ORIGINAL ARTICLE

IJPHY

Effects of Pilates Exercises Versus Conventional Exercises Among Post-Menopausal Women Suffering From Non-Specific Low Back Pain, By Improving Lumbar Flexibility, Endurance, and Quality of Life – A Comparative Study

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ABSTRACT

Background: Low back pain (LBP), or lumbago, is a major global public health issue, affecting up to 80% of people during their lifetime, with a peak incidence between 50 and 55 years of age. It is a leading cause of pain, functional limitations, and reduced quality of life. In India, nearly 60% of individuals report significant back pain. Most LBP cases are non-specific and idiopathic, making diagnosis and treatment challenging. Contributing factors include sedentary lifestyles, obesity, smoking, and physical strain.

Methods: A 12-week intervention study involved 80 postmenopausal women with lumbago, randomly assigned to a Pilates group (n=40) or a conventional exercise group (n=40) after getting informed consent. Participants exercised three times per week. Outcomes were measured pre- and post-intervention using the Numeric Pain Rating Scale (NPRS), Oswestry Disability Index (ODI), Menopause-Specific Quality of Life (MENQOL) questionnaire, and the Kraus-Weber test.

Results: Both groups showed significant improvements ($p < 0.05$), but the Pilates group had more significant reductions in pain (NPRS: mean difference = 3.42, $p = 0.001$), disability (ODI: 6.6 points, $p = 0.002$), and enhanced flexibility (8.63 points, $p = 0.001$). Lumbar flexion improved by 4.25° ($p = 0.001$) vs. 2.68° in controls, and extension/rotation improved significantly ($p = 0.003$). Quality of life (MENQOL) improved by 13.02 points ($p = 0.001$), and endurance (Kraus-Weber) by 2.37 points ($p = 0.001$) vs. 1.02 in the control group. Pilates enhanced lumbar mobility, strength, endurance, and overall quality of life in postmenopausal women with nonspecific low back pain.

Conclusion: While both exercise methods benefit postmenopausal women with lumbago, Pilates was more effective in reducing pain and disability and improving flexibility and quality of life. A 12-week Pilates program is a beneficial, non-invasive approach for managing lumbago and enhancing physical function in postmenopausal women.

Trial registration: Clinical Trials Registry- India (CTRI), CTRI/2024/04/065057. Registered on 02/04/2024.

Keywords: Pilates exercises, Postmenopausal women, MENQOL Questionnaire, ODI scale, Krause-Weber scale, NRPS scale.

Received 14th November 2024, accepted 02nd March 2025, published 09th March 2025

www.ijphy.com

10.15621/ijphy/2025/v12i1/1685

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INTRODUCTION

Lumbago, or low back pain (LBP), is a prevalent global health concern, affecting up to 80% of individuals during their lifetime, with peak prevalence occurring between the ages of 50 and 55. It is a leading contributor to pain, functional disability, and decreased quality of life. In the Indian population, nearly 60% report experiencing significant back pain [1]. Most LBP cases are non-specific and idiopathic, which complicates diagnosis and treatment. Commonly identified risk factors include physical inactivity, obesity, smoking, and high physical strain [2–6]. Menopause, typically occurring between the ages of 45 and 55, marks the end of the menstrual cycle and is associated with a decline in estrogen and progesterone levels [7,8]. These hormonal changes lead to physiological alterations such as decreased bone density, reduced muscle mass, and diminished joint flexibility, all increasing susceptibility to musculoskeletal conditions like lumbago [9–13]. Physical activity is essential in managing menopausal symptoms and improving overall health outcomes [14]. Current management strategies for LBP emphasize a multidisciplinary approach, incorporating physical therapy, lifestyle modifications, and psychological support [15,16]. Conventional exercise programs for chronic LBP typically focus on improving muscle strength, flexibility, and function through abdominal bracing, erector spinae strengthening, and lumbar stabilization exercises.

Pilates, developed by Joseph Pilates in the 1920s, emphasizes core strength, flexibility, balance, and controlled movement. It integrates centering, concentration, control, precision, breath, and flow [17–20]. Recent research suggests Pilates may effectively manage LBP by enhancing posture, core strength, and body mechanics [18,19], while also improving flexibility and endurance—benefits particularly relevant for postmenopausal women experiencing age-related physical decline like the prevention of fall also [21,22]. This study compares the effects of a 12-week Pilates exercise program with conventional exercise routines on non-specific low back pain in postmenopausal women. The primary objective is to evaluate the impact of Pilates on pain reduction, lumbar flexibility, endurance, and quality of life. Understanding the unique challenges faced by postmenopausal women, such as chronic LBP, reduced physical activity, and lowered quality of life, highlights the importance of targeted interventions. Although conventional exercises are commonly prescribed, limited comparative research exists evaluating Pilates in this context. This study addresses that gap by exploring the effectiveness of Pilates as a potentially superior approach to managing chronic low back pain in postmenopausal women.

METHODOLOGY

The study design utilized a Randomized Controlled Trial (RCT) with a parallel group design and a single-blind approach. This design ensures robust intervention testing by comparing the effects of Pilates exercise with conventional back exercises on postmenopausal women with non-specific low back pain. The research was conducted at the Physiotherapy Department of Shri Indra Ganesan Institute of Medical Science College of Physiotherapy, Trichy, Tamil Nadu, India. This setting provided a controlled environment for administering the interventions and collecting data. Before participation, the study's purpose and procedures were explained to all participants, and written informed consent was obtained per the Helsinki Declaration. The study was approved by the Institutional Ethics Committee of K.A.P. Vishwanatham Government Medical College, Tiruchirappalli (Ethical Clearance Number: KAPV/IEC/221104001). A total of eighty patients with non-specific low back pain were recruited from the outpatient department of physiotherapy. Participants were randomly assigned to one of two groups: Group A (Experimental Group) or Group B (Control Group). Before randomization, the purpose of the study and the research methodology were clearly explained to each participant, and written informed consent was obtained. The intervention was administered over 12 weeks, with three sessions per week for forty minutes per session.

Figure 1 tells us the flow diagram of the selection of the samples allocated, followed up, and analyzed. Group allocation was performed using a randomization with an allocation concealment method. Participants were randomly assigned to Group A (Experimental) and Group B (Control). To ensure allocation concealment, the randomization process was conducted by a BPT intern who was not involved in the study design and had no knowledge of its objectives. This approach minimized the risk of selection bias. Furthermore, participants were not informed of their group assignments, preserving the single-blind nature of the study.

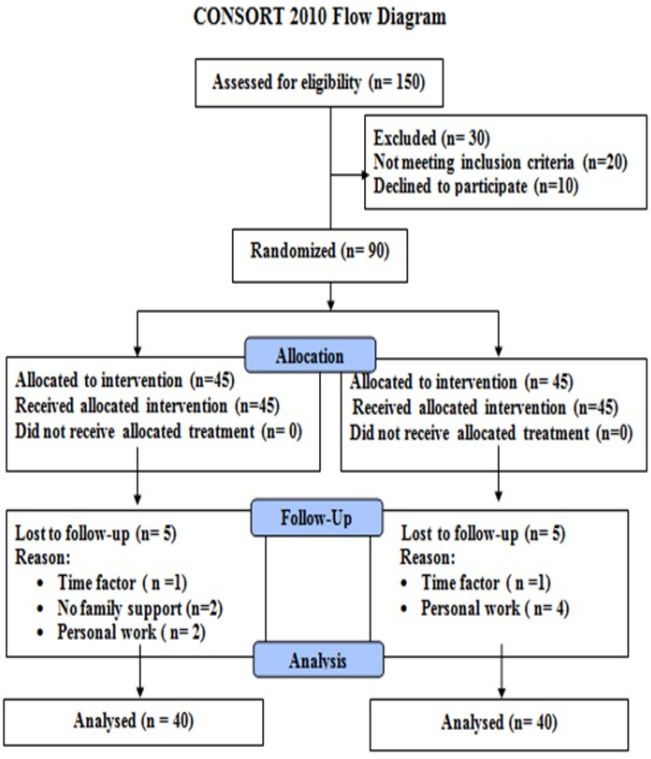

Figure 1: Patients allocation flow diagram

Intervention

Dynamic warming-up exercises

These exercises help the patient to do the exercise programme easily. These exercises will help warm up the muscles (Table 1). The study Procedure was systematically designed. Before the intervention, baseline assessments were conducted to evaluate pain levels, range of motion (ROM), and lumbar function. Participants were randomly assigned to groups like Group A (Experimental Group) and Group B (Control Group), who performed warming-up exercises as in Table 1.

Table 1: Warm-Up Exercises for both the Groups A and B

S.No	Exercise	Repetitions	Duration	Progression
1	Arm swing	10 times	3 minutes	Weeks 1 -12
2	Side reach	10 times	3 minutes	Weeks 1 -12
3	Hip circles	10 times	4 minutes	Weeks 1 -12

Table 2 shows the exercise program performed by Group A (Experimental Group), who performed warming-up exercises followed by Pilates exercises, focusing on core stability, flexibility, and strength.

Table 2 : Group A – Pilates exercise Programme

S.No	Exercise	Repetitions	Duration	Progression
1	The Hundred	4-5 times	8 minutes	Weeks 1 -12
2	The Roll up	3-4 times	8 minutes	Weeks 1 -12
3	Side kick	4-5 times on each side	8 minutes	Weeks 1 -12
4	The saw	5 times on each side	8 minutes	Weeks 1 -12
5	Spine stretch	4-5 times	8 minutes	Weeks 1 -12

Table 3 : Group B – Conventional exercise programme

S.No	Exercise	Repetitions	Duration	Progression
1	Bridging	15 times	8 minutes	Weeks 1 -12
2	Drawing-in maneuver	5 times	8 minutes	Weeks 1 -12
3	Lateral leg raises	10 times on each side	8 minutes	Weeks 1 -12
4	Supermans	10 times	8 minutes	Weeks 1-12
5	Partial curls	10 times	8 minutes	Weeks 1 -12

As in Table 3, Group B (Control Group) performed warming-up exercises followed by conventional exercises, targeting similar objectives through traditional strengthening and flexibility techniques. Each session began with a 10-minute general warm-up followed by group-specific exercises (as shown in Table 1), lasted 50 minutes, and was held thrice weekly for 12 weeks, totaling 36 sessions. All sessions were carefully supervised and conducted within the physiotherapy department to ensure consistency and adherence to the protocol. There was an attendance and Make-Up Policy, and Participants were required to complete all 36 sessions. If participants missed one or two sessions, they could make up for them immediately following the regular schedule to ensure program completion. Participants who missed more than two sessions were classified as dropouts, and their data were excluded from the final analysis.

Statistical Analysis

Post-intervention assessments were conducted the day after the final exercise session to avoid any immediate influence on the outcome measures. The data from pre- and post-intervention assessments were then compared within and between the two groups using appropriate statistical tests to determine the effectiveness of the Pilates exercise program. Statistical analysis was conducted using SPSS version 21 (IBM Corporation, Armonk, New York). Data was presented as Mean ± standard deviation. A predetermined significance level (alpha), such as $p < 0.05$, was utilized to assess the statistical significance of the findings. A statistically significant difference indicated a meaningful impact of Pilates on the dependent variables. After the completion of the study, the collected data from both Group A (Pilates -experimental) and Group B (control-conventional) were subjected to data analysis using appropriate statistical methods. The analysis was conducted using the Shapiro-Wilk test of normality and Wilcoxon's signed rank test.

RESULTS

The results of the study provide valuable insights into the effect of intervention for the post menopausal women suffering from low back pain in two groups: Group A (experimental group) and Group B (Conventional group). Group A received the structured pilates exercise programme and Group B received the conventional exercise programme (Tables 4,5, 6, and 7). Pilates exercise training demonstrates a superior effectiveness compared to conventional physical therapy for managing nonspecific low back pain in postmenopausal women that is: the lumbar flexion in the experimental group improved by 4.25° compared to 2.68° in the control group, lumbar flexion of experimental group improved from 31.25° ± 4.71° to 35.50° ± 5.09°. In comparison, the control group improved from 31.97° ± 5.17° to 34.65° ± 4.77° and of lumbar extension and rotation with 4.25° ± 0.73° to 4.92° ± 0.60° in the experimental group and 4.02° ± 0.75° to 4.32° ± 0.64° in the control group. The ODI score improved from 32.5 ± 3.02 to 23.87 ± 4.24, with a mean improvement of 8.63. Similarly, the flexibility was also improved from 32.5 ± 3.02 to 23.87 ± 4.24, with a mean improvement of 8.63 for the experimental group, and the ODI improved from 33.9 ± 3.09 to 27.30 ± 2.37, showing a mean improvement of 6.6. Between-group comparisons show a significant improvement of 3.42 points in the Pilates group. When we consider the quality of life, the Pilates group improved from 50.87 ± 7.53 to 37.85 ± 5.57, while the control group improved from 49.70 ± 3.09 to 41.90 ± 2.37. The pilates group showed an improvement of 1.69 points within the group and 4.05 points between the groups, demonstrating better quality-of-life outcomes. As for endurance, from the Krause-Weber Test, the pre-treatment mean for the Pilates group was 6.10 ± 0.96, which improved to 8.47 ± 0.94 post-treatment. For the control group, the pre-treatment score was 6.30 ± 3.09, improving to 7.32 ± 2.37 post-treatment. The Pilates group demonstrated a slightly

greater improvement (0.90) than the control group (0.86), suggesting Pilates may better enhance lumbar muscle endurance in postmenopausal women with low back pain. This program enhances lumbar range of motion and significantly improves lumbar function, strength, and endurance. As a versatile and holistic approach, Pilates offers physical benefits alongside improved quality of life by enhancing physical capacities, promoting mindfulness, and reducing the risk of falls, all crucial during the postmenopausal phase. The results of this study are statistically analysed and provided below.

Analysis of the demographic variables of the study

As per Tables 4 and 5, the average age of participants in both groups was 50.75 years, with the majority (62.5%) in the 50-56 age range and 37.5% in the 45-50 age range. The concentration of postmenopausal women in this study's 51-56 age group aligns with these findings. Occupationally, participants' distribution was as follows: experimental group—housewives (30%), government sector employees (7.5%), private sector employees (32.5%), self-employed (15%), retired (7.5%), and other occupations (12.5%); control group—housewives (30%), government sector (5%), private sector (35%), self-employed (17.5%), retired (7.5%), and others (5%). A sedentary lifestyle combined with physical inactivity due to hormonal changes may contribute to nonspecific low back pain, resulting in stiffness and reduced flexibility. Regarding marital status, most were married (82.5% in the experimental group, 85% in the control group), with small proportions unmarried or separated. Most participants came from nuclear families (57.5% in Group A, 62.5% in Group B), suggesting they may have more physical responsibilities. Among associated comorbidities, 17.5% had diabetes, 12.5% had hypertension, and 5% had thyroid issues. Including these comorbidities adds to the study's generalizability; excluding them could risk turning the study into an explanatory rather than a pragmatic trial. Demographic descriptive statistics of age, height, and weight were presented in Table 5.

Table 4: Demographic Variables of the study participants

Demographic Values		GROUP			
		Experimental (n =40)		Control (n = 40)	
		n	%	n	%
Age in years	45 - 50 years	15	37.50%	13	32.50%
	50 - 56 years	25	62.50%	27	67.50%
Education	Post Graduate	6	15.00%	5	12.50%
	Under Graduate	10	25.00%	10	25.00%
	Higher Secondary	12	30.00%	11	30.00%
	Primary education	8	20.00%	9	20.00%
	Illeterate	4	10.00%	5	12.50%
Occupation	Government sector	3	7.50%	2	5.00%
	Private sector	13	32.50%	14	35.00%
	Self employed	6	15.00%	7	17.50%
	Retired	3	7.50%	3	7.50%
	Home maker	10	25.00%	12	30.00%
	others	5	12.50%	2	5.00%
Monthly income	Below 5000	2	5.00%	2	5.00%
	5001 - 10000	13	32.50%	12	30.00%
	10001 - 15000	11	27.50%	12	30.00%
	Above 15001	14	35.00%	16	40.00%
Religion	Hindu	27	67.50%	25	67.50%
	Muslim	4	10.00%	6	15.00%
	Christian	9	22.50%	9	22.50%
Marital status	Maried	33	82.50%	34	85.00%
	Unmaried	3	7.50%	4	10.00%
	seperated	2	5.00%	2	5.00%
	Divorced	2	5.00%	0	0.00%
Type of family	Nuclear family	23	57.50%	25	62.50%
	Joint family	17	42.50%	15	37.50%
Dietry Habits	Vegetarian	31	77.50%	28	70.00%
	Mixed	9	22.50%	12	30.00%

Table 5: Demographic descriptive statistics of age, height and weight

Variables	Group A	Group B
Age (Years)	52.10±1.40	52.40±1.60
Height (cms)	157.185±6.48	155.775±7.45
Weight (Kg)	62±6	61±6

Analysis of Lumbar Range of motion between the experimental and control group

The study infers that Table 6 shows improvements in the lumbar range of motion (ROM) for flexion, extension, lateral flexion, and rotation in both the Pilates and control groups. However, the Pilates group exhibited slightly greater improvements than the control group, both within-group and between-group. In the experimental group, lumbar flexion improved from 31.25° ± 4.71° to 35.50° ± 5.09°, while the control group improved from 31.97° ± 5.17° to 34.65° ± 4.77°. Similar trends were observed for lumbar extension and lateral flexion, although lumbar rotation showed a smaller increase, with 4.25° ± 0.73° to 4.92° ± 0.60° in the experimental group and 4.02° ± 0.75° to 4.32° ± 0.64° in the control group.

Table 6: Lumbar Range of motion – Between the experimental and control group

Groups	Pre & Post Measurement	Active Lumbar Flexion (in degrees)						
		Shapiro-Wilk Test of Normality		M	S.D.	M.D.	Wilcox on Signed Rank Test	
		Value	p				Z	P
A	Pre	0.86	0.002*	31.25	4.71	4.25	4.78	0.0001*
	Post	0.89	0.001*	35.5	5.09			
B	Pre	0.92	0.001	31.97	5.17	2.68	4.45	0.0001*
	Post	0.84	0.001	34.65	4.77			
		Active Lumbar Extension (in degrees)						

A	Pre	0.86	0.002*	31.25	4.71	4.25	4.78	0.0001*
	Post	0.89	0.001*	35.5	5.09			
B	Pre	0.92	0.001	31.97	5.17	2.68	4.45	0.0001*
	Post	0.84	0.001	34.65	4.77			
		Active Lumbar Lateral flexion (in degrees)						
A	Pre	0.83	0.002*	15.87	2.81	2.98	4.78	0.0001*
	Post	0.63	0.001*	18.85	1.79			
B	Pre	0.91	0.004	16	2.53	0.9	3.72	0.0001*
	Post	0.9	0.003	16.9	2.49			
		Active Lumbar Rotation (in degrees)						
A	Pre	0.77	0.002*	4.25	0.73	0.67	3.91	0.0004*
	Post	0.47	0.001*	4.92	0.6			
B	Pre	0.79	0.001	4.02	0.75	0.3	2.93	0.0001*
	Post	0.76	0.001	4.32	0.64			

Analysis of the lumbar pain between the experimental and control group

Significant reductions in pain, as shown in Table 7, were measured by the Numerical Pain Rating Scale (NPRS) and were observed in both groups. The NPRS mean in the Pilates group decreased from 7.2 ± 0.75 to 5.85 ± 0.72, while in the control group, it decreased from 6.97 ± 0.96 to 5.85 ± 0.72. The reduction in NPRS was greater in the Pilates group, with a statistically significant mean reduction of 1.38 compared to the control group. The enhanced reduction in pain for the Pilates group may be attributed to including dynamic movements and breathing techniques in the exercise routine. Studies such as those by U. Albert Anand et al. and Mauricio Antonio da Luz Jr. support the superiority of Pilates for pain management in nonspecific low back pain, making it a recommended addition for early intervention.

Table 7: Numerical Pain Rating Scale – Between the experimental and control group

Groups	Pre & Post Measurement	NPRS – Pre and Post Treatment Comparison						
		Shapiro-Wilk Test of Normality		M	S.D.	M.D.	Wilcox on Signed Rank Test	
		Value	P				Z	P
A	Pre	0.8	0.001*	7.2	0.75	2.5	5.51	0.0001*
	Post	0.83	0.001*	4.7	0.85			
B	Pre	0.82	0.002*	6.97	0.96	1.12	4.85	0.0001*
	Post	0.83	0.004*	5.85	0.72			

Analysis of ODI, MENQOL, and Krause-Weber between the experimental and control group

The Oswestry Disability Index (ODI) – Functional Measure Questionnaire covers pain intensity, personal care, lifting, walking, sitting, standing, sleeping, social life, traveling, and employment/homemaking. It assesses the impact of low back pain on daily life. In the experimental group, from Table 8, the ODI score improved from 32.5 ± 3.02 to 23.87 ± 4.24, with a mean improvement of 8.63. In the control group, the ODI improved from 33.9 ± 3.09 to 27.30 ± 2.37, showing a mean improvement of 6.6. Between-group comparisons show a significant improvement of 3.42 points higher in the Pilates group.

The Menopause-Specific Quality of Life Questionnaire (MENQOL) questionnaire, with items covering vasomotor, psychological, physical, and genitourinary symptoms, indicated quality-of-life improvements in both groups. For the Pilates group, from Table 8, scores improved from 50.87 ± 7.53 to 37.85 ± 5.57, while the control group improved from 49.70 ± 3.09 to 41.90 ± 2.37. The Pilates group showed an improvement of 1.69 points within the group and 4.05 points between the groups, demonstrating better quality-of-life outcomes. Haelim Lee et al. found that continuous Pilates participation enhances health and promotes independence among postmenopausal women. The Krause-Weber Test was used to evaluate abdominal and back endurance. From Table 8, the pre-treatment mean for the Pilates group was 6.10 ± 0.96, which improved to 8.47 ± 0.94 post-treatment. For the control group, the pre-treatment score was 6.30 ± 3.09, improving to 7.32 ± 2.37 post-treatment. The Pilates group demonstrated a slightly more significant improvement (0.90) than the control group (0.86), suggesting Pilates may better enhance lumbar muscle endurance in postmenopausal women with low back pain.

Table 8: ODI, MENQOL, Krause weber – Between the experimental and control group

Groups	Pre & Post Measurement	ODI – Pre and Post Treatment Comparison						
		Shapiro-Wilk Test of Normality		M	S.D.	M.D.	Wilcox on Signed Rank Test	
		Value	p				Z	P
A	Pre	0.93	0.002*	32.5	3.02	8.63	5.51	0.0001*
	Post	0.92	0.001*	23.87	4.24			
B	Pre	0.97	0.002*	33.9	3.09	6.6	5.53	0.0001*
	Post	0.91	0.004*	27.3	2.37			
		MENQOL – Pre and Post Treatment Comparison						
A	Pre	0.9	0.001*	50.87	7.53	13.2	5.51	0.0001*
	Post	0.91	0.005*	37.85	5.57			
B	Pre	0.79	0.001*	49.7	3.09	7.8	5.44	0.0001*
	Post	0.87	0.002*	41.9	2.37			
		Krause weber – Pre and Post Treatment Comparison						
A	Pre	0.89	0.001*	6.1	0.96	2.37	5.38	0.0001*
	Post	0.9	0.001*	8.47	0.94			
B	Pre	0.84	0.002*	6.3	3.09	1.02	5.08	0.0001*
	Post	0.86	0.001*	7.32	2.37			

DISCUSSION

Non-specific low back pain (NSLBP) in post-menopausal women remains a persistent clinical challenge due to the multifactorial influences of hormonal changes, musculoskeletal deconditioning, and reduced physical activity. This study sought to compare the effects of Pilates exercises versus conventional therapeutic exercises on

lumbar flexibility, core endurance, and overall quality of life in this population. The findings indicate that although both exercise modalities were effective, Pilates interventions resulted in superior improvements across all measured domains.

Lumbar Flexibility and ROM

Pilates exercises improved lumbar flexibility across all planes of motion, including flexion, extension, lateral flexion, and rotation. For example, lumbar flexion in the experimental group improved by 4.25° compared to 2.68° in the control group. These enhancements are likely due to the emphasis of Pilates on dynamic stretching, spinal articulation, and segmental control, which have been reported to increase joint mobility and muscle length (Kloubec, 2011)[7] and flexibility Kao YH et.al, 2014 [24]. The principles of controlled movement, precision, and concentration in Pilates contribute to better neuromuscular coordination and postural alignment, which are critical for spinal health, particularly in post-menopausal women.

Pain Reduction

The experimental group demonstrated a more significant reduction in pain levels (mean difference = 2.5) than the control group (mean difference = 1.12). This is clinically significant, as a 2-point reduction on the NPRS is considered meaningful Coppieters et al., 2011[25]. The higher improvement was in the Pilates group due to the exercise's briskness and breathing techniques. This finding correlated with the study by U. Albert Anand et al, 2014 [26], which demonstrated more or less similar improvements concerning the current work in NPRS compared to controls. A more recent study by Nageswari et al. 2025[27] provides updated evidence supporting the role of Pilates in enhancing core muscle activation and reducing pain in individuals with chronic low back pain.

Endurance and Functional Strength

Kraus-Weber test outcomes indicated superior core strength and muscular endurance improvement in the Pilates group (mean difference = 2.37) versus the control group (mean difference = 1.02). The Krause-Weber test is used to find females' abdominal and back endurance. A more recent study by Franks et al. 2023[28] supports the role of Pilates in enhancing core muscle strength and activation in individuals with chronic low back pain. Additionally, research by Lee H and Kim et al. 2017 [23] demonstrated that a 16-week Pilates program significantly improved isometric trunk extension and flexion strength in women with chronic low back pain. These findings reinforce the efficacy of Pilates in targeting core musculature, emphasizing isometric control and muscular endurance, which are essential for supporting spinal structures in individuals with low back pain.

Quality of Life Improvements

The experimental group also exhibited more notable enhancements in the MENQOL and ODI scores, reflecting better physical functioning and reduced disability. This aligns with prior research indicating that Pilates improves physical capacity and has psychological benefits such as reduced anxiety and improved mood in menopausal populations Cruz-Ferreira et al., 2011 [29].

Study Limitations

The relatively small sample size limits the generalizability of the findings. Additionally, the absence of long-term follow-up makes it difficult to determine whether the observed improvements are sustained over time. Importantly, adherence to the intervention, especially outside supervised settings, was not monitored. Important physiological variables such as hormonal levels and other biochemical markers were not assessed, which could have provided more profound insights into the effects of exercise on menopausal symptoms.

Scope of the Study

This study contributes to growing evidence supporting Pilates as a beneficial exercise for post-menopausal women with non-specific low back pain. Integrating Pilates into clinical and community-based rehabilitation programs can be a viable strategy to address flexibility, endurance, and quality of life concerns in this population. This study has comprehensive focus on improving both physical function and quality of life for postmenopausal women's health.

CONCLUSION

Pilates serves as a preventive tool that can be particularly advantageous for early management of postmenopausal symptoms. By focusing on core strengthening, balanced muscle engagement, and controlled movements, it addresses pain relief and mobility challenges effectively. The specific techniques employed in Pilates—such as dynamic stretching, spinal alignment correction, and breathing practices—further target pain management and enhance overall mobility. Pilates serves as a preventive tool that can be particularly advantageous for early management of postmenopausal symptoms. By focusing on core strengthening, balanced muscle engagement, and controlled movements, it addresses pain relief and mobility challenges effectively. The specific techniques employed in Pilates—such as dynamic stretching, spinal alignment correction, and breathing practices—further target pain management and enhance overall mobility. Ultimately, the findings of this study underscore the importance of incorporating Pilates into the exercise regimens of postmenopausal women. By doing so, they can better maintain their health, manage symptoms, and enjoy a fulfilling, active lifestyle.

Acknowledgment: The authors would like to thank all participants.

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