

Review Article

Sarcopenic Obesity: Current Management Strategies and the Role of Exercise Training

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A B S T R A C T

Sarcopenia is the term used to describe the gradual decrease of muscular mass that occurs with ageing, while obesity signifies the excessive accumulation of body fat (BF) in relation to lean body mass. The combination of increased adiposity and decreased muscle mass and strength defines sarcopenic obesity. In India, the overall prevalence rates of obesity, sarcopenia, and sarcopenic obesity are 27.1%, 41.9%, and 8.7%, respectively. Management techniques for sarcopenic obesity include nutritional interventions, pharmacological interventions, and exercise interventions. Thus, the study aims to raise awareness among the population regarding the condition of sarcopenic obesity and effective management strategies utilizing various types of exercises. Exercise interventions, including high-speed circuits, aerobic training, resistance training, and combined exercise training, have shown positive effects on physical performance, body composition, muscle mass, and functional capacity in individuals with SO. These interventions offer promising strategies for managing sarcopenic obesity and improving the overall health and well-being of older individuals.

Keywords: Sarcopenia, Exercise, Obesity, Intervention

Introduction

Sarcopenia Obesity (SO) is a prevalent condition commonly observed in the geriatric population, which is characterised by the presence of both sarcopenia and obesity.^{1,2} Sarcopenia refers to the gradual decrease in muscular mass that occurs with ageing, while obesity signifies the excessive accumulation of body fat (BF) in relation to lean body mass. The combination of increased adiposity and decreased muscle mass and strength defines sarcopenic obesity. This condition is more frequently found in older women compared to men. The prevalence of sarcopenic obesity varies depending on the diagnostic criteria employed, ranging from 15% to 30% in the general elderly population. Globally, the prevalence rate of SO is 11%. The prevalence of SO differs based on the measurements used

to diagnose sarcopenia, with muscle mass measurement alone resulting in a higher prevalence (15%) compared to when muscle strength and/or physical performance are also considered (4%).¹ The use of DXA (15%) to assess muscle mass yields a higher prevalence than BIA (7%).¹ Additionally, specific population subgroups, show greater prevalence rates including those individuals above the age of 75 (23%), South Americans (21%), North Americans (19%), and hospitalized patients (16%).¹ However, there are non-significant variations in the overall incidence of SO between researches using different measurements body fat (BF: 10%), body mass index (BMI: 13%), waist circumference (WC: 16%) to diagnose obesity or among female (14%) and male (10%) patients.¹ In India, the overall prevalence rates of obesity, sarcopenia, and sarcopenic obesity are 27.1%, 41.9%, and 8.7%, respectively.² Adults

with sarcopenic obesity tend to have higher mean age, weight, BMI, and blood pressure compared to others. Factors such as higher age, urban residence, residing in the western and southern regions of India, tobacco or alcohol consumption, inactivity, and diabetes can lead to the emergence of SO.² The condition primarily manifests as an age-related phenomenon due to physiological alterations that occur during the natural ageing process.

SO defined and has evolved over time. Initially, Baumgartner defined it as having a muscle mass index more than 2 standard deviations below the reference value for healthy adults.³ In 2002, researchers proposed an alternative definition based on anthropometric measurements and bioelectrical impedance analysis. The development of SO is significantly influenced by age-associated alterations in the composition of the body, which are characterized by the reduction in skeletal muscle mass (SMM) and the accumulation of adipose tissue. (shown in figs 1 & 2).³ Factors such as inactivity, insufficient nutritional intake, and age-associated alterations contribute to the progression of sarcopenia.⁴ The decline in SMM and the increase in visceral fat deposition are associated with adverse health outcomes, including metabolic disorders and cardiovascular diseases.⁴ Accurate diagnosis of SO requires comprehensive assessments of BF, SMM, and muscle strength.⁴ Future research should further investigate the underlying mechanisms and potential interventions to effectively manage and prevent SO, ultimately improving the health and well-being of individuals affected by this condition.

Management techniques for SO include nutritional interventions, pharmacological interventions, and exercise interventions. Nutritional interventions focus on protein-rich and hypocaloric diets, while pharmacological interventions involve the use of myostatin inhibitors, testosterone, and growth hormone therapy.^{3,4,5} Exercise interventions encompass aerobic training, strength training, circuit training, and combination training. These interventions aim to reduce fat mass, increase muscle mass and strength, improve physical function, and alleviate metabolic dysregulation and inflammation associated with excess fat deposition.^{3,4,5}

Thus, the study intends to raise public knowledge about the condition of sarcopenic obesity and effective management strategies utilizing various types of exercises.

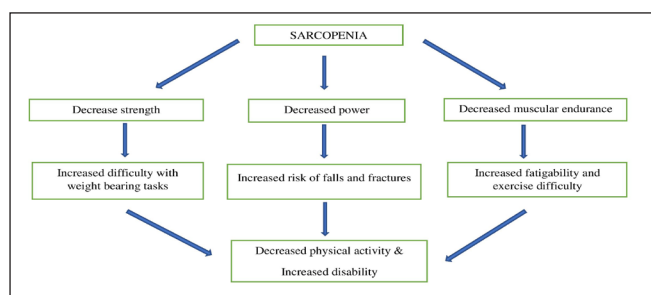


Figure 1. Consequences of Sarcopenia

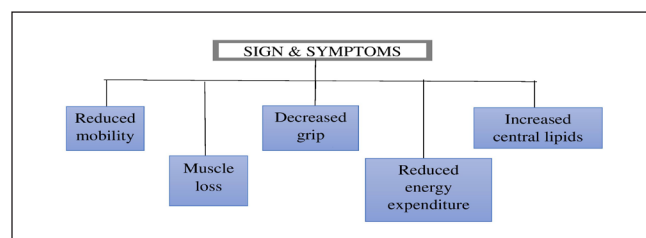


Figure 2. Sign & Symptom

Management Strategies of Sarcopenia Obesity:

The objectives of interventions targeting sarcopenic obesity encompass multiple aspects (shown in fig 3). These objectives include the reduction of fat mass, the enhancement of muscle mass, the improvement of muscle strength, the enhancement of physical function, and the amelioration of metabolic dysregulation and inflammation associated with excess fat deposition.^{3,4,5,6,7}

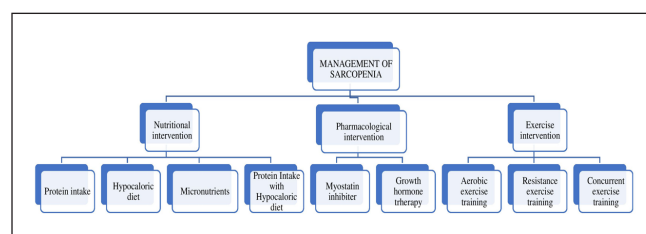


Figure 3. Management of Sarcopenia

Nutritional Intervention

Nutritional intervention strategies for sarcopenic obesity encompass various approaches, including protein intake, hypocaloric diet, micronutrient supplementation, and the combination of a hypocaloric diet with adequate protein consumption.^{3,4,5,8}

Pharmacological Intervention

While lifestyle interventions play a crucial role in managing sarcopenic obesity, there are instances where these measures may not be feasible due to physical limitations or poor adherence. Consequently, the exploration of pharmacological therapies has gained attention in addressing this increasingly prevalent condition. In a study, changes in body composition in postmenopausal women with SO were compared to placebo after a 6-month soy isoflavones dose. Additionally, pharmacological interventions such as myostatin inhibitors, testosterone therapy, and growth hormone therapy have been considered in the management of sarcopenic obesity.^{6,7}

Exercise Intervention

As described in table 1 the decline in physical activity with ageing is recognized as a contributing factor to the development of sarcopenic obesity, prompting investigations into the impact of exercise on SO. Increased muscle protein synthesis, decreased myostatin expression,

elevated intramuscular IGF-1 levels, restored skeletal muscle sensitivity to insulin's anabolic effects, improved nutrient-stimulated vasodilation and nutrient delivery to muscles, improved mitochondrial function, and activation of skeletal muscle satellite cells—which are thought to be protective—are just a few of the ways that exercise has been shown to improve various aspects of SO. Exercise interventions for sarcopenic obesity may involve circuit

training, aerobic training, resistance training, or combined/concurrent training. It has been demonstrated that circuit training, a type of strength training that involves a repetitive series of exercises with shorter rest intervals than standard resistance training, is efficient in reducing body fat, building muscle mass, and enhancing strength and functional performance..^{3,4,5,8,9,10}

Table I. Exercises prescribed for Sarcopenia Obesity

Study (Author, Year)	Study Design	Groups (Sample Size)	Age	Gender	Definition Of Sarcopenic Obesity	Type & Duration Of Intervention	Results/ Outcome Measures
Shu-Ching Chiu et al. 2020 ¹⁶	Quasi-experimental study	RE (57) Control (52)	79.9±7.8	Male & Female	-	Resistance exercise & control 3 months (twice a week)	QoL, GS, ASMI
Christina M. Dieli, Kerry S Courneya et al. 2018 ¹⁷	RCT	CE (49) Control (48)	53±10.4	Female	Waist circumference > 88 cm ASMI < 5.45kg/m ² BMI > 25 kg/m ²	Combined exercise & control 16 weeks (3 times per week.)	ASMI, Lean mass ↑ BMI, Hip circumference, FM, TF, BF% ↓
Shu-Ching Chiu et al. 2018 ¹⁵	Quasi-experimental study	RE (33) Control (31)	79.9±7.8	Male & Female	SMI < 37.15% in men SMI < 32.26% in women BF % > 29 in men BF % > 40 in women	Resistance exercise & control 12 weeks (twice a week)	GS, PS ↑ ASM, BF%, SMI ⇒

Balachandran et al did a study in 2014 on the impact of high-speed circuits on individuals with sarcopenic obesity. The study findings revealed significant improvements in physical performance, as assessed by measures such as a 4-meter usual pace gait speed test, 5-second continuous chair stand, and standing balance tests.¹¹

It is now widely accepted that aerobic exercise is a crucial strategy for improving aerobic capacity and muscle function in older persons. Through a number of processes, including as the beginning of mitochondrial adaptation, improvement of cardiovascular function (such as improved stroke volume capacity), and increased capillary density in muscle tissue, this type of exercise has the potential to boost aerobic capacity. An RCT was performed by Chen HT et al. to evaluate the effects of various exercise forms on SO. The Aerobic Training (AT) group, one of the study's groups, participated in aerobic activity. The results demonstrated that after 8 weeks of training, all groups exhibited significant increases in Skeletal Muscle Mass (SMM) and Appendicular Skeletal Mass (ASM), accompanied by significant reductions in Body Fat Mass (BFM) and Visceral Fat Area (VFA) compared to the control group. Moreover, these effects were sustained for week.¹² Another study reported that 12 weeks of aerobic training not only improved skeletal muscle mass but also enhanced cardiorespiratory fitness.⁴

Resistance training has been established as the most effective method to improve muscle function and increase muscle mass in frail older individuals. It offers various benefits, including enhancements in muscle performance, functional activities, and quality of life. Resistance exercises encompass a range of techniques and methods aimed at enhancing muscle strength, power, or endurance. These exercises have also been recommended as a non-pharmacological therapy for older individuals with sarcopenic obesity to mitigate sarcopenia and alleviate the pro-inflammatory state associated with obesity. Chen HT et al conducted an RCT to explore the effects of different exercise types, including resistance training. The Resistance Training (RT) group in the study participated in resistance training sessions using weight-training equipment under the guidance of a qualified professional trainer. The RT group exhibited significantly stronger grip strength and back extensor strength compared to other groups, and there were notable improvements in SMM, ASM, BFM, and VFA after 8 weeks of training, which persisted until week 12.⁴

Researchers have looked into how exercise therapies affect SO. An RCT comprising a resistance training regimen for elderly women with sarcopenic obesity was carried out by Vasconcelos et al. After the 10-week progressive resistance training programme, the study did not discover

any appreciable changes in the end measures.¹² For older women with sarcopenic obesity, Liao CD et al. did an RCT to look at the effects of elastic resistance training on body composition and physical capacity. In older women with sarcopenic obesity, the study showed the beneficial effects of a 12-week elastic resistance exercise training (RET) on body composition and functional mobility results. Another study by Liao CD et al. examined the effects of elastic band training on lean mass and physical capacity in older women with sarcopenic obesity. The findings revealed that a 12-week elastic RET had a beneficial effect on outcomes related to muscle mass and functional capacity.^{13,14} In an RCT, Gadelha et al. examined how resistance training affected sarcopenic obesity in older women. The experimental group participated in a 24-week resistance training regimen.⁹

In order to ascertain the effects of chair resistance training on body composition and physical performance in nursing home patients with sarcopenic obesity, Shu-Ching Chiu et al. undertook a preliminary study in 2018. The study showed that sandbag resistance training boosted muscle strength, even in elderly people with impairments. The results of the study showed that sandbag chair muscle training twice a week was practical and advantageous for preserving skeletal muscle mass and enhancing pinch and grip strength in long-term care (LTC) residents with sarcopenic obesity.¹⁵ Another study by Shu-Ching Chiu et al in 2020 investigated the effect of resistance training on the quality of life in older people with sarcopenic obesity residing in long-term care institutions. The intervention group received progressive resistance training with sandbags or dumbbells twice a week for 3 months. However, the study did not find significant differences in quality of life between the intervention group and the comparison group based on the criteria of sarcopenia and appendicular skeletal mass index (ASMI) even after the 3-month intervention.¹⁶

Combined exercise training, involving both resistance exercise and aerobic exercise, has the potential to positively affect body composition parameters in sarcopenic obesity and improve muscle function. Chen HT et al conducted an RCT to examine the effects of combined or concurrent exercise training on individuals with sarcopenic obesity. After 8 weeks of training, all three groups in the study demonstrated significant increases in SMM and ASM, along with significant reductions in BFM and VFA compared to the control group. The effects were sustained until week 12. The combined exercise group exhibited lower weight and BFM and higher SMM than the control group at both time points. Additionally, the body mass index (BMI) and percentage of body fat (PBF) in the combined exercise group were significantly lower than those in the control group at week 8.⁴

The benefits of resistance and aerobic exercise on sarcopenic obesity in breast cancer survivors were also investigated in a study by Christina and Kerry et al. The combined exercise programme, which included supervised aerobic and resistance workouts for 16 weeks, significantly reduced the risk of sarcopenic obesity, metabolic syndrome, and circulating biomarkers. These improvements persisted during a 3-month follow-up. This study was the first to show that a planned exercise intervention in breast cancer survivors significantly reduced all symptoms of the metabolic syndrome. Along with decreasing insulin resistance, the intervention also reduced pro-inflammatory and hormonal indicators linked to breast cancer and obesity.¹⁷

In an RCT, Park et al. examined how combined exercise affected the carotid artery's intima-media thickness (CIMT) and flow rate in sarcopenic, obese older women. In older women, sarcopenic obesity is closely related to cardiovascular disease. Increased carotid intima-media thickness (CIMT) is directly related to increases in body fat and decreases in muscle mass. For 24 weeks, he administered a mix of exercise interventions. The 24-week combined exercise programme for elderly women with SO lowered CIMT, which is the study's key finding.¹⁸

Discussion & Conclusion

In summary, various exercise interventions, including high-speed circuits, aerobic training, resistance training, and combined exercise training, have shown beneficial effects on physical performance, body composition, muscle mass, and functional capacity in individuals with SO. These interventions offer promising strategies for managing sarcopenic obesity and improving the overall health and well-being of older individuals.

During our literature review, we observed that various types of exercise exhibit favorable effects in significantly mitigating the impact of SO. These exercise interventions demonstrate positive modifications in several parameters including visceral fat area (VFA), skeletal muscle mass (SMM), appendicular skeletal mass (ASM), grip strength (GS), fat mass (FM), waist circumference (WC), trunk fat percentage (TF%), trunk fat (TF), appendicular skeletal mass index (ASMI), walking speed (WS), knee extensor strength (KES), back extensor strength (BES), knee extensor power (KEP), body fat percentage (BF%), and body mass index (BMI). Among these exercise modalities, aerobic exercise, resistance exercise, and concurrent exercise all yield positive effects, with resistance exercise emerging as the most preferable and effective approach. Our review also revealed that engaging in resistance exercise training for durations exceeding 10 weeks can significantly reduce BF%, TF%, and TF, while concurrently increasing muscle strength, SMM, GS, ASM, BES, and KES. Therefore, based

on our analysis, aerobic exercise appears to be the optimal choice for preventing cardiovascular diseases in individuals with sarcopenic obesity. However, a combined exercise approach combining aerobic and resistance exercises (AE+RE) is recommended as the preferred management technique for sarcopenic obesity, with emphasis placed on the inclusion of resistance exercise training.

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