# EFFICACY OF AEROBIC AND CORE EXERCISE TRAINING ON IMPROVING MUSCLE MASS AND PHYSICAL PERFORMANCE IN POSTMENOPAUSAL WOMEN WITH SARCOPENIC OBESITY

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**Abstract**

**Background & Objective:** Sarcopenia and obesity may interact and have a synergistic effect, lead to negative health outcomes such as increased prevalence of chronic diseases and functional decline, which resulting in frailty, poor quality of life, physical disability, and death. Exercise and nutrition remain the cornerstone for good health, treat or prevention of sarcopenia. So, this study had been conducted to determine the efficacy of aerobic and core exercise training on improving muscle mass and physical performance in postmenopausal women with sarcopenic obesity. **Methods:** Randomized controlled trial.Forty postmenopausal women with sarcopenic obesity, aged from 55 to 65 years participated in this study. They were randomly assigned into two groups: Control group consisted of 20 patients. They followed low caloric diet (1200 kcal/day) for 3 months and they were encouraged to perform physical activity in the form of walking for 30 mins 3 times/week. Study group consisted of 20 patients. They followed the same low caloric diet (1200 kcal/day) for 3 months and performing physical activity in the form of walking for 30 mins 3 times/week in addition to core exercises for 3 session / week for 3 months. Dietary program was modified every week for all women in both groups. **Assessment** was performed before the start and after the end of the treatment program. All participants in both groups were assessed for weight, BMI, waist circumference, waist/hip ratio, muscle mass, gait speed, hand grip and chair stand. **Results:** Comparison betweenthe control and the study groups showed an improvement following treatment in both groups. This improvement showed a non-significant difference in BMI, waist circumference, muscle mass, gait speed and chair stand with p-value (p=0.66), (p=0.91), (p=0.58), (p=0.48) and (p=0.10) respectively. The results showed a statistical significant increase (p=0.007) in hand grip favoring the study group. **Conclusion:**Following low caloric diet, physical activity and core exercises can improve BMI, waist circumference, physical performance and prevent or treat SO. Core exercises has a beneficial effect on increase hand grip in SO Postmenopausal Women.

**Key word:** Sarcopenic obesity,Core Exercise,Postmenopausal Women.

## INTRODUCTION

In 1989, Irwin Rosenberg coined the term sarcopenia (penia for loss and sarx for flesh from Greek) to describe this age-related decrease of muscle mass[1]. Sarcopenia affects 5–13% of older people (60–70 years) and up to 11% to 50% of those who are 80 years or older; however, muscle function and mass loss have been recorded in middle-aged adults. In fact, after the age of 40, muscle mass decreases by 8% every ten years, and grows by 15% every ten years after the age of 70[2].

The initial SO definition, presented in the early 2000s, emphasized the presence of absolute or relative low muscle mass in conjunction with a BMI greater than 30 or a high total or percentage fat mass as assessed by DXA or body composition study (BIA) [3].

Skeletal muscle mass loss is seen as a result of serious illnesses such as cancer, chronic obstructive pulmonary disease, heart failure, and renal failure, in addition to the well-established role of age-related skeletal muscle mass loss (primary sarcopenia) as a potential risk for mortality, morbidity, and frailty in the elderly [4]It's also become a prognostic factor for a variety of diseases[5,6].

Sarcopenia is diagnosed by the presence of decreased muscle mass along with either low physical performance or low grip strength, according to the EWGSOP operational definition[7]. One of the current sarcopenia diagnostic approaches is muscle mass measurement using DXA or BIA [8].

Several research using bio impedance analysis (BIA) methodologies to examine sarcopenia have recently been undertaken [9,10,11]. BIA is a low-cost, easy-to-use, portable solution that does not expose the user to radiation. As a result, BIA may be a viable portable alternative to DXA [10]. Hand grip strength is a simple and accurate method of determining muscular strength [12,13].

Gait speed is a safe, quick, and highly accurate measure for detecting severe sarcopenia, and it has been shown to predict unfavorable consequences [14,15].

Nutrition and physical activity have been shown to influence muscle homeostasis and prevent muscle mass loss [16,17]. Furthermore, exercise is a popular strategy for increasing muscle mass, physical performance and muscle strength in sarcopenic older adults [18].

The ability of these core muscles to maintain the lumbar spine and pelvic girdle during static and dynamic motions is referred to as "core strength" by many people[19].The core is a complex collection of muscles that encompasses everything but your upper and lower bodies. It can be found in almost every human movement. These muscles can act as a dynamic or isometric movement stabilizer, transfer force from one extremity to the other, and even initiate movement. They are the most active group of muscles in the human body[20].

The diaphragm (superior), rectus abdominus (inferior), internal and external oblique (anterior-lateral), pelvic floor muscles (inferior), and multifidus and (posterior) gluteus maximus, medius, and minimus are the main core muscles[21].Poor core stability is thought to place excess force from the extremity muscles on spinal structures, leading to earlier fatigue and a higher risk of injury [22, 23]. When the core muscles function normally, they can reduce stress on the lumbar vertebrae and intervertebral discs and maintain segmental stability, protect the spine [23]; thus, the core muscles are also known in humans as the “natural brace” [24].

## SUBJECT AND METHODS

### A- Study Design

Two groups pre- test post-test design. This study was conducted between October 2019 till June 2021, at gynecology and physical therapy outpatient clinics at El-Sahel Teaching Hospital.

### B- Subjects:-

i- Forty postmenopausal women were participated in this study.

They were selected from the gynecology and physical therapy outpatient clinics at El-Sahel Teaching Hospital. Their age ranged from 55-65 years and their BMI were >30 $kg/m^2$.They were assigned to two groups:

- Control group: consisted of 20 patients followed low caloric diet (1200 kcal/day) for 3 months and encouraged to perform physical activity in the form of walking for 30 mins 3 times/week.
- Study group: consisted of 20 patients followed the same low caloric diet (1200 kcal/day) for 3 months and performing physical activity in the form of walking for 30 mins 3 times/week in addition to core exercises / 3 session per week for 3 months.
- Both groups followed the same dietary program (1200kcal/day) for 3 months and this program was modified every one week.

ii- **Inclusive criteria:**

Postmenopausal women aged from 55-65 years and their BMI were >30 $kg/m^2$. None of them had pituitary or thyroid alterations, serious neurological diseases. They were free of painful conditions that could interfere with the measurement of physical performance outcomes.

iii- **Exclusive criteria:**

Women with a history of liver cirrhosis, stoke with paralysis, cerebral palsy, malignancy, hemodialysis or peritoneal dialysis, renal failure or been receiving prescribed medications such as long-term steroid treatment which is known

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to affect body composition, mental disorders, severe cognitive impairment and women with major operations were excluded from this study.

iv- **Ethical consideration and approval:**

The whole procedure was explained for every patient. Patients signed an informed consent before the beginning of the study.

**C- Instruments:-**

a. Recording data sheet was used to record data for each patient before starting this study.

b. Weight- Height scale was used to measure height for each patient participated in this study to calculate BMI at starting and after the end of the treatment course,

c. Tape measurement to measure the waist and hip circumference to calculate waist circumference and waist/hip ratio for each patient in this study at starting and after the end of the treatment course.

d. Bioelectrical impedance analysis (BIA):(Beurer GmbH, BF105, Body Complete, Germany) machine was used to measure body composition and evaluate muscle mass in both groups before and after the treatment.

e. Hand grip dynamometer: SAEHAN model SH5001 Hydraulic Hand Dynamometer, manufactured by (Saehan Corporation, Masan, 630-728, Korea) was used to measure grip strength of each patient in both groups before and after the treatment program.

f. Gait speed, a 4-m walk at the subject's usual pace was timed. Gait speed was calculated in meters per second.

**D- Procedures:**

- **Assessment procedures:**

**1- History taking:**

All data and information of each patient in this study were recorded in a recording data sheet. It including personal, present, past histories. Detailed medical, obstetrical and gynecological histories were taken from each patient.

**2- Weight and height measurement:**

Weight and height of each patient in both groups (control & study) was measured to calculate the BMI.

**3- BMI:**

BMI was calculated according to the following equation:

$$BMI=\frac{\text{weight(kg)}}{\text{height (m}^2)}\,\text{kg/m}^2$$

**4- Waist circumference:**

Waist circumference can provide an indication of increased abdominal fat even if there is no change in BMI, preventing some misclassification. Waist circumference was measured by tape measurement while the patient in standing position , women with a waist circumference more than 88 cm were considered obese. Because waist circumference predicts health risk better than BMI, it should be given more weight in the obesity classification scheme[25].

**5-Waist/hip ratio:**

The circumference of the hips was measured at the maximal circumference at the level of the femoral trochanter, using the narrowest point between the xipho-sternum and the iliac crest at the conclusion of a mild expiration. The waist/hip ratio was then computed by dividing waist circumference by hip circumference. The waist-hip ratio (>0.9 for men and >0.85 for women) and absolute waist circumference (>102 cm for men and >88 cm for women) are also used as indications of central obesity[26].

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**6- Bioelectrical impedance analysis (BIA):**
**Application of BIA:**

- All patients were asked to fast for at least 2 hours, urinate, defecate, stop vigorous exercise for 24h before the measurement status, and then stand for about 5 min before measurement because BIA is sensitive to hydration.
- BIA was measured in the morning after fasting for 2 hours to make the hydration status as uniform as possible.
- To minimize the contact noise, we cleaned the contacting surface of the electrodes with an alcohol swab before every measurement.
- All patients were asked to remove their shoes and socks, and wear light clothing, then stand on the device while body weight was measured.
- The measurement was performed with the subject in a standing position grasping the electrodes with both hands abducted from the mid-body. There was a total of eight electrodes: two for each foot and two for each hand.
- Age and height of all patients were entered into BIA [27].
- The current electrode and voltage electrode were separated from each other by a total of eight electrodes because of the structure of the hand.
- Starting the measurement at the wrist and ankle, where the flow of current and measurement of voltage meet, minimized the influence of the finger and palm, which have high contact resistance.

**7- Hand grip measurement:**

**Steps for hand grip measurement:**

- Different methods of grip strength measures have been reported, using dominant or both hands, considering that dominant hand is stronger than other hand by 10% for right handed people, whereas its force is similar among left handed people [28].
- Reliability of one trial is similar to three trial particularly among untrained populations, and hand grip force could reduce during repeated trials [28]. Some studies take the mean of measures[29], but the majority of studies take maximal reading of dominant hand[30].
- The patient was positioned, as recommended by the American Society of Hand Therapists [31], seated with back support while shoulder fully adducted and neutrally rotated with elbow flexed at 90° and the forearm and the wrist maintained in a neutral position.
- The patients were instructed to squeeze the dynamometer with maximal isometric effort without any other body movement, for five seconds.
- Hand grip measurement was reported by using dominant hand for one trial.
- Hand grip measurement was conducted for each patient was participated in this study pre and post treatment program for both groups with the same sequences.
- The calibration of the dynamometer was tested prior to each force measurement during the study.

**8- Gait speed:** Stop watch, 2 cones, measuring tape and marker tap were used to measure gait speed.
The test was performed with patients walked 4 meters, they followed the instructions below:

- Each patient was instructed to walk at their normal pace. Patients might use an assistive device, if needed.
- Each patient was asked to walk down a hallway through a 1-metre zone for acceleration, a central 4-metre "testing" zone that is timed with stopwatch, and a 1-metre zone for deceleration (the patient should not start to slow down before the 4-metre mark).
- The central 4-meter testing zone is bounded by a starting line and a finish line.
- The timer was started when the patient's lead leg crosses the starting line.
- The timer was stopped when the patient's lead leg crosses the finish line.
- Time was taken to walk 4-meters.
- Gait speed in meters per second.

**9-Chair stand:**

With arms folded across their chests, women were asked to stand and sit five times as quickly as they could, and the time from the first sitting position to the fifth standing position was recorded in seconds.[25].

- **Treatment procedures for study group :**

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**Core Exercises program:**

Twenty patients in study group received core exercises for 3 session / week for 3 months as following:

1. **Drawing-in maneuver (Abdominal hollowing exercise):**

From crock lying position,the patient was asked to contract the abdominals to draw in the abdomen, then relax (breath normally during the contraction) [32].

2. **Diaphragmatic breathing exercise:**

Patient was asked to put one hand below the rib cage and the other on the upper chest, then took a deep breath through the nose solely to raise the abdomen like a balloon, therefore, the hand over the abdomen raised and the other moved a little; then, the patient let the air escape through the mouth with sigh. The patient breathed slowly and deeply without moving shoulder. It was repeated for not more than 3-5 times [33].

3. **Pelvic bridging exercise:**

Patient was asked to lie incrock lying with both knees bent and feet flat on the floor and shoulder width apart,thenraised her pelvis upward until pelvis and trunk in the same line, hold and relax The exercise has been done with 5 repetitions and 5 seconds holding while breathing deeply, then the repetitions increase gradually to be 10 times till the end of 3 months and time of hold was equal to the time of relaxation [33]..

4. **Abdominal crunches (hands behind head):**

Patient was asked to lie on her back with both knees bent and feet flat on the floor and hip width apart then place her hands behind her head with her thumbs behind the ears and her elbows out to the sides, then tilt her chin slightly, pull her abdominals inward gently and curl up so that her head, neck and shoulder blades lift off the plinth, hold at the top of the movement and then lower back down slowly. [32].

5. **Abdominal crunches (hands behind head):**

Patient was asked to lie on her back with both knees bent and feet flat on the floor and hip width apart then place her hands behind her head with her thumbs behind the ears and her elbows out to the sides, then tilt her chin slightly, pull her abdominals inward gently and curl up so that her head, neck and shoulder blades lift off the plinth, hold at the top of the movement and then lower back down slowly [32].

6. **Abdominal “tuck in” in quadruped position:**

Patient was asked to take the quadruped position with her knees under hips and hands under shoulders, then contract the abdominals to breathe in deeply then relax, make sure that the patient doesn’t arch her back as she pulls in. [32].

7. **Cat - camel motions:**

Position of therapist was stride standing beside the patient. Initially by recognizing the neutral spine position (midrange between lumbar extension and flexion) [34].Patient was asked to take prone kneel position, then activate the abdominal wall musculature, then, “taking a deep breath from the nose while making hump in the back as a camel and breathing out from mouth while curving the spine as a cat”. [35].

8. **Bird – dog exercise :**

Patient was asked to take quadruped position, her knees directly under her hips and hands directly under shoulders, then the patient was asked to slightly her abdominals, lumbar and pelvic floor muscles, then raise the right arm only and hold this position for 5 seconds, then relax. Then, raise the left leg only for 5 seconds then relax. Finally, she asked to raise both right arm and left leg as much as possible in the same line with the trunk with maintaining the normal curve of the lumbar spine and hold this position for 5 seconds. Then lower her arm and her leg back to the plinth and the same steps were repeated on the other side. [33]

**Statisticalanalysis:**

Unpaired t-test were conducted for comparison of subject characteristics between groups. Normal distribution of data was checked using the Shapiro-Wilk test. Homogeneity of variances was checked using Levene’s test to ensure the homogeneity between group. Mixed MANOVA was conducted to compare the effect of time (pre versus post) and the effect of treatment (between groups), as well as the interaction between time and treatment on mean values of weight, body mass index, waist circumference, waist/hip ratio, muscle mass, gait speed, hand grip and chair stand between both groups. Post-hoc tests using the Bonferroni correction were carried out for subsequent multiple comparison. The level of significance for all statistical tests was set at $p < 0.05$. All statistical analysis was conducted through the statistical package for social studies (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).

**Results**

**- Subject characteristics:**

Table (1) showed the subject characteristics of the control and study groups. There was no significant difference between groups in the subject characteristics ($p > 0.05$).

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**Table 1. Comparison of subject characteristics between control and study groups:**

| | Mean ± SD | | p-value |
|---|---|---|---|
| | Control group | Study group | |
| **Age (years)** | 58.15 ± 3.06 | 58.30 ± 2.81 | 0.87 |
| **Weight (kg)** | 95.82 ± 12.97 | 96.25 ± 12.05 | 0.91 |
| **Height (cm)** | 160.00 ± 4.48 | 159.25 ± 4.76 | 0.61 |
| **BMI (kg/m²)** | 37.33 ± 4.07 | 37.89 ± 4.22 | 0.67 |

**SD, standard deviation; p value, probability value**

**<u>Effect of treatment on weight, BMI, waist circumference, waist/hip ratio, muscle mass, gait speed, hand grip and chair stand:</u>**

Mixed MANOVA revealed that there was a significant interaction of treatment and time (F = 4.37, p = 0.001). There was a significant main effect of time (F = 127.14, p = 0.001). There was no significant main effect of treatment (F = 0.47, p = 0.86).

**- Within group comparison:**

There was a significant decrease in weight, BMI, waist circumference and chair stand in the control and study groups post treatment compared with that pre treatment (p < 0.001). The percent of change of weight, BMI, waist circumference and chair stand of the control group was 7.58, 7.55, 4.05 and 14.31% respectively and that of the study group was 7.49, 7.41, 4.25 and 22.01% respectively. There was a significant decrease in waist/hip ratio of the study group post treatment (p = 0.03) while there was no significant change in the control group (p > 0.05).

There was a significant increase in muscle mass, gait speed and hand grip in the control and study groups post treatment compared with that pre treatment (p < 0.01). The percent of change of muscle mass, gait speed and hand grip of the control group was 1.93, 25.93 and 37.02% respectively and that of the study group was 1.8, 28.05 and 22.01% respectively. (table 2-3)

**- Between groups comparison:**

There was no significant difference in all variables between groups pre-treatment (p > 0.05). Comparison between groups post treatment revealed a non significant difference in weight, BMI, waist circumference, waist/hip ratio, muscle mass, gait speed and chair stand (p > 0.05) while there was a significant increase in hand grip of the study group compared with that of the control group post treatment (p > 0.01). (table 2-3).

***Table (2):*** **Mea*n* weight, BMI, waist circumference and waist/hip ratio pre and post treatment of the control and study groups:**

| | Pre-treatment | Post-treatment | | | |
|---|---|---|---|---|---|
| | **Mean ± SD** | **Mean ± SD** | **MD (95% CI)** | **% of change** | **p value** |
| **Weight (kg)** | | | | | |
| **Control group** | 95.82±12.97 | 88.56±13.33 | 7.26 (6.14:8.37) | 7.58 | 0.001 |
| **Study group** | 96.25±12.05 | 89.04±11.31 | 7.21 (6.09:8.33) | 7.49 | 0.001 |
| **MD (95% CI)** | -0.43 (-8.45: 7.58) | -0.48 (-8.39: 7.43) | | | |
| | ***p = 0.91*** | ***p = 0.9*** | | | |
| **BMI (kg/m²)** | | | | | |

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| | | | | | |
|---|---|---|---|---|---|
| **Control group** | 37.33±4.07 | 34.51±4.29 | 2.82 (2.39: 3.25) | 7.55 | 0.001 |
| **Study group** | 37.89±4.22 | 35.09±4.05 | 2.81 (2.37:3.23) | 7.41 | 0.001 |
| **MD (95% CI)** | -0.56 (-3.21: 2.09) ***p = 0.67*** | -0.58 (-3.25: 2.09) ***p = 0.66*** | | | |
| **Waist circumference (cm)** | | | | | |
| **Control group** | 111.00±12.33 | 106.50±12.63 | 4.5 (2.87:6.12) | 4.05 | 0.001 |
| **Study group** | 111.65±11.60 | 106.90±11.16 | 4.75 (3.12:6.37) | 4.25 | 0.001 |
| **MD (95% CI)** | -0.65 (-8.31: 7.01) | -0.4 (-8.03: 7.23) | | | |
| | ***p = 0.86*** | ***p = 0.91*** | | | |
| **Waist/hip ratio** | | | | | |
| **Control group** | 0.83±0.07 | 0.82±0.06 | 0.01 (-006: 0.01) | 1.2 | 0.34 |
| **Study group** | 0.85±0.05 | 0.83±0.5 | 0.02 (0.001:0.02) | 2.35 | 0.03 |
| **MD (95% CI)** | -0.02 (-0.05: 0.02) | -0.01 (-0.04:0.03) | | | |
| | ***p = 0.44*** | ***p = 0.65*** | | | |

**SD, Standard deviation; MD, Mean difference; CI, confidence interval; p value, Probability value**

***Table (3):*** **Mea*n muscle* mass, gait speed, hand grip and chair stand pre and post treatment of the control and study groups:**

| | **Pre-treatment** | **Post-treatment** | | | |
|---|---|---|---|---|---|
| | **Mean ± SD** | **Mean ± SD** | **MD (95% CI)** | **% of change** | **p value** |
| **Muscle mass (%)** | | | | | |
| **Control group** | 28.44±0.67 | 28.99±1.13 | -0.55 (-0.89:-0.21) | 1.93 | 0.002 |
| **Study group** | 28.32±0.53 | 28.83±0.54 | -0.51 (-0.85: -0.17) | 1.8 | 0.004 |
| **MD (95% CI)** | 0.12 (-0.26: 0.51) | 0.16 (-0.41: 0.72) | | | |
| | ***p = 0.53*** | ***p = 0.58*** | | | |
| **Gait speed (m/sec)** | | | | | |
| **Control group** | 0.81±0.09 | 1.02±0.11 | -0.21 (-0.24: -0.16) | 25.93 | 0.001 |
| **Study group** | 0.82±0.11 | 1.05±0.14 | -0.23 (-0.27: -0.18) | 28.05 | 0.001 |
| **MD (95% CI)** | -0.01 (-0.06: 0.06) | -0.03 (-0.11: 0.56) | | | |
| | ***p = 0.93*** | ***p = 0.48*** | | | |
| **Hand grip (kg)** | | | | | |
| **Control group** | 11.75±3.73 | 16.10±3.14 | -4.35 (-5.54: -3.15) | 37.02 | 0.001 |
| **Study group** | 11.55±3.53 | 18.70±2.61 | -7.15 (-8.34: -5.95) | 61.9 | 0.001 |
| **MD (95% CI)** | 0.2 (-2.12: 2.52) | -2.6 (-4.45: -0.74) | | | |
| | ***p = 0.86*** | ***p = 0.007*** | | | |
| **Chair stand (sec)** | | | | | |
| **Control group** | 14.88±2.21 | 12.75±1.96 | 2.13 (1.78: 2.49) | 14.31 | 0.001 |

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| | | | | | |
|---|---|---|---|---|---|
| **Study group** | 14.99±2.10 | 11.69±2.03 | 3.3 (2.95: 3.65) | 22.01 | 0.001 |
| **MD (95% CI)** | -0.11 (-1.48: 1.27) | 1.06 (-0.22: -2.34) | | | |
| | ***p = 0.87*** | ***p = 0.1*** | | | |

**SD, Standard deviation; MD, Mean difference; CI, confidence interval; p value, Probability value**

**Discussion**:

According to the results, it concluded that BMI, waist circumference, muscle mass, gait speed, and chair stand improve when a low-calorie diet, physical activity, and core workouts are followed. Core workouts have been shown to improve hand grip in postmenopausal women, which is especially essential in Egyptian women.

A low-caloric diet paired with physical activity resulted in significant weight, BMI, and waist circumference reductions, according to the current study.

The percentage of weight loss in the control and study groups was 7.58 percent and 7.49 percent, respectively. However, there was no statistically significant difference between the control and study groups at the end of treatment.

While both the control and study groups had their BMIs drop by 7.55 percent and 7.41 percent, there was no statistically significant difference between the two groups at the end of therapy.

Furthermore, although there was no statistically significant difference between the two groups at post-treatment, both the control and study groups reported a 4.05 percent and 4.25 percent reduction in waist circumference, respectively.

According to **Zamboni et al. [36]**, the most effective solution for both obesity and SO is a mix of moderate caloric restriction diet and exercise.

According to **Hershberger and Bollinger [37]**, dietary adjustments can help with obesity and sarcopenia. Protein synthesis can be boosted by eating up to 0.8 grams of protein per kilogram of body weight.

These findings are supported by studies by [38] and [39], which found that as people age, their ASM, hand strength, and gait speed diminish, while their prevalence rates of low muscle mass, low physical performance, and low muscular strength rise.

A low-calorie diet, physical activity, and core exercise led to a large increase in muscle mass and gait speed, as well as a considerable reduction in chair stand, according to this study.

Both the control and study groups saw a 1.93 percent and 1.80 percent increase in muscle mass, respectively, whereas the control and study groups saw a 25.93 percent and 28.05 percent increase in gait speed, respectively, and a 14.31 percent and 22.01 percent decrease in chair stand, respectively.

By favoring physical function decline, low muscle mass increases the risk of disability, falls, poor quality of life, and mortality [25]. SO has been demonstrated to have a synergistic effect on elderly people's physical performance [40]. According to the findings of a study, exercise may minimize the loss of lean mass observed after weight loss caused by energy restriction, resulting in greater muscle strength and physical performance [41]. Energy restriction combined with aerobic and resistance exercise appears to be the most effective method for improving physical performance and maybe reducing frailty in older obese adults.

**Villareal et al. [42]** backed up the findings of this trial, reporting that obese and frail older people benefited from a comprehensive intervention involving several exercise elements and a weight-loss diet, which improved body weight and physical function. According to one study, function increased by 21% in the combination therapy group compared to baseline, while exercise-only and weight-loss-only

In addition, in a randomized 4-month clinical trial including a group of SO women aged 41 to 74 years, **Sammarco et al. [43]** found that a hypocaloric protein-rich diet can help to preserve muscular mass and strength.

**Tieland et al. [44]** backed up the findings of this study, stating that dietary protein supplements and exercise can assist older people maintain muscle mass and strength while also preventing them against sarcopenia and frailty.

Although there is very limited information on the benefits of AE on SO, **Trouwborst et al. [45]** stated that AE appears to be a beneficial technique for decreasing extra fat mass and enhancing muscle function in older persons who are sarcopenic obese. However, aerobic exercise combined with other techniques, such as a food strategy or resistance training, may be more beneficial in reducing SO.

**Trouwborst et al. [45]** observed that while exercise combined with a hypocaloric diet was more successful than either intervention alone, skeletal muscle mass was not totally retained. Skeletal muscle mass had to be maintained, if not augmented, particularly in the elderly.

In addition, **Chen et al. [47]** discovered that an 8-week RCT on 60 men and women aged 65–75 with SO looked at the effects of various types of exercise on body composition and muscle strength: Participants were divided into four groups and given resistance training, aerobic training, combination training, or no training: despite no changes in body weight, those who did resistance training, aerobic training, or combination training had a significant increase in muscle mass and strength, as well as a greater reduction in total fat mass.

**Martnez-Amat et al. [46]** looked at eight RCTs that looked at the effects of various types of exercise on sarcopenia and obesity-related parameters in SO patients, and found that seven out of eight studies showed improvement in at least one sarcopenia-related parameter, but only a few studies showed an increase in muscle strength and endurance.

According to **Villareal et al. [41]**, a weight management program that comprised both resistance and aerobic exercise was more successful than either aerobic or resistance exercise alone in improving the functional status of obese older people.

**Choi et al. [48]** Health Aging and Body Composition study, which indicated that a lower muscle mass is the primary cause of decreased muscular strength, supports the conclusions of this study.

The findings of the current study are similar to those of [49], who discovered that fat infiltration into muscle causes aging-related loss of mobility and that a decrease in thigh muscle area predicts a drop in gait speed. Although the slower mean gait speeds seen in women with SO are not statistically significant, they may have an immediate impact on their functional abilities and quality of life.

**Lim et al. [50]** discovered that older Asian men and women in Singapore walk more slowly (65 years).

The findings of this study contradict those of [51], who stated that among the elderly, even adding or maintaining lean mass did not prevent weakness loss.

By causing physical function to decline, low muscle mass increases the risk of falls, poor quality of life, disability, and mortality [25]. SO has been hypothesized to have a synergistic effect on the physical performance of the elderly [52].

According to **Beavers et al. [49]** despite the fact that excessive intermuscular fat in the thigh is a known predictor of gait-speed reduction, there were no significant differences in gait speed across groups.

Furthermore, the findings of this study contradict those of **Liu et al. [53]**, who said that older persons with SO should walk slower than those with only obesity or sarcopenia because both can induce physical function decline. In contrast, there were no significant differences in gait speed between the obese, sarcopenia, and SO groups.

When comparing the study group's low-calorie diet, physical activity, and core exercise to the control group's low-calorie diet and physical activity, the study group's low-calorie diet, physical activity, and core exercise showed a significant improvement in hand grip.

The percentage increase in hand grip in the study group was 37.02 percent, which was higher than the 61.90 percent in the control group, according to the findings of this study.

Hand grip strength of 18 kg in women and 32 kg in men, as well as voluntary walking speed of 0.8–1 m/s, were shown to represent sarcopenia criterion measurements by [37].

The preceding findings are consistent with **Silva Neto et al. [54]**, who discovered that SO is linked to decreased grip strength in elderly women in a recent Brazilian study.

Accordingly, the findings of this study correlate with those of **Lim et al. [50]**, who found that obesity mixed with sarcopenia causes a drop in performance and strength markers, notably grip strength, in older Asian women from Singapore.

The application's relatively strong correlation coefficient between BIA- (InBody 720) and DXA-measured ASMs, according to **Wang et al. [55]**, indicates that it may be used to monitor body composition in elderly Chinese in a quick, noninvasive, and easy manner.

Due to cost, accessibility, and radiation exposure issues, **Wang et al. [55]** reported that CT, MRI, and DXA assessments of ASM are not appropriate for large-scale sarcopenia surveys in the elderly. BIA could be a good way to measure ASM in epidemiological surveys. According to a recent study, BIA equations should not be used without previous verification against reference methods in the subject population investigated due to recognized differences in body structure among ethnic groups.

The connection between ASM assessed by DXA and BIA was high in both women and men [55].

According to **Moreira et al., [25]** SO was shown to be frequent and linked with poor physical performance in middle-aged women from Northeast Brazil. Women with SO had significantly lower grip strength, flexion strength, and knee extension when compared to obese and normal women. The three muscle strength measures (knee extension, flexion strength, and grip strength) were lower in women with SO than in sarcopenic non-obese women, albeit this was not statistically significant.

**Conclusion:**

Following low caloric diet, physical activity and core exercises can improve BMI, waist circumference, physical performance and prevent or treat SO. Core exercises has a beneficial effect on increase hand grip in SO Postmenopausal Women.

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