

# The Effect of Mat Pilates vs Mat Pilates with a Resistance Band on Muscle Strength and Flexibility in Postmenopausal Women

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## ABSTRACT

**Background:** Menopause is linked with a reduction in estrogen levels, which results in decreased muscle strength, flexibility, and overall functional ability in women. These changes can adversely influence daily activities and quality of life in postmenopausal women. Exercise interventions, especially Pilates, have been shown to enhance musculoskeletal health. This study aimed to compare the effects of Mat Pilates and Mat Pilates combined with a resistance band (TheraBand) on muscle strength and flexibility in postmenopausal women. A randomized comparative study was carried out on 62 postmenopausal women aged between 50–65 years, who were divided into two groups: Group A performed Mat Pilates exercises, while Group B performed Mat Pilates with TheraBand exercises.

**Aims of the study:** Effect of mat Pilates VS mat Pilates with TheraBand on increasing muscle strength and flexibility in postmenopausal women.

**Procedure:** Ethical clearance was obtained from the institutional ethical committee. A total of 62 participants meeting the inclusion and exclusion criteria were selected and were randomly divided into two groups. Group A (32 participants) received mat Pilates and Group B (32 participants) received mat Pilates with TheraBand exercises for 4 weeks.

**Outcome measures:** Manual Muscle Testing (MMT) for assessing muscle strength, Sit and Reach Test for hamstring flexibility, and Scratch Test for upper limb flexibility.

**Result:** This suggests that adding resistance using TheraBand increases the effectiveness of Pilates exercises. Effect of Group A assessed using MMT, sit and reach test, and scratch test and group B assessed using MMT, sit and reach test, and scratch test. Comparison between both the group was done using MMT, sit and reach test, and scratch test. The results indicated statistically significant improvement within both groups for all outcome measures. However, Group B (MAT Pilates with TheraBand) showed greater improvement than Group A (mat Pilates).

**Conclusion:** Both Mat Pilates and Mat Pilates with TheraBand are effective in improving muscle strength and flexibility in postmenopausal women, the addition of resistance bands offers superior benefits. Therefore, incorporating resistance training with Pilates may be more effective in enhancing functional fitness and quality of life in this population.

**Keyword's:** postmenopausal women with age 45 to 65, mat Pilates, mat Pilates with TheraBand, muscle strength, flexibility, MMT, sit and reach test, scratch test.

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## INTRODUCTION

The normal ovulatory menstrual cycle is composed of three phases: the follicular (proliferative) phase, the ovulatory phase, and the luteal (secretory) phase. Estradiol serves as the main hormone during

the follicular phase, whereas progesterone is the dominant hormone in the luteal phase.<sup>[15]</sup>

Normal ovulation and menstruation take place due to the pulsatile release of gonadotropin-releasing hormone (GnRH) from the hypothalamus, which

stimulates the anterior pituitary to secrete luteinizing hormone (LH) and follicle-stimulating hormone (FSH). LH and FSH act directly on the ovarian cells, leading to the production of ovarian androgens and estradiol, additionally, FSH is responsible for the recruitment of ovarian follicles and their growth. Well-coordinated feedback mechanisms result in the growth of the endometrial lining and the development of a dominant follicle during the first phase of the menstrual cycle, ovulation at mid-cycle, and preparation of the endometrium for implantation during the third phase of the cycle.<sup>[15]</sup>

Menstruation pattern prior to menopause is irregular menstruation cycle, gradual reduction in duration and quantity. it's may be delayed which could eventually result in cessation, unpredictable, whether or not there is heavy bleeding. genital malignancy should be ruled out before declare it to be the typical premenopausal pattern <sup>[2]</sup>

Menopause is the no menses for 12 consecutive months at the end of reproductive life, due to decrease in ovarian follicular activity.<sup>[1]</sup> Absence of period for 12 months in a consecutive year despite any of the specific cause such as pregnancy, lactation, use of exogenous hormones, lack of nutrition or uterine or ovarian surgery.<sup>[2]</sup>

Ageing gets promoted by menopause, the production of estrogen diminishes after menopause, oestrogen greatly impact on ligament, tendon and muscle function. Clinical symptom involves vasomotor, somatic, psychological, urogenital symptom, osteoporosis and fracture, cardiovascular disease, sexual dysfunction.<sup>[2]</sup>

Endocrine changes that begin around menopause, along with the abrupt decline in hormone secretion, affect multiple body systems. Menopausal symptoms include cardiovascular, musculoskeletal, metabolic, and weight-related abnormalities, as well as genitourinary and skin degeneration and hirsutism, along with central nervous system disorders.<sup>[16]</sup>

Although the biological basis of these manifestations is complex and interconnected, estrogen deficiency is not the sole cause. Furthermore, metabolism-related disturbances are closely associated, persistent, and progressive, significantly influencing the overall health of postmenopausal women.<sup>[16]</sup>

The increase in average life expectancy, especially among women, prolongs the postmenopausal phase while also enhancing awareness of its impact on various health issues during this period <sup>[16]</sup>.

Early menopause is more frequent in thinner women even though may additionally, be caused due to smoking, cigarettes, lack of nutrition.<sup>[1]</sup>

Post menopause is the period of life that occurs after menopause 45-to-55-years of Women.<sup>[3]</sup>

Cross sectional studies for pre, peri and postmenopausal female age 40 to 65 shows that there is decrease in lower limb and upper limb muscle strength and flexibility throughout the menopausal transition may be reduced with more physical activity. Women tend to be especially prone to this decrease during and after menopause as skeletal muscle strength and quality naturally decrease above the age of 40 years.<sup>[4]</sup>

Menopausal women go through physical changes that involve decline muscle strength and flexibility which may result in skeletal disorder.<sup>[4]</sup>

Menopausal age is not correlated with menarche age, age at last pregnancy or age while breastfeeding, oral pills, socioeconomic status, height and weight.<sup>[5]</sup>

Perimenopausal and postmenopausal women represent a rapidly increasing population in India, expected to reach approximately 103 million by 2026, indicating an important public health issue <sup>[17]</sup>.

Research shows that a majority of women during this stage experience physical symptoms, with almost all reporting at least one complaint, and a high prevalence of reduced muscle strength (86.4%), decreased stamina (80.4%), and overall fatigue.<sup>[17]</sup>

These alterations are frequently associated with decreased flexibility, musculoskeletal pain, and joint stiffness, which together lead to functional limitations and a decline in quality of life. Hence, the reduction in muscle strength and flexibility during menopause is widely prevalent and significantly contributes to a higher risk of disability and loss of physical independence in women.<sup>[17]</sup>

The sit-and-reach test is a simple and commonly used field test to evaluate flexibility, particularly of the hamstring muscles and lower back. According to the meta-analysis, it shows moderate validity for assessing hamstring extensibility but low validity for lumbar extensibility, indicating it is more appropriate for measuring hamstring flexibility than spinal flexibility. <sup>[18]</sup>

Flexibility is determined by measuring the maximum distance the fingertips reach beyond (positive value) or fall short of (negative value) the toes while sitting with legs extended; this distance represents the extensibility of the hamstring muscles and posterior chain. The test is useful because it offers a quick estimation of range of motion when more advanced angular measurements are not practical <sup>[18]</sup>

The Back Scratch Test is utilized to evaluate upper limb flexibility by determining the range of motion at the shoulder joint, particularly how near the hands can come together behind the back. This evaluation is important as it helps in detecting restrictions in shoulder mobility, which may influence everyday tasks such as dressing, reaching, and lifting. Assessing upper limb flexibility also gives an understanding of overall musculoskeletal health and functional fitness. Regular evaluation enables early identification of stiffness or decreased range of motion, assisting in planning suitable exercises or interventions to maintain or enhance flexibility.<sup>[19]</sup>

Manual Muscle Testing (MMT) grades (0–5) are utilized to evaluate muscle strength by observing the patient's capacity to move a limb against gravity and applied resistance, where Grade 0 represents no contraction and Grade 5 represents normal strength with maximum resistance. In postmenopausal women. This test is important because muscle strength declines with aging and hormonal changes, and MMT helps in identifying weakness, comparing both sides, and providing a baseline for treatment planning and functional ability. It also assists in evaluating mobility, preventing frailty, and enhancing quality of life.<sup>[20]</sup> Pilates is a mind-body practice that increase strength, muscular control, flexibility and core stability, breathing and posture. the main feature is that it has eight basic concepts: focus, breath, control, center isolation, routine, accuracy, and fluidity.<sup>[8]</sup>

Besides sustaining life, breathing offers several physiological benefits, Helps oxygenate the blood, Aids in the elimination of toxins, enhances blood circulation, promotes relaxation of the mind and body, improves focus and concentration, establishes a natural rhythm for movement, Supports the activation of specific target muscles.<sup>[12]</sup>

The term center has a deeper meaning. In Pilates, it is believed that all movement begins from the center or core of the body. This idea is a fundamental principle of Pilates and is commonly referred to as the powerhouse.<sup>[12]</sup>

Three higher principles of Pilates, Establish complete harmony between the body, mind, and spirit. Attain the natural internal rhythm that is connected with subconscious functions. Implement the natural principles of life in daily activities.<sup>[12]</sup>

Pilates calls for the synchronized activation of several muscle group at once using a holistic approach, as opposed to common resistance training techniques that develop muscle in

isolation, Pilates exercise is becoming more well-known and widely recognized.<sup>[8]</sup>

Non-impact workout can be developed to several physical condition and health changes the mat Pilates approach is suggested for number of populations of people.<sup>[4]</sup>

Pilates can be performed a no of methods such as mat Pilates using your own body weight and range of equipment such as band Pilates. The Pilates approach is unique as it focuses an extreme value on breathing and sensory input as well as quality, accuracy, a control of movement during workout.<sup>[9]</sup>

By altering the exercise difficulty, the Pilates method also called as mat Pilates can be performed on the ground increasing and enhancing the intensity. Greater load has significant beneficial effect on a person's endurance, strength, ability to trained.<sup>[7]</sup>

According to research by Hagmans and thomasan where the intervention program uses a TheraBand, Pilates training could be considered as a type of physical exercise which focus on strengthening, core stability, flexibility, muscular control posture breathing.<sup>[5]</sup>

Resistance band exercise which may be simply performed at home, have been indicated and it can be helpful for gaining muscle strength.<sup>[4]</sup>

Evaluating muscular strength is important for both strength and conditioning coaches as well as physical therapists.<sup>[14]</sup>

Muscular strength can be evaluated in various ways, and is generally measured using isokinetic or isometric methods.<sup>[14]</sup>

Estimating maximal strength using a submaximal test with elastic resistance bands is an effective alternative, and may be more suitable in many situations, particularly when significant musculoskeletal pain is present. Since muscle strength increases rapidly with resistance training in untrained individuals.<sup>[14]</sup>

The elastic bands utilized in this study had a standard length of 1.80 m, with resistance levels ranging from very low to very high (yellow, red, green, blue, black, silver, gold). the elastic bands were stretched 50–100 times to reduce potential alterations in their mechanical properties during the early stretching cycles. The same set of elastic bands was consistently used for each exercise throughout the study. The TheraBand feature continuous loops, with the loops at both ends serving either as handles or for securing the band to wall-mounted stall bars, depending on the specific exercise performed.<sup>[14]</sup>

While typical resistance exercise that target muscle separately, Pilates required the coordinated activation of multiple muscle group simultaneously utilizing a holistic approach. The scientific benefits of Pilates

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exercise are becoming more widely understood. Numerous studies have proven the physiological and psychological benefits of Pilates including advantages in psychological health, physical fitness, quality of fitness, quality of life, anxiety and depression.<sup>[8]</sup> Pilates is more than just a physical activity. It's a type of conditioning that works both mentally and physical.<sup>[12]</sup>

Pilates is a comprehensive method of maximizing human movement, not just exercise.<sup>[12]</sup>

Pilates targets the core muscles, also known as the powerhouse. Pilates exercise focuses on both stability and mobility.

Because the core, or centre, is where all movement begins. This seems like a sensible place to start. how crucial the deepest abdominal muscles are both in clinical practice and the literature, the transverse abdominis is a well-established spinal stabilizer.<sup>[12]</sup>

### MATERIALS AND METHODOLOGY

The comparative study conducted on Postmenopausal Women at D.Y. Patil hospital, physiotherapy OPD. The sampling method was Probability sampling. The study was conducted for 6 Months. Study subjects were fulfilling inclusion and exclusion criteria were selected for study.

**Materials** -Mat, Resistance Band, Consent letter

**Inclusion criteria**- Postmenopausal women, Age: 50 -65 years.

**Exclusion Criteria**-Recent surgery, Cardiac problems, Neurological Disorder, Recent fracture

### PROCEDURE

According to inclusion and exclusion criteria participants will be screened.

The procedure will be explained to the subject.

Prior written consent form from the participants will be obtained.

There will be 2 group consisting of Group A receives mat Pilates and Group B receives mat Pilates with TheraBand

Pre assessment value will be recorded before study is started.

Pre assessment value will be recorded before study is started.

Education of the participants about the postmenopausal women and procedure of the exercise will be explained in detail

In case patient has pain / discomfort due to the exergues causing harm, she will be given appropriate standard of care and withdrawn from the study.

Treatment for a period of 4 weeks

### GROUP A: Effect of Mat Pilates

mat Pilates can be performed on the ground increasing and enhancing the intensity. Greater load has significant beneficial effect on a person's endurance, strength, ability to trained

One leg circle.

Single leg lift.

Side lying hip abduction.

Side lying hip adduction.

Pilates swimming.

Side lying shoulder adduction.

Push-ups.

Prone arm lift.

The hundred.

Each exercise will be demonstrated to the participants and they will be instructed perform movements slowly with controlled breathing.

### Group 2: effect of mat Pilates with TheraBand

Pilates can be performed a no of methods such as mat Pilates using your own body weight and range of equipment such as band Pilates. The Pilates approach is unique as it focuses an extreme value on breathing and sensory input as well as quality, accuracy, a control of movement during workout

resistance band lateral raises.

resistance band mild back band pull.

resistance band ankle plantar flexion.

resistance band double triceps.

resistance band bicep -curls.

resistance band standing leg flexion.

resistance band standing leg extension

resistance band bridge thrust.

resistance band shoulder internal rotation

resistance band with shoulder external rotation

### RESULT

Effect of mat Pilates VS mat Pilates with TheraBand on increasing muscle strength and flexibility in postmenopausal women revealed that Mat Pilates with TheraBand group improved more significantly than the Mat Pilates. However, both exercise increasing muscle strength and flexibility in postmenopausal women, as measured by the (MMT, Sit and reach test, scratch test). these finding suggest that while the Mat Pilates with TheraBand exercise is more effective for improving muscle strength and flexibility in postmenopausal women.

### Age Distribution

|                                 | Mea<br>n  | Std.<br>Deviation |
|---------------------------------|-----------|-------------------|
| Age                             | 52.6<br>3 | 4.46              |
| Age at which menopause<br>occur | 45.8<br>8 | 1.08              |

here the mean age of the postmenopausal women is considered to be 52.63 yrs old and mean age at which menopause occur 45.88

The standard deviation of age is 4.46

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The standard deviation of age at which menopause occur 1.08

## **Pre and post value in group A**

the table presents the pre and post values of MMT, Sit and Reach test, Scratch test in **Group A**.

For the MMT the mean pre intervention score for upper limb 3.09 with std deviation 0.08 and the post intervention score for 3.85 with std deviation 0.11

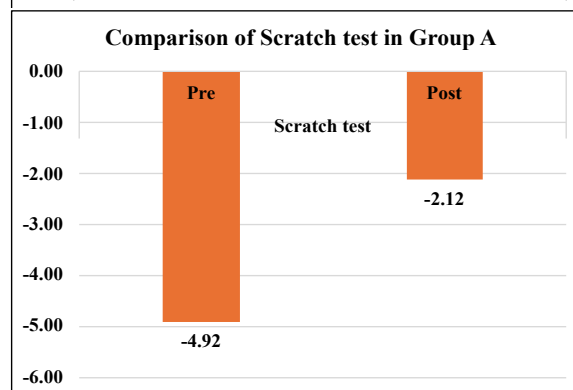
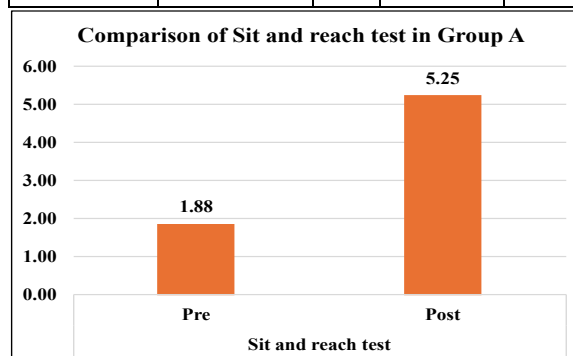
For the MMT the mean pre intervention score for lower limb 3.09 with std deviation 0.08 and the post intervention score for 3.85 with std deviation 0.11. both upper limb and lower limb showing that significantly increase muscle strength. the statistical analysis revealed p-value <0.001

For the Sit and reach test the mean pre intervention score was 1.88 with std deviation 1.13 and the post intervention score for 5.25 with std deviation 1.34. showing that significantly increase flexibility of lower limb. the statistical analysis revealed p-value <0.001

For the scratch test the mean pre intervention score was -4.92 with std deviation 0.33 and the post intervention score for -2.12 with std deviation 0.31. showing that significantly increase flexibility of upper limb. the statistical analysis revealed p-value <0.001

| Group A            |                   |       |                |         |
|--------------------|-------------------|-------|----------------|---------|
| Parameter          | Assessment Period | Mean  | Std. Deviation | p-value |
| MMT Upper Limb     | Pre               | 3.09  | 0.08           | <0.001* |
|                    | Post              | 3.85  | 0.11           |         |
| MMT Lower Limb     | Pre               | 3.09  | 0.08           | <0.001* |
|                    | Post              | 3.85  | 0.11           |         |
| Sit and reach test | Pre               | 1.88  | 1.13           | <0.001* |
|                    | Post              | 5.25  | 1.34           |         |
| Scratch test       | Pre               | -4.92 | 0.33           | <0.001* |

|  |      |    |      |  |
|--|------|----|------|--|
|  | Post | -2 | 0.31 |  |
|--|------|----|------|--|



## **Pre and post value in group B**

the table presents the pre and post values of MMT, Sit and Reach test, Scratch test in **Group B**.

For the MMT the mean pre intervention score for upper limb 3.09 with std deviation 0.08 and the post intervention score for 4.42 with std deviation 0.13

For the MMT the mean pre intervention score for lower limb 3.09 with std deviation 0.08 and the post intervention score for 4.48 with std deviation 0.16. both upper limb and lower limb showing that significantly increase muscle strength. the statistical analysis revealed p-value <0.001

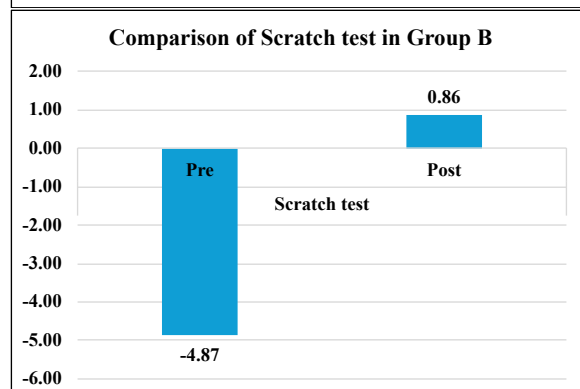
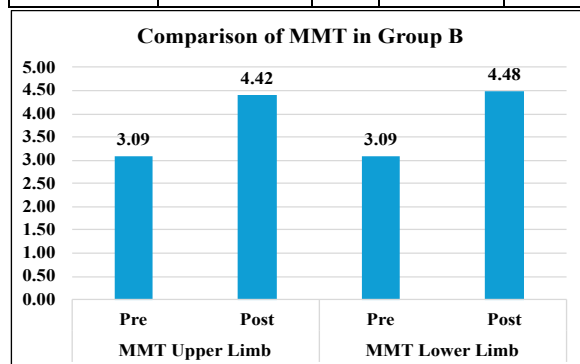
For the Sit and reach test the mean pre intervention score was 1.88 with std deviation 1.13 and the post intervention score for 9.28 with std deviation 1.30. showing that significantly increase flexibility of lower limb. the statistical analysis revealed p-value <0.001

For the scratch test the mean pre intervention score was -4.87 with std deviation 0.31 and the post intervention score for 0.86 with std deviation 0.41. showing that significantly increase flexibility of upper limb. the statistical analysis revealed p-value <0.001

| Group B |  |  |  |  |
|---------|--|--|--|--|
|         |  |  |  |  |

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| Parameter          | Assessment Period | Mean  | Std. Deviation | p-value |
|--------------------|-------------------|-------|----------------|---------|
| MMT Upper Limb     | Pre               | 3.09  | 0.08           | <0.001* |
|                    | Post              | 4.42  | 0.13           |         |
| MMT Lower Limb     | Pre               | 3.09  | 0.08           | <0.001* |
|                    | Post              | 4.48  | 0.16           |         |
| Sit and reach test | Pre               | 1.88  | 1.13           | <0.001* |
|                    | Post              | 9.28  | 1.30           |         |
| Scratch test       | Pre               | -4.87 | 0.31           | <0.001* |
|                    | Post              | 0.86  | 0.41           |         |



**Comparison Group A and Group B**

The Group comparison analysis demonstrated statistically difference between group A and group B. across all measured parameter.

For MMT, group A upper limb showed lower mean score of 3.85 with std deviation 0.11 group B upper limb showed higher mean score of 4.42 with std. deviation 0.13. group A lower limb showed lower mean score of 3.85 with std deviation 0.11 group B lower limb showed higher mean score of 4.48 with std. deviation 0.16, which indicates **group A** indicates better muscle strength

For sit and reach test, group A upper limb showed lower mean score of 5.25with std deviation 1.34 group B upper limb showed higher mean score of 9.28 with std. deviation 1.30. which indicates **group A** indicates better lower limb flexibility

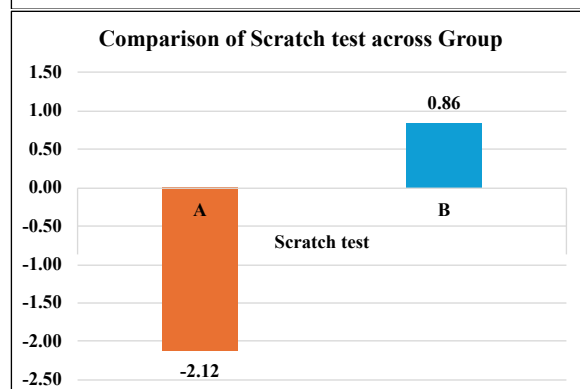
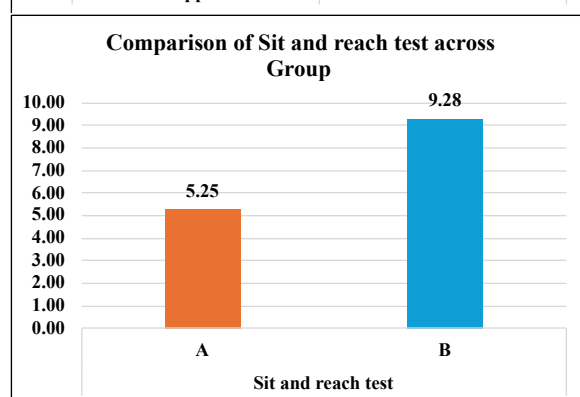
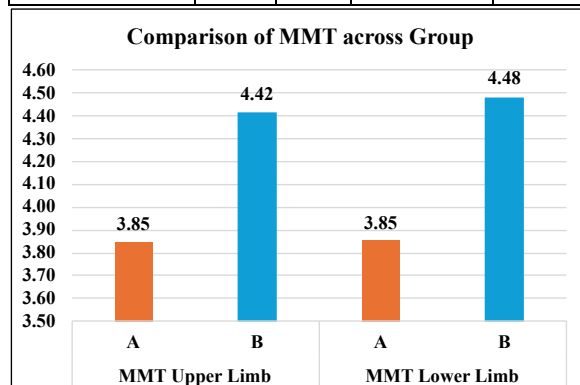
For scratch, group A upper limb showed lower mean score of -2.12with std deviation 0.31 group B upper limb showed higher mean score of 0.86 with std. deviation 0.41. which indicates **group A** indicates better upper limb flexibility.

All the observe difference were highly statistically significant ( $< 0.001$ ), indicating that intervention in **group A was more effective than group B**

| Group Comparison   |       |       |                |         |
|--------------------|-------|-------|----------------|---------|
| Parameter          | Group | Mean  | Std. Deviation | p-value |
| MMT Upper Limb     | A     | 3.85  | 0.11           | <0.001* |
|                    | B     | 4.42  | 0.13           |         |
| MMT Lower Limb     | A     | 3.85  | 0.11           | <0.001* |
|                    | B     | 4.48  | 0.16           |         |
| Sit and reach test | A     | 5.25  | 1.34           | <0.001* |
|                    | B     | 9.28  | 1.30           |         |
| Scratch test       | A     | -2.12 | 0.31           | <0.001* |

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|  |   |      |      |  |
|--|---|------|------|--|
|  | B | 0.86 | 0.41 |  |
|--|---|------|------|--|



## DISCUSSION

This study aims Effect of Mat Pilates VS Mat Pilates with TheraBand on increasing muscle strength and flexibility in postmenopausal women.

A total 62 subject were recruited in the study age group of 50 to 65 yrs, divided into two group with 32 in each group.

Group A will receive Mat Pilates exercise for 5 days/week for 4 week and

Group B will receive Mat Pilates with TheraBand exercise for 5days/week for 4 weeks.

Menopause is the no menses for 12 consecutive months at the end of reproductive life, due to decrease in ovarian follicular activity. [1] Absence of period for 12 months in a consecutive year

despite any of the specific cause such as pregnancy, lactation, use of exogenous hormones, lack of nutrition or uterine or ovarian surgery. [2]

Research shows that a majority of women during this stage experience physical symptoms, with almost all reporting at least one complaint, and a high prevalence of reduced muscle strength (86.4%), decreased stamina (80.4%), and overall fatigue. [17]

The Group comparison analysis demonstrated statistically difference between group A and group B. across all measured parameter.

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By altering the exercise difficulty, the Pilates method also called as mat Pilates can be performed on the ground increasing and enhancing the intensity. Greater load has significant beneficial effect on a person's endurance, strength, ability to trained. [7]

According to research by Hagmans and thomasan where the intervention program uses a TheraBand, Pilates training could be considered as a type of physical exercise which focus on strengthening, core stability, flexibility, muscular control posture breathing. [5].

The general improvement seen in both the groups emphasizes how crucial regular exercises is for postmenopausal women management. Exercises increase muscle strength and flexibility in upper limb and lower limb.

The findings of the present study suggests that both mat Pilates and mat Pilates with TheraBand in postmenopausal women improve muscle strength and flexibility, but mat Pilates with TheraBand was more effective than mat Pilates.

### CONCLUSION

The present study was conducted to the Effect of mat Pilates VS mat Pilates with TheraBand on increasing muscle strength and flexibility in postmenopausal women. the findings of the study revealed that both interventions were effective on increasing muscle strength and flexibility among the participants. statistically significant improvements were observed within both the group for all outcome measures.

However, on comparison between both the groups, Mat Pilates with TheraBand demonstrated greater effectiveness in improving muscle strength and flexibility as it is been compared with the mat Pilates. this may be attributed to the emphasis of mat Pilates with TheraBand on strength, flexibility, controlled breathing and mind body co-ordination, which collectively contributes to better physiological outcomes.

Thus, it can be concluded that while both mat Pilates and mat Pilates with TheraBand are beneficial and can be used as non-pharmacological intervention for managing muscle strength and flexibility in postmenopausal women, mat Pilates with TheraBand appears to be more effective in enhancing the overall outcomes in postmenopausal women

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