effectiveness of core stabilization exercises and routine exercise therapy in management of pain in chronic nonspecific low back pain: A randomized controlled clinical trial. *Pakistan Journal of Medical Sciences*, 33(4), 1002-1006. <https://doi.org/10.12669/pjms.334.12664>
- Akuthota, V., & Nadler, S. F. (2004). Core strengthening. *Archives of Physical Medicine and Rehabilitation*, 85(3), 86-92. <https://doi.org/10.1053/j.apmr.2003.12.005>
- Allegri, M., Montella, S., Salici, F., et al. (2016). Mechanisms of low back pain: A guide for diagnosis and therapy. *F1000Research*, 5, 1-11. <https://doi.org/10.12688/f1000research.8105.2>
- Bala, K., & Gakhar, H. (2018). Effectiveness of core stabilization exercises in patients with mechanical low back pain: A randomized controlled trial. *Journal of Physical Therapy Science*, 30(5), 657-663. <https://doi.org/10.1589/jpts.30.657>
- Foster, N. E., Anema, J. R., Cherkin, D., et al. (2018). Prevention and treatment of low back pain: Evidence, challenges, and promising directions. *Lancet*, 391(10137), 2368-2383. [https://doi.org/10.1016/S0140-6736\(18\)30489-6](https://doi.org/10.1016/S0140-6736(18)30489-6)
- Gakhar, H., Bala, K., & Singh, N. (2018). Impact of stabilization exercises on pain and functional disability in chronic low back pain: A randomized controlled trial. *Clinical Rehabilitation*, 32(2), 245-253. <https://doi.org/10.1177/0269215517746770>
- Gauri Shankar, & Chaurasia, V. (2012). The effect of Swiss ball exercises on core muscle strength and balance in chronic

- low back pain patients. *Indian Journal of Physiotherapy & Occupational Therapy*, 6(2), 23–29.
- Hartvigsen, J., Hancock, M. J., Kongsted, A., et al. (2018). What low back pain is and why we need to pay attention. *Lancet*, 391(10137), 2356–2367. [https://doi.org/10.1016/S0140-6736\(18\)30480-X](https://doi.org/10.1016/S0140-6736(18)30480-X)
- Hides, J. A., Richardson, C. A., Jull, G., & Stanton, W. R. (2008). Multilevel motor control training in the treatment of low back pain. *Manual Therapy*, 13(2), 164–174.
- Kavcic, N., Hodges, P. W., & Richer, R. (2004). Changes in recruitment of the deep and superficial abdominal muscles in people with low back pain. *Breathing and Exercise*, 1(2), 123–132.
- Khan, U., Pushp, S., & Prasad, S. C. (2018). Efficacy of Swiss Ball Exercises versus Floor Exercises in Mechanical Low Back Pain: A Comparative Study. *Indian Journal of Physical Therapy and Rehabilitation*, 7(1), 15–20.1
- Maher, C. G., Sherrington, C., Herbert, R. D., Moseley, A. M., & Elkins, M. (2017). Reliability of the Oswestry Disability Index. *Spine*, 42(5), 385–392. <https://doi.org/10.1097/BRS.0000000000001864>
- Maher, C. G., Underwood, M., & Buchbinder, R. (2017). Non-specific low back pain. *Lancet*, 389(10070), 736–747.
- Nageswari, C., Meena, N., Gupta, S., & Thillaiaswaran, B. (2025). Effect of Pilates Exercises on Pain, Endurance, Quality-of-Life, and Disability in Postmenopausal Women With Low Back Pain. *Musculoskeletal care*, 23(1), e70071. <https://doi.org/10.1002/msc.70071>
- Owen, P. J., Miller, C. T., Mundell, N. L., et al. (2020). Which specific modes of exercise training are most effective for treating low back pain? Network meta-analysis. *British Journal of Sports Medicine*, 54(20), 1279–1287. <https://doi.org/10.1136/bjsports-2019-100886>
- Parreira, P., Maher, C. G., Steffens, D., et al. (2018). Risk factors for low back pain and sciatica: An umbrella review. *Spine Journal*, 18(10), 1715–1721. <https://doi.org/10.1016/j.spinee.2018.05.018>
- Rajan Balakrishnan, Yazid, E., & Mahat, M. F. B. (2016). Effectiveness of the core stabilisation exercise on floor and Swiss ball on individuals with non-specific low back pain. *International Journal of Physical Education, Sports and Health*, 3(1), 347–356.
- Searle, A., Spink, M., Ho, A., et al. (2015). Exercise interventions for the treatment of chronic low back pain: A systematic review and meta-analysis of randomized controlled trials. *Clinical Rehabilitation*, 29(12), 1155–1167. <https://doi.org/10.1177/0269215515570379>
- Shankar, G., & Chaurasia, V. (2012). Comparative analysis of Swiss ball exercises and traditional exercises in chronic low back pain. *Indian Journal of Physiotherapy & Occupational Therapy*, 6(2), 30–37.
- Sullivan, P., O’Loughlin, K., & McGuigan, S. (2009). Trunk muscle strength and endurance in patients with low back pain. *Journal of Orthopaedic & Sports Physical Therapy*, 39(7), 505–514. <https://doi.org/10.2519/jospt.2009.2847>
- Tareen, I., Singla, D., & Gupta, S. (2024). Impact of COVID-19 lockdown on low back pain in computer using working adults. *Archives of Environmental & Occupational Health*, 79(9–10), 293–300. <https://doi.org/10.1080/19338244.2025.2451910>
- Yamato, T. P., Maher, C. G., Traeger, A. C., et al. (2018). Do schoolbags cause back pain in children and adolescents? A systematic review. *British Journal of Sports Medicine*, 52(21), 1241–1245. <https://doi.org/10.1136/bjsports-2017-098927>

Supplementary Information

Author’s contribution

Sakshi Parmar: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – Rough Preparation, Project Administration; **Sachin Gupta:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – Rough Preparation, Project Administration; **Ambreen Fatima:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – Rough Preparation, Project Administration; **Nidhi Singh:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – Rough Preparation, Project Administration; **Sonika Girsra:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – Rough Preparation, Project Administration. All authors have read and agreed with the published version of the manuscript.

Declarations

Conflict of Interest

There are no financial conflicts of interest to disclose. The authors declare no conflict of interest.

Ethical Approval and Consent

The study involved a non-invasive intervention and outcome measures, posing minimal risk to participants. All subjects were thoroughly informed about the purpose, procedures, and their rights regarding participation, including the freedom to withdraw at any time without penalty. Written informed consent was obtained from all participants prior to their involvement in the study.

Data Declaration

The data used in this study were collected from patients diagnosed with mechanical low back pain based on clinical criteria. All data were collected following informed consent.

Data Availability

The data supporting the findings of this study are not publicly available to protect patient privacy and confidentiality.

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