JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

TO OBSERVE THE EFFECT OF PHYSICAL THERAPY INTERVENTIONS WITH MUSCLE STRENGTHING EXERCISES AND WEIGHT MANAGEMENT WITH LIFESTYLE MODIFICATIONS FOR POST MENOPAUSAL OSTEOPOROTIC WOMEN

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Abstract

Background

Osteoporosis and related fragility fractures are a global public health problem in which pharmaceutical agents targeting bone mineral density (BMD) are the first line of treatment. However, pharmaceuticals have no effect on improving other key fracture risk factors, including low muscle strength, power and functional capacity, all of which are associated with an increased risk for falls and fracture, independent of BMD. Targeted exercise training is the only strategy that can simultaneously improve multiple skeletal and fall-related risk factors, but it must be appropriately prescribed and tailored to the desired outcome(s) and the specified target group.Objectives-In this

review, we provide an overview of the general principles of training and specific loading characteristics underlying current exercise guidelines for the prevention of osteoporosis, and an update on the latest scientific evidence with regard to the type and dose of exercise shown to positively influence bone mass, structure and strength and reduce fracture risk in postmenopausal women.**Purpose** ;Osteoporosis is both preventable and treatable with exercise playing an important role in osteogenesis. The purpose of this systematic review was to determine which specific exercise programs utilizing weights were effective in maintaining or increasing bone mineral density (BMD) in postmenopausal women.**Methods:** The study was conducted for over 30subjects of age group nearer to post menopausal and after menopausal age with age group of 45 to 55 years age group Using weight management interventions and measuring MMT for muscle strength.

Results : Postmenopausal women in the 45–55 age group who engaged in structured weight management programs (combining balanced nutrition and regular physical activity) demonstrated **improved body composition**, with a reduction in fat mass and preservation or slight increase in lean muscle mass,Resistance training and weight-bearing exercises were particularly effective in **increasing muscle strength** and enhancing bone density, thereby lowering the risk of osteoporosis and sarcopenia,Aerobic exercises combined with strength training helped in **improving cardiovascular fitness**, reducing waist circumference, and controlling body weight, which are important in lowering the risk of metabolic disorders such as type 2 diabetes and cardiovascular disease ,Nutritional interventions, including a **protein-rich diet with adequate calcium and vitamin D**, supported muscle repair and bone health, while also helping to maintain a healthy body weight,Participants who consistently followed lifestyle modifications reported improvements in **functional capacity, energy levels, and overall quality of life**.

- **Key words :**Postmenopausal women, Age 45–55,weight management,muscle strength,aerobic exercises,bone health,sarcopenia prevention,osteoporotic ,nutrition,protein intake,calcium and vitamin d

- Introduction
- Osteoporosis is recognized as a major global health concern due to its strong association with fragility fractures, which often result in pain, functional decline, loss of independence, and increased morbidity and mortality. The condition disproportionately affects women, with prevalence rising sharply after menopause. Studies suggest that nearly one-third of postmenopausal women in Europe and the United States are affected, and about 40% of them are expected to experience one or more osteoporotic fractures during their lifetime. Following an initial fracture, the likelihood of subsequent fractures more than doubles within the first year and remains elevated for up to a decade.
- Hip fractures, in particular, carry severe consequences, with approximately one-third of patients dying within a year, 40% losing the ability to walk independently, and over half requiring ongoing assistance. While pharmacological treatments aimed at improving bone mineral density (BMD) remain the primary approach and can lower fracture risk by 20–60%, their effectiveness is limited by poor follow-up care and low adherence, often due to safety concerns or side effects. Importantly, these medications do not address other critical determinants of fracture risk, such as reduced muscle strength, balance, coordination, and overall physical function.
- Exercise training uniquely offers benefits across all modifiable risk factors, including bone strength, fall prevention, and impact reduction. However, effectiveness depends on appropriate prescription and consistent participation. This review will highlight [1] the foundational principles of exercise training and mechanical loading relevant to osteoporosis prevention, and[2] recent evidence on the optimal type and intensity of exercise that can enhance bone mass and strength while lowering fracture risk in postmenopausal and older women. The emphasis is placed on prevention strategies rather than post-fracture management[3-5]Given the importance of osteoporotic fractures to public health, national health services have been recommending more widespread availability of
- 6 The aim of this review is to determine the benefits of PE after the menopause, the requirements and measures that are needed for starting PE and the characteristics of optimal PE7Osteoporosis therapies have been shown to reduce incidence of vertebral and non-vertebral fractures in placebo-controlled randomized clinical trials. However, information on the real-world effectiveness of these therapies is limited[.8]The lifetime risk of fracture in white women is 20% for the spine, 15% for the

wrist, and 18% for the hip, with an exponential increase in risk beyond the age of 50 years[9]. To evaluate the impact of osteoporosis on the patients' quality of life, particularly in the absence of fractures.[10]Since post-menopausal osteoporosis (PMO) was considered a serious public health concern (World Health Organization, 1994), methodologies for its diagnosis and follow-up as well as new treatments are being investigated continuously, mainly to avoid derived fractures. According to the definition of the World Health There are many diseases and conditions that cause low bone mineral density (BMD), the most prevalent being post-menopausal loss of estrogen and osteoporosis. [11]The World Health Organization has defined osteoporosis as a BMD value of more than 2.5 standard deviations below the mean for normal young white women or the presence of a fragility fracture with a BMD "T score" value between 1.0 and 2.5 standard deviations below the mean Caucasian and Asian women are at the highest risk for osteoporosis, and as much as 20% of the overall bone loss can occur within the first few years following menopause .Organization (WHO), osteoporosis is an illness that produces low bone mass density (BMD) and deterioration of the bone micro-architecture. It develops into greater bone fragility and a high risk of bone fracture. (World Health Organization, 1994).[12]Determining the most appropriate exercise regime for an individual based on current knowledge is difficult and further studies are required to ensure the potential benefits of exercise of attenuating bone mineral density (BMD) loss and/or addressing other fracture-related risk factors are optimized. In addition, further studies are required to evaluate alternative models of exercise delivery.[12]The purpose was to estimate the relative efficacy of reduction of fractures in post-menopausal women, and to assess robustness of the results.[13] Raloxifene (RAL) increases bone mineral density in the spine and femoral neck and reduces risk of vertebral fracture.[14]The beneficial effects of parathyroid hormone (PTH) treatment have also been clearly demonstrated through randomised clinical trials (RCT)[15]and its few adverse events (AE) make it a good candidate for various uses such as PTH treatment, leading to induction bone formation without inducing bone resorption[.16] There have been many RCTs conducted on these therapies in order to identify the most effective method in preventing NVF in post-menopausal women. Several studies attempting to compare the results of pairwise meta-analyses in regard to the prevention and safety of different treatments can also be found in the current literature.

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- MATERIALS: materials used for study for weight reduction diet management and exercises for increase muscle strength.

I **Inclusion Criteria**

1. **Age group:** Women between **45 to 55 years**.
2. **Menopausal status:** Postmenopausal women (no menstrual cycle for at least 12 consecutive months).
3. **Health status:**
   - Clinically stable with no acute illness.
   - Capable of participating in physical activity (as confirmed by a physician).
4. **BMI / Weight considerations:**
   - Overweight or obese (BMI ≥ 25 kg/m²), or
   - Women seeking structured weight management and muscle-strengthening interventions.
5. **Muscle condition:** Women experiencing **reduced muscle strength, endurance, or sarcopenic changes**.
6. **Lifestyle factors:**
   - Not currently engaged in a structured resistance training or weight management program in the last 6 months.
7. **Consent:** Willing to participate, follow dietary and exercise protocols, and provide

Exclusion Criteria

Postmenopausal Osteoporotic Women (Healthy Lifestyle & Muscle Strength Program)

Medical Conditions

Women with **severe or uncontrolled systemic diseases** (e.g., hypertension, diabetes mellitus, heart disease, or thyroid disorders).

Presence of **secondary osteoporosis** due to endocrine or metabolic disorders.

Neurological disorders affecting balance, coordination, or muscle function (e.g., Parkinson's disease, stroke).

Severe respiratory or cardiac limitations that restrict exercise participation.

Musculoskeletal Limitations

1. Recent **osteoporotic fracture** or **major orthopedic surgery** (within the last 6 months).
2. **Severe osteoarthritis**, joint deformities, or any condition limiting movement or exercise performance.
3. **Severe back pain** or spinal deformities (kyphosis, scoliosis) interfering with exercise safety.

Medication and Treatment Factors

1. Current or recent use of **glucocorticoids**, anticonvulsants, or medications affecting bone metabolism.
2. Ongoing **hormone replacement therapy (HRT)** or **antiresorptive therapy** (unless controlled under study protocol).

Functional and Cognitive Barriers

1.Inability to **walk independently** or perform basic daily activities.

2.Cognitive impairment or memory disorders (e.g., dementia) affecting ability to follow instructions.

3.Uncontrolled psychological conditions such as severe anxiety or depression.

Lifestyle Factors

1. **Active smoking** or **alcohol abuse** (>2 drinks/day).
2. Lack of willingness to **adhere to exercise or dietary interventions**.
3. **Poor attendance** or non-compliance in previous exercise or wellness programs.

STUDY SETUP:

Post menopausal osteoporortic women who are osteoporosis and came to SRI VENKATESWARA UNIVERSITY OF MEDICAL SCIENCES.TIRUPATHI,ANDHRA PRADESH was taken for the study period

STUDY PERIOD

Exercise protocol and weight management for healthy styles for 4 weeks data collection done in may 2025.

STUDY DESIGN

The design adopted for observation study the date collection ,physiotherapy exercises and life style modification intervention was done in SVIMS , TIRUPATHI.

Procedure

1. Initial Assessment

- Medical history (menopausal status, comorbidities, medications).
- Baseline body weight, BMI
- Muscle strength testing (handgrip, sit-to-stand test).
- Cardiovascular fitness assessment.
- Bone health screening (to rule out severe osteoporosis).

2. Diet Modification

Goals: Reduce calorie intake moderately, maintain adequate protein and micronutrients, and improve metabolism.

- **Caloric intake:** 500–700 kcal/day deficit (individualized).
- **Macronutrient distribution:**
  - Protein: **1.0–1.2 g/kg body weight/day** (to support muscle mass).
  - Carbohydrates: **45–50%** of daily calories (preferably complex carbs).
  - Fats: **25–30%**, focusing on healthy fats (omega-3, MUFA, PUFA).
- **Dietary strategies:**
  - Increase intake of whole grains, legumes, vegetables, fruits.
  - Include calcium- and vitamin D-rich foods (milk, yogurt, fortified foods).
  - Reduce refined sugar, saturated fats, and processed foods.
  - Encourage **small, frequent meals** to stabilize blood sugar.
  - Adequate hydration (1.5–2 liters/day).

3. Physiotherapy Exercise Program

Goals: Promote fat loss, maintain bone health, and improve muscle strength and flexibility.

(a) Aerobic Training (4–5 days/week, 30–45 min)

- Brisk walking, stationary cycling, swimming, or low-impact aerobics.
- Start at **moderate intensity (50–70% HRmax)**, progress gradually.

(b) Resistance Training (2–3 days/week)

- Focus on **major muscle groups** (legs, arms, core, back).
- Exercises: squats (chair-assisted if needed), lunges, wall push-ups, resistance band exercises, dumbbell curls.
- **2–3 sets of 10–15 repetitions** each, with progressive overload.

(c) Flexibility & Balance Training (daily or 3–4 days/week)

- Stretching of hamstrings, quadriceps, calf, shoulder, back muscles.
- Yoga, Pilates, or simple stretching for flexibility.
- Balance drills (single-leg stance, heel-to-toe walk) to prevent falls.

(d) Core & Postural Exercises

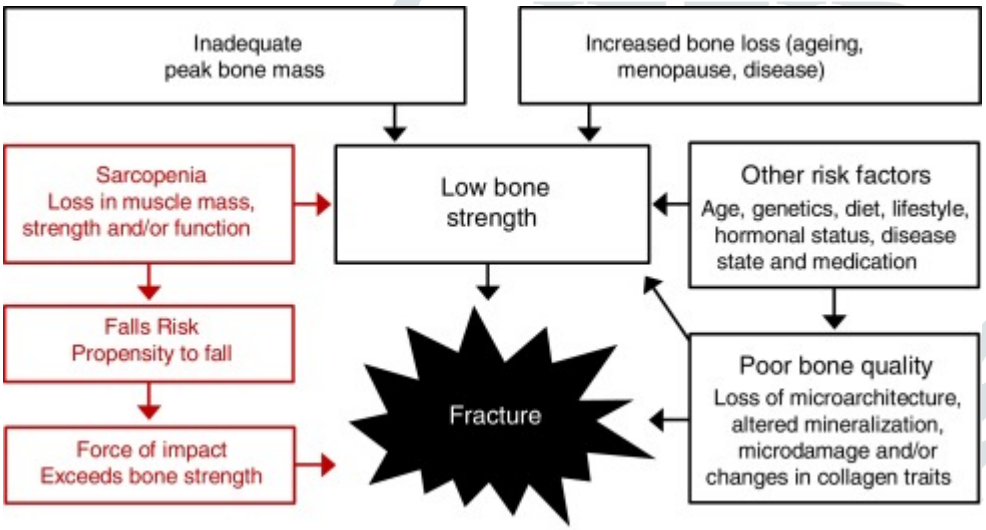
- Pelvic tilts, bridges, gentle planks.
- Helps improve stability and reduce back pain.

4. Behavioral & Lifestyle Interventions

- Education on portion control and mindful eating.
- Stress management (yoga, meditation, breathing exercises).
- Sleep hygiene (7–8 hours of quality sleep).
- Regular follow-up and motivational counseling.

5. Monitoring & Follow-up

- **weight and BMI calculation**
- Strength re-assessment after 4 weeks.
- Adjust diet and exercise intensity progressively.
- Long-term maintenance program for sustained results.



After completing 4 weeks of assesments and exercixes intervention the all post values measurements were taken in all subjects and data were sent for statistical analysis.

Table 1 : Age wise distribution of the sample of the respondents

Sl.No	Age	Frequency	Percent
1	40-50 years	11	36.70
2	50-60 years	15	50.00
3	Above 60 years	4	13.30
	Total	30	100.00

Table 2 : Average age of the respondents

Variable	N	Minimum Age	Maximum Age	Mean Age	Std. Deviation
Age	30	43	67	53.73	6.612

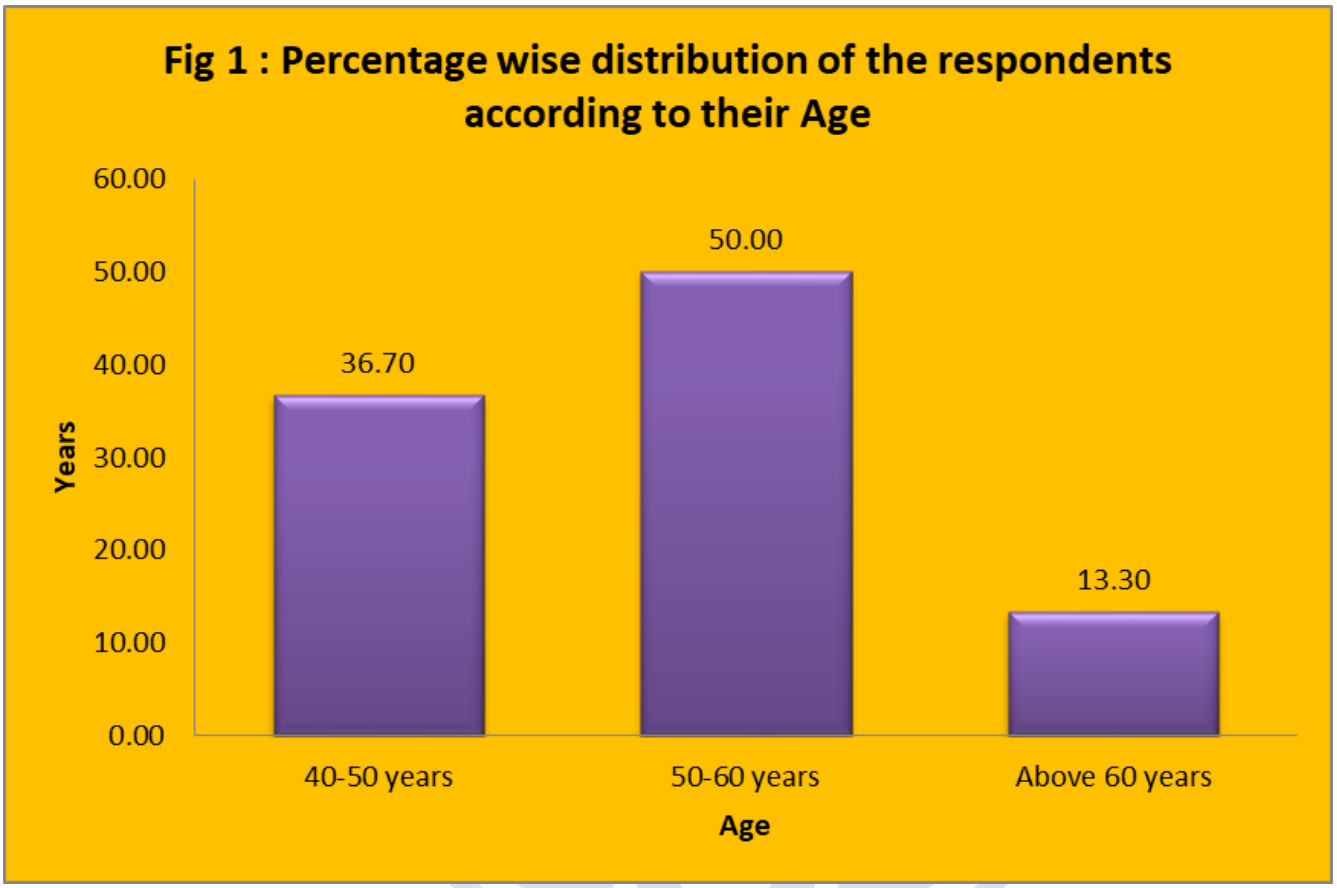


Table 1 shows the Age wise distribution of participants in the present study. In this study 11 respondents(36.70%) are 40-50 years, 15 respondents (50.00%) are in the age group of 50-60 years and 4 members (13.30) are in the age group of above 60 years are participated. The average age of the respondents is 53.73 years. All females are participated in this study.

Inferential Statistics:

Comparison of Pre-Test and Post-Test Scores for Outcome Measures in the study Group Using Paired Samples t-Test

Null hypothesis, H_0: There is no significant difference between the pre-test and post-test scores for a given outcome score in the study group

Alternate hypothesis, H_1: There is a significant difference between the pre-test and post-test scores for a given outcome score in the study group

Table 3 : Weight wise Significant difference between Pre test and Post of the Respondents

Variable	test	Mean	N	Std. Deviation	t-value	p value	sig
Weight	Pre test	63.70	30	9.51	2.766	0.010	**
	Post test	62.90	30	9.03			

Table 3 shows that there is a significant (P<0.01) difference between pre test and post test scores regarding weight of the respondents. The pre test weight mean score (63.70) found to be more than post test weight score (62.70) and weight of the respondents was reduced in post test.

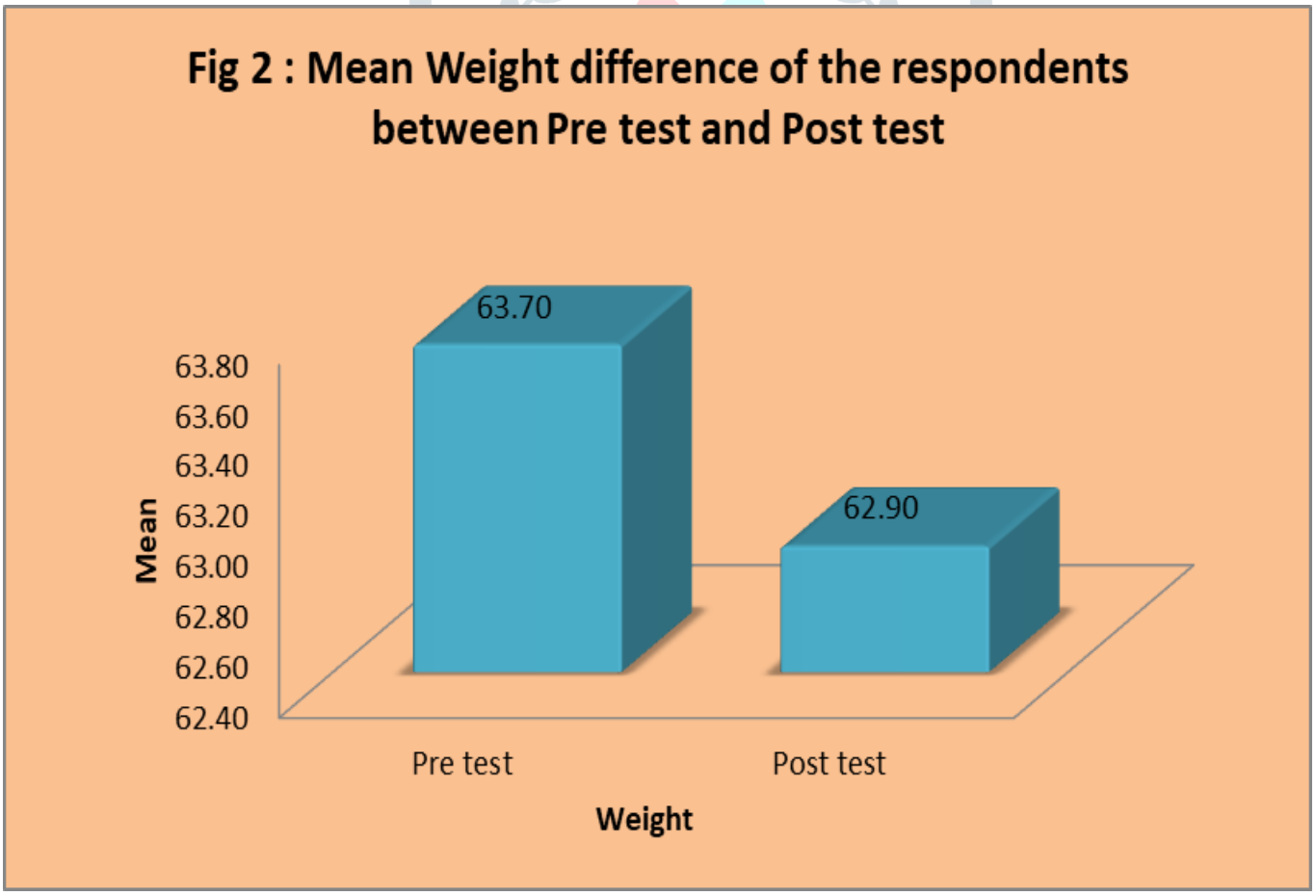


Table 4 : BMI wise Significant difference between Pre test and Post of the Respondents

Variable	test	Mean	N	Std. Deviation	t-value	p value	sig
BMI	Pre test	25.38	30	3.86	2.354	0.026	*
	Post test	24.75	30	3.55			

Table 4 above shows that there was a significant (P=0.026) difference between pre test and post test scores regarding BMI levels of the respondents. The BMI level score (25.38) found to be more than post test BMI score (24.75). This results indicates that the BMI levels was reduced in Post OP.

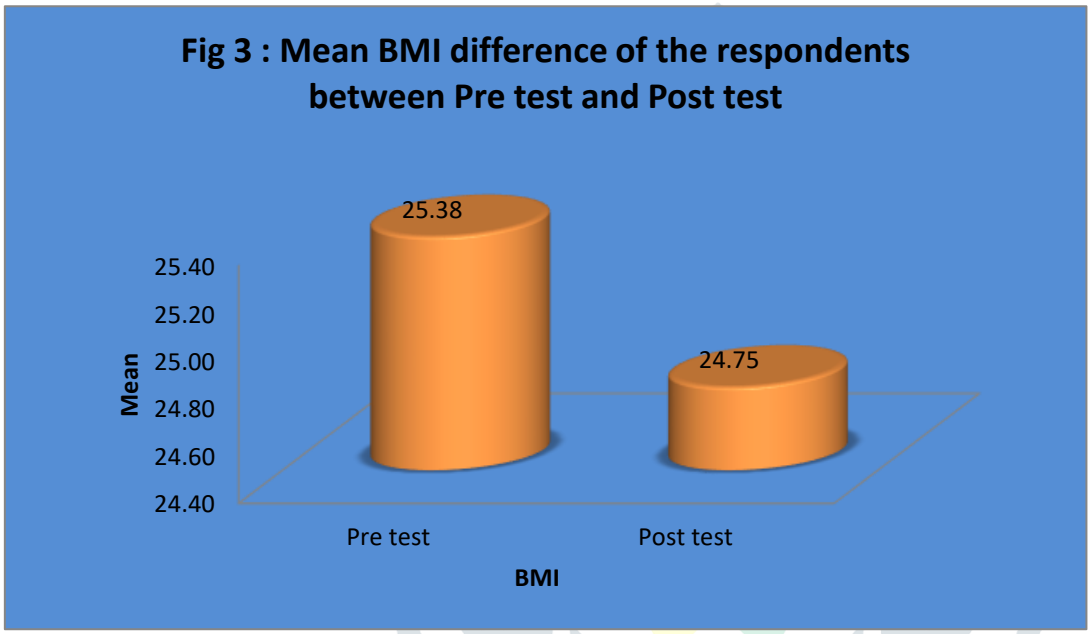


Table 5 : Muscle Strenth UL wise Significant difference between Pre test and Post of the Respondents

Variable	test	Mean	N	Std. Deviation	t-value	p value	sig
Muscle Strength UL	Pre test	0.78	30	0.13	3.247	0.003	**
	Post test	0.83	30	0.08			

The above table 5 depicts that there was a significant (P<0.01) difference between pre test and post test Scores Pre OP (0.78). This results indicates that Muscle strength UL increased after OP.

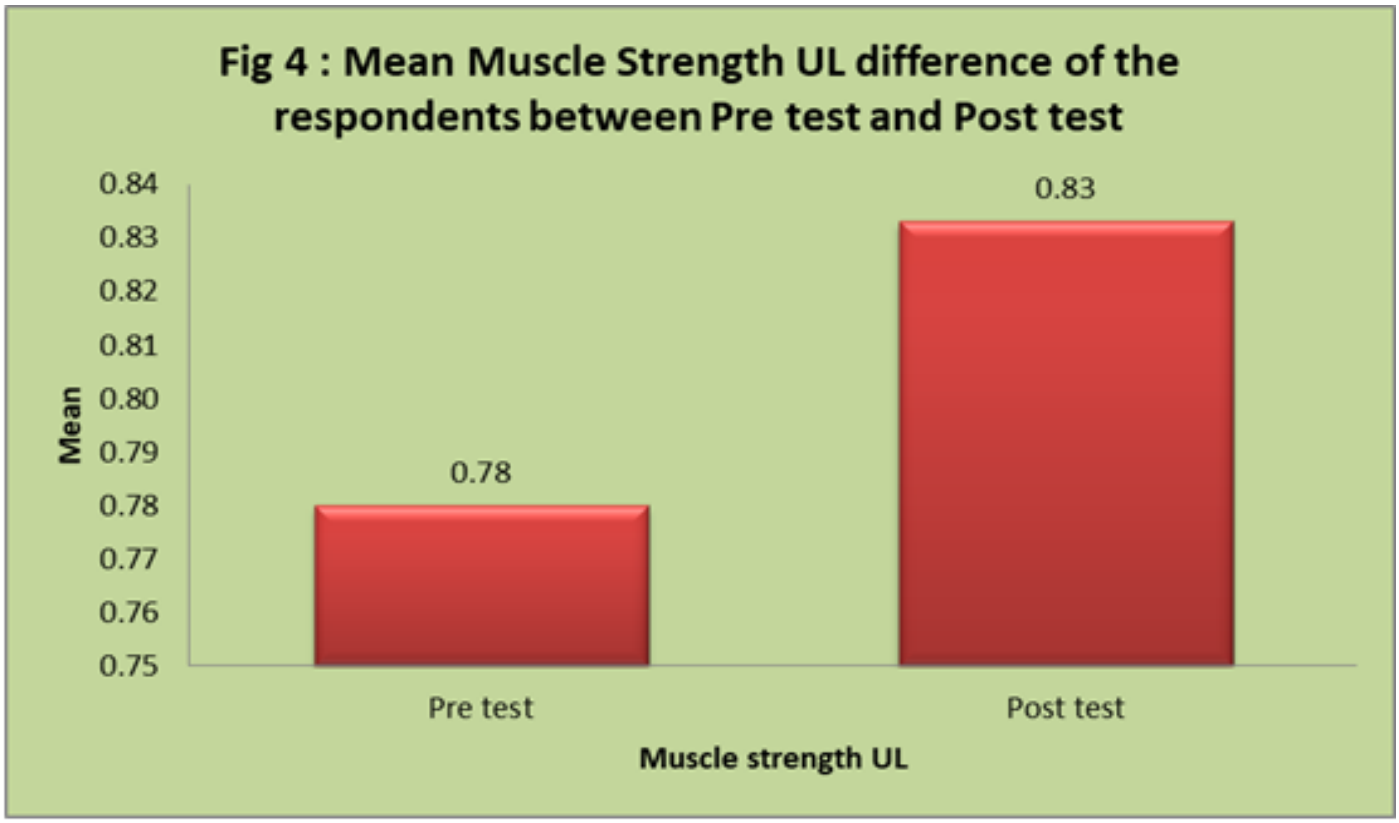
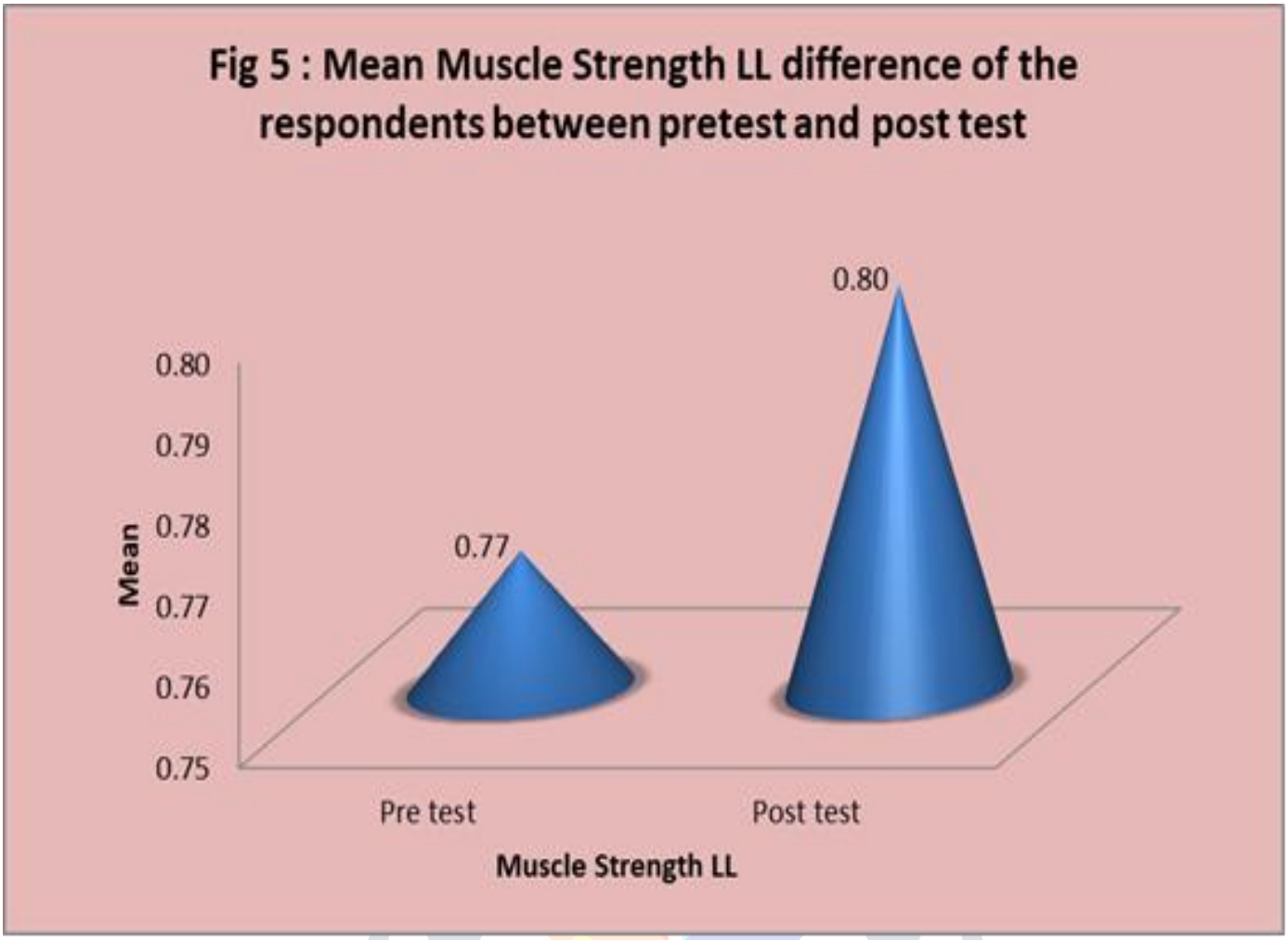


Table 6 : Muscle Strength LL wise Significant difference between Pre test and Post of the Respondents

Variable	test	Mean	N	Std. Deviation	t-value	p value	sig
Muscle Strength LL	Pre test	0.77	30	0.13	2.408	0.023	*
	Post test	0.80	30	0.11			

Table 6 depicts that there was a significant (P=0.023) difference between pre OP and post OP Scores regarding Muscle Strength LL. In terms of Muscle strength LL mean score was increased in post OP (0.80) than Pre OP (0.77). This results shows that Muscle strength LL is better in Post OP. Finally variables of Weight and BMI scores was reduced in the post OP and Muscle strength UL , LL scores increased in Post OP. This results indicates that the Post OP is better than Pre OP of the Participants.



Discussion

Weight management in postmenopausal women between the ages of 45 to 55 years is a crucial health concern, as this period is associated with significant hormonal, metabolic, and musculoskeletal changes. The decline in estrogen levels contributes to increased visceral fat deposition, reduced lean body mass, and lower bone mineral density. These changes, when combined with sedentary lifestyles and altered dietary patterns, heighten the risk of obesity, osteoporosis, cardiovascular disease, and diabetes.

Weight Management Skills

Developing effective self-management skills is fundamental for sustaining long-term weight reduction and muscle strength improvements. These skills include:

- **Dietary Self-regulation**: Learning portion control, mindful eating, and balanced diet planning with emphasis on calcium, vitamin D, protein, and fiber intake.
- **Behavioral Modification**: Setting realistic goals, maintaining food diaries, and monitoring daily activity levels.
- **Stress and Sleep Management**: Incorporating relaxation techniques such as yoga, meditation, and ensuring 7–8 hours of quality sleep to minimize cortisol-driven weight gain.

- **Motivation and Adherence Skills**: Building social support systems, family encouragement, and regular follow-ups with health professionals to sustain adherence to lifestyle modifications.

Exercise Interventions

Physical activity is a cornerstone in weight management and functional independence in postmenopausal women. A combination of aerobic, strength, flexibility, and balance exercises has proven effective:

- **Aerobic Exercises** (e.g., brisk walking, cycling, swimming) help in calorie expenditure, cardiovascular health, and reduction of central adiposity.
- **Resistance Training** (using weights, resistance bands, or body weight) preserves lean muscle mass, enhances bone density, and improves metabolic rate.
- **Flexibility Training** (yoga, Pilates, stretching routines) reduces stiffness, enhances joint mobility, and aids in stress reduction.

Balance and Core Exercises (tai chi, stability ball exercises) minimize the risk of fall

Conclusion

Weight management and structured exercise interventions play a vital role in promoting health and independence among postmenopausal women aged 45–55 years. This population is at increased risk of obesity, osteoporosis, and functional decline due to hormonal and metabolic changes. Incorporating dietary self-regulation, behavioral skills, and lifestyle modifications with guided exercise programs ensures sustainable improvements in muscle strength, bone health, and body composition.

Physiotherapy exercises, in particular, hold a key role in fall prevention and osteoporosis management. Resistance and weight-bearing activities strengthen muscles and bones, while balance and flexibility training enhance postural stability, coordination, and mobility. These targeted interventions reduce the likelihood of falls and subsequent fragility fractures, which are the most serious complications of osteoporosis.

Therefore, a comprehensive physiotherapy-based weight management program not only helps in weight reduction and strength building but also provides a protective strategy against falls and fractures, thereby improving quality of life and functional independence in postmenopausal women.

- s and fractures, which are common in this age group due to osteoporosis.

Overall Impact

When weight management skills are integrated with structured exercise interventions, postmenopausal women show improvements in body composition, muscle strength, functional mobility, and quality of life. Moreover, the combination of diet modification and physical activity is more effective than either intervention alone. Regular physiotherapy-guided exercise programs, combined with personalized counseling, provide sustainable outcomes in both weight reduction and strength enhancement.

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