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Nutritional management for institutionalized elderly people with sarcopenia: Integrative review

Condutas nutricionais para pessoas idosas institucionalizadas com sarcopenia: Revisão integrativa

Conductas nutricionales para personas mayores institucionalizadas con sarcopenia: Revisión integrativa

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Cora de Freitas Pupin
ORCID: https://orcid.org/0000-0002-9256-8781
Barão de Mauá University Center, Brazil
E-mail: corapupin13@gmail.com
Gláucia Costa Degani
ORCID: https://orcid.org/0000-0002-5848-0495
Barão de Mauá University Center, Brazil
E-mail: glaucia.costa@baraodemaua.br

Abstract
Objective: To identify the scientific evidence available on nutritional conducts to prevent the aggravation and treat institutionalized elderly people with sarcopenia. Methods: Integrative review conducted in the databases: LILACS, PUBMED, EBSCO and SciELO, from the descriptors: Diet Therapy; Elderly; Long-Stay Institution for the Elderly; Sarcopenia. The PICO strategy was used to develop the guiding question. Articles that answered the guiding question "what is the available evidence on nutritional management for institutionalized elderly people with sarcopenia to prevent the worsening and treatment of the disease" were included. Literature review: Six articles that responded to the theme were included in the integrative review. It was found that oral supplements plus high quality protein, vitamin D, Medium Chain Triglycerides (MCTs), beta-hydroxy-beta-methylbutyric acid (HMB) and leucine were nutritional interventions used to prevent the aggravation and treat sarcopenia in institutionalized elderly people. The practice of physical exercises was considered as an alternative intervention combined with nutritional conducts in order to improve results. Conclusion: Nutritional interventions of oral supplementation of high quality protein, vitamin D, TCMs, HMB and leucine may be beneficial to prevent the onset of sarcopenia and to treat institutionalized elderly people with sarcopenia.
Keywords: Diet therapy; Aged; Homes for the Aged; Sarcopenia.

Resumo
Objetivo: Identificar as evidências científicas disponíveis sobre condutas nutricionais para prevenir o agravo e tratar pessoas idosas institucionalizadas com sarcopenia. Métodos: Revisão integrativa realizada nas bases de dados: LILACS, PUBMED, EBSCO e SciELO, a partir dos descritores: Dietoterapia; Idoso; Instituição de Longa Permanência para Idosos; Sarcopenia. Para a elaboração da pergunta norteadora utilizou-se a estratégia PICO. Foram incluídos os artigos que responderam à questão norteadora: "quais são as evidências disponíveis sobre as condutas nutricionais para pessoas idosas institucionalizadas com sarcopenia para prevenir o agravo e tratar a doença?". Revisão da literatura: Foram incluídos na revisão integrativa 6 artigos que respondiam à pergunta. Constatou-se que suplementos orais acrescidos de proteínas de alta qualidade, vitamina D, Triglicerídeos de Cadeia Média (TCMs), ácido beta-hidroxi-beta-metilbutírico (HMB) e leucina foram intervenções nutricionais utilizadas para prevenir o agravo e tratar a sarcopenia em pessoas idosas institucionalizadas. A prática de exercícios físicos foi considerada como uma alternativa de intervenção combinada às condutas nutricionais, a fim de melhorar os resultados. Conclusão: Condutas nutricionais de suplementação oral de proteína de alta qualidade, vitamina D, TCMs, HMB e leucina podem ser benéficas para prevenir o agravo e tratar pessoas idosas institucionalizadas com sarcopenia.
Palavras-chave: Dietoterapia; Idoso; Instituição de Longa Permanência para Idosos; Sarcopenia.

Resumen
Objetivo: Identificar la evidencia científica disponible sobre las conductas nutricionales para prevenir el agravamiento y tratar a las personas mayores institucionalizadas con sarcopenia. Métodos: Revisión integrativa realizada en las bases de datos LILACS, PUBMED, EBSCO y SciELO, utilizando los descriptores: Terapia Dietética; Personas Mayores; Instituciones de Larga Estancia para Personas Mayores; Sarcopenia. Se empleó la estrategia PICO para formular la pregunta orientadora. Se incluyeron artículos que respondieran a la pregunta "¿cuáles son las evidencias disponibles sobre el manejo nutricional de personas mayores institucionalizadas con sarcopenia para prevenir el agravamiento y

tratar la enfermedad?". Revisión de la literatura: Se incluyeron seis artículos que abordaron el tema. Se encontró que los suplementos orales con proteínas de alta calidad, vitamina D, triglicéridos de cadena media (TCM), ácido beta-hidroxi-beta-metilbutírico (HMB) y leucina fueron intervenciones nutricionales utilizadas para prevenir el agravamiento y tratar la sarcopenia en personas mayores institucionalizadas. La práctica de ejercicios físicos fue considerada una intervención alternativa combinada con conductas nutricionales para mejorar los resultados. Conclusión: Las intervenciones nutricionales basadas en la suplementación oral de proteínas de alta calidad, vitamina D, TCM, HMB y leucina pueden ser beneficiosas para prevenir la aparición de sarcopenia y tratar a las personas mayores institucionalizadas con esta condición.
Palabras clave: Terapia dietética; Personas mayores; Instituciones para personas mayores; Sarcopenia.

1. Introduction

Tanure et al., (2005) define senescence as primary or eugeria aging, which refers to the natural changes that occur in an individual due to the aging process, without the interference of diseases. In this context, senility denotes secondary aging or pathogenesis, characterized by the pathological mediation of diseases in the human aging process (Papaléo Netto, 2002; Bublitz et al., 2020).

Analogous to the definitions presented, it is well understood that with senescence comes a process of physiological changes in the human body. Among these changes, one can highlight the impairment of the digestive system caused by losses in the mechanical and chemical conditions of digestion. Such alterations contribute to greater deficiencies in the absorption of both micro and macronutrients, which leads to senile malnutrition (Abreu et al., 2008). Additionally, there are also failures in mastication, swallowing, and losses in the elderly's sense of taste (Damo et al., 2018).

Thus, malnutrition in the elderly is a common adversity in relation to senescence. However, neglecting treatment for this problem leads to a significant loss of muscle mass in older adults. This decline in muscle mass creates risks and diminishes the elderly person's quality of life (Sousa & Guariento, 2009). In this regard, in 2019, the European Working Group on Sarcopenia in Older People (EWGSOP2) defined sarcopenia as a muscle disease rooted in adverse muscular changes that accumulate throughout life (Reiss et al., 2019).

Moreover, within this vulnerable context, the degree of independence and autonomy in elderly individuals with sarcopenia is reduced (Mantovani et al., 2018). In order to receive qualified and constant care, elderly individuals with sarcopenia often seek care in Long-Term Care Facilities (LTCFs). However, in these facilities, there is a sudden change in the elderly's routine, which may influence the progression of senescence (Bispo et al., 2020).

In this context, factors such as standardized meal times for institutionalized elderly individuals and limited food variety contribute to senile malnutrition (Harris & Fraser, 2004), the loss of strength and muscle mass, and, therefore, sarcopenia, which exacerbates senility (Xavier & Aquino, 2020).

It is observed that there are few studies in the medical literature that address potential nutritional interventions aimed at preventing the worsening of sarcopenia and treating the disease in institutionalized elderly individuals. Thus, the results of this research could contribute to the advancement of scientific knowledge through an integrative review to synthesize scientific evidence.

Therefore, this study aims to identify available scientific evidence regarding nutritional interventions to prevent and treat sarcopenia in institutionalized elderly individuals.

2. Methodology

This research was an integrative review. This method encourages the analysis, identification, and synthesis of results from different studies on the same topic, evaluating the relevance and applicability of the findings obtained through these studies (Souza, Silva, & Carvalho, 2010).

The following steps were carried out, respectively: 1. Selection of the theme and definition of the guiding research question, which was established as: "What is the available evidence regarding nutritional interventions for institutionalized elderly individuals with sarcopenia to prevent worsening and treat the disease?"; 2. Literature review and delimitation of the inclusion and exclusion criteria for studies; 3. Definition of key information to be extracted from the analyzed studies and later categorized; 4. Rigorous analysis of the materials gathered in the review; 5. Clarification of the discussions found in the study results; 6. Presentation of the review and synthesis of the learning (Sousa et al., 2017).

For the formulation of the guiding question, the PICO strategy was used, where P (Population) referred to institutionalized elderly individuals with sarcopenia, I (Intervention) referred to nutritional interventions, C (Comparison) was not used, and O (Outcome) referred to the prevention of worsening and the treatment of sarcopenia.

Subsequently, the inclusion criteria were defined as publications between 2012 and 2022, available for full reading, directly answering the guiding question, and written in English, Spanish, French, or Portuguese. The exclusion criteria were publications that did not answer the guiding question, those classified as editorials, integrative review articles, experience reports, monographs, theses, letters, conference proceedings, and reviews, as this review sought to use publications with the highest levels of evidence.

For the literature search, the following databases were used: Latin American and Caribbean Literature in Health Sciences (LILACS), National Library of Medicine and National Institutes of Health (NCBI/PUBMED), and Business Source Complete (EBSCO). Searches were also conducted in the Scientific Electronic Library Online (SciELO). The following descriptors, their relevant synonyms, and their respective combinations in English, Spanish, French, and Portuguese, present in the Descriptors in Health Sciences (DeCS) and Medical Subject Headings (MeSH) platforms, were selected: Diet Therapy; Elderly; Long-Term Care Institutions for the Elderly; Sarcopenia, and the boolean operators AND and OR. In addition to the descriptors and their adaptations between the chosen languages, the search was performed by two researchers independently in June 2022. No third reviewer was needed to resolve disagreements.

An adaptation of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart (Page et al., 2021) was used to analyze the selected articles.

For the evaluation of evidence levels, the classification criteria proposed by the Oxford Centre for Evidence-Based Medicine (2009) were used (Oxford Centre for Evidence-Based Medicine, 2009).

This study adhered to ethical aspects, respecting copyright laws.

3. Results and Discussion

With the search over the ten years (2012-2022), 3 articles were found in the PUBMED database and 50 articles in the EBSCO database, totaling 53 articles. In this way, 32 articles were selected for full reading. Of these, 2 were excluded because they were duplicates and 24 because they did not meet the objective of the study. Among the studies found, 6 were chosen to integrate the research results, which are available in Table 1.

Table 1 – Selected Studies

Title/ Author	Method/ Sample	Objectives	Main Results / Conclusions
Allaert, F. A., Guérin-Deremaux, L., Mauray-Soulier, A., & Saniez-Degrave, M. H. (2016). Evaluation of adherence by elderly nursing home patients to regular consumption of apple compote enriched with protein and soluble fiber. *Aging Clinical and Experimental Research*, 28(2), 189–195. https://doi.org/10.1007/s40520-015-0415-3	This study was conducted in two long-term care facilities for older adults. The volunteers were aged between 70 and 90 years (mean age: 83.7 ± 6.2 years). An enriched compote was provided as a dessert at lunchtime every other day for a period of three consecutive weeks. Sample size: N = 24.	To evaluate the perception of older adults regarding the quality of compotes enriched with NUTRALYS® pea protein, NUTRALYS W® hydrolyzed wheat gluten, and NUTRIOSE® soluble fiber, as well as changes in perception over repeated consumption. The authors also assessed the evolution of the amount of compote consumed, the level of satisfaction, and changes in fatigue levels, comfort, and tolerance.	The introduction of the enriched compote with protein and fiber was well-received, with 91.6% of the volunteers rating it as very pleasant. This rating was maintained at 79.2% ($p = 0.1797$) after one week, 83.3% ($p = 0.3173$) after two weeks, and 79.2% ($p = 0.2568$) after three weeks. This consumption did not induce any adverse changes in digestion and did not produce any adverse effects directly attributable to the compote. Thus, the enriched compote, when combined with traditional foods, provides an alternative to habitual dietary intake, diversifies protein supplementation, stimulates appetite in older adults, and contributes to the maintenance of muscle mass in the elderly.
Karlsson, E. S., Grönstedt, H. K., Faxén-Irving, G., Franzén, E., Luiking, Y. C., Seiger, A., et al. (2021). Response and adherence of nursing home residents to a nutrition/exercise intervention. *Journal of the American Medical Directors Association (JAMDA)*, *22*(9), 1939–1945. https://doi.org/10.1016/j.jamda.2021.04.001	This is a post-hoc analysis of the "observed power" based on data from the Older Person's Exercise and Nutrition Study (OPEN Study). Data were collected from elderly individuals over the age of 75 residing in long-term care facilities, with a sample of n=52 (intervention group) and n=49 (control group), and an average age of 85.8 years. Among them, 74% were diagnosed with sarcopenia. The OPEN Study was a 12-week intervention consisting of a combination of the Sit-to-Stand Test performed four times per day and oral nutritional supplements of 2 bottles/day, providing 600 kcal and 36 g of protein (Fortimel Compact Protein, Nutricia®). Sarcopenia was assessed and defined according to the stages outlined by the EWGSOP consensus. Sample size: N=101.	To identify factors associated with the response to nutritional and physical exercise interventions in institutionalized elderly individuals, as measured by changes in physical function and body composition.	Early-stage sarcopenia ($p = 0.005$) and high adherence to nutritional supplements ($p = 0.002$) increased the likelihood of a positive response (maintenance/improvement). Greater independence in daily activities enhanced adherence to the Sit-to-Stand Test exercises ($p = 0.027$) and to the combined intervention of physical exercises and protein supplementation ($p = 0.020$). These findings indicate that the Sit-to-Stand Test exercises, combined with protein supplementation, are associated with a positive response in maintaining or improving physical function and body composition.
Abe, S., Ezaki, O., & Suzuki, M. (2016). Medium-Chain Triglycerides in Combination with Leucine and Vitamin D Increase Muscle Strength and Function in Frail Elderly Adults in a Randomized Controlled Trial. *The Journal of Nutrition*, 146(5), 1017–1026. https://doi.org/10.3945/jn.115.228965	This was a randomized study involving institutionalized elderly individuals (most of whom were women, with a mean age of 86.6 ± 4.8 years). Participants were randomly assigned to three groups: one received a daily supplement enriched with L-leucine (1.2 g) and cholecalciferol (20 mg), plus 6 g of medium-chain triglycerides (MCTs) (LD + MCT);	To investigate the treatment of sarcopenia in very frail elderly individuals using a combination of nutrients.	The administration of MCTs (6 g) and a supplement enriched with leucine and cholecalciferol at dinner daily for three months significantly improved muscle strength and functionality in frail elderly individuals. Therefore, the combined supplementation of MCTs (6 g), leucine-rich amino acids, and cholecalciferol at dinner appears to enhance muscle strength and function in frail elderly

	the second group received the same L-leucine and cholecalciferol supplement enriched with 6 g of long-chain triglycerides (LCTs) (LD + LCT); and the third group did not receive any supplements (control). Changes in muscle mass, strength, and function were monitored. Sample size: N = 38.		individuals. However, it remains unclear whether the favorable effects are attributable to the isolated use of MCTs or their combination with the two nutrients.
Grönstedt, H. K., Vikström, S., Cederholm, T., Franzén, E., Luiking, Y. C., & Seiger, A. (2020). Effect of sit-to-stand exercises combined with protein-rich oral supplementation in older persons: The Older Person's Exercise and Nutrition Study. *Journal of the American Medical Directors Association*, 21(9), 1229–1237. https://doi.org/10.1016/j.jamda.2020.03.030	This is a randomized study involving elderly individuals residing in eight long-term care institutions, aged 75 years or older (mean age 86 ± 5 years, with 62% of the elderly participants being female). The intervention lasted for 12 weeks, providing an oral nutritional supplement of 125 ml containing 18 g of protein and 300 kcal (Fortimel Compact Protein, Nutricia®), administered twice a day for one week, between main meals. Sample size: N=102.	Investigate the effects of the Sit-to-Stand Test integrated into daily care, combined with an oral protein-rich supplementation, on physical function, nutritional status, body composition, and quality of life of institutionalized elderly individuals.	No improvements were observed in the physical function assessments of the Intervention Group; however, body weight significantly increased (2.05 ± 3.5 kg, p = 0.013) compared to the Control Group. Of the 52 participants with high adherence to the intervention (i.e., at least 40% adherence to the combined intervention), 21 increased their muscle mass (2.12 kg [0.13, 4.26 interquartile range], p = 0.007) compared to the Control Group. Logistic regression analyses indicated that the odds ratio for maintaining or improving the Sit-to-Stand Test in 30 seconds was 3.5 (confidence interval 1.1, 10.9, p = 0.034) among participants with high adherence compared to the Control Group. Thus, the intervention led to an increase in muscle composition in elderly individuals, but no improvement in physical function was observed in the analyzed subgroup.
Yang, L. J., Wu, G. H., Yang, Y. L., Wu, Y. H., Zhang, L., Wang, M. H., et al. (2019). Effects of exercise on physical performance in older adults: A randomized controlled trial. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research*, *25*, 4390–4399. https://doi.org/10.12659/MSM.914031	This is a study involving elderly individuals residing in three long-term care institutions, aged 60 years or older, with a majority being women (112 men and 204 women). To diagnose sarcopenia, the appendicular skeletal muscle mass index (ASMM), hand grip strength, and mobility capacity were measured. The correlation between sarcopenia and factors such as age, sex, body mass index (BMI), ASMM, arm circumference, calf circumference, muscle content, grip strength, food intake, and the degree and duration of movement were also evaluated. Sample size: N=316 .	This study aims to investigate the factors associated with sarcopenia in elderly individuals residing in three long-term care institutions in Suzhou, eastern China, including the association with nutrition and physical exercise.	The prevalence of sarcopenia was 28.8% (30.4% for men and 27.9% for women). Patients with sarcopenia were older compared to the controls. The prevalence of sarcopenia was correlated with the intake of meat, fish, eggs, and milk, as well as the duration of weekly aerobic and resistance exercises. The logistic regression analysis showed a positive correlation between the prevalence of sarcopenia and age, and a negative correlation between BMI and the consumption of meat, eggs, and milk.

Abe, S., Ezaki, O., & Suzuki, M. (2019). Medium-chain triglycerides (8:0 and 10:0) are promising nutrients for sarcopenia: A randomized controlled trial. *The American Journal of Clinical Nutrition*, 110(3), 652–665. https://doi.org/10.1093/ajcn/nqz138	This is a randomized, single-blind investigation lasting three months, conducted with elderly people residing in long-term care institutions, with an average age of 85.6 ± 6.3 years. The first group received supplemental leucine (1.2 g) and colecalciferol (20 μg) enriched with 6 g/day of MCTs, the second group received 6 g/day of MCTs (positive control), and the third group received 6 g/day of long-chain triglycerides (TCL group) (negative control). Changes in muscle mass, strength, function, and activities of daily living (ADLs) were evaluated four times over the three-month period. Sample size: N=64.	Examine whether treatment with medium-chain triglycerides (MCTs) alone is sufficient to increase strength, muscle function, and activities of daily living (ADLs) in elderly people.	The data revealed that in frail elderly individuals, MCTs are an important nutrient for increasing muscle strength and function, and improving activities of daily living (ADLs). Greater improvements were achieved over a three-month period. It is suggested that supplementation with MCTs (6 g/day) is a feasible way to enhance muscle strength, function, and ADLs in frail elderly individuals.

Source: prepared by the author

In 2010, the first consensus was proposed by the European working group EWGSOP (Cruz-Jentoft et al., 2010) with the aim of characterizing and providing a definition for sarcopenia in order to encourage future research on its causes, prevention, and treatment. In this integrative review, the investigation of the studies allowed for the visualization and understanding of recent literature aimed at answering the questions proposed by the EWGSOP.

The amount of body muscle mass is a determinant of an individual's muscle strength and is strongly associated with the independence of elderly individuals and their ability to perform daily activities (Morley, 1997). In this regard, Yang et al. (2019) pointed out that aging is a factor that contributes to the prevalence of sarcopenia. Protein malnutrition plays a fundamental role in the development of sarcopenia (Giuliani et al., 2008).

Therefore, the adoption of nutritional measures that may promote muscle gain, especially in institutionalized elderly individuals, is essential. Some study findings highlighted that oral supplementation with Fortimel Compact Protein, Nutricia® (125 mL, 18 g protein, 300 kcal), twice a day for one week, combined with exercise interventions from the Sit-to-Stand Test four times a day, increased muscle mass in elderly individuals. However, no improvements in physical function were observed. Additionally, it is important to emphasize that elderly individuals with probable sarcopenia showed better results for the intervention offered (Karlsson et al., 2021; Grönstedt et al., 2020).

Two other trials (Abe, Ezaki, & Suzuki, 2019; Abe, Ezaki, & Suzuki, 2016) tested the use of MCT (Medium-Chain Triglycerides) as a nutritional intervention for the treatment of sarcopenia. These studies aimed to offer nutritional measures to increase muscle strength and function in frail elderly individuals residing in long-term care institutions, as well as to improve the performance of their activities of daily living (ADLs). Abe, Ezaki, & Suzuki (2016) indicated that the use of MCT, combined with leucine amino acids and cholecalciferol, appears to improve muscle strength and function in frail elderly individuals. However, it was not clear whether such benefits were solely attributed to the MCTs or if they resulted from the combined influence of the amino acids. Another study (Abe, Ezaki, & Suzuki, 2019) indicated that isolated MCT supplementation is a viable method to improve muscle strength, function, and ADLs in frail elderly individuals.

Incorporating oral supplements into the elderly individual's diet is a challenging task. Besides the swallowing difficulties (dysphagia) commonly observed in this population (Sura, Madhavan, Carnaby-Mann, & Crary, 2012), there is also the challenge of adapting to changes in their daily nutritional routine, particularly for institutionalized elderly individuals (Caixeta, 2020).

It is also important to highlight that food supplementation should be done with care regarding the physiological functioning of elderly individuals, as over the years, there is a decline in the function of organs such as the liver and kidneys (Rodrigues & Oliveira, 2016). Supplementation puts additional strain on the human body as it provides a quantity of nutrients higher than what the individual is accustomed to. The metabolic process of breaking down these nutrients is primarily carried out by the liver and kidneys. Therefore, it is crucial that supplementation be conducted responsibly, considering the qualitative functioning of these organs in the elderly individual receiving the intervention.

Therapeutic or preventive interventions must carefully weigh the benefits and potential adverse effects. Before any clinical measures are taken, a thorough evaluation of the elderly individual's health is necessary, along with an assessment of their family history and consideration of the potential benefits and possible adverse effects of the proposed treatment.

In this regard, Allaert, Guérin-Deremaux, Mauray-Soulier, & Saniez-Degrave (2016) aimed to evaluate the perception of some institutionalized elderly individuals regarding a compote enriched with three oral supplements available on the market (NUTRALYS®, NUTRALYS W®, and NUTRIOSE®) to address the problem of limited options for protein oral supplementation, which complicates acceptance by elderly individuals when ingesting these foods. The study concluded that this therapeutic model is a good alternative for protein diversification, stimulating appetite and helping to maintain lean body mass.

In another review (Woo, 2018), which sought to document recent evidence on the role of nutrition as an intervention to minimize sarcopenia in elderly individuals, it was found that the intervention of certain nutrients, such as leucine, high-quality protein, vitamin D, and HMB, significantly enhanced the benefits of physical exercise, improving the muscle composition of elderly individuals and becoming potential treatments for sarcopenia while also preventing its progression.

Considering the relationship between physical exercise and sarcopenia, it is worth emphasizing that physical activity is beneficial for increasing gait speed, improving balance, and enhancing performance in ADLs of frail elderly individuals (Chou, Hwang, & Wu, 2012). Thus, the practice and maintenance of physical exercise are preventive strategies for sarcopenia (Lee et al., 2018).

Among the physical activity options, Karlsson et al. (2021) and Grönstedt et al. (2020) highlighted the Sit-to-Stand exercises as favorable for the prevention and treatment of sarcopenia when combined with supplemental nutritional interventions.

A good history of healthy eating habits is essential for healthy aging (Tomasi et al., 2014). Thus, it is crucial that the elderly individual's diet be adequate and varied, containing all the essential nutrients for proper bodily function, such as carbohydrates, proteins, lipids, fibers, vitamins, and minerals.

Among the various prevalent diseases in senescence, Yang et al. (2019) identified that, among the institutionalized elderly individuals studied, sarcopenia becomes more prevalent with age. Furthermore, it was observed that the recurrent consumption of quality proteins in the diet, such as meats, eggs, and milk, is associated with lower prevalence rates of the disease.

It is evident that the research conducted examined different nutrients and their roles in the bodily composition of elderly individuals. Abe, Ezaki & Suzuki (2019) and Abe, Ezaki, & Suzuki (2016) focused on leucine, and one of them (Abe, Ezaki, & Suzuki, 2019) analyzed one of its metabolites, HMB acid. This nutrient is a vital amino acid for protein synthesis, which is why its effect on muscle mass gain is studied. Protein sources such as meats, eggs, and milk are also metabolized into amino acids and, therefore, contribute to protein synthesis and muscle mass gain (Yang et al., 2019).

Some studies investigated the action of vitamin D, or cholecalciferol, as this hormone affects muscle size, function, neuromuscular performance, contractility, and coordination. This highlights that low levels of vitamin D contribute to sarcopenia (Duarte, 2021).

The treatment of sarcopenia with MCTs has also been investigated, with positive results observed. This lipid is metabolized into smaller molecules, fatty acids, which are then used as a preferred energy source for muscle tissue as they enter the mitochondria (cellular organelles responsible for energy synthesis through oxidative processes) and prioritize their oxidation (Papamandjaris, MacDougall, & Jones, 1998). Thus, MCTs are beneficial for the maintenance and synthesis of muscles, assisting in the prevention and treatment of sarcopenia.

In this context, Allaert, Guérin-Deremaux, Mauray-Soulier, & Saniez-Degrave (2016), Karlsson et al. (2021), and Grönstedt et al. (2020) used some ready-made oral supplements available on the market in their analyses, such as NUTRALYS®, NUTRALYS W®, Fortimel Compact Protein, Nutricia®, and NUTRIOSE®. The first three are primarily composed of proteins, while the last is mainly composed of fibers (indigestible carbohydrates found in plant-based derivatives that are beneficial to the human body). These oral supplements offer alternatives to diversify the diet, improve appetite, and increase protein and fiber intake, becoming allies in the nutritional approach to sarcopenia in institutionalized elderly individuals.

A Brazilian study aimed at characterizing the functioning aspects, services offered, and infrastructure of Brazilian long-term care institutions (ILPIs) showed that most of them meet the conditions established by RDC 283/2005 (Ministry of Health, 2005). However, many have structural limitations and scarce resources, which should comply with existing legislation, in addition to lacking qualified professional staff in geriatrics (Wanderley et al., 2020).

In this context, a review aimed at gathering studies using the Mini Nutritional Assessment (MNA) in different contexts of elderly care showed that the frequency of elderly individuals at risk of malnutrition was higher among those residing in ILPIs (57.4%) compared to elderly individuals living in the community (34.27%) (Pereira et al., 2017).

Thus, there is an urgent need for decision-making based on scientific evidence to guide the choice of preventive or therapeutic nutritional interventions for institutionalized elderly individuals with sarcopenia, as this population is vulnerable.

The limitations of this integrative review were based on the lack of standardization of the samples used, the limited number of recent studies available that answered the guiding question, and the fact that all studies were in English. Additionally, no studies were found that exclusively analyzed sarcopenia as a disease. In the selected studies for this review, aspects of frailty in elderly individuals were also considered, and the interventions aimed at improving other aspects of elderly health, beyond sarcopenia, which made the results less exclusive to sarcopenia.

Moreover, three studies (Allaert et al., 2016; Karlsson et al., 2021; Grönstedt et al., 2020) received financial support from companies producing the product used as the nutritional intervention, which may present a bias of interest.

4. Conclusion

In this review, it was evidenced that nutritional interventions can serve as favorable clinical approaches for preventing the worsening of nutritional status related to sarcopenia and treating the condition. Among these interventions, oral supplementation with high-quality proteins, vitamin D, MCT, HMB, and leucine stood out. Additionally, it was found that an adequate diet including meat, eggs, and milk can reduce the prevalence of the disease. Physical exercise emerged as an effective complementary intervention alongside nutritional strategies.

Therefore, the results of the present study emphasize the importance of conducting further research to deepen the understanding of strategies and enrich knowledge on this topic. They also encourage healthcare professionals to adopt a thorough approach when considering preventive and therapeutic measures for sarcopenia in institutionalized older adults. Finally, this review effectively synthesized the subject matter in a current and productive manner, contributing to future research in the field and providing a comprehensive summary of scientific knowledge.

References

Abe, S., Ezaki, O., & Suzuki, M. (2016). Medium-Chain Triglycerides in Combination with Leucine and Vitamin D Increase Muscle Strength and Function in Frail Elderly Adults in a Randomized Controlled Trial. *The Journal of Nutrition*, 146(5), 1017–1026. https://doi.org/10.3945/jn.115.228965

Abe, S., Ezaki, O., & Suzuki, M. (2019). Medium-chain triglycerides (8:0 and 10:0) are promising nutrients for sarcopenia: A randomized controlled trial. *The American Journal of Clinical Nutrition*, 110(3), 652–665. https://doi.org/10.1093/ajcn/nqz138

Abreu, W. C., Franceschini, S. C. C., Tinoco, A. L. A., Pereira, C. A. S., & Silva, M. M. S. (2008). Inadequação no consumo alimentar e fatores interferentes na ingestão energética de idosos matriculados no programa municipal da terceira idade de Viçosa (MG). *Revista Baiana de Saúde Pública*, 32(2), 190–192. http://bases.bireme.br/cgi-bin/wxislind.exe/iah/online/?IsisScript=iah/iah.xis&src=google&base=LILACS&lang=p&nextAction=lnk&exprSearch=516003&indexSearch=ID

Allaert, F. A., Guérin-Deremaux, L., Mauray-Soulier, A., & Saniez-Degrave, M. H. (2016). Evaluation of adherence by elderly nursing home patients to regular consumption of apple compote enriched with protein and soluble fiber. *Aging Clinical and Experimental Research*, 28(2), 189–195. https://doi.org/10.1007/s40520-015-0415-3

Bublitz, C., Ribeiro da Costa, A., Teixeira Panza, B., Ribeiro Antonelli, L., Aparecida Novelli Sanfelice, F., & Prado Bereta Vilela, R. (2020). Déficit de mobilidade em idosa senil e em depressão: Relato de caso. *CuidArte, Enferm*, 14(2), 276–281. http://www.webfipa.net/facfipa/ner/sumarios/cuidarte/2020v2/p.276-281.pdf

Caixeta, T. R. (2020). *Alimentação de idosos institucionalizados no Brasil: Uma revisão integrativa da literatura* [Trabalho de Conclusão de Curso – Bacharelado em Nutrição]. Universidade de Brasília. https://bdm.unb.br/handle/10483/25636

Chou, C. H., Hwang, C. L., & Wu, Y. T. (2012). Effect of exercise on physical function, daily living activities, and quality of life in the frail older adults: A meta-analysis. *Archives of Physical Medicine and Rehabilitation*, 93(2), 237–244. https://doi.org/10.1016/j.apmr.2011.08.042

Cruz-Jentoft, A. J., Baeyens, J. P., Bauer, J. M., Boirie, Y., Cederholm, T., Landi, F., ... & Zamboni, M. (2010). Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. *Age and Ageing*, 39(4), 412–423. https://doi.org/10.1093/ageing/afq034

Damo, C. C., Doring, M., Alves, A. N. S., & Portella, M. R. (2018). Risco de desnutrição e fatores associados em idosos institucionalizados. *Revista Brasileira de Geriatria e Gerontologia*, 21(6), 735–742. https://doi.org/10.1590/1981-22562018021.180152

Duarte, B. S. N. (2021). *O papel da vitamina D em indivíduos com sarcopenia* [Trabalho de Conclusão de Curso – Bacharelado em Nutrição]. Universidade do Porto. https://repositorio-aberto.up.pt/bitstream/10216/135964/2/492525.pdf

Giuliani, C. A., Gruber-Baldini, A. L., Park, N. S., Schrodt, L. A., Rokoske, F., & Sloane, P. D. (2008). Physical performance characteristics of assisted living residents and risk for adverse health outcomes. *The Gerontologist*, 48(2), 203–212. https://doi.org/10.1093/geront/48.2.203

Grönstedt, H. K., Vikström, S., Cederholm, T., Franzén, E., Luiking, Y. C., & Seiger, A. (2020). Effect of sit-to-stand exercises combined with protein-rich oral supplementation in older persons: The Older Person's Exercise and Nutrition Study. *Journal of the American Medical Directors Association*, 21(9), 1229–1237. https://doi.org/10.1016/j.jamda.2020.03.030

Karlsson, E. S., Grönstedt, H. K., Faxén-Irving, G., Franzén, E., Luiking, Y. C., Seiger, A., et al. (2021). Response and adherence of nursing home residents to a nutrition/exercise intervention. *Journal of the American Medical Directors Association (JAMDA)*, *22*(9), 1939–1945. https://doi.org/10.1016/j.jamda.2021.04.001

Lee, S. Y., Tung, H. H., Liu, C. Y., & Chen, L. K. (2018). Physical activity and sarcopenia in the geriatric population: A systematic review. *Journal of the American Medical Directors Association (JAMDA)*, *19*(5), 378–383. https://doi.org/10.1016/j.jamda.2018.02.003

Mantovani, L. M., Viebig, R. F., & Morimoto, J. M. (2018). Associação entre estado nutricional e vulnerabilidade em idosos institucionalizados. *BRASPEN Journal*, *33*(2), 181–187. http://arquivos.braspen.org/journal/abr-mai-jun-2018/12-AO-Associacao-entre-estado-nutricional.pdf

Ministério da Saúde (Brasil), Agência Nacional de Vigilância Sanitária. (2005). Resolução – RDC n. 283, de 26 de setembro de 2005. Brasília: Ministério da Saúde. https://bvsms.saude.gov.br/bvs/saudelegis/anvisa/2005/res0283_26_09_2005.html

Morley, J. E. (1997). Anorexia of aging: Physiologic and pathologic. *The American Journal of Clinical Nutrition*, *66*(4), 760–773. https://doi.org/10.1093/ajcn/66.4.760

Oxford Centre for Evidence-Based Medicine. (2009). Levels of evidence. Oxford: CEBM. http://www.cebm.net/oxford-centre-evidence-basedmedicine-levels-evidence-march-2009/

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, 1–9. https://doi.org/10.1136/bmj.n71

Papamandjaris, A. A., MacDougall, D. E., & Jones, P. J. (1998). Medium chain fatty acid metabolism and energy expenditure: Obesity treatment implications. *Life Sciences*, *62*(14), 1203–1215. https://doi.org/10.1016/s0024-3205(97)01143-0

Papaléo Netto, M. (2002). O estudo da velhice no século XX: Histórico, definição do campo e termos básicos. In F. A. X. Cançado, E. V. Freitas, M. L. Gorzoni, L. Py, & A. L. Neri (Eds.), *Tratado de geriatria e gerontologia* (pp. 1–12). Rio de Janeiro: Guanabara Koogan.

Pereira, D. S., Oliveira, A. C. S., Pereira, M. H. Q., & Pereira, M. L. A. S. (2017). Mini Avaliação Nutricional: Utilização e panorama nos diferentes cenários de atenção ao idoso. *Revista Saúde.com*, *13*(1), 824–832. https://doi.org/10.22481/rsc.v13i1.426

Pereira, M. L. A. S., & Oliveira, C. A. (2016). Drug-drug interactions and adverse drug reactions in polypharmacy among older adults: An integrative review. *Revista Latino-Americana de Enfermagem*, *24*, 1–17. https://doi.org/10.1590/1518-8345.1316.2800

Reiss, J., Iglseder, B., Alzner, R., Mayr-Pirker, B., Pirich, C., Kässmann, H., et al. (2019). Consequences of applying the new EWGSOP2 guideline instead of the former EWGSOP guideline for sarcopenia case finding in older patients. *Age and Ageing*, *48*(5), 719–724. https://doi.org/10.1093/ageing/afz035

Rodrigues, M. C. S., & Oliveira, C. (2016). Drug-drug interactions and adverse drug reactions in polypharmacy among older adults: An integrative review. *Revista Latino-Americana de Enfermagem*, *24*, 1–17. https://doi.org/10.1590/1518-8345.1316.2800

Sura, L., Madhavan, A., Carnaby-Mann, G., & Crary, M. (2012). Dysphagia in the elderly: Management and nutritional considerations. *Clinical Interventions in Aging*, *7*, 287–298. https://doi.org/10.2147/CIA.S23404

Tomasi, E., Nunes, B. P., Thumé, E., Siqueira, F. V., Duro, S. M. S., Dilélio, A. S., et al. (2014). Utilização de serviços de saúde no Brasil: Associação com indicadores de excesso de peso e gordura abdominal. *Cadernos de Saúde Pública*, *30*(7), 1515–1524. https://doi.org/10.1590/0102-311X00078413

Vieira, R. A., Gomes, M. S., & Menezes, T. N. (2015). Indicadores antropométricos de obesidade como preditores de risco para doenças crônicas em idosos. *Revista Brasileira de Cineantropometria e Desempenho Humano*, *17*(3), 269–279. https://doi.org/10.5007/1980-0037.2015v17n3p269

Villareal, D. T., Apovian, C. M., Kushner, R. F., & Klein, S. (2005). Obesity in older adults: Technical review and position statement of the American Society for Nutrition and NAASO, The Obesity Society. *Obesity Research*, *13*(11), 1849–1863. https://doi.org/10.1038/oby.2005.228

Volkert, D., Chourdakis, M., Faxen-Irving, G., Frühwald, T., Landi, F., Suominen, M. H., et al. (2015). ESPEN guidelines on nutrition in dementia. *Clinical Nutrition*, *34*(6), 1052–1073. https://doi.org/10.1016/j.clnu.2015.09.004

Wanderley, V. B., Bezerra, I. N. M., Pimenta, I. D. S. F., da Silva, G., Machado, F. C. de A., Nunes, V. M. de A., & Piuvezam, G. (2020). Long-stay institutions for the elderly: The reality in Brazil. *J. Health NPEPS*, *5*(1), 321–337. Retrieved from https://periodicos.unemat.br/index.php/jhnpeps/article/view/4183

WHO (World Health Organization). (2002). Active ageing: A policy framework. Geneva: WHO. https://www.who.int/ageing/publications/active_ageing/en/

WHO (World Health Organization). (2017). Integrated care for older people: Guidelines on community-level interventions to manage declines in intrinsic capacity. Geneva: WHO. https://www.who.int/publications/i/item/9789241550109

Yamada, M., Nishiguchi, S., Fukutani, N., Tanigawa, T., Yukutake, T., Kayama, H., et al. (2013). Prevalence of sarcopenia in community-dwelling Japanese older adults. *Journal of the American Medical Directors Association (JAMDA)*, *14*(12), 911–915. https://doi.org/10.1016/j.jamda.2013.08.015

Yang, L. J., Wu, G. H., Yang, Y. L., Wu, Y. H., Zhang, L., Wang, M. H., et al. (2019). Effects of exercise on physical performance in older adults: A randomized controlled trial. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research*, *25*, 4390–4399. https://doi.org/10.12659/MSM.914031

Yoshimura, Y., Wakabayashi, H., & Nagano, F. (2020). Sarcopenia and nutritional status in older patients with cardiovascular disease. *Journal of Clinical Medicine*, *9*(8), 2555. https://doi.org/10.3390/jcm9082555

Zamboni, M., Mazzali, G., Fantin, F., Rossi, A., & Di Francesco, V. (2008). Sarcopenic obesity: A new category of obesity in the elderly. *Nutrition, Metabolism and Cardiovascular Diseases*, *18*(5), 388–395. https://doi.org/10.1016/j.numecd.2007.10.002