



## RESEARCH PAPER

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## The effectiveness of Pilates exercise training on selected post-menopausal Women with non-specific low back pain in improving pain, flexibility and endurance- A pilot study

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### Abstract

Post-menopausal women, especially among the Indian population, are susceptible to experience non-specific low back pain which refers to pain or discomfort in the lower back region without a clear underlying structural cause or specific pathology. Pilates can help with the low back pain through a combination of strengthening, flexibility, postural improvement, and body awareness. Pilates reduces the pain by core strengthening, improving spinal alignment, balanced muscle development, dynamic stretching and controlled movements, encouraging mindfulness and awareness of movement patterns, specific breathing techniques, mind-body connection approach. By gradual progression of exercises it can help in proper form to reduce the risk of exacerbating existing pain. A three weeks Pilates training program was given to the experimental group, which was composed of ten postmenopausal women with non-specific low back pain, following an assessment of their pain, flexibility, and endurance. The study was a quantitative true experiment. A statistical analysis was performed on the experimental and control groups' pretest and posttest results. The post-test and post-test scores of the experimental group showed a significant difference in pain reduction, improved flexibility, and increased endurance in postmenopausal women, while the control group showed no significant change in any of these parameters.

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## Introduction

Increased muscular tension or stiffness above and below the gluteal folds, with or without radiation to the lower extremities, is the primary cause of low back pain (Van Tudler *et al.*, 2004). Dorsalgia, or lumbago, is another name for back pain, which is discomfort that can be felt anywhere along the spine. People of any age might be affected by it for various reasons. Most cases of back pain are idiopathic and non-specific. A frequent and unpleasant ailment that affects the lumbar area or lower part of the spine is low back pain. Most people have low back discomfort at some time in their lives. This is the sixth most frequent reason for a doctor's appointment and impacts between 60 and 80 percent of individuals during the course of their lifetime. According to estimates, between the ages of 50 and 55, 30 to 70% of postmenopausal women report experiencing back discomfort at some point. As stated by Wang (2016) a possible explanation for why women experience low back pain more frequently than males of same age is menopause. The postmenopausal women's flexibility and movement are limited by this nonspecific low back discomfort (Makris *et al.*, 2013). Today's women experience menopause for one-third of their lives as they become older (Poomalar and Bupathy, 2013). Women have low back discomfort more often than men do, and it becomes worse as they get older according to Branden *et al.*, 2008, Stang *et al.*, 2006 and Von Korff *et al.*, 2005. Eighty percent of women have pain and other symptoms throughout the postmenopausal era, which is often described as the 45–55 age range, according to Whelan *et al.* (2005)

Approximately 80% of people will have lower back discomfort at some point in their lives, which can lead to considerable disability and a loss of productive working hours. Anxiety and depression are common in people with low back pain and reduced function, and they can have an adverse effect on social and professional lives. Women who have gone through menopause and are between the ages of 45 and 60 are most affected by low back pain, which causes social and financial hardship. Post-menopausal women had a greater age-predicted incidence of low back pain

(90% between 40 and 60). Post-menopausal women's quality of life is particularly impacted by declines in psychological and cognitive performance as well as other health-related issues like heart disease, mood swings, and cancer risk.

Women's hormones during and after menopause may also affect their quality of life in terms of their health, especially in the areas of their physical, mental, and sexual well-being. The most cutting-edge conservative method of treating low back pain is still physical therapy. According to some research, up to 23% of postmenopausal women worldwide have persistent low back discomfort. 11–12% of people are unable to function due to low back discomfort. Apart from home chores, the remaining time is devoted to energy-intensive pursuits such as child care, farming and gardening, and animal maintenance. Numerous musculoskeletal conditions are partly caused by female sex hormones. Disc degeneration is more common in postmenopausal women due to a relative estrogen deficit.

LBA is a significant global public health issue that results in pain, functional impairment, and a low quality of life (Hughes and Nancy, 2009). The prevalence of low back pain (LBP) in India is concerning; over 60% of Indians have severe back pain at some point in their life. For the treatment of persistent low back pain, a wide range of therapeutic therapies are available, including muscular strengthening, aerobic exercise, general physical fitness, and other forms of flexibility and stretching exercises according to Hayden *et al.*, 2005 and Lee *et al.*, 2016. Pilates exercise is a series of exercises that, when combined with proper breathing, may improve the body's potential by resolving muscle imbalances, achieving ideal alignment, and generating effective movement patterns. It maintains the structural integrity of our body by balancing strength, mobility, and flexibility, and every workout works the core. Pilates has several advantages, such as strengthening the core, enhancing balance, and lowering the chance of falling. Pilate's exercises stimulate neuromuscular re-education while improving functional activity and

core strength. Women's muscular strength and trunk flexibility can be considerably increased by a simple Pilates exercise program, which can also lessen the changes in vasomotor, psychological, and somatic problems associated with post menopause (Lee *et al.*, 2016; Yu-Hsiu Kao *et al.*, 2014; Yu *et al.*, 2023). Pilates can help women over 65 who suffer from low back pain with their balance and fear of falling [13]. In postmenopausal women with nonspecific chronic low back pain, Pilates training was found to be more effective than aerobic exercise in reducing pain and disability (Ravindran *et al.*, 2022). For individuals with nonspecific low back pain, the study offers a valid and secure foundation for the inclusion of Pilates activities that are adequately taught and advanced as a therapeutic exercise intervention. The purpose of the current study was to use a Pilates exercise regimen to help postmenopausal women improve their flexibility and endurance while also lowering their low back pain.

### Materials and methods

Random sampling method was used to select postmenopausal women with non-specific low back pain samples with ten in experimental and ten in control group. Inclusion criteria for the study included post-menopausal of age group between 45 to 55 years, with symptoms of back pain for more than three weeks with less than 30 degrees of flexion and 5 degrees of extension as range of motion of lumbar spine. Post-menopausal women having pain levels more than five on a numerical pain rating scale, Postmenopausal having a score of less than 24 in Oswestry Disability Index scores for functional disability and Post-menopausal women with non-specific low back pain are having score of greater than 40 in MENQOL Questionnaire score for decreased quality of life. The participants who are coming under the inclusion criteria are asked to complete the Oswestry Disability Index Questionnaire for Pain and how it affects their ability to manage everyday life. The MENQOL questionnaire is self-administered and contains 28 questions that assess the physical, psychological, and social impact of menopause on a woman's Quality of life. The questions cover areas

such as hot flashes, sleep disturbances, mood changes, sexual function, and overall health. The answers to the questions are scored and used to calculate a total score, which provides a summary of the woman's Quality of life pre and post test. The Pre-menopausal women, Women with psychological pain, Menopause women diagnosed with lumbar fractures or who have undergone any lumbar Surgery, stroke, spinal cord pathology, inflammatory joint disease, lumbar spine infection, marked osteoporosis, lumbar spine cancer, history of diabetes mellitus, hypertension, ODI scores more than 40 were excluded from the study. Written consent was obtained from each participant and their privacy and confidentiality were assured.

The experimental group received a 3-week therapy consisting of three 40-minute Pilate's sessions per week, whereas the control group received a 3-week treatment consisting of three 40-minute sessions per week of a conventional exercise program. Following a three week period, a post-test survey questionnaire was administered, and participant responses were documented. Pilates is a method of strengthening, stabilizing, and extending flexibility through a series of repeated movements done on a yoga mat or with additional apparatus. Pilates routines use core-driven muscle contraction to build the physique. In order to facilitate efficient and elegant daily motions, the approach develops body awareness. Joseph Pilates created the Pilates Method in the 1920s. Proponents of Pilates (Kloubec, 2011; Iulian-Doru *et al.*, 2013) highlight the technique's ability to strengthen the core, which helps with balance and posture. Pilates focuses on the "powerhouse" muscles— the lower back, hips and pelvic floor and this workout involves deep, mindful breathing.

### Results and discussion

Potential personal and demographic characteristics were listed in frequency along with percentages. The mean and standard deviation were provided for the physical parameters. The non-parametric Mann Whitney U Test was used to assess the quantitative data difference between the experiment and control.

A two-tailed test was employed for significance testing, with a p value of less than 0.05 being deemed statistically significant. The majority wise % is also described in relation to the possible demographic profile of the 10 postmenopausal women.

**Table 1.** Demographic Variables of the study participants

Demographic values	Exp. n =10	Control n = 10
Age in years	45 - 50 years	6
	50 - 56 years	4
Education	Post Graduate	2
	Under Graduate	3
	Higher Secondary	2
	Primary education	2
	Illiterate	1
Occupation	Government sector	1
	Private sector	3
	Self employed	3
	Retired	1
	Home maker	2
	Others	0
Monthly income	Below 5000	2
	5001 – 10000	3
	10001 – 15000	3
	Above 15001	2
Religion	Hindu	6
	Muslim	2
	Christian	2
	Others	0
Marital status	Married	8
	Unmarried	2
	Separated	0
	Divorced	0
Type of family	Nuclear family	4
	Joint family	6
Dietary Habits	Vegetarian	2
	Mixed	8

Sixty percent of the ten experimental groups were women, and sixty percent of them had experienced back discomfort in less than six weeks. The remaining thirty percent had completed their education, thirty percent worked in the private sector, and eighty percent were married. For three months, three days a week of Pilates exercise training were given to 60% of individuals with low levels of physical activity. Of the ten individuals in the control group, sixty percent were between the ages of forty and fifty, thirty percent had completed their education, thirty percent worked in the private sector, eighty percent were married, sixty percent of women reported having back pain in less than six weeks, and sixty percent of those with

low levels of physical activity participated in traditional exercise training three days a week for three weeks.

The Table 1 shows a number of possible demographic factors were taken into account while analyzing low back pain in postmenopausal women, including age, the degree of the condition, socioeconomic status (including income, education, and religion), marital status, the type of family, and dietary habits for the 10 samples used in the pilot study.

The Table 2 shows the Personal life style variables includes duration of pain, daily physical activity level, history of stressful life style, sedentary behavior, smoking, alcohol consumption, habit of chewing tobacco, regular performance of exercises, abdominal obesity, hormonal replacement therapy undergone information collected from the samples.

From the Table 3, we are able to see that there are no considerable changes in the physical parameters because the treatment session was only for twelve weeks. The post weight measurement in unpaired two tailed T test shows that a value of  $t = 2.00$ ,  $p = 0.47 < 0.05$  which is significant with a mean difference of 13.55. The values of BMI with  $t = 0.10$ ,  $p = 0.091$  shows that this is not significant with a mean difference of 0.09. Similarly the waist circumference with  $t = 1.22$ ,  $p = 0.022 < 0.05$  shows statistical significance with a mean difference of 3.35. The reduction in weight or the waist circumference or the improvement in BMI is not our main aim and it needs few months and years to find the same because we are not giving the treatment for weight reduction there is no restriction of diet or any nutritional advice given to the group to follow. There will be a different dietary patterns followed by the samples and no recommendation of any kind of food is given.

Table 4 presents a comparison of the experimental group's pre- and post-test lumbar flexion and extension. The results demonstrate significance, with p values of 0.00652 and 0.00168, respectively. The experimental group's outcome measures the

MENQOL score for quality of life, the Oswestry disability scale for flexibility, and the Numerical pain rating scale for pain show significance with p values of 0.00024, 0.00018, and 0.00022, respectively, less than 0.05.

**Table 2.** Personal Variables of the post-menopausal women Participants of the study

Personal variables		Exp. n=10	Control n=10
Duration of the low back pain	Less than 6 weeks	6	6
	Between 6 to 12 weeks	2	2
	More than 12 weeks	2	2
Habit of smoking	Yes	0	0
	No	10	10
Habit of Alcohol	Yes	0	0
	No	10	10
Habit of chewing tobacco	Yes	0	0
	No	10	10
Abdominal obesity	yes	6	6
	No	4	4
History of daily Physical activity	Light	6	6
	Moderate	2	2
	Vigorous	2	2
History of stressful life style	Yes	6	6
	No	4	4
Undergone any hormonal therapy	Yes	0	0
	No	10	10

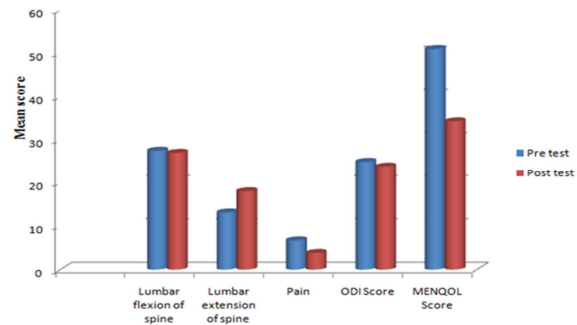
**Table 3.** Analysis of physical parameters - between group analysis

Groups	Physical parameters	Unpaired T Test		
		MD	T	P
A	Weight	13.55	2.00	0.047
B	Weight			
A	BMI	0.09	0.10	0.091
B	BMI			
A	Waist circumference	3.35	1.22	0.022
B	Waist circumference			

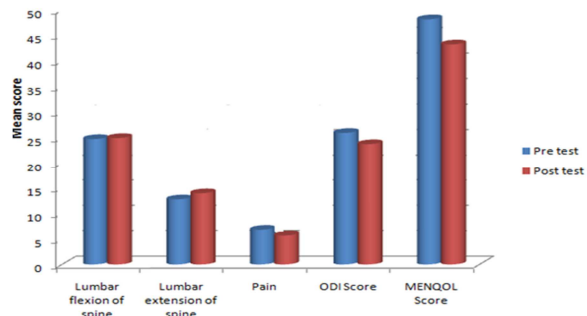
The Table 5 shows with a p value of 0.0161 and 0.0236, respectively, the comparison of the control group's lumbar flexion and extension during the pre- and post-test demonstrates significance. The experimental group's outcome measures—the MENQOL score for quality of life, the Oswestry disability scale for flexibility, and the Numerical pain rating scale for pain—show significance with p values of less than 0.05 for each.

The Table 6 shows the comparison of lumbar flexion, extension of the post- test of the experimental and

control group shows significance with a p value of 0.042, and 0.045, respectively. The outcome measures of the experimental group the Numerical pain rating scale for pain, Oswestry disability scale for flexibility and MENQOL score for quality of life shows significance of p value of 0.004, 0.007, 0.001 respectively less than 0.05.



**Fig. 1.** Comparison of pretest and post test among experimental group



**Fig. 2.** Comparison of pretest and post test among control group

The effectiveness of the Pilates exercise program in reducing the low back pain was ascertained by comparing the pretest and post test of the experimental and control group is portrayed in Fig. 1.

In Fig. 2, the control group's pretest and posttest comparison is shown, along with an explanation of the lumbar flexion, extension, low back pain measure using the NRI, ODI score, and MENQOL score. Fig. 1 and 2 demonstrate that, in comparison to the control group, the experimental group is significantly more successful in demonstrating a reduction in pain symptoms, an increase in flexibility, and an improvement in the postmenopausal women's quality of life with nonspecific low back pain.

**Table 4.** Comparison among experimental group

Physical assessment	Pre test		Post test		Mean difference	Mann whitney U Test
	Mean	SD	Mean	SD		
Lumbar flexion of spine	27.5	9.8	27	3.16	0	$z = -2.7213$ $p = 0.00652$
Lumbar extension spine	13.1	2.02	18	2.5	4.9	$z = -3.1371$ $p = 0.00168$
Pain	6.7	0.94	3.8	0.78	2.9	$z = -3.666$ $p = 0.00024$
ODI Score	24.9	3.47	23.8	2.8	0.1	$z = -3.741$ $p = 0.00018$
MENQOL Score	51	10.3	34.3	3.5	16.7	$z = 3.704$ $p = 0.00022$

**Table 5.** Comparison among control group

Physical assessment	Pre test		Post test		Mean difference	Mann witney U test
	Mean	SD	Mean	SD		
Lumbar flexion of spine	24.8	3.79	27	3.8	0.2	$z = -1.398$ $p = 0.01615$
Lumbar extension spine	12.8	2.14	15	2.74	2.2	$z = -1.927$ $p = 0.0236$
Pain	6.8	1.1	5.7	0.48	1.1	$z = -2.192$ $p = 0.02852$
ODI Score	26	3.8	23.8	2.8	2.2	$z = 1.020$ $p = 0.03077$
MENQOL Score	48.2	8.6	43.3	6.01	3.9	$z = -1.738$ $p = 0.00818$

**Table 6.** Comparison between the experimental and control group

Physical assessment	Group				Mean difference	Mann Whitney U Test
	Exp. (n=10)		Control (n = 10)			
	Mean	SD	Mean	SD		
Lumbar flexion of spine	29	3.16	27	3.88	2	$z = .7937$ $p = 0.04295$
Lumbar extension spine	18	2.58	15	2.74	3	$z = -2.0032$ $p = 0.04551$
Pain	3.8	0.78	5.7	0.48	1.9	$z = -3.515$ $p = 0.0044$
ODI Score	18.6	1.57	23.8	2.85	5.2	$z = -3.363$ $p = 0.0078$
MENQOL Score	34.3	3.5	43.3	6.01	9	$z = -3.212$ $p = 0.00132$

### Importance of pilates training

Rehabilitating the strength and flexibility of the spine's musculature in people with non-specific low back pain is crucial for restoring function and preventing recurrence, according to several writers (Curnow *et al.*, 2009). Conventional exercises, such as lumbar stabilization exercises, are mostly recommended for back discomfort (Rydeard *et al.*, 2006). The purpose of the research was to evaluate the impact of a Pilates exercise program on a subset of postmenopausal women with generalized low back pain. The main goal was to assess the experimental group's response to the Pilates training program. The results of the study showed that the postmenopausal women in the experimental group had a substantial improvement in their quality of life, reduction in pain, and increased flexibility. The MENQOL Questionnaire was used to determine improvements in quality of life. The numeric pain scale questionnaire was used to assess the decrease in pain, the Oswestry disability scale index was used to measure the decrease in disability, and the universal goniometer was used to test the flexibility.

The control group that completed the typical conservative activities showed no discernible differences between the pretest and posttest. Pilates is a mind-body workout that calls for focus on posture, breathing, and muscle control in addition to core stability, strength, and flexibility. Pilates improves an older woman's quality of life, personal autonomy, and static equilibrium (Siqueira Rodrigues *et al.*, 2010). Muscular strength and endurance are enhanced by the functional exercises used in the Pilates technique (Kloubec, 2010; Rydeard *et al.*, 2006; Kulkarni *et al.*, 2022).

Week by week, the intensity of these exercises' practice grows and ultimately contributes to the improvement of strong postural control [18]. Postmenopausal women are more likely to develop sedentary behaviors and lose fitness (Sowers *et al.*, 2007), which is unquestionably linked to declining health and a poorer standard of living (Martin *et al.*, 2009). Consequently, it's critical that postmenopausal women engage in physical activity to modify their sedentary lives (Marini *et al.*, 2017).



## Conclusion

The results of the study showed that the Pilates exercise program is more successful in lowering non-specific low back pain by enhancing postmenopausal women's flexibility, strength, and quality of life. Pilates exercise regimen is more successful in reducing pain and enhancing lumbar flexibility and strength [25]. By conquering the symptoms of postmenopause and boosting her physical activity with the aid of a Pilates exercise program, a postmenopausal woman may take care of her health and lead a happy quiet life.

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