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Protein Supplements and Exercise for Sarcopenic Obesity: Benefits and Negative Effects

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ABSTRACT

Background: Protein supplements are frequently consumed by the elderly who are afflicted with sarcopenic obesity. Notwithstanding their widespread appeal, there is presently a dearth of conclusive evidence regarding the potential advantages and disadvantages of protein supplements and physical activity in relation to sarcopenic obesity.

Objective: Consequently, we aimed to determine the effects of protein supplementation and exercise on elderly individuals with sarcopenic obesity. The approach A comprehensive search of databases was conducted in order to identify randomized controlled trials, quasi-experimental studies, and pre-post research designs that investigated the impact of protein supplementation on the reduction of sarcopenic adiposity in the elderly. This scoping review was conducted using the PRISMA-Scr protocols and the databases PubMed, Embase, Web of Science, and the Cochrane Library. To ascertain the eligibility of records, a comprehensive systematic screening approach was executed by two independent evaluators..

Results: Seven of the papers with 1,811 citations identified satisfied the inclusion criteria. One of the investigations was a pre-post test, whereas the other six were randomized controlled trials. The majority of studies investigated the relationship between protein supplementation and physical activity. In the included trials, the protein intake for the intervention group varied between 1.0 and 1.8 g/kg/BW/day. Additionally, the exercise sessions were administered for a maximum of 2 to 3 times per week, with each session lasting 1 hour. It has been shown that supplementation with whey protein can ameliorate sarcopenic symptoms and enhance the weight status of SO patients. In addition to biomarkers, the integration of resistance training and protein supplementation yielded supplementary advantages in lean muscle mass. Additionally, the research revealed a dearth of consistency in exercise design across sarcopenic obesity treatments.

Conclusion: For SO individuals desiring to improve their sarcopenic state and weight status, resistance training in conjunction with whey protein supplementation seems to be a viable alternative. Nevertheless, this emphasizes the importance of exercising caution when it comes to prescribing substantial protein intake. Further investigation is warranted regarding the most suitable exercise regimen for this demographic, considering the paucity of studies in this field.

KEYWORDS: Sarcopenia, Obesity, Sarcopenic obesity, Protein supplement, Whey protein, Exercise

ARTICLE DETAILS

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INTRODUCTION

The exponential increase in the global population of senior adults has led to the emergence of age-related health issues as a matter of global significance. In 2017, the global population aged 60 years or older amounted to 962 million, representing an estimated 13 percent of the total global population [1]. According to the World Health Organization (WHO), the population surpassed that of children under the age of five in 2020, having risen to one billion. [2]. By 2050, this number is projected to have doubled, amounting to 2.1 billion [2]. The matter of population aging is not restricted solely to affluent nations. The elderly population in low-income and middle-income nations is expanding at a higher rate than in high-income nations [3]. As a consequence of the significantly accelerated rate of population aging compared to previous eras, it is projected that eighty percent of the elderly will reside in low- and middle-income nations [2].

Older individuals have a significantly increased risk of developing health issues, such as sarcopenia [5–7] and sarcopenic obesity [8, 9], according to research [4]. Sarcopenia is a condition that exhibits a higher incidence among the elderly in comparison to the younger demographic, with prevalence rates that vary between 5% and 50% [5] contingent upon diagnostic criteria and geographic location. To illustrate, within the Asian continent, the prevalence rates of sarcopenia were as follows: 22.2% in Thailand, 59.8% in Malaysia, and 32.2% in Singapore [7, 10, 11]. A study conducted in Canada documented the prevalence of sarcopenic obesity, a high-risk geriatric syndrome, according to varying definitions: 0.1% to 85.3% in males and 0% to 80.4% in females [9]. An upward trend in the incidence of sarcopenic obesity among adults aged 65 and above has been documented [8]. Among elderly women, this condition appears to be especially prevalent [12].

Adipose inflammation can lead to alterations in the distribution of visceral fat into the intra-abdominal region as individuals age. This inflammation can also facilitate fat infiltration into the skeletal muscles, ultimately causing a decline in overall strength and functional capacity [13]. Sarcopenia, denoting the progressive decline in muscle mass that occurs with advancing age, is a pathological condition that is notably associated with an elevated susceptibility to injuries [14], compromised mental well-being, cognitive deterioration, reduced physical activity [15], and overall increased mortality [14, 16]. Conversely, sarcopenic obesity is a condition wherein sarcopenia and obesity coexist [17]. Sarcopenia may manifest in obese individuals at any stage of life due to the deleterious consequences of metabolic abnormalities dependent on adipose tissue. These consequences include insulin resistance, oxidative stress, and inflammation, all of which substantially impair muscle mass [18]. Obesity and sarcopenia are regarded as a double health burden due to the fact that they each independently increase the likelihood of negative health outcomes. As an illustration, there is a notable incidence of chronic non-communicable diseases that have an adverse effect on muscle metabolism among individuals who are obese [19, 20]. Individuals with sarcopenic obesity have an increased risk of metabolic disorders, a higher prevalence of cardiovascular diseases, higher mortality rates, and diminished physical performance [21–23] in comparison to those with sarcopenia or obesity alone. In the presence of these two disorders, the health risks may be augmented synergistically [8, 23]. Furthermore, it should be noted that individuals who have sarcopenic obesity are more susceptible to the development of chronic ailments, including cachexia, full-blown sarcopenia, systemic inflammation, insulin resistance, and other clinical complications [13].

A research investigation was undertaken in 2015 to examine the impact of a supplement enriched with leucine, vitamin D, and high whey protein on the mass of muscle tissue during deliberate weight loss among elderly individuals who were obese. The results indicated that the supplement effectively promoted weight loss and muscle mass maintenance among the participants [24]. A six-month experiment, on the other hand, examining the safety and tolerability of a medical nutrition drink fortified with vitamin D, calcium, and leucine among older individuals with sarcopenia, concluded that the beverage was both safe and well-tolerated by the participants [25]. Without impairing muscle mass and strength, the results of these studies suggest that the oral supplement drink containing protein supplement may have potential benefits for the treatment of sarcopenic obese older adults. The aforementioned research has brought attention to the possible effectiveness of protein supplementation in mitigating the adverse effects of sarcopenic obesity on muscular health.

Conversely, recent comprehensive analyses have suggested that protein supplementation in isolation might not result in substantial alterations in sarcopenia-related parameters [26, 27]. This contradicts the conclusions drawn in earlier research [28]. Conversely, a meta-analysis review has demonstrated that individuals with sarcopenia benefited from exercise training alone or in conjunction with protein supplementation, as evidenced by improvements in grip strength, muscle mass, total adipose mass, and waist circumference [29]. Exercise and protein supplementation appear to have a synergistic effect on the condition of sarcopenia in individuals with sarcopenia, according to the evidence [30, 31]. On the sarcopenic obesity population, however, was not the focus of any of these systematic reviews, and potential adverse effects of protein supplementation were not discussed. Greater emphasis was placed on the effects of exercise in previous reviews of sarcopenic obesity [32, 33], whereas the effect of protein supplementation has received relatively little attention. In aggregate, the results pertaining to the impact of protein supplementation on sarcopenia failed to reach a definitive conclusion. Consequently, the current scoping review seeks to delineate the diverse categories of protein supplements that are commercially accessible, examine their potential adverse effects, and determine the efficacy of exercise in the context of sarcopenic obesity among older adults.

Table 1. The search string and key search terms used in the study

# of Search	Search Term(s)
#1	"sarcopenic obesity" OR "sarcopenic adiposity" OR "lipotoxic sarcopenia" OR sarcopenia OR "muscle loss" OR "amyotrophy" OR "sarcobesity" OR "sarcopenic obese" OR "obese sarcopenia"
#2	"Protein" OR "Amino Acid" OR "Protein supplement" OR "Dietary protein" OR "Dietary aminoacid" OR "nutritional supplement" OR "Dietary supplement" OR "Oral supplement"
#3	#1 AND #2

Table 2. PICOS criteria for inclusion of studies

Population	Human subjects > 55 years old with sarcopenic obesity
Intervention	Consumption of and/or adherence to the supplement intake, different supplement dosage, exercise training
Comparison	Without consumption of and/or adherence of different supplement intake, supplement dosage, exercise training
Study design	Randomized controlled trials/Quasi-experimental/ pre-post study
Outcome	BIA skeletal muscle index, changes in body composition, muscle mass, fat mass, weight, BMI, waist circumference, biochemical data
Research Question	What is the effect of protein supplementation and exercise on body composition in sarcopenic obesityadults?

While emphasis was placed on the benefits of exercise [32, 33], the effects of protein supplements were not adequately reported. When considered collectively, the results regarding the impact of protein supplementation on sarcopenia were inconclusive. Consequently, this comprehensive review seeks to ascertain the diverse varieties of protein supplements that are presently accessible, assess their impact on sarcopenia and obesity, scrutinize possible adverse effects, and approximate the effect of exercise on elderly individuals afflicted with sarcopenic obesity.

METHOD

Study design

In order to present an all-encompassing analysis of protein supplementation interventions and their outcomes in elderly individuals with sarcopenic obesity, we undertook an exhaustive review of the pertinent literature. The scoping review was conducted in accordance with the methodological framework suggested by Arksey and O'Malley [34]. This framework comprised the subsequent stages: (i) formulation of the research question; (ii) identification of pertinent studies; (iii) study selection; (iv) information charting; and (v) results synthesis. Following the guidelines for Preferred Reporting Items for Systematic Review and Meta-analysis Extension for Scoping Review (PRISMA-ScR) [35], the present scoping review was carried out.

Identifying research question

For this review, the following research questions served as guidance:

(i) Which protein supplements are conventionally prescribed for the management of sarcopenic obesity?

(ii) In older individuals, what is the impact of protein supplementation intervention on sarcopenic obesity?

(iii) What hazards are associated with protein supplementation?

Identifying relevant studies

An exhaustive exploration was undertaken by utilizing the Cochrane Library, PubMed, Embase, and Web of Science databases. Articles published within the time frame of December 25, 2012 to February 1, 2023 (i.e., the preceding decade) were sought. The search was limited to interventions that occurred within the last decade, as the authors hypothesized that such interventions might not have been as consequential in the present context. Furthermore, a web search was conducted via the Google search engine, employing a diverse range of pertinent search terms and examining the initial ten pages of search outcomes in an effort to identify any potentially pertinent articles. This literature review assessed the effectiveness of protein supplementation in relation to frailty, body composition, and muscle strength, and compared it to a placebo. Randomized or quasi-randomized controlled trials involving adults with sarcopenic obesity were utilized for this review. The efficacy of protein supplemented or control groups supplemented with potentially anabolic substances (e.g., creatine, testosterone) was not assessed. The following search string was utilized as part of the search strategy; the key search terms utilized in the article search are detailed in Table 1.

Study selection

The screening procedure consisted of two distinct stages: (1) evaluation of titles and abstracts; and (2) examination of the full texts. The effects of supplementing with protein or amino acids from any source were examined. Eligibility for sarcenic obesity was determined by the clarity with which the term was defined in the article. The articles were selected utilizing the PICOS (Participants, Intervention, Comparison, Outcomes, and Study Design) framework. An exposition of the PICOS criteria employed to establish the research query can be found in Table 2.

Research studies that satisfied the subsequent criteria were taken into account:

The following criteria were met for this study: (1) participants had to be at least 55 years old; (2) healthy participants had to have sarcopenia, which was defined as muscle mass loss, low muscle strength, or poor physical performance; (3) the comparison group received exercise alone or with placebo supplementation; (4) the study design was randomized controlled trials; and (5) the outcomes were muscle strength, muscle mass, and physical performance.

The scoping review excluded the following articles for the following reasons: (1) an undefined classification of sarcopenic obesity; (2) clinical research involving patient populations diagnosed with chronic and acute disorders or undergoing treatments that may independently induce catabolic changes in protein turnover with detrimental effects on skeletal muscle mass and function; and (3) observational studies, description studies, and animal studies.

Following a distinct assessment of the complete texts of the papers that were not initially excluded by two investigators, the studies that satisfied the inclusion criteria were selected. Disputes regarding the article selection process were resolved through discussion and agreement.

Charting the data

The data graphing was primarily performed by two distinct assessors (K.J. and L.J.) utilizing a pre-established template. The subsequent classifications were employed to derive information from this review: (a) attributes of the research, (b) methodological qualities, (c) approaches to the intervention, and (d) intended results.

Collating, summarizing, and reporting the results

A theme narrative synthesis was generated from each included article, which succinctly outlined the efficacy of each intervention technique in addressing sarcopenic obesity.

Ethics

Ethical approval was not necessary from the Medical Research and Ethics Committee for this study, as the data was obtained from secondary sources (i.e., extant publications) and no direct human contact was made.

RESULTS

The results of the computerized queries amounted to 1,811 records in total. Ninety-seven of them were deemed eligible and their study abstracts were evaluated. The exclusion criteria for the articles were as follows: case studies (n = 58) or those that failed to include a sarcopenic obesity sample; interventions in which sarcopenic obesity was not the primary reported outcome (n = 18); reviews (n = 10); or studies with inadequate design (n = 7) that failed to meet the inclusion criteria. An additional article was incorporated subsequent to a manual search. In total, this scoping review investigated seven trials. An overview of the study selection process is illustrated in Figure 1.

Characteristics of included articles

None of the seven included investigations enrolled subjects of both sexes; however, three studies enrolled male participants [36, 39, 40], whereas four studies enrolled female subjects [37, 38, 41, 42]. The sample consisted of between 16 and 139 individuals. Four out of six trials [36-39, 41] examined the combined effects of protein supplementation and physical activity. An investigation was conducted into the impact of protein supplementation on whole-body electromyostimulation [40], whereas an alternative study assessed the effects of a low-calorie diet supplemented with protein on sarcopenic obesity [42]. Six of the studies [36–41] were randomized controlled trials, whereas one utilized a pre-post design [42]; the others were not. Investigations reported from Italy [38, 42], Germany [39, 40], Canada [36], Japan [37], and Brazil [41] comprised the majority (26 percent). A summary of the characteristics of the studies that were included is provided in Table 3.

Definition of sarcopenic obesity

The utilization of diverse sarcopenia diagnoses varied across studies, contingent upon the sarcopenia criteria. For the evaluation of sarcopenia, the majority of studies utilized skeletal muscle mass (Appendicular skeletal mass, ASM), lean body mass, ideal fat-free mass, and skeletal muscle mass index [36-38, 41]. The EWGSOP (European Working Group on Sarcopenia in Older People) diagnostic criteria for sarcopenia in older adults were suggested in three investigations [39, 40, 42]. Body fat percentages utilized in the context of obesity varied between 27% and 38% [37-42]. A single study [36] utilized body mass index (BMI) values exceeding 30 kg/m2 in order to ascertain the weight status of the participants.

Types of protein supplementation & protein intake

Protein supplementation therapies, such as whey protein and leucine-enriched essential amino acids (EAA), were incorporated into these investigations [36-42]. The subjects of one study were administered a protein supplement and a catechin supplement for three months [37]. The intervention group was instructed to consume protein at a rate of 1.0 to 1.8 g/kg/BW/day in these studies [36, 38-42]. In contrast, the control group maintained a protein intake of 0.8 to 1.0 g/kg/BW/day on average.

Effects of different interventions on sarcopenic obesity

A range of sarcopenia assessments were employed to ascertain the efficacy of the intervention in the elderly.

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Handgrip strength [39, 42], lean muscle mass [36, 38], and muscle strength [38, 42] were the most frequently employed sarcopenia metrics. The vast majority of studies [36, 37, 39, 42] incorporated body fat mass measurements. In addition, in order to evaluate the effect on obesity, measurements of body weight [36, 38], body trunk fat [36, 40, 42], and waist circumference [40, 42] were taken.

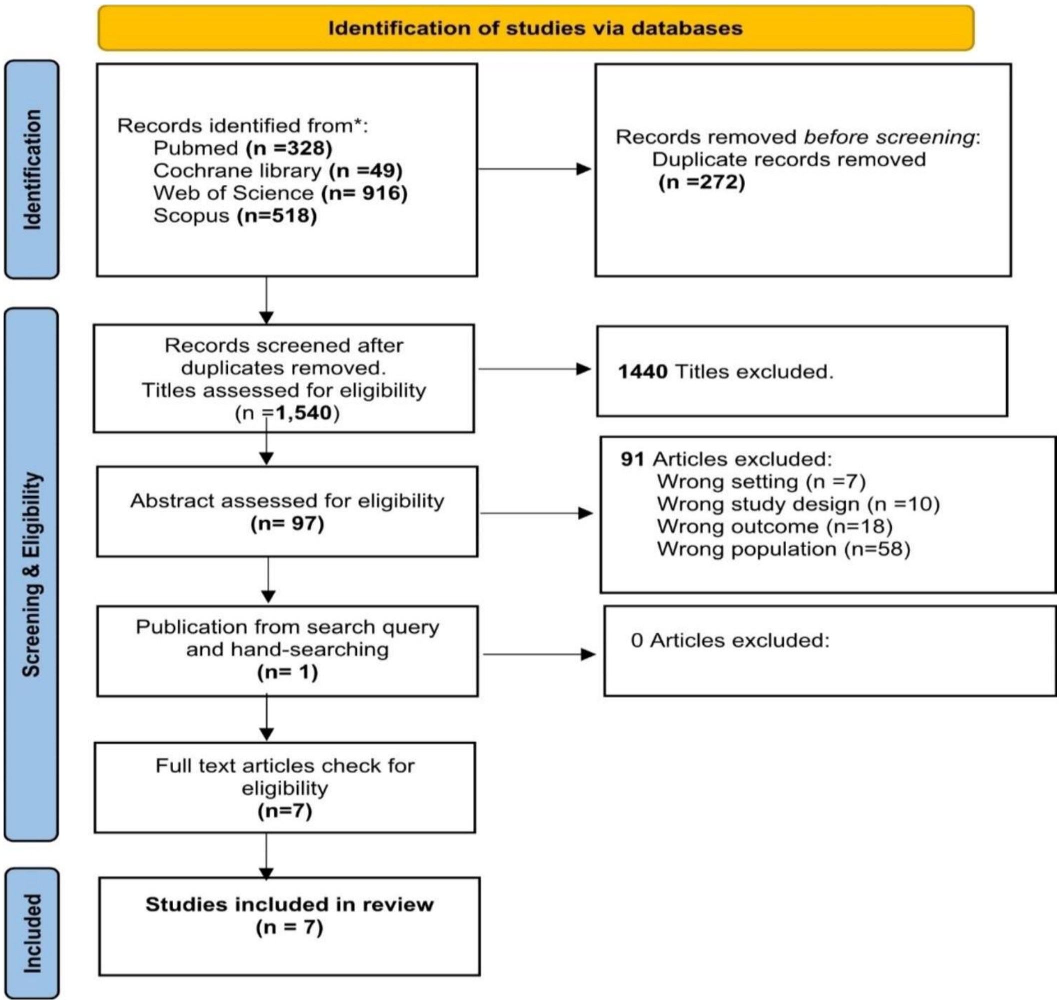

Fig. 1 Flow chart of scoping review

Table 3 Characteristics & outcomes of included articles

Table 3 (continued)

Articles (First author & Year)	Characteristics of participants (sample size, mean age)	Study design	Setting (Country)	Diagnosis algorithm	Interventions: Mode of intervention	Interventions: Content of Intervention	Outcomes: Effect on sarcopenia	Outcomes: Effect on obesity	Outcomes: Notable findings
Sammarco et al., 2017 [33]	Total (N =18); Control (n = 9), Intervention (n=9), Mean age= Control (58±10y/o),	Randomised controlled trial (RCT), 4 months **Control**: Hypocaloric diet + placebo **Int**: Hypocaloric +	Primary care setting, Italy	Obesity diagnosed as fat mass > 34.8% and sarcopenia was defined when lean body mass was < 90% of	Adherence to diet through a 7-day dietary record, dietitians followed up via phone calls every 2	**Control**: low calorie diet (minus 10% from REE calorimetry; 0.8-1 g protein/kg/day) **Intervention** 1: Low calorie + high protein diet (1.2–1.4 g protein/kg/day) with 15 g of protein of high biological	Women with high-protein diet preserved lean body mass and improved in muscle strength compared to	Weight significantly decreased in both groups.	Dietary protein enrichment may represent a protection from the risk of sarcopenia following a hypocaloric diet (increased muscle strength score + 1.6

Articles	Characteristics of participants (sample size, mean age)	Study design	Setting (Country)	Diagnosis algorithm	Interventions		Outcomes		
First author & Year					Mode of intervention	Content of Intervention	Effect on sarcopenia	Effect on obesity	Notable findings
Maltais et al., 2016 [31]	Total (N = 26); Control (n = 10), Intervention 1, Int 1 (n = 8), Int 2 (n = 8) Mean age = 65 ± 5 years old (y/o)	Randomised controlled trial (RCT), 4 months Control: Post-exercise shakes Intervention 1: Dairy Group Int 2: Non-dairy isocaloric and Isoprotein	Research center, Canada	Sarcopenia: appendicular lean mass index lower than 10.75 kg/m2 Obesity: BMI > 30 kg/m²	Three weekly 1 h-sessions, including a 10-min warm-up, were held on 3 non-consecutive days for 16 weeks. Drink the shake immediately after the exercise session Health education class: every 2 weeks	**Control**: Rice milk (0.6 g protein) 1.0-1.2 g protein/kg/day **Int 1**: Dairy shake (13.53 g protein, 7 g EAA) 1.3–2.1 g protein/kg/day **Int 2**: Non-dairy protein shake (12 g protein, 7 g EAA) 1.0-1.3 g protein/kg/day	Significant decreases were observed with Fat Mass only in the dairy supplement group. Resistance training significantly increased lean mass in all groups (p < 0.05) independently of supplementation (1.9 kg, nondairy shake; 1.7 kg, dairy shake; 1.4 kg, control).	Body weight significantly increased in the non-dairy shake group only (1.9 kg, p < 0.05). No changes were observed for body mass index.	Small number of participants were included in the group, statistical power to investigate any potential underlying mechanisms is limited. Resistance training combined with a milk-based post-exercise supplementation significantly reduced fat mass (FM) and increased lean mass (LM) No significant changes in biochemical profile (i.e. inflammatory marker). ***men only***
Kim et al., 2016 [32]	Total (N = 139); Control (n = 34), Int 1 (n = 36), Int 2 (n = 35) Int 3 (n = 34) Mean age= Control (81.1 ± 5.1 y/o), Int 1 (80.9 ± 4.2) Int 2 (81.4 ±	Randomised controlled trial (RCT), 3 months **Control**: Health education **Int 1**: Exercise and nutrition supplement, **Int 2**: Exercise **Int 3**: Nutritional high	Community based, Japan	Sarcopenic obesity : body fat percent of 32% or greater, measured by dual x-ray energy absorptiometry (DXA, Hologic QDR 4500 A), combined with skeletal muscle mass index less the	Each exercise class was 60 min, twice per week Nutrition: Protein supplementation & Tea catechin was taken daily Edu class: weeks	**Protein supplementation**: 3 g leucine-enriched EAA **Tea catechin**: 540 mg catechin **Education class**: topic focused including cognitive function, long-term care insurance, etc. for elderly value	Compared to control group, exercise (Ex) + nutrition (N) supplement group showed significant decreased in total body fat mass (p = 0.036) and	Exercise group showed decreased in trunk fat (p = 0.014). kg).	The Ex + N and Ex interventions were over four times as likely to reduce body fat mass than the control group. Catechin can reduce body fat. Effects of exercise and nutrition alone were **insufficient in**

	4.3) Int 3 (81.2 ± 4.9)	supplement		than 5.67 kg/m2 ;	every 2 weeks		increased stride (p = 0.038). Total body fat mass decreased in all intervention groups with greatest decrease found in Ex + N (5.5%, p = 0.036).		**increasing muscle strength** among sarcopenic elderly people. No different in inflammatory biomarker. ***women only**
	Intervention (53.9 ± 9)	protein diet		subject's ideal fat free mass		for each main meal	control group.		***women only**
Kemmler et al., 2017 [34]	Total (N = 100); Control (n = 34), Int 1 (n = 33), Int 2 (n-= 33) Mean age= Control (76.9 ± 5.1y/o), Int 1 (77.1 ± 4.3), Int 2 (78.1 ± 5.1)	Randomised controlled (RCT), 4 months **Control**: Non-intervention **Int 1**: WB-EMS + protein supplementation Int 2: Isolated protein supplementation	Community based, German	Sarcopenia: EWGSOP Obesity: percentage body fat ratio of > 27% (PBF) representing obesity	**WB-EMS**: 1.5 times per week, from 14 to 20 min after week 4 (4s electromuostimula-tion 4s rest) **Protein supple- ment**: Take with water, each time not more than 40 g (**no specific time on intake**)	**Protein supplement + Vit D**: Whey protein powder to achieve protein intake of 1.7-1.8 g/kg/day (per 100 g: 80 g whey protein, 9 g L-leucine, 57 g EAA)	Handgrip strength increased the WB-EMS group (1.90 kg; P,0.001; P = 0.050 vs. control). Skeletal muscle mass increased significantly in both groups (P,0.001 and P = 0.043) and decreased significantly in the control group (p = 0.033).	Both intervention in groups loss body fat (Int 1: 2.1%; Int 2: 1.1%), p < 0.001.	No adverse effects of WB-EMS or protein supplementation were found. ***men only**
Nabuco et al., 2019 [36]	Total (N = 26); Control (n = 13), Intervention (n = 13), Mean age= Control (70.1 ± 3.9 y/o), Intervention (68.0 ± 4.2)	Randomised controlled (RCT), 3 months Control: Placebo + supervised resistance training Intervention: Protein supplement + supervised	Communitynity, Brazil	Sarcopenic: Appendicular lean soft tissue ALST < 15.02 kg Obesity: body fat mass ≥ 35%	**Protein**: Consumed only on training day **Resistance exercise**: (8 exercises, 3 × 8–12 rep, 3 times a week)	**Protein**: 35 g of whey protein (1.0 g protein/kg/day)	Intervention group presented greater increased in ALST (p < 0.05) compared to control group.	Intervention group showed decreased in trunk fat mass (p < 0.05) compared to control	Both groups showed improved (p < 0.05) scores for muscle strength, functional capacity, and metabolism biomarkers (IL-6) but no significant different between groups. Resistance training in-

		resistance training						group.	creased HDL-c, reduced glucose, TG, and CRP, without affecting LDL-c, insulin. ***women only**
Camajani et al., 2022 [37]	Total (N = 16); Mean age = 60 y/o (50–70 years)	Pre-post pilot study, 45 days Intervention: Low calories diet + protein supplementation	Primary care, Italy	Sarcopenia: EWGSOP2 Obesity: Fat mass > 38%, according to NHANES III	**Low calories diet**: 1000 kcal/day (28% protein; 32% fat, 30% carbohydrate) **Protein**: taken at 5pm daily	**Protein**: 18 g whey protein (4.1 g of leucine); 5 mg vitamin D3; 1.38 g protein/kg/day	Women preserved total lean body mass and significantly improved their muscle strength, as measured by handgrip (15.3 vs. 20.1 Kg), and their muscle function.	A significant reduction in BMI (37.6 vs. 35.7 Kg/m2) and waist circumference (107 vs. 102.4 cm). Significant decreased in total trunk fat (p = 0.049).	No significant different in biomarkers. No significant adverse effects were recorded. **Significant increased in BUN, slight increased in** serum creatine and mild reduction in eGFR were found. ***women only**

*Whole-body electromyostimulation (WB-EMS)

*European Working Group on Sarcopenia in Older People (EWGSOP)

In the included intervention studies, exercise combined with protein supplementation has repeatedly been shown to enhance sarcopenic symptoms including muscle mass, strength, and physical function. One study [37] combined resistance and aerobic exercise as part of its intervention, whereas two studies [36, 41] incorporated weight training exercise. The exercise regimen was conducted two to three times per week for a total of one hour per session [36, 37, 41]. Nevertheless, a single publication [36] neglected to incorporate the activity's duration. Additionally, exercise training led to significant reductions in body weight, adipose mass, and trunk mass, while maintaining lean muscle mass [36, 37, 41]. The results align with those of intervention trials in which electromyostimulation (EMS) was employed in lieu of physical activity [39]. In addition to enhancing sarcopenia [38, 39, 42], fat mass [36, 37], weight status [28], and waist circumference [42], protein supplementation alone enhanced these parameters.

Effects of interventions on metabolic and inflammatory biomarkers

The effects of intervention on metabolic and inflammatory biomarkers, including C-reactive protein (CRP), Interleukin-6 (IL-6), total cholesterol (CHOL), triglycerides (TG), low density lipoprotein (LDL), and high density lipoprotein (HDL), were examined in five studies [36, 37, 40-42]. During the intervention period, two investigations [36, 37, 42] found no significant changes in cardiometabolic parameters or inflammatory biomarkers. In contrast, EMS intervention increased HDL and IL-6 levels in one study [40]. Resistance training increased HDL levels while decreasing fasting glucose, triglyceride, and CRP levels, according to another study [41].

Side effects of protein supplementation

No adverse effects were documented in the clinical trials pertaining to the articles that were included [36-41]. A daily protein intake of 1.38 g/kg for 45 days did, however, have some but not significant adverse effects on the BUN, serum creatinine, and eGFR of the subjects in one study [42].

DISCUSSION

The objective of this all-encompassing analysis was to assemble an inventory of protein supplementation and exercise regimens that have demonstrated efficacy in the treatment of sarcopenic obesity (SO) among the elderly. By itself, protein supplementation increased body weight, abdominal circumference, muscle strength, and muscle mass [36–42] over a period of 1.5 to 4 months. Interventions that integrated exercise and protein supplementation in the sarcopenic obesity population exhibited supplementary advantages, such as enhanced fasting glucose levels, improved blood lipid profiles, and inflammation markers, as well as a more substantial effect on weight loss with the preservation of lean muscle mass [41]. By integrating whey protein supplementation, which supplies essential amino acids for muscle protein synthesis [28, 44], with resistance training, which promotes muscle development and strength [43], SO individuals can enhance both muscular mass and function while maintaining their weight.

The effects of whey and leucine protein supplementation as a nutritional intervention for sarcopenic obesity have been the subject of numerous studies [37, 39-42]. Whey protein is an exceptional protein source that furnishes every essential amino acid required for the development and maintenance of muscle tissue. Leucine, an essential branched-chain amino acid found in whey protein, plays a critical role in promoting the synthesis of muscle proteins. Sarcopenia was identified as a consequence of these protein supplements, according to a systematic review [45, 46]. Supplementation with whey and leucine (L-EAA) has been shown in our research to increase muscle mass, enhance muscle strength and function, and decrease body fat in individuals with sarcopenic obesity [37, 39-42]. Conversely, protein supplements have demonstrated the capacity to enhance metabolic health indicators in conjunction with physical activity [36]. Unfortunately, the effect of this substance on biomarkers in elderly adults with sarcopenic obesity has been the subject of only a handful of studies.

Consistent with recent systematic studies examining elderly individuals (50-70 years old) with sarcopenic obesity, this scoping analysis reveals that fat mass loss is enhanced when exercise and nutritional interventions are combined [33]. The inclusion of exercise interventions in the majority of the trials implies that exercise training may be beneficial in the treatment of sarcopenic obesity. Exercise therapies have been demonstrated to enhance adipose mass, muscle mass, physical performance, and muscle strength in prior research [29, 32]. As a consequence of the training stimulus, resistance exercise can induce muscle hypertrophy, which in turn improves muscular strength and physical performance [47]. It has been determined that resistance training is the primary treatment for sarcopenia in the elderly; two sessions per week consisting of one to three sets of six to twelve repetitions are recommended [48]. Our recommended exercise regimen is, for the most part, consistent with our findings and previous research [33]. However, there is variation in the design of the exercise interventions, specifically with regard to the desired body areas and the number of sessions that are necessary. There are currently no explicit guidelines available regarding this matter [36, 37, 41]. Conversely, the integration of weight training and aerobic exercise may offer prospective advantages in the context of sarcopenic obesity [37]. It has been demonstrated that this method improves ectopic fat deposition, physical function, and metabolism in obese senior adults [49].

This investigation revealed that a number of studies substituted exercise with whole-body electromyostimulation (WB-EMS), an intervention that has the potential to enhance strength and muscle growth in non-athletics [39, 41]. Based on the limited number of studies that have employed WB-EMS as an intervention, it is challenging to formulate conclusive findings using the available information. However, our research revealed that exercise regimens, specifically resistance training conducted twice or thrice weekly for sixty minutes per session, led to significant improvements in body fat percentage, waist circumference, and weight loss. In light of the prevalent issue of obesity, further investigation is warranted to examine the optimal exercise regimen, duration, and modes of exercise (including aerobic exercise) that can ameliorate sarcopenic obesity. Additionally, the effectiveness of WB-EMS in the sarcopenic obese population must be assessed.

Three studies [39, 40, 42] utilized the European Working Group on Sarcopenia in Older People (EWGSOP) definition of sarcopenia, according to this scoping review. Combining multiple methods for diagnosing sarcopenia on the basis of the presence or absence of diminished muscle mass, limited muscle strength, and/or poor physical performance is recommended by the EWGSOP [51]. Additional research [36-38, 41] examined lean mass as a diagnostic parameter for sarcopenia. This aligns with the diagnostic criteria put forth by the Society of Sarcopenia, Cachexia, and Wasting Disorders [53] and the European Society for Clinical Nutrition and Metabolism [52]. These organizations have identified lean muscle mass and gait speed as significant indicators of physical disability and mortality in individuals with sarcopenia.

Aside from one study [36] that utilized BMI as diagnostic criteria, a number of studies [37-42] employed body fat percentage ranges between 27% and 38% to assess obesity. As it measures body fat directly and BMI does not always reflect actual body fat, the percentage of body fat index (PBF) has been deemed a more precise criterion for determining overweight or obesity [54] than BMI. This differentiation is particularly critical in the case of geriatric individuals with sarcopenia, who often exhibit excessive body fat and inadequate muscle mass despite having a seemingly healthy body mass index [13]. In order to evaluate the obesity status of sarcopenic elderly adults, it is therefore essential to utilize PBF (fat mass/total mass 100) whenever feasible. Thus, by incorporating PBF measurements, medical professionals can identify and treat obesity in this population more precisely by obtaining a more precise understanding of body composition.

Consensus recommends that elderly adults in good health consume between 1.0 and 1.2 grams of protein daily per kilogram of body weight (BW) [55, 56]. According to the PROT-AGE Study Group [55] and The Society of Sarcopenia, Cachexia, and Wasting Disorders, individuals with acute or chronic disorders necessitate a higher protein intake of 1.2-1.5 g/kg BW/d. In contrast, the latter organization advises elderly individuals to consume 1.0 to 1.5 g/kg BW/day in order to preserve muscle mass [57]. The intervention groups exhibited a protein intake ranging from 1.0 to 1.8 g/kg BW/day, which marginally exceeds the suggested daily allowance of 1.5 g/kg BW. During the intervention period, one of the included studies found that a daily protein intake of 1.38 g/kg BW had adverse effects on the renal profiles of the subjects [7]. While the adverse consequences of excessive protein consumption did not seem to be substantial, it is imperative to exercise prudence when recommending protein intake levels exceeding 1.4 g per kilogram of body weight in elderly individuals with sarcopenic obesity. Alongside protein, micronutrients play a significant role in the management of sarcopenic obesity. The etiology of sarcopenia has been associated with deficiencies in particular micronutrients, including magnesium, selenium, calcium, vitamin B complex, vitamin D, and iron [59].

A few restrictions apply to this scoping review. One primary constraint of this review was the incorporation of studies that employed varied definitions of sarcopenic obesity, potentially compromising the comparability of findings. Conversely, the absence of consensus regarding diagnostic criteria for sarcopenic obesity represents an unavoidable barrier that demands attention. Furthermore, body composition may vary between Asians and Caucasians, as six of the seven studies examined were conducted in Western nations. As a consequence, the generalizability of the results may be restricted. Third, the duration of the interventions in the included studies might be insufficient to generalize to long-term effects. Protein supplement and exercise research should be prioritized due to its critical importance to public health.

CONCLUSION

This integrative review provides a comprehensive examination of dietary and exercise interventions aimed at managing sarcopenic obesity. Research has demonstrated the efficacy of resistance training and protein supplements, including whey protein, in mitigating sarcopenic adiposity among elderly individuals experiencing age-related declines in muscle mass and strength. Nevertheless, physical activity may provide additional advantages beyond those provided by protein in isolation. Particularly, exercise has been shown to enhance waist circumference, body weight, body fat trunk, and inflammatory indicators. Combining protein supplements with resistance training (two to three times per week) may therefore be the most effective method for preventing sarcopenic obesity and promoting healthy aging. In individuals with sarcopenic obesity, we hypothesize that a protein supplement in conjunction with a relatively high protein diet (1–1.3 g/kg BW/day) could preserve muscle mass. Over 1.4 g/kg BW per day, cautious consumption is advised. To determine the optimal form of exercise and whether aerobic exercise should be incorporated into the treatment of sarcopenic obesity, additional research is required.

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