ISSN: 2347-6567

International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

IJAMSCR |Vol. 14 | Issue 4 | Oct - Dec 2026

www.ijamscr.com

DOI : https://doi.org/10.61096/ijamscr.v14.iss4.2026.1687-1693

"Effectiveness of Swiss Ball Exercise and Pilates Exercise on Pain and Quality of Life in Female Sweepers with Chronic Non-Specific Low Back Pain: A Comparative Study"

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Published on: 21-10-2026
ublished by: Futuristic Publications
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Abstract

Background: Chronic non-specific low back pain (NSLBP) is low back pain without an identifiable specific cause and is commonly associated with occupational activities involving repetitive bending and prolonged postures. Female sweepers are particularly exposed to such physical demands. Physiotherapy techniques like Pilates exercise and Swiss ball exercise are commonly used; however, evidence comparing their effectiveness are limited.

Objective: To compare the effects of Swiss ball exercises and Pilates exercises on pain and functional disability in female sweepers with chronic NSLBP.

Methods: A comparative study was conducted in the Department of Physiotherapy, Revathi Medical Centre, over six months. 40 female sweepers with chronic NSLBP were equally divided into Group A (Swiss ball exercises) and Group B (Pilates exercises). Both groups received their respective interventions thrice weekly for 4 weeks, totalling 12 sessions. Pain and functional disability were assessed using the Numerical Pain Rating Scale (NPRS) and Oswestry Disability Index (ODI), respectively. Statistical significance was set at $p \leq 0.05$.

Results: Both groups demonstrated significant improvement following treatment. However, Group A showed significantly greater reduction in NPRS score and ODI score compared with Group B ($p<0.05$)

Conclusion: The study concludes that both the Swiss ball exercise and Pilates exercise are effective in reducing pain, enhancing function and quality of life in subjects with non-specific low back pain. In the pre-test and post-test collected data analysis the group A shows superior difference than group B.

Keywords: Chronic non-specific low back pain, Pilates exercise, Swiss ball exercise, Functional disability, Pain, Quality of life.

Introduction

The ache that's localized between the 12th caricature and the lower gluteal folds, with or without leg pain is called Low back pain (LBP).[1] Which is a usual symptom of people of all periods are suffering.[2] It is the guiding reason of exertion restriction and lack in work throughout the people and it causes so important economic burden on individuals, families, communities, assiduity and governments.[3] Non-specific low back pain is defined as low back pain not identifiable to a recognisable, known specific pathology (e.g., infection, tumour, osteoporosis, fracture, structural disfigurement, inflammatory disorder, radicular

syndrome, or cauda equina syndrome). The most common form of low back pain is non-specific low back pain.[5]

The Oswestry Disability Index (ODI) is largely recommended and one of the most popularly used back-specific questionnaires in the field and it's also extensively used in medical studies.[13] The Oswestry Disability Index (ODI) reflects high quality psychometric properties and has been demonstrated as being a largely effective outcome measure.[15] The Oswestry Disability Index (ODI) remains a valid and vigorous measure of condition-specific disability.[16]

The 11- point numerical pain rating scale (NPRS) is a measure of pain in which cases rate their pain ranging from 0 (no pain) to 10 (worst imaginable pain), and it has been shown to have concurrent and predictive validity as a measure of pain intensity.[17]

The Pilates program is a one-of-a-kind strategy of outstretching and substantiating practices created by Joseph H Pilates about 90 years back that utilizes sets of controlled, proper movements and the use of special equipment. The Pilates Method is a one-of-a-kind way to accord with preparing at the tip of the precedence list body, mind, body knowledge, and control of movement and posture. The Pilates program depends on 6 fundamental principles: precision, attention, centring, control, fluidity, and diaphragmatic breathing.[19]

The use of the Swiss ball exercise for core muscle development has been popularized for several years. Most researchers who studied the usage of Swiss ball exercises quantified abdominal muscle activity during the crunch, push-up, and bench press trainings, and generally investigated the recruitment patterns of only 1 or 2 muscles. Multitudinous other Swiss ball exercises are used in training and rehabilitation to enhance core development and stability.[21] Therefore, the purpose of this study was to evaluate the effectiveness of Swiss ball exercise and Pilates exercise on pain and quality of life in female sweepers with chronic non-specific low back pain.

Methodology

Study Design and Participants

The study was approved by the institute ethics committee, IEC- RIPT/DT/21/4506. A comparative study was conducted over a period of six months in the Outpatient Department of Revathi Medical Center, Kumar Nagar, Tirupur. A total of 40 subjects diagnosed with chronic non-specific low back pain was recruited using a simple sampling method and randomly allocated into two groups of 20 participants each.

Inclusion and Exclusion Criteria:

Participants with age group of 30 to 50, diagnosed non-specific low back pain > 3 months, minimum to moderate disability (up to 40%) on ODI, NPRS grade of 7 and below and willing to participate for full duration were included in the study. Individuals with past history of fracture (spine, rib) or injury, abdominal surgery, any other systemic illness, spinal or disc pathologies, non-cooperative and psychiatric subjects and having attended Pilates or physiotherapy interventions for low back pain in the last 6 months were excluded. Written informed consent was obtained from all participants before enrolment.

Intervention

Group A received Swiss ball exercise which included curl-up, bridging, side plank and front plank. Each session lasted 45 minutes and was administered thrice a week for 4 weeks (12 sessions). Group B performed a Pilates exercise consisting of bridging, curl-up, the hundred preps and front plank exercises with progressive repetitions over the same treatment duration.

Outcome Measures

Numerical pain rating scale (NPRS) was used to assess pain intensity in patients with nonspecific low back pain and Oswestry disability index (ODI) was used to assess the quality of life. Outcome measures were assessed before and after completion of the intervention program.

Statistical Analysis

Data were analysed using SPSS version 24. The Shapiro–Wilk test confirmed normal data distribution. Within-group comparisons were performed using the paired t-test, while between-group comparisons were analysed using the independent t-test. Statistical significance was set at $p < 0.05$.

Results

A total of 40 female sweepers with chronic non-specific low back pain participated in the study. The participants were divided equally into Group A, which received Swiss ball exercises, and Group B, which received Pilates exercises. Both groups underwent treatment for four weeks, three days per week, for a total of 12 sessions.

Within-group comparison of NPRS

In Group A, the mean NPRS score decreased from 6.00 ± 0.585 at pre-test to 1.90 ± 0.718 at post-test. The paired t-test showed a statistically significant reduction in pain (t = 41.00, p = 0.001).

In Group B, the mean NPRS score decreased from 5.65 ± 0.670 at pre-test to 4.40 ± 0.598 at post-test. The paired t-test also showed a statistically significant reduction in pain (t = 12.58, p = 0.001).

Within-group comparison of ODI

In Group A, the mean ODI score decreased from 29.60 ± 5.60 at pre-test to 17.60 ± 4.79 at post-test. The paired t-test showed a statistically significant improvement in functional disability (t = 27.56, p = 0.001).

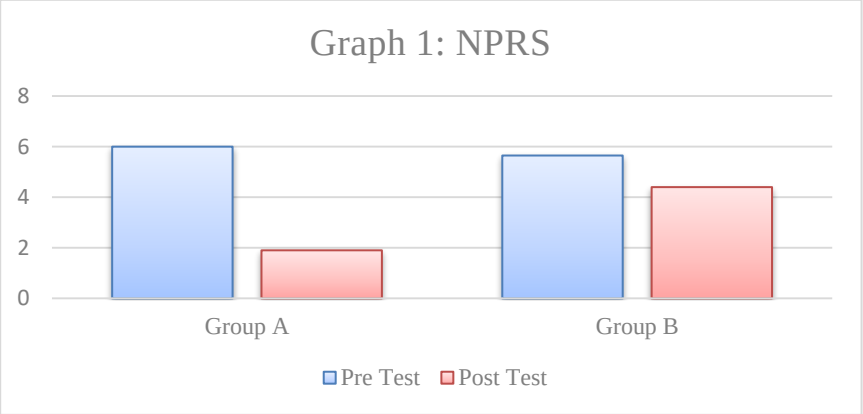
In Group B, the mean ODI score decreased from 30.30 ± 4.64 at pre-test to 25.80 ± 4.89 at post-test. The paired t-test showed a statistically significant improvement in functional disability (t = 22.65, p = 0.001)

Comparison of NPRS between Group A and Group B

The pre-test mean NPRS score was 6.00 ± 0.858 in Group A and 5.65 ± 0.670 in Group B. The independent t-test showed no statistically significant difference between the groups at baseline (t = 1.43, df = 38, p = 0.159). After four weeks of intervention, the post-test mean NPRS score decreased to 1.90 ± 0.718 in Group A and 4.40 ± 0.598 in Group B. The independent t-test showed a statistically significant difference between the groups (t = −11.96, df = 38, p = 0.001). Group A demonstrated a greater reduction in pain compared with Group B.

Table 1: Between-group comparison of NPRS scores

Group	Pre-test mean ± SD	Post-test mean ± SD	t-value	df	p-value
Group A	6.00 ± 0.858	1.90 ± 0.718	1.43*/-11.96^{+}	38	0.159*/ 0.001^{+}
Group B	5.65 ± 0.670	4.40 ± 0.598			

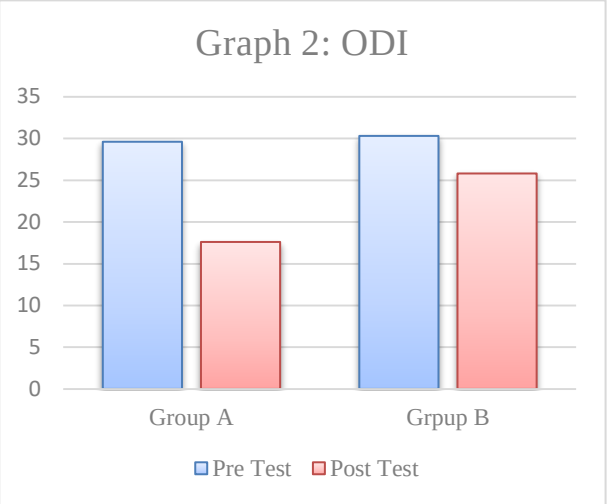


Comparison of ODI between Group A and Group B

The pre-test mean ODI score was 29.60 ± 5.60 in Group A and 30.30 ± 4.64 in Group B. The independent t-test showed no statistically significant difference between the groups at baseline (t = −0.430, df = 38, p = 0.670). Following the intervention, the post-test mean ODI score decreased to 17.60 ± 4.79 in Group A and 25.80 ± 4.89 in Group B. The independent t-test showed a statistically significant difference between the groups (t = −5.35, df = 38, p = 0.001). Group A demonstrated a greater improvement in functional disability compared with Group B.

Table 2: Between-group comparison of ODI scores

Group	Pre-test mean ± SD	Post-test mean ± SD	t-value	df	p-value
Group A	29.60 ± 5.60	17.60 ± 4.79	-0.430*/ - 5.35^{+}	38	0.670*/ 0.001^{+}
Group B	30.30 ± 4.64	25.80 ± 4.89			



Overall, both Swiss ball exercises and Pilates exercises produced statistically significant improvements in pain and functional disability. However, the between-group comparison showed that Swiss ball exercises produced a greater reduction in NPRS scores and a greater improvement in ODI scores than Pilates exercises.

Discussion

The present study compared the effectiveness of Swiss ball exercise and Pilates exercise in subjects with nonspecific low back pain. Both interventions significantly reduced pain and improved quality of life after 4 weeks of treatment. However, Swiss ball exercise produced significantly greater Improvements in NPRS and ODI than Pilates exercise.

The superior effect observed with Swiss ball exercise may be attributed to the unstable surface of the ball, which requires continuous postural adjustments and increased activation of the trunk musculature. Maintaining balance on an unstable surface can increase proprioceptive input, neuromuscular control, and co-contraction of the trunk muscles. These responses may contribute to improved spinal stability and reduction of pain and functional disability.

Swiss ball exercises may increase activation of both global and local trunk muscles during exercises such as bridging. The reduction in the area of support and continuous perturbations produced by the unstable surface require the participant to control the centre of gravity, thereby increasing muscular demand. Progressive adaptation to these demands may improve trunk muscle strength, endurance, balance, and proprioception.

Pilates exercise also produced significant improvements in the present study. Pilates emphasizes core stabilization, postural alignment, controlled movement, breathing, precision, and neuromuscular control. These principles may improve lumbopelvic stability and the coordinated activation of muscles involved in spinal stabilization. Previous literature included in the project has also reported beneficial effects of Pilates on pain and disability in individuals with chronic non-specific low back pain.

The present findings are consistent with previous research reporting that Swiss ball-based core stabilization exercises can be effective in reducing pain and disability in individuals with non-specific low back pain. Studies included in the project also suggest that Pilates can improve pain, disability, flexibility, balance, and functional ability.

Although both interventions were effective, the greater improvement observed in Group A may be related to the additional neuromuscular and proprioceptive demands created by the unstable Swiss ball surface. The findings therefore suggest that Swiss ball exercise may provide a greater therapeutic effect than the selected Pilates program for female sweepers with chronic non-specific low back pain.

Conclusion

The present study compared the effects of Swiss ball exercise and Pilates exercise on pain and functional disability in female sweepers with chronic non-specific low back pain.

Both Swiss ball exercise and Pilates exercise produced statistically significant improvements in NPRS and ODI scores following four weeks of intervention. However, the Swiss ball exercise group demonstrated a greater reduction in pain and functional disability than the Pilates exercise group.

Therefore, Swiss ball exercise can be considered a more effective exercise intervention than the selected Pilates exercise program for reducing pain and improving functional disability in female sweepers with chronic non-specific low back pain.

Limitations and Recommendations

The present study had a relatively small sample size, which may limit the generalizability of the findings. The intervention period was limited to 4 weeks, and no long-term follow-up was conducted to evaluate the sustainability of treatment effects. Additionally, the study included participants from a single clinical center, which may reduce the external validity of the results. The study was only conducted in female populations with occupation as a sweeper and age group of 30 to 50 so it is recommended in future studies to include male population and other occupation and different age groups to include in the studies. Future studies should include a larger sample size and recruit participants from multiple centers to improve the generalizability of the findings. Long-term follow-up is recommended to assess the durability of treatment outcomes. Further research may also compare Swiss ball exercise with other therapeutic techniques.

Informed Consent

Written informed consent was obtained from all participants before the commencement of the study. Participation was voluntary, and confidentiality of participant information was maintained throughout the study.

Conflict of Interest

The authors declare that they have no conflict of interest regarding the publication of this study.

Author contributions

Arya K: Conceptualization, methodology, participant recruitment, data collection, statistical analysis, manuscript preparation, and manuscript revision.

Dr. Stanley E, Dr. S Ramkumar & Dr. Prabhuraja R: Study conception and design, supervision, methodology validation, interpretation of results, critical revision of the manuscript, and final approval of the manuscript.

Dr. P Bright Alwin Victor: Administrative support, overall academic guidance, and final approval of the manuscript.

Data availability statement

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

Acknowledgments

The authors sincerely thank the Principal, Guide, and faculty members of Revathi Institute of Physiotherapy and Research for their valuable guidance and support throughout this study. The authors also express their gratitude to all participants for their voluntary participation and cooperation during the research.

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