RESEARCH PAPER

Effectiveness of William's Exercise versus Lumbar Stabilization Exercise in Functional Ability in Post Menopausal Women with Low Back Pain

Miss. Mehvish Syed Imran Kadri[1], Dr. Amruta Doijad[2*], Dr. Umiya Pathan[3]
[1]Intern, D. Y. Patil College of Physiotherapy, D. Y. Patil Education Society (Deemed to be University), Kolhapur 416003, Maharashtra, India
Email: mehvishkadri7641@gmail.com
[2*]Professor and HOD, Department of Neurosciences Physiotherapy, D. Y. Patil College of Physiotherapy, D. Y. Patil Education Society (Deemed to be University), Kolhapur 416003, Maharashtra, India
Email: doijadamruta@gmail.com
[3]Professor and HOD, Department of Musculoskeletal Science Physiotherapy, D. Y. Patil College of Physiotherapy, D. Y. Patil Education Society (Deemed to be University), Kolhapur 416003, Maharashtra, India
Email: drumiyapathan@gmail.com
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ABSTRACT

Background – Low back pain in post-menopausal women occurs due to estrogen decline, sarcopenia and spinal degeneration, significantly impairing functional ability. William's flexion exercise is designed to reduce back pain by lengthening the extensor muscle group while building strength within the musculature responsible for stabilizing the lumbosacral area, with primary involvement of the core muscle group and the major hip extensor muscles, including the gluteus maximus. Lumbar stabilisation exercises aim to relieve back pain by enhancing core stability and neuromuscular control, strengthening deep spinal stabilisers such as the transversus abdominis and multifidus muscles that support the lumbosacral spine. Despite the widespread clinical use of both Williams exercises and lumbar stabilization exercises, there is limited evidence directly comparing their relative effectiveness, especially among postmenopausal women experiencing lower back pain

Aim of the study- This study aims to compare the effect of Williams exercise and lumbar stabilisation exercise on functional ability in postmenopausal women with low back pain.

Objective of study –

To analyse the effect of Williams exercise on functional ability in postmenopausal women with low back pain.

To analyse the effect of lumbar stabilisation exercise on functional ability in postmenopausal women with low back pain.

To compare the effect of Williams exercise and lumbar stabilisation exercise on functional ability in postmenopausal women with low back pain.

Method - A randomised controlled experimental study was conducted on 76 postmenopausal females within the age range of 45–60 years who had been medically confirmed to have low back discomfort and satisfied all established eligibility requirements. Baseline and post-intervention evaluations were performed using the Numeric Pain Rating Scale (NPRS) and the Roland–Morris Disability Questionnaire (RMDQ) to determine pain severity and functional impairment. Demographic and clinical variables, including age, duration of symptoms, and pertinent medical history, were systematically documented. The eligible participants were arbitrarily divided into two study cohorts, namely Group A and Group B, with 38 participants allocated to each group.

Group A underwent the William's Flexion Exercise protocol, which comprised pelvic tilt exercises, single knee-to-chest exercises, double knee-to-chest exercises, partial curl-ups, hamstring stretching, and hip flexor stretching. In contrast, Group B participated in a Lumbar Stabilization Exercise program that included transverse abdominis activation in the crook lying position, single arm raises in the quadrupod position, and single leg raises in the quadrupod position, among other stabilization activities.

Both intervention protocols were administered under physiotherapy supervision for three consecutive weeks. Evaluation of outcomes was performed prior to and following the treatment protocol. Evaluation of outcomes was performed prior to and following the treatment protocol using the NPRS and the RMDQ. Paired and unpaired t-tests were used to interpret statistical results and compare changes within and between groups.

Result- The effectiveness of Group A was reviewed utilising the Paired *t*-test/Wilcoxon Signed Rank Test, while the effectiveness of Group B was also reviewed using the Paired *t*-test/Wilcoxon Signed Rank Test. Statistical assessment of intergroup differences was undertaken employing the Unpaired *t*-test and Mann–Whitney testing procedures. The findings demonstrated a statistically significant improvement within both groups for all assessed parameters, including NPRS and RMDQ scores.

Conclusion

Both exercise interventions, that is, Williams exercise as well as Lumbar Stabilization exercise, demonstrated beneficial effects in alleviating pain intensity and minimising functional limitations among postmenopausal females experiencing low back pain. However, Group A demonstrated greater reduction in Numeric Pain Rating Scale (NPRS) and Roland–Morris Disability Questionnaire (RMDQ) scores compared to Group B.

Keywords- Low back pain, Post- Menopausal women, Williams Exercise, Lumbar Stabilization Exercise, Numerical pain rating scale and Roland-Morris Disability Questionnaire.

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INTRODUCTION

Lower back pain involves soreness and restricted movement in the lumbar area. It affects about 84% experienced by a large segment of the population at various stages of life, making it one of the most prevalent disorders involving the musculoskeletal system conditions. This type of pain is often classified according to how long it lasts. Acute pain typically persists for less than a week, while pain that continues from one week to several months is considered chronic in nature. With proper care, acute episodes usually subside within a short period, but if not addressed, they can progress into long-term, chronic discomfort. [1]

Low back pain refers to acute or long-standing discomfort in the lumbar area and is generally considered a non-specific condition. It is extremely common, often associated with the demands of maintaining an upright posture. Around 70% of acute cases improve with rest, although recurrence is also seen in a similar proportion of individuals. Back pain is typically categorised into two types: inflammatory, which tends to worsen after periods of rest and is more noticeable in the morning, and mechanical, which is aggravated by physical activity. One of the leading causes is poor posture, as it increases stress on spinal discs and ligaments, contributing to faster degeneration. Proper spinal movement relies on the coordinated function of the facet joints and intervertebral discs. Disruptions in biomechanics—caused by weak muscles, ligament injuries, fractures, or disc damage— may increase the likelihood of experiencing low back pain. A variety of risk determinants are known to be related to this disorder, particularly modifiable ones such as occupational demands (including heavy lifting, frequent bending or twisting, prolonged sitting, and awkward working positions) as well as lifestyle-related habits (physical exercise, inadequate muscle strength, obesity, smoking). Growing older, having more children, having experienced a prior episode of LBP, and having significant spinal abnormalities are among the non-modifiable risk factors. [2]

Last menstruation is referred to as menopause. The period of time when ovarian function stops, leading to permanent amenorrhea, is known as menopause. The World Health Organisation states that amenorrhea must last for a full year before menopause is confirmed. Around 25 million women globally went through menopause in 1990; by the late 2020s, this figure is predicted to quadruple. By 2015, it is anticipated that 130 million Indian women will survive past menopause. Many women are expected to live in an estrogen-deficient state for more than 20 years after menopause due to the general rise in life expectancy brought about by modern treatment. These women may encounter menopausal symptoms that are severe enough to interfere with their daily lives. [3]

The ovaries' reduced synthesis of female hormones causes the transition from the premenopausal to postmenopausal stage. This is a normal aspect of ageing and happens gradually over time. There are many symptoms that have been linked to the perimenopausal stage. Spine and joint discomfort, hot flashes, night sweats, and persistent fatigue are examples of physical symptoms; irritability and worry, mood swings, depression, and sleep difficulties are examples of psychological symptoms. [6] Across the studies reviewed, women who were in the menopausal transition or had already reached menopause consistently reported higher levels of joint and back pain.[6]

Low back pain (LBP) is a widespread and often debilitating condition that can affect individuals at any age, with a particularly strong impact on quality of life in women undergoing postmenopausal changes. LBP has become more common as the world's population ages, having a wide-ranging effect on socioeconomic position, mental well-being, and physical function. According to research, women are disproportionately affected by LBP, which is more common after menopause due to hormonal changes that worsen musculoskeletal deterioration and pain sensitivity. Numerous factors, such as age-related physiological changes, socioeconomic determinants, and differences in healthcare access, affect the prevalence of LBP among postmenopausal women. Hormone levels are significantly altered during menopause, especially estrogen, which is essential for maintaining bone density and joint stability. [2] When combined with

ageing-related musculoskeletal deterioration, estrogen insufficiency can accelerate osteoporosis and increase vulnerability to back and joint discomfort. Additionally, postmenopausal women's declining muscle mass and reduced physical activity increase their likelihood of developing chronic pain disorders, with low back pain (LBP) ranking among the most frequently reported concerns. Examining how biological and environmental risk factors interact is a crucial part of comprehending LBP in postmenopausal women.

Because estrogen affects the expression of pain sensitivity and the preservation of connective tissue integrity, hormonal alterations that occur after menopause are linked to musculoskeletal pain. A lack of estrogen may hasten the development of osteoporosis, which can result in deformities, persistent discomfort, and vertebral fractures. Reduced estrogen levels are also associated with elevated inflammatory markers, which may intensify discomfort and contribute to the earlier progression toward chronic pain localised to the lumbar area.[4]

Musculoskeletal pain of the lower back arises from multiple interacting causes. In postmenopausal women, reduced estrogen levels accelerate degeneration of the intervertebral discs. Other important factors include central adiposity, loss of muscle mass, sleep disturbances, psychological influences, and vitamin D deficiency. Management typically combines non-medicinal approaches, including heat therapy, manual techniques, and exercise, with medications like non-anti-inflammatory pharmacological agents combined with muscle relaxants to relieve pain and improve function. However, long-term drug use increases the risk of adverse effects, and excessive reliance on opioids remains a significant issue. Besides this, dysfunction of the autonomic nervous system in postmenopausal females adds complexity to the selection of medicinal therapy, underscoring the need for further research. Evidence from Wang et al. suggests that minodronic acid may help relieve ache in lumbar region in individuals with osteoporosis. Despite these findings, a well-defined, comprehensive treatment framework tailored specifically to postmenopausal women is still lacking, and stronger implementation of multidisciplinary care pathways and clinical guidelines is needed. [7]

WILLIAMS FLEXION EXERCISE -

In 1937, Paul C. Williams introduced Williams' flexion exercises—also known as lumbar flexion exercises—for individuals accompanied by chronic musculoskeletal pain affecting the lower back . This approach was developed from his clinical observations that many such patients exhibited vertebral deterioration associated with degenerative disc disease.(Akbar and Zainuddin 2020). [1]

Williams exercises are considered beneficial for managing various spinal conditions. Paul C. Williams proposed that alterations in the spine's natural curvature are a major contributor to low back pain. Specifically, he suggested that excessive lumbar lordosis, along with weak abdominal musculature, can increase discomfort. He also emphasized that reduced strength and flexibility in the hip and thigh regions—particularly tight hamstrings—and impaired coordination of hip and pelvic movements may further aggravate back pain.

Based on these concepts, Williams developed a series of therapeutic exercises intended to correct excessive curvature of the lumbar spine, reinforce core musculature, and improve mobility of the muscles surrounding the hip and buttock region. [8]

Williams flexion exercises are designed to decrease pain in the lower back by improving stability of the lumbosacral spine through strengthening of the abdominal and gluteal musculature, along with flexibility training for the spinal extensors. Paul C. Williams suggested that this approach helps correct poor posture, decreases stiffness in intervertebral joints, and alleviates muscle spasms through controlled movements. Regular practice of these exercises—such as three sessions per week over the course of a month—has been shown to significantly reduce pain levels.(Amila et al., 2021). [1] Williams flexion exercises include movements such as squatting exercises, modified abdominal curls, stretching of the hamstring and hip flexor muscles, unilateral and bilateral knee-to-chest movements, together with pelvic tilting activities.[1]

LUMBAR STABILZATION EXERCISE –

The fundamental aim of lumbar stabilization exercises is to optimise muscular stability, strength, and endurance, and develop neuromuscular control, all of which are crucial for maintaining dynamic stability of the spine and trunk. These exercises are generally considered safe and offer advantages such as cost-effectiveness and adaptability across different progression stages. [9]

Lumbar stabilization exercises are an active form of training aimed at reducing the likelihood of musculoskeletal pain in the lumbar region through reinforcement of the musculature responsible for spinal support. This multicomponent approach incorporates elements of strength, flexibility, and endurance training. It is typically prescribed after an extensive evaluation of the participant's condition and can be applied across all phases of a back pain episode. Under the supervision of a qualified physiotherapist, patients are trained to identify and maintain a "neutral spine" position through a structured series of exercises. They then learn to

stabilise the spine in this posture by engaging specific muscle groups. These include the transversus abdominis (TrA), lumbar multifidus, paraspinal muscles, abdominal muscles, diaphragm, and pelvic floor muscles. [5]

METHODOLOGY

An Interventional Analytical study conducted at D. Y. Patil Medical College Hospital and Research Center, Kolhapur, on Post- Menopausal women using Simple random sampling. The study population fulfilling the determined selection and exclusion parameters was selected for the study. After getting ethical fulfilling the determined selection and exclusion parameters, the Institutional Ethics Committee. Sample size was 72

Materials

Measuring tape, Numerical pain rating scale, Roland Moris Questionnaire, Data collection form
Consent form.

Inclusion Criteria

Post-Menopausal Women aged 42 to 57 years, pain intensity – Moderate, patients with LBP who are willing to take part in the study.

Exclusion criteria

History of operative treatment of the spine, fracture or trauma, signs of neurological involvement, such as weakness and numbness, any psychological disorder that may affect compliance, severe osteoporosis or other bone disease

The study protocol was submitted to the Institutional Ethics Committee and Protocol Committee of D. Y. Patil Medical College for review and approval. Following approval, eligible participants were contacted and informed about the objectives of the study. Individuals who agreed to participate and fulfilled the specified selection and exclusion conditions were included in the research. Formal written consent was secured from every participant before the commencement of data acquisition, which was subsequently conducted using the specified diagnostic criteria.

PROCEDURE

The study participants were recruited from the outpatient department of D. Y. Patil Medical College and Hospital. Preliminary demographic information was recorded using the designated data collection form. Before participation in the study, informed consent in both spoken and written forms was obtained from each individual.

Basic demographic information, such as name, age, gender, and other necessary details, was documented using the data collection form. Informed written consent was voluntarily obtained from every participant prior to their enrollment in the study. The participants were then randomly assigned to two groups through a computer-generated randomisation method. Baseline and post-intervention assessments of NPRS and RMDQ were conducted for all subjects. Participants in Group A performed Williams flexion exercises, whereas those in Group B underwent lumbar stabilization exercises. The treatment protocol was implemented over the course of three weeks, with three treatment sessions scheduled per week.

Group A - Williams flexion exercise

- **Pelvic Tilt:** Lie flat on the back with the bent knees. Without exerting pressure through the legs, flatten the lower back against the floor.
- **Single Knee-to-Chest Exercise**
- **Double Knee-to-Chest Exercise**
- **Partial Sit-Up:** A partial sit-up involves slightly lifting the head and shoulders from the floor while keeping the lower back supported and the knees bent.
- **Hamstring Stretch:** Sit with both legs extended straight and toes pointing upward. Keeping the knees straight, lean the trunk forward over the legs with the stretched arms
- **Hip Flexor Stretch:** Position one leg forward with the front knee bent while keeping the opposite leg extended behind. Lean the trunk for ward until a stretch is felt in the hip flexor region. Repeat the exercise by alternating the leg positions.
- **Squat Exercise:** Stand upright with feet shoulder-width apart. Slowly bend the knees, keep the back straight, look forward, and maintain both feet flat on the floor.

Group B - Lumar Stabilization exercise

- **Transverse Abdominis Contraction in Crook-Lying Position:** Lie comfortably on your back with your knees flexed. Gently activate the transverse abdominis muscle by drawing the abdomen inward, as if pulling the navel toward the spine.
- **Quadruped position single arm lift**
- **Quadruped position single leg lift**
- **Quadruped Position with Single Arm Lift and Hold**
- **Quadruped Position with Single Leg Lift and Hold**
- **Transverse Abdominis Contraction in Sitting and Standing:** Sit upright on a chair with the feet placed flat on the floor and positioned hip-width apart. Gently contract the transverse abdominis muscle by drawing the abdomen inward toward the spine while maintaining a neutral posture. The same contraction can also be performed in a standing position.
- **Sit-ups**
- **Plank**

RESULTS

A] Age Distribution

The table illustrates the classification of participants according to age enrolled in the study. Age ranged from 41 to 55 years, confirming that all individuals belonged to the postmenopausal age group. The average age was observed to be 47.17 years, indicating that most participants were in their late forties. The standard deviation was 3.14, which indicates that the ages of the participants were relatively close to the mean age and that there was less variation in age among the study population. Overall, the data show that the participants included in the study were within a similar age range, ensuring homogeneity of the sample with respect to age.

Minimum	Maximum	Mean	Std. Deviation
41	55	47.17	3.14

Table no 1- Age Distribution

B] Comparison of Pre- and Post-Intervention NPRS and RMDQ Scores in Group A

Table presents the comparison of pre and post-intervention outcome measures in Group A, who underwent Paul C. Williams exercises. For the NPRS, the mean pre-intervention score was 6.22 with a SD of 1.15, which suggests that women experienced moderate levels of pain before the intervention. After the intervention period, the mean post-intervention score reduced to 2.72 with a SD of 0.88, which is a reduction in pain intensity following the application of William's Exercise. The decrease in the mean NPRS score demonstrates that the participants experienced significant relief in low back pain after performing the exercise program. Similarly, improvement was also observed in functional ability as measured by the Roland–Morris Disability Questionnaire. The mean pre-intervention RMDQ score was 11.33 ± 1.96 After completion of the exercise program, the mean post-intervention RMDQ score reduced to 4.33 ± 1.10, demonstrating a marked improvement in functional capacity and a significant reduction in disability levels among the participants.

Parameters	Assessment Period	Mean	Std. Deviation	p-value
NPRS	Pre	6.22	1.15	<0.001*
	Post	2.72	0.88	
RMDQ	Pre	11.33	1.96	<0.001*
	Post	4.33	1.10	

Table no 2 - Pre and post intervention of NPRS and RMDQ of Group A

Graph no 1 – Pre and post intervention of NPRS in group A

Graph no 1 – Pre and post intervention of NPRS in group A

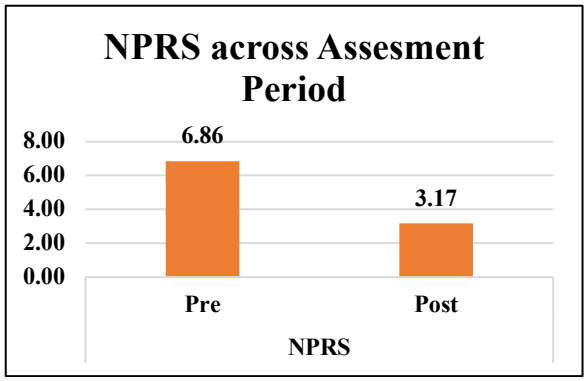
Graph no 2 – Pre and post intervention of RMDQ in group A

C] Pre and post intervention of NPRS and RMDQ of Group B

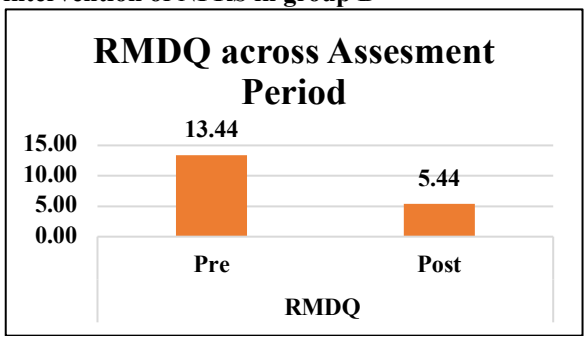
The table depicts the comparison of outcome measures before and after the intervention among participants in Group B. The mean pre-intervention NPRS score was 6.86 ± 0.83, indicating that the participants experienced a considerable degree of pain prior to the intervention. Following the intervention, the mean NPRS score declined to 3.17 ± 0.66, reflecting a marked reduction in pain intensity. The obtained p-value (<0.001) demonstrated that the improvement was statistically significant. The mean pre-intervention RMDQ score was 13.44 ± 2.31, suggesting the presence of moderate disability associated with low back pain before treatment. After completion of the intervention, the mean RMDQ score reduced to 5.44 ± 1.52, indicating a substantial decrease in disability and enhanced functional performance among the participants. The p-value (<0.001) confirmed that the observed change was statistically significant

Parameters	Assessment Period	Mean	Std. Deviation	p-value
NPRS	Pre	6.86	0.83	<0.001*
	Post	3.17	0.66	
RMDQ	Pre	13.44	2.31	<0.001*
	Post	5.44	1.52	

Table no 3 - Pre and post intervention of NPRS and RMDQ in Group B



Graph no 3 – Pre and post intervention of NPRS in group B



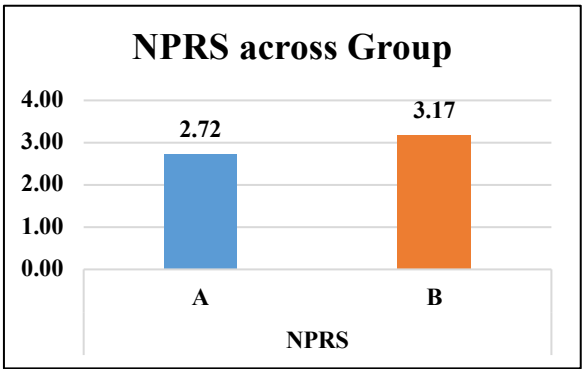
Graph no 4 – Pre and post intervention of RMDQ in group B

D] Comparison of Post-Intervention NPRS and RMDQ Scores Between Group A and Group B

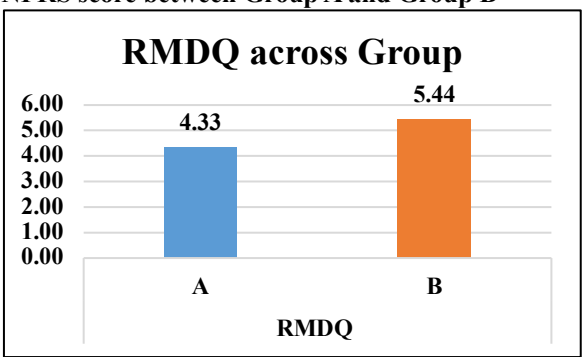
The following illustrates the comparison of post-intervention outcome measures between participants in Group A and Group B. With regard to the NPRS scores, Group A mean score of 2.72 ± 0.88, whereas Group B showed a mean score of 3.17 ± 0.66. In terms of functional disability, the mean RMDQ score in Group A was 4.33 ± 1.10, while Group B recorded a mean score of 5.44 ± 1.52.

Parameters	Group	Mean	Std. Deviation	p-value
NPRS	A	2.72	0.88	0.018*
	B	3.17	0.66	
RMDQ	A	4.33	1.10	<0.001*
	B	5.44	1.52	

Table no 4 - Group Comparison of NPRS and RMDQ



Graph no 5 – Comparison of post-intervention NPRS score between Group A and Group B



Graph no 6 – Comparison of post-intervention RMDQ score between Group A and Group B

DISCUSSION

This research was conducted to evaluate and compare the effectiveness of Williams Exercises and Lumbar Stabilization Exercises in enhancing functional ability among postmenopausal women experiencing low back pain. 76 participants were enrolled and randomly divided into two equal groups consisting of 36 participants each: Participants in Group A performed Williams Exercises, whereas those in Group B underwent Lumbar Stabilization Exercises. Both intervention programs were provided at a frequency of three sessions per week during the three-week intervention phase. Assessments were performed before and after the intervention using the chosen outcome measures to determine the effectiveness of both exercise programs.

Nonspecific low back pain is defined as a musculoskeletal condition marked by sudden or persistent pain in the lower lumbar area and adjacent structures. Poor posture is one of the leading contributors to back pain, as it places pressure on the vertebral discs, thereby accelerating degenerative disc changes. The intervertebral discs and facet joints function together to support normal spinal movement and stability. Any impairment, such as muscle weakness, ligament damage, fractures, or injury to the intervertebral discs, may disturb spinal biomechanics and contribute to the onset of low back pain. Several risk factors have been linked with low back pain.

Modifiable factors include lifestyle-related aspects such as reduced muscle power, increased body mass, as well as other factors like repetitive lifting, bending, twisting, stooping, prolonged sitting, and maintaining improper working postures. Non-modifiable risk factors include advancing age, higher parity, and significant spinal deformities. [2]

Menopause is described as the occurrence of a woman's final menstrual cycle. It is characterised by the irreversible termination of menstrual cycles resulting from a decline in ovarian function and activity.[3] The transition from the premenopausal stage to the postmenopausal phase occurs due to a gradual decline in the production of female hormones by the ovaries. This change develops progressively over time and represents a normal aspect of the ageing process. Several symptoms are commonly associated with menopausal transition changes. Common physical manifestations may involve lumbar and joint discomfort, vasomotor symptoms such as hot flashes, nocturnal sweating, and ongoing tiredness, while psychological manifestations may involve irritability, anxiety, mood fluctuations, depression, and disturbances in sleep. [6] The occurrence of low back pain showed a marked rise with advancing age among women. [10]

The rate of low back discomfort among women after menopause is influenced by a multitude of factors, including age-related physiological changes, socioeconomic determinants, and healthcare access disparities. Menopause brings about significant shifts in hormone levels, particularly estrogen, which plays a key role in bone density maintenance and joint stability [2]. Estrogen deficiency, coupled with ageing-related musculoskeletal decline, can precipitate osteoporosis and increased susceptibility to joint and back pain. Furthermore, muscle mass deterioration and decreased physical activity in post-menopausal women compound the risk of chronic pain conditions, with LBP being one of the most commonly reported symptoms [4]

A recent randomised controlled trial conducted by Guo et al. (2026) noted that lumbar stabilization exercises were beneficial in reducing pain severity and enhancing functional performance among individuals experiencing chronic musculoskeletal pain in the lumbar region. The study further revealed positive changes in lumbar muscle characteristics, suggesting that stabilization exercises contribute to enhanced muscle performance and improved spinal stability, thereby supporting the results observed in the present study. [11]

Another study conducted by Khan et al. (2024) reported that lumbar stabilization exercises were beneficial in alleviating pain and enhancing functional performance among individuals experiencing non-specific musculoskeletal pain in the lumbar region. The findings also emphasised enhancements in neuromuscular control and postural stability, further supporting the role of lumbar stabilization interventions in increasing functional capacity, consistent with the outcomes of the present study. [12]

The study by Dydyk et al. (2025) reported that Williams flexion exercises are effective in managing low back pain by improving lumbar flexion, strengthening abdominal and gluteal muscles, and reducing stress on posterior spinal structures. These biomechanical changes contribute to pain reduction and improved functional ability, supporting the results obtained in the current study.[13]

Another study by Kusuma and Setiowati demonstrated that Williams flexion exercises significantly improve lumbar mobility in individuals with low back pain. Improved spinal mobility directly enhances functional ability, which corresponds to the improvements observed in the present study. [14]

This study confirms that both Williams exercises and lumbar stabilization exercises are effective in reducing pain and improving functional ability in postmenopausal women with low back pain. However the study outcomes demonstrated that William's flexion exercises produced superior improvements over lumbar stabilization training in decreasing pain severity and enhancing functional performance among postmenopausal women experiencing low back pain.

CONCLUSION

The results obtained from the present study indicate that both Williams exercises and lumbar stabilization exercises are effective in alleviating pain and improving functional ability in postmenopausal women with low back pain. Significant improvements were observed in the outcome measures, after the intervention period.

However, when the two interventions were compared, Williams exercises demonstrated greater effectiveness than lumbar stabilization exercises in reducing pain intensity and enhancing functional ability among postmenopausal women with low back pain.

CONFLICT OF INTEREST

No possible competing interests concerning the research work, authorship, or publication of this article have been declared by the authors

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