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WHY SARCOPENIC OBESITY IS THE STRATEGIC INTERSECTION? – A NARRATIVE REVIEW

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ABSTRACT

Sarcopenic obesity has emerged as a significant clinical and public health concern due to the simultaneous presence of decreased skeletal muscle mass and increased adipose tissue accumulation. This condition represents a complex metabolic state that combines the adverse consequences of both sarcopenia and obesity, leading to deterioration of physical function and metabolic health.

The purpose of this review is to analyze current scientific evidence regarding the epidemiology, pathophysiological mechanisms, diagnostic challenges, and clinical consequences of sarcopenic obesity, as well as potential therapeutic and preventive strategies. A narrative review of studies published between 2000 and 2025 using PubMed, Scopus, and Web of Science was conducted.

The findings indicate that sarcopenic obesity is associated with aging, metabolic dysregulation, and lifestyle-related factors such as physical inactivity and inadequate nutrition. Chronic low-grade inflammation, insulin resistance, hormonal alterations, and mitochondrial dysfunction play key roles in its development. Sarcopenic obesity has been associated with an increased risk of cardiovascular diseases, type 2 diabetes, frailty, disability, and mortality.

The condition remains underdiagnosed due to the lack of standardized diagnostic criteria and limitations of traditional indicators such as body mass index. Effective management requires a multidisciplinary approach combining resistance exercise, nutritional interventions, and lifestyle modifications. Understanding its mechanisms may improve prevention and clinical management in aging populations.

KEYWORDS

Sarcopenic Obesity; Sarcopenia; Aging; Body Composition; Metabolic Disorders

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1. Introduction

Sarcopenic obesity has emerged as an increasingly important clinical and public health challenge in modern medicine. This condition is characterized by the simultaneous presence of reduced skeletal muscle mass and strength together with excessive adipose tissue accumulation. The coexistence of these two disorders creates a complex metabolic state that carries greater health risks than either condition alone (Kim et al., 2022, 695-704).

Over the past decades, the global increase in life expectancy combined with the growing prevalence of obesity has significantly contributed to the rising incidence of sarcopenic obesity. Aging is associated with progressive changes in body composition, including the gradual loss of muscle mass and redistribution of adipose tissue. These physiological processes, when combined with sedentary lifestyle patterns and metabolic disturbances, may accelerate the development of this condition (Andrieieva & Nahorna, 2020, 36-44).

Sarcopenia alone is characterized by the progressive decline of skeletal muscle mass and function, which typically begins after the fourth decade of life and may decrease by approximately 1–2% per year after the age of fifty. At the same time, obesity is defined by excessive accumulation of adipose tissue that disrupts metabolic homeostasis and increases the risk of multiple chronic diseases. When these two conditions coexist, they may act synergistically, creating a vicious cycle of metabolic dysfunction that promotes further muscle loss and fat accumulation (Mitchell et al., 2012).

The pathophysiology of sarcopenic obesity is multifactorial and involves complex interactions between hormonal changes, chronic low-grade inflammation, mitochondrial dysfunction, insulin resistance, and alterations in energy metabolism. These mechanisms contribute to a progressive deterioration of metabolic health and physical function. Moreover, sarcopenic obesity has been associated with an increased risk of cardiovascular disease, type 2 diabetes, fractures, frailty, disability, hospitalization, and all-cause mortality.

Despite growing scientific interest, the diagnosis and management of sarcopenic obesity remain challenging. One of the major difficulties lies in the absence of universally accepted diagnostic criteria and the limitations of commonly used measures such as body mass index, which often fail to detect abnormal body composition. As a result, the condition may remain underdiagnosed in both clinical practice and epidemiological studies (Wei et al., 2023).

Understanding sarcopenic obesity as a strategic intersection between aging, metabolic disorders, and changes in body composition may provide new insights into the prevention and treatment of chronic diseases associated with modern lifestyles. Therefore, the aim of this review is to analyze the current scientific evidence regarding the epidemiology, pathophysiological mechanisms, clinical consequences, diagnostic approaches, and potential management strategies related to sarcopenic obesity.

2. Methods

2.1. Literature Search Strategy

This study was conducted as a narrative literature review aimed at summarizing current scientific evidence regarding sarcopenic obesity, with particular emphasis on its epidemiology, pathophysiology, diagnostic challenges, and clinical consequences. The review also aimed to identify potential therapeutic and preventive strategies discussed in recent scientific literature.

A comprehensive literature search was performed using several major electronic scientific databases, including PubMed, Scopus, and Web of Science. In addition, supplementary searches were conducted within journals relevant to health sciences, physical activity, and sport sciences.

The search covered articles published between 2000 and 2025. This time frame was selected to capture both the early conceptual development of sarcopenic obesity and the most recent advances in research concerning metabolic health and aging populations.

The following key terms and combinations of keywords were used during the search process: *"sarcopenic obesity", "sarcopenia", "obesity", "aging", "body composition", "muscle mass", "metabolic disorders", "physical activity", "frailty"* and *"insulin resistance"*. Boolean operators (AND, OR) were applied to refine search results and improve the relevance of identified publications.

Inclusion and Exclusion Criteria

Studies were considered eligible for inclusion if they met the following criteria:

- original research articles, systematic reviews, or narrative reviews
- publications written in English
- studies focusing on sarcopenic obesity, body composition changes, or related metabolic disorders
- studies involving adult or older populations
- articles published in peer-reviewed scientific journals

Articles were excluded if they:

- focused exclusively on pediatric populations
- lacked clear methodological descriptions
- were conference abstracts without full text availability
- did not directly address sarcopenia, obesity, or their combined effects.

2.2. Study Selection and Data Analysis

The initial search identified a broad pool of publications. Titles and abstracts were screened to determine their relevance to the topic of sarcopenic obesity. Full texts of potentially relevant articles were subsequently reviewed to assess their eligibility according to the predefined inclusion criteria.

Selected studies were analyzed qualitatively, focusing on the main research themes, including epidemiological data, biological mechanisms underlying sarcopenic obesity, diagnostic approaches, and clinical outcomes. Particular attention was given to studies examining the interaction between aging, metabolic health, and lifestyle factors such as physical activity and nutrition.

The findings were then synthesized to provide a comprehensive overview of current knowledge regarding sarcopenic obesity and to identify key areas requiring further research.

3. Epidemiology of Sarcopenic Obesity

Sarcopenic obesity has become an increasingly recognized health concern in aging societies worldwide. The coexistence of reduced skeletal muscle mass and increased adiposity reflects complex interactions between aging processes, metabolic disturbances, and lifestyle factors. As both obesity and age-related muscle decline become more prevalent globally, the epidemiology of sarcopenic obesity has gained growing attention in scientific research.

The prevalence of sarcopenic obesity varies significantly depending on the diagnostic criteria used, the population studied, and the methods applied to assess body composition. Estimates suggest that sarcopenic obesity affects approximately 5–20% of older adults, although some studies report even higher prevalence in specific populations. A recent meta-analysis including more than 70,000 older adults estimated the global prevalence of sarcopenic obesity at approximately 14% among community-dwelling individuals aged 65 years and older (Luo et al., 2024, 357). Differences in prevalence rates are largely related to variations in definitions of sarcopenia and obesity, as well as the use of different diagnostic tools such as dual-energy X-ray absorptiometry (DXA), bioelectrical impedance analysis, computed tomography, or magnetic resonance imaging (Wei et al., 2023).

Age is one of the most significant determinants influencing the development of sarcopenic obesity. With advancing age, individuals typically experience progressive loss of skeletal muscle mass and strength, a process often referred to as age-related sarcopenia. This phenomenon is frequently accompanied by an increase in fat mass and redistribution of adipose tissue, particularly the accumulation of visceral fat. These simultaneous changes in body composition create conditions that favor the development of sarcopenic obesity (Wei et al., 2023).

Sex differences have also been observed in epidemiological studies. Some research indicates that sarcopenic obesity may be more prevalent among older women due to hormonal changes associated with menopause, which can accelerate both muscle loss and fat accumulation. Reduced estrogen levels may contribute to alterations in body composition and metabolic regulation, thereby increasing susceptibility to metabolic disorders. In contrast, older men may experience a gradual decline in testosterone levels, which also affects muscle mass and strength and may contribute to the development of sarcopenic obesity.

Physical inactivity represents one of the most important modifiable risk factors associated with sarcopenic obesity. Sedentary behavior contributes to decreased muscle protein synthesis, reduced muscle strength, and increased fat mass. Similarly, inadequate nutritional intake, particularly insufficient protein consumption, may further exacerbate muscle loss. These lifestyle-related factors interact with biological aging processes, amplifying the risk of sarcopenic obesity in older adults (Karaağaç, 2023, 237-246).

In addition to age and lifestyle factors, several chronic diseases have been associated with a higher prevalence of sarcopenic obesity. Metabolic disorders such as Type 2 Diabetes, as well as cardiovascular diseases and chronic inflammatory conditions, may accelerate the deterioration of muscle mass and metabolic health. The presence of multiple comorbidities often worsens the overall health status of affected individuals, increasing the risk of disability, hospitalization, and mortality (van den Broek-Altenburg et al., 2022, 962).

Another important epidemiological aspect is the potential underdiagnosis of sarcopenic obesity in clinical practice. Traditional anthropometric indicators such as body mass index are frequently insufficient to detect abnormal body composition, as individuals may present with normal or elevated BMI despite significant loss of muscle mass. Consequently, sarcopenic obesity may remain unrecognized in many patients, particularly in primary healthcare settings where advanced body composition assessment methods are not routinely available.

Given the ongoing demographic shift toward aging populations worldwide, the burden of sarcopenic obesity is expected to increase substantially in the coming decades. The growing proportion of individuals aged 60 years and older will likely lead to a higher prevalence of conditions associated with age-related changes in body composition. This trend highlights the importance of developing effective preventive strategies focused on maintaining muscle mass, promoting physical activity, and supporting healthy nutritional habits throughout the lifespan (Wei et al., 2023).

4. Pathophysiological Mechanisms of Sarcopenic Obesity

Sarcopenic obesity represents a complex metabolic condition resulting from the interaction between age-related decline in skeletal muscle mass and excessive adipose tissue accumulation. The development of this disorder involves multiple biological pathways including chronic low-grade inflammation, insulin resistance, hormonal dysregulation, mitochondrial dysfunction, and alterations in muscle protein metabolism. These mechanisms interact in a synergistic manner, contributing to progressive deterioration of metabolic health and physical function (Wei et al., 2023).

4.1. Chronic Low-Grade Inflammation

One of the most important mechanisms underlying sarcopenic obesity is chronic low-grade systemic inflammation. Adipose tissue, particularly visceral fat, acts as an active endocrine organ that secretes pro-inflammatory cytokines such as tumor necrosis factor-α (TNF-α), interleukin-6 (IL-6), and C-reactive protein. Increased levels of these inflammatory mediators promote catabolic processes in skeletal muscle tissue, leading to accelerated muscle protein breakdown and impaired muscle regeneration (Di Pino & DeFronzo, 2019, 1447-1467).

Inflammation also affects the signaling pathways responsible for muscle protein synthesis. Elevated inflammatory cytokines may inhibit the activity of anabolic pathways such as the mechanistic target of rapamycin (mTOR), which plays a critical role in muscle growth and maintenance. As a result, chronic inflammation contributes to the gradual loss of muscle mass observed in individuals with sarcopenic obesity (Batsis & Villareal, 2018, 513-537).

4.2. Insulin Resistance and Metabolic Dysregulation

Insulin resistance represents another key factor involved in the pathophysiology of sarcopenic obesity. Skeletal muscle is responsible for a significant proportion of glucose uptake in the human body. When muscle mass declines, glucose utilization becomes impaired, contributing to metabolic disturbances and increased risk of metabolic disorders (Shulman, 2000, 171-176).

Excess adipose tissue further exacerbates insulin resistance through the release of free fatty acids and inflammatory mediators that interfere with insulin signaling pathways. This metabolic dysfunction leads to decreased glucose uptake by muscle cells and promotes lipid accumulation within muscle fibers, a process known as myosteatosis. The presence of intramuscular fat further reduces muscle strength and metabolic efficiency, creating a vicious cycle that promotes both muscle loss and fat accumulation (Batsis & Villareal, 2018, 513-537).

4.3. Hormonal Changes Associated with Aging

Hormonal alterations play an important role in the development of sarcopenic obesity, particularly in aging populations. With advancing age, the levels of several anabolic hormones decline, including testosterone, growth hormone, and insulin-like growth factor-1 (IGF-1). These hormones are essential for maintaining muscle protein synthesis and preserving muscle mass (Karaağaç, 2023, 237-246).

In women, menopause is associated with a rapid decline in estrogen levels, which may contribute to increased fat deposition and reduced muscle mass. Estrogen deficiency has been linked to increased visceral fat accumulation and changes in energy metabolism. Similarly, age-related reductions in testosterone levels in men are associated with decreased muscle mass and strength, potentially increasing susceptibility to sarcopenic obesity (Shin et al., 2018, 192-198).

4.4. Mitochondrial Dysfunction and Oxidative Stress

Mitochondrial dysfunction represents another important biological mechanism contributing to the development of sarcopenic obesity. Aging and obesity are both associated with reduced mitochondrial capacity and increased production of reactive oxygen species (ROS). Excessive oxidative stress may damage muscle cells and impair their metabolic function, further accelerating muscle degeneration (Batsis & Villareal, 2018, 513-537).

Impaired mitochondrial function reduces the ability of skeletal muscle to efficiently utilize fatty acids and glucose, leading to metabolic inflexibility and accumulation of lipids within muscle tissue. This phenomenon contributes to reduced muscle endurance, decreased physical performance, and increased fatigue, all of which are commonly observed in individuals with sarcopenic obesity (Shulman, 2000, 171-176).

4.5. Anabolic Resistance

Another important mechanism contributing to sarcopenic obesity is anabolic resistance, defined as the reduced ability of skeletal muscle to respond to anabolic stimuli such as dietary protein intake or resistance exercise. Aging muscles often require higher amounts of protein or stronger exercise stimuli to achieve the same anabolic response observed in younger individuals (Batsis & Villareal, 2018, 513-537).

In the presence of obesity, anabolic resistance may become even more pronounced. Chronic inflammation and metabolic dysregulation impair the activation of signaling pathways responsible for muscle protein synthesis. Consequently, muscle tissue becomes less responsive to interventions that would normally stimulate muscle growth, further accelerating the loss of muscle mass (Karaağaç, 2023, 237-246).

4.6. Interaction Between Muscle and Adipose Tissue

Recent research highlights the importance of cross-talk between skeletal muscle and adipose tissue in the development of sarcopenic obesity. Both tissues function as endocrine organs, releasing signaling molecules known as myokines and adipokines. These molecules regulate metabolic processes, inflammation, and energy balance (Park & Choi, 2023).

Excess adipose tissue may disrupt this communication by increasing the secretion of pro-inflammatory adipokines while reducing the beneficial metabolic effects of myokines produced by skeletal muscle. This imbalance further promotes systemic inflammation, insulin resistance, and metabolic dysfunction (Oh et al., 2016).

Lifestyle factors such as physical inactivity and inadequate nutrition may intensify these biological processes. Reduced physical activity contributes to decreased muscle stimulation and further accelerates muscle atrophy. At the same time, poor dietary habits, particularly low protein intake and excessive caloric consumption, may worsen both obesity and muscle loss (Jocz et al., 2025, 61168).

Understanding these interconnected mechanisms is essential for developing effective strategies aimed at preventing and treating sarcopenic obesity. Interventions that combine resistance exercise, adequate nutritional support, and metabolic management may help counteract the biological processes responsible for this condition. Given the increasing prevalence of sarcopenic obesity in aging populations, further research is needed to better understand its complex pathophysiology and to identify effective therapeutic approaches.

5. Clinical Consequences and Comorbidities of Sarcopenic Obesity

Sarcopenic obesity has significant clinical implications due to the combined negative effects of reduced skeletal muscle mass and excessive adiposity. The coexistence of these two conditions creates a metabolic environment that contributes to the development of numerous chronic diseases and functional limitations. Compared with individuals presenting with either sarcopenia or obesity alone, patients with sarcopenic obesity often demonstrate a substantially higher risk of adverse health outcomes, including metabolic disorders, cardiovascular complications, physical disability, and increased mortality (Batsis & Villareal, 2018, 513-537).

5.1. Metabolic Disorders

One of the most important clinical consequences of sarcopenic obesity is the increased risk of metabolic disorders. Skeletal muscle plays a central role in glucose metabolism, accounting for a large proportion of insulin-mediated glucose uptake. When muscle mass decreases, glucose utilization becomes impaired, leading to disturbances in glycemic control and increased risk of Type 2 Diabetes (Merz & Thurmond, 2020, 785-809)

Excess adipose tissue further aggravates metabolic dysfunction by releasing free fatty acids and pro-inflammatory cytokines that interfere with insulin signaling pathways. This metabolic imbalance contributes to the development of systemic insulin resistance, which is a key factor in the pathogenesis of metabolic syndrome. Studies have shown that individuals with sarcopenic obesity exhibit higher levels of insulin resistance compared with those presenting with obesity or sarcopenia alone (Batsis & Villareal, 2018, 513-537).

5.2. Cardiovascular Complications

Sarcopenic obesity is also associated with an elevated risk of cardiovascular disease. Chronic low-grade inflammation, dyslipidemia, and metabolic disturbances observed in this condition contribute to the development of atherosclerosis and endothelial dysfunction. The presence of increased visceral fat, combined with reduced muscle mass, may accelerate the progression of cardiovascular complications such as coronary artery disease and hypertension (Batsis & Villareal, 2018, 513-537).

Furthermore, decreased muscle strength and reduced physical capacity often limit the ability of affected individuals to engage in regular physical activity, which is an important protective factor against cardiovascular disease. Reduced cardiorespiratory fitness may therefore further increase the risk of cardiovascular morbidity in individuals with sarcopenic obesity (Prado et al., 2012, 583-601).

5.3. Physical Disability and Functional Decline

Another important consequence of sarcopenic obesity is the progressive deterioration of physical function. Loss of muscle mass and strength leads to impaired mobility, reduced balance, and decreased physical performance. These changes significantly increase the risk of mobility limitations, loss of independence, and reduced quality of life among older adults (Kucharczuk et al., 2020, 148-157).

Individuals with sarcopenic obesity often demonstrate slower gait speed, decreased grip strength, and reduced ability to perform activities of daily living. Functional limitations may also increase the risk of falls and fall-related injuries. In older populations, falls represent one of the leading causes of hospitalization and disability. Research suggests that the combination of muscle weakness and excess body weight places additional mechanical stress on joints and the musculoskeletal system. This may contribute to the development of degenerative joint diseases, further exacerbating physical limitations (Batsis & Villareal, 2018, 513-537).

5.4. Frailty and Geriatric Syndromes

Sarcopenic obesity has been strongly associated with the development of Frailty syndrome, a geriatric condition characterized by decreased physiological reserve and increased vulnerability to stressors. Frailty is often accompanied by fatigue, weakness, slow walking speed, and reduced physical activity levels. The presence of both sarcopenia and obesity may accelerate the progression of frailty by combining metabolic dysfunction with declining physical capacity. This interaction may lead to a rapid deterioration of health status in older adults, increasing the likelihood of hospitalization, institutionalization, and dependency on long-term care (Wei et al., 2023).

5.5. Increased Risk of Mortality

Several epidemiological studies have demonstrated that sarcopenic obesity is associated with increased all-cause mortality. The combined impact of metabolic disturbances, chronic inflammation, cardiovascular complications, and functional decline contributes to poorer health outcomes and reduced life expectancy. In addition, individuals with sarcopenic obesity often present with multiple comorbidities, including diabetes, cardiovascular disease, and musculoskeletal disorders. The presence of these conditions may complicate clinical management and increase healthcare utilization (Batsis & Villareal, 2018, 513-537).

5.6. Impact on Healthcare Systems

The clinical consequences of sarcopenic obesity extend beyond individual health outcomes and represent a growing challenge for healthcare systems worldwide. The increasing prevalence of aging populations, combined with rising rates of obesity, suggests that the burden of sarcopenic obesity will continue to increase in the coming decades.

Healthcare costs associated with the management of chronic diseases, disability, and long-term care needs may rise substantially as the number of individuals affected by sarcopenic obesity grows. Preventive strategies focused on maintaining muscle mass, promoting physical activity, and improving nutritional habits are therefore essential for reducing the public health burden associated with this condition (Prado et al., 2012, 583-601).

The clinical consequences of sarcopenic obesity illustrate the complex interaction between metabolic, functional, and lifestyle-related factors. Recognizing these risks is essential for early diagnosis and the development of effective preventive and therapeutic strategies aimed at improving health outcomes in aging populations.

6. Diagnostic Challenges in Sarcopenic Obesity

The diagnosis of sarcopenic obesity remains a significant challenge in both clinical practice and research due to the lack of universally accepted diagnostic criteria. Unlike traditional obesity or sarcopenia diagnoses, which may rely on relatively straightforward indicators, sarcopenic obesity requires the simultaneous assessment of both body composition and muscle function. This complexity often leads to underdiagnosis or misclassification of the condition, particularly in routine clinical settings (Schluessel et al., 2023).

6.1. Limitations of Traditional Anthropometric Measures

One of the primary diagnostic difficulties lies in the limitations of commonly used anthropometric indicators, particularly body mass index (BMI). Although BMI is widely used to assess obesity, it does not differentiate between fat mass and lean body mass. Consequently, individuals with reduced muscle mass but increased fat mass may present with a normal or elevated BMI, masking the presence of sarcopenic obesity (Wei et al., 2023).

Similarly, other basic anthropometric measures such as waist circumference or body weight alone are insufficient to accurately evaluate changes in body composition associated with aging. In older adults, muscle mass may decrease while fat mass increases, resulting in relatively stable body weight despite significant physiological changes (Batsis & Villareal, 2018, 513-537).

Because of these limitations, relying solely on BMI-based obesity classification may lead to the underrecognition of sarcopenic obesity, particularly among older adults and individuals with chronic diseases.

6.2. Body Composition Assessment Methods

Accurate diagnosis of sarcopenic obesity requires more advanced techniques that can differentiate between fat mass and lean muscle mass. Several body composition assessment methods are commonly used in research and clinical practice.

Dual-energy X-ray absorptiometry (DXA) is considered one of the most reliable tools for assessing body composition. DXA allows for precise measurement of fat mass, lean mass, and bone mineral density. Due to its relatively high accuracy and accessibility, DXA is frequently used in epidemiological studies investigating sarcopenia and sarcopenic obesity.

Bioelectrical impedance analysis (BIA) represents another commonly used method for estimating body composition. BIA measures the resistance of body tissues to electrical currents, allowing for the estimation of fat mass and lean mass. Although BIA is less precise than DXA, it is widely used due to its lower cost, portability, and ease of use in large population studies.

More advanced imaging techniques, such as computed tomography (CT) and magnetic resonance imaging (MRI), provide highly accurate assessments of muscle mass and fat distribution. These methods are particularly useful for evaluating intramuscular fat infiltration, also known as myosteatosis, which is an important characteristic of sarcopenic obesity. However, their high cost and limited availability restrict their routine use in clinical practice (Batsis & Villareal, 2018, 513-537).

6.3. Functional Assessment of Muscle Strength and Performance

In addition to measuring muscle mass, modern diagnostic approaches emphasize the importance of evaluating muscle function. Reduced muscle strength and physical performance are now recognized as central components of sarcopenia and sarcopenic obesity.

One of the most commonly used clinical tests is handgrip strength measurement, which serves as a simple and reliable indicator of overall muscle strength. Reduced grip strength has been associated with increased risk of disability, hospitalization, and mortality in older adults (Batsis & Villareal, 2018, 513-537).

Another widely used functional test is gait speed assessment. Slower walking speed may indicate impaired mobility and reduced physical performance, both of which are common among individuals with sarcopenic obesity. Additional tests, such as chair stand tests or the short physical performance battery (SPPB), may also be used to evaluate functional capacity in clinical and research settings (Wei et al., 2023).

Recent studies emphasize that combining body composition measurements with functional performance assessments provides a more accurate evaluation of sarcopenic obesity than relying on a single diagnostic parameter.

6.4. Lack of Standardized Diagnostic Criteria

Despite increasing scientific interest in sarcopenic obesity, there is still no universally accepted definition of the condition. Different research groups and scientific organizations have proposed varying diagnostic thresholds for muscle mass, fat mass, and muscle strength.

For example, the European Working Group on Sarcopenia in Older People (EWGSOP) and other expert groups have proposed diagnostic frameworks focusing primarily on muscle strength and physical performance. However, integrating obesity-related parameters into these frameworks remains challenging (Batsis & Villareal, 2018, 513-537).

As a result, studies investigating sarcopenic obesity often use different diagnostic criteria, making it difficult to directly compare prevalence rates and clinical outcomes across populations.

6.5. Emerging Diagnostic Approaches

Recent research has begun to explore novel approaches to improving the diagnosis of sarcopenic obesity. These include the use of biomarkers related to inflammation, metabolic dysfunction, and muscle metabolism. Potential biomarkers under investigation include inflammatory cytokines, myokines, and metabolic markers associated with insulin resistance.

Additionally, advances in digital health technologies and wearable devices may provide new opportunities for monitoring physical activity, muscle function, and metabolic health in real-world settings. These tools may support earlier detection of functional decline associated with sarcopenic obesity.

Improving diagnostic strategies is crucial for the early detection and effective management of sarcopenic obesity. The integration of body composition analysis, functional performance testing, and lifestyle assessment may provide a more comprehensive understanding of this condition and support the development of targeted prevention and treatment strategies (Feng et al., 2025, 5113) (Panagiotou & Brage, 2025, 1911).

7. Therapeutic and Preventive Strategies for Sarcopenic Obesity

The management of sarcopenic obesity represents a major clinical challenge due to the need to simultaneously address both reduced muscle mass and excessive adiposity. Effective therapeutic strategies must therefore focus on improving body composition, enhancing muscle strength and physical performance, and reducing metabolic risk factors. Current evidence suggests that the most effective approach involves a combination of lifestyle interventions, including physical activity, nutritional optimization, and behavioral strategies (Batsis & Villareal, 2018, 513-537).

7.1. Physical Activity and Resistance Training

Regular physical activity is widely recognized as the cornerstone of both prevention and treatment of sarcopenic obesity. Exercise interventions have been shown to improve muscle mass, increase muscle strength, and reduce fat mass, thereby addressing the key components of this condition (Batsis & Villareal, 2018, 513-537).

Resistance training is considered the most effective form of exercise for stimulating muscle protein synthesis and increasing muscle mass in older adults. Progressive resistance exercise activates anabolic pathways within skeletal muscle, including the mechanistic target of rapamycin (mTOR) signaling pathway, which plays a critical role in muscle growth and repair (Wei et al., 2023).

Studies indicate that resistance training performed two to three times per week can significantly improve muscle strength, functional capacity, and overall physical performance in older individuals. In addition to resistance training, aerobic exercise such as walking, cycling, or swimming may help reduce adipose tissue and improve cardiovascular health (Prado et al., 2012, 583-601).

Combined exercise programs that integrate resistance and aerobic training appear to provide the most comprehensive benefits. Such interventions not only improve muscle mass and metabolic health but also enhance mobility and quality of life in aging populations.

7.2. Nutritional Interventions

Adequate nutrition is another essential component of sarcopenic obesity management. Older adults frequently experience inadequate protein intake, which may contribute to accelerated muscle loss and impaired muscle regeneration. Increasing dietary protein intake has been shown to stimulate muscle protein synthesis and support the maintenance of muscle mass (Batsis & Villareal, 2018, 513-537).

Current guidelines suggest that older adults may require higher protein intake compared with younger individuals in order to counteract anabolic resistance associated with aging. Daily protein intake of

approximately 1.0–1.2 g per kilogram of body weight is often recommended to support muscle health (Prado et al., 2012, 583-601).

Protein quality is also important. High-quality protein sources containing essential amino acids, particularly leucine, may enhance muscle protein synthesis. Nutritional strategies that distribute protein intake evenly throughout the day may further improve anabolic responses in skeletal muscle.

In addition to protein, several micronutrients may influence muscle metabolism. Vitamin D has received particular attention due to its role in muscle function and bone health. Vitamin D deficiency has been associated with reduced muscle strength, impaired balance, and increased risk of falls in older adults. Supplementation may therefore contribute to improved physical performance and reduced risk of functional decline (Zhang & Li, 2024, 577-595).

Caloric balance must also be carefully managed in individuals with sarcopenic obesity. Excessive caloric restriction aimed solely at weight loss may worsen muscle loss. Therefore, weight reduction strategies should be designed to minimize muscle loss while promoting fat reduction through combined dietary and exercise interventions.

7.3. Behavioral and Lifestyle Interventions

Behavioral factors play an important role in the development and progression of sarcopenic obesity. Sedentary lifestyles, poor dietary habits, and low levels of physical activity significantly increase the risk of both obesity and muscle loss. Addressing these behavioral factors is therefore essential for effective prevention strategies.

Community-based physical activity programs may also play an important role in preventing sarcopenic obesity. Group exercise programs, supervised training sessions, and structured rehabilitation programs may improve adherence to physical activity interventions while providing social support (Kim et al., 2022).

7.4. Emerging Pharmacological Approaches

Although lifestyle interventions remain the primary treatment strategy, several pharmacological approaches are currently being investigated for the management of sarcopenic obesity. These include medications targeting metabolic pathways involved in obesity, inflammation, and muscle metabolism.

Anti-obesity medications may support weight reduction in individuals with excessive adiposity, potentially improving metabolic health. However, careful monitoring is required to ensure that weight loss does not exacerbate muscle loss.

Other potential therapeutic strategies involve agents targeting muscle growth pathways or inflammatory processes that contribute to muscle catabolism. While some of these treatments show promising results in early studies, further clinical trials are required to establish their safety and effectiveness in older populations (Batsis & Villareal, 2018, 513-537).

7.5. Integrated Multidisciplinary Approaches

Given the complex nature of sarcopenic obesity, multidisciplinary approaches are increasingly recommended for its management. Collaboration between physicians, nutritionists, physiotherapists, and exercise specialists may provide a more comprehensive approach to patient care.

Integrated interventions combining exercise programs, nutritional counseling, and behavioral support may produce greater improvements in body composition and functional outcomes compared with single-component interventions.

Preventive strategies implemented earlier in life may also help reduce the risk of developing sarcopenic obesity later in adulthood. Promoting regular physical activity, balanced nutrition, and healthy lifestyle habits across the lifespan may play a crucial role in maintaining muscle mass and metabolic health in aging populations.

Overall, current evidence strongly supports lifestyle-based interventions as the most effective strategy for managing sarcopenic obesity. Continued research is necessary to further refine treatment protocols and develop innovative therapeutic approaches aimed at improving health outcomes among individuals affected by this increasingly prevalent condition.

8. Discussion

Sarcopenic obesity has emerged as an increasingly important topic in contemporary medical research due to the growing prevalence of both obesity and age-related muscle loss in aging populations. The present review highlights the complex and multifactorial nature of this condition, emphasizing the interaction between metabolic disturbances, chronic inflammation, hormonal changes, and lifestyle-related factors. Understanding these interconnected mechanisms is essential for improving diagnostic accuracy and developing effective therapeutic strategies (Karaağaç, 2023, 237-246).

One of the key findings highlighted in the reviewed literature is the strong association between sarcopenic obesity and adverse metabolic outcomes. Reduced skeletal muscle mass combined with increased adipose tissue significantly alters metabolic homeostasis, leading to insulin resistance, systemic inflammation, and impaired glucose metabolism. These metabolic disturbances contribute to the increased risk of chronic diseases, including Type 2 Diabetes, cardiovascular disorders, and other components of metabolic syndrome. The interaction between reduced muscle function and increased fat accumulation creates a vicious cycle that further accelerates metabolic deterioration (Batsis & Villareal, 2018, 513-537) (Di Pino & DeFronzo, 2019, 1447-1467) (Karaağaç, 2023, 237-246) (Shulman, 2000, 171-176).

Another important aspect discussed in the literature is the impact of sarcopenic obesity on physical function and quality of life. Loss of muscle strength and reduced physical performance contribute to mobility limitations, increased risk of falls, and functional dependence in older adults. These functional impairments may ultimately lead to the development of Frailty syndrome, which is characterized by decreased physiological reserve and increased vulnerability to stressors. As a result, individuals affected by sarcopenic obesity often experience reduced independence and increased need for long-term healthcare support (Wei et al., 2023).

The diagnostic complexity of sarcopenic obesity represents another important issue identified in current research. Traditional indicators such as body mass index are insufficient for detecting abnormal body composition, particularly in older adults. Individuals may present with normal or elevated BMI while simultaneously experiencing significant muscle loss. This limitation underscores the importance of using more advanced body composition assessment methods, including dual-energy X-ray absorptiometry and bioelectrical impedance analysis, combined with functional tests evaluating muscle strength and physical performance (Batsis & Villareal, 2018, 513-537) (Prado et al., 2012, 583-601).

Despite increasing recognition of sarcopenic obesity as a distinct clinical entity, the absence of universally accepted diagnostic criteria remains a major challenge for both research and clinical practice. Different definitions of sarcopenia and obesity have been proposed by various scientific organizations, resulting in substantial variability in reported prevalence rates and clinical outcomes across studies. Standardization of diagnostic criteria would therefore facilitate better comparison of epidemiological data and improve the identification of individuals at risk.

The literature reviewed in this study also emphasizes the crucial role of lifestyle factors in the development and progression of sarcopenic obesity. Physical inactivity, poor dietary habits, and sedentary behavior represent major modifiable risk factors that contribute to both muscle loss and excessive fat accumulation. Interventions aimed at promoting regular physical activity and adequate nutrition appear to be the most effective strategies for preventing and managing this condition (Feng et al., 2025, 5113).

Exercise, particularly resistance training, plays a central role in improving muscle mass, strength, and functional capacity. At the same time, aerobic exercise contributes to the reduction of adipose tissue and improvement of cardiovascular health. Combined exercise interventions may therefore provide synergistic benefits for individuals with sarcopenic obesity (Batsis & Villareal, 2018, 513-537).

Nutrition represents another key component of sarcopenic obesity management. Adequate protein intake is essential for maintaining muscle protein synthesis, particularly in older adults who often experience anabolic resistance. Dietary strategies that ensure sufficient protein intake and balanced caloric consumption may help preserve muscle mass while reducing excessive adiposity. Educational interventions promoting healthy dietary behaviors may therefore play an important role in long-term prevention strategies (Karaağaç, 2023, 237-246).

In addition to lifestyle-based interventions, emerging pharmacological approaches are currently being investigated as potential complementary therapies for sarcopenic obesity. However, existing evidence suggests that pharmacological treatments should not replace lifestyle interventions but rather be considered as supportive strategies in specific clinical cases. Further research is necessary to determine the long-term effectiveness and safety of these treatments (Batsis & Villareal, 2018, 513-537).

Another important perspective highlighted in the literature is the need for interdisciplinary approaches to addressing sarcopenic obesity. Given the multifactorial nature of this condition, effective prevention and

treatment strategies require collaboration among healthcare professionals, including physicians, nutritionists, physiotherapists, and exercise specialists. Integrating medical care with lifestyle interventions may significantly improve patient outcomes.

Despite the growing body of evidence regarding sarcopenic obesity, several research gaps remain. Many existing studies are cross-sectional, limiting the ability to establish causal relationships between risk factors and disease development. Longitudinal studies are needed to better understand the progression of sarcopenic obesity and to identify the most effective intervention strategies. Additionally, future research should focus on developing standardized diagnostic criteria and exploring novel biomarkers that may facilitate earlier detection of this condition.

In summary, sarcopenic obesity represents a complex and multifaceted health issue that requires comprehensive approaches to prevention, diagnosis, and management. Addressing lifestyle-related risk factors, improving diagnostic methods, and promoting interdisciplinary collaboration may significantly contribute to reducing the health burden associated with this condition in aging societies.

9. Conclusions

Sarcopenic obesity represents a complex and increasingly prevalent health condition resulting from the interaction between age-related loss of skeletal muscle mass and excessive accumulation of adipose tissue. As global populations continue to age and the prevalence of obesity rises, the coexistence of these two conditions is expected to become a major public health concern. The present review highlights that sarcopenic obesity should be understood as a strategic intersection of metabolic dysfunction, aging processes, and lifestyle-related risk factors.

Current evidence indicates that sarcopenic obesity is associated with a wide range of adverse health outcomes, including metabolic disorders, cardiovascular diseases, functional decline, and increased risk of Type 2 Diabetes and Frailty syndrome. The combination of reduced muscle mass and increased fat accumulation creates a metabolic environment that accelerates physical deterioration and contributes to reduced quality of life among older adults.

Despite growing scientific interest, important challenges remain regarding the diagnosis and management of this condition. The lack of standardized diagnostic criteria and the limitations of commonly used indicators such as body mass index complicate early detection. More comprehensive approaches that integrate body composition assessment with functional performance testing may improve diagnostic accuracy.

Preventive and therapeutic strategies should primarily focus on lifestyle-based interventions. Regular physical activity, particularly resistance training, combined with adequate nutritional support, represents the most effective approach for preserving muscle mass and improving metabolic health. Further research is needed to develop standardized diagnostic criteria, identify reliable biomarkers, and evaluate innovative therapeutic strategies. Addressing these challenges will be essential for improving prevention, early diagnosis, and effective management of sarcopenic obesity in aging populations.

Conflicts of Interest: No conflicts of interest to declare.

REFERENCES

1. Andrieieva, O., & Nahorna, A. (2020). Evaluation of the effectiveness of the program of independent preventive and health-enhancing exercise classes for middle-aged overweight women. *Pedagogy and Psychology of Sport, 6*(4), 36–44. https://doi.org/10.12775/PPS.2020.06.04.004
2. Batsis, J. A., & Villareal, D. T. (2018). Sarcopenic obesity in older adults: Aetiology, epidemiology and treatment strategies. *Nature Reviews Endocrinology, 14*(9), 513–537. https://doi.org/10.1038/s41574-018-0062-9
3. Di Pino, A., & DeFronzo, R. A. (2019). Insulin resistance and atherosclerosis: Implications for insulin-sensitizing agents. *Endocrine Reviews, 40*(6), 1447–1467. https://doi.org/10.1210/er.2018-00141
4. Feng, Z., Xia, J., Yu, J., Wang, J., Yin, S., Yang, J., Wu, T., Zhang, Z., Yan, W., Wang, S., & Sun, G. (2025). Pathophysiological mechanisms underlying sarcopenia and sarcopenic obesity: A systematic review and meta-analysis of biomarker evidence. *International Journal of Molecular Sciences, 26*(11), Article 5113. https://doi.org/10.3390/ijms26115113
5. Jocz, A. M., Wagner-Bieleń, N. K., Zwierzchowska, M., Antoniak, A., Centkowska, A., Banaśkiewicz, J. K., Żyta, A. M., Dąbrowska, G. H., Żmijewska, M. A., & Ziółkowski, J. (2025). Sarcopenic obesity: A growing public health concern—A literature review. *Quality in Sport, 43*, Article 61168. https://doi.org/10.12775/QS.2025.43.61168
6. Karaağaç, Y. (2023). Sarcopenic obesity: Pathogenesis and treatment with a focus on exercise and protein intake. *Journal of Mind and Medical Sciences, 10*(2), 237–246. https://doi.org/10.22543/2392-7674.1419
7. Kim, Y. J., Moon, S., Yu, J. M., & Chung, H. S. (2022). Implication of diet and exercise on the management of age-related sarcopenic obesity in Asians. *Geriatrics & Gerontology International, 22*(9), 695–704. https://doi.org/10.1111/ggi.14442
8. Kucharczuk, M., Sikorska, H., Juraszek, K. M., Wyżgowski, P., & Leksowski, K. (2020). Physical activity as one of the elements of a comprehensive obesity treatment. *Journal of Education, Health and Sport, 10*(3), 148–157. https://doi.org/10.12775/JEHS.2020.10.03.016
9. Luo, Y., Wang, Y., Tang, S., Xu, L., Zhao, X., Han, M., Liu, Y., Xu, Y., & Han, B. (2024). Prevalence of sarcopenic obesity in the older non-hospitalized population: A systematic review and meta-analysis. *BMC Geriatrics, 24*, Article 357. https://doi.org/10.1186/s12877-024-04952-z
10. Merz, K. E., & Thurmond, D. C. (2020). Role of skeletal muscle in insulin resistance and glucose uptake. *Comprehensive Physiology, 10*(3), 785–809. https://doi.org/10.1002/cphy.c190029
11. Mitchell, W. K., Williams, J., Atherton, P., Larvin, M., Lund, J., & Narici, M. (2012). Sarcopenia, dynapenia, and the impact of advancing age on human skeletal muscle size and strength: A quantitative review. *Frontiers in Physiology, 3*, Article 260. https://doi.org/10.3389/fphys.2012.00260
12. Oh, K.-J., Lee, D. S., Kim, W. K., Han, B. S., Lee, S. C., & Bae, K.-H. (2017). Metabolic adaptation in obesity and type II diabetes: Myokines, adipokines and hepatokines. *International Journal of Molecular Sciences, 18*(1), Article 8. https://doi.org/10.3390/ijms18010008
13. Panagiotou, G., & Brage, S. (2025). Advancing precision diagnosis of sarcopenic obesity through digital technologies, wearables and omics data. *Life, 15*(12), Article 1911. https://doi.org/10.3390/life15121911
14. Park, M. J., & Choi, K. M. (2023). Interplay of skeletal muscle and adipose tissue: Sarcopenic obesity. *Metabolism, 144*, Article 155577. https://doi.org/10.1016/j.metabol.2023.155577
15. Prado, C. M. M., Wells, J. C. K., Smith, S. R., Stephan, B. C. M., & Siervo, M. (2012). Sarcopenic obesity: A critical appraisal of the current evidence. *Clinical Nutrition, 31*(5), 583–601. https://doi.org/10.1016/j.clnu.2012.06.010
16. Schluessel, S., Huemer, M.-T., Peters, A., Drey, M., & Thorand, B. (2023). Sarcopenic obesity using the ESPEN and EASO consensus statement criteria of 2022—Results from the German KORA-Age study. *Obesity Research & Clinical Practice, 17*(4), 349–352. https://doi.org/10.1016/j.orcp.2023.08.002
17. Shin, M. J., Jeon, Y. K., & Kim, I. J. (2018). Testosterone and sarcopenia. *The World Journal of Men's Health, 36*(3), 192–198. https://doi.org/10.5534/wjmh.180001
18. Shulman, G. I. (2000). Cellular mechanisms of insulin resistance. *The Journal of Clinical Investigation, 106*(2), 171–176. https://doi.org/10.1172/JCI10583
19. van den Broek-Altenburg, E., Atherly, A., & Holladay, E. (2022). Changes in healthcare spending attributable to obesity and overweight: Payer- and service-specific estimates. *BMC Public Health, 22*, Article 962. https://doi.org/10.1186/s12889-022-13176-y
20. Wei, S., Nguyen, T. T. T., Zhang, Y., Ryu, D., & Gariani, K. (2023). Sarcopenic obesity: Epidemiology, pathophysiology, cardiovascular disease, mortality, and management. *Frontiers in Endocrinology, 14*, Article 1185221. https://doi.org/10.3389/fendo.2023.1185221
21. Zhang, F., & Li, W. (2024). Vitamin D and sarcopenia in the senior people: A review of mechanisms and comprehensive prevention and treatment strategies. *Therapeutics and Clinical Risk Management, 20*, 577–595. https://doi.org/10.2147/TCRM.S471191