



A Comprehensive Literature Review of Prevention of Osteoporosis and Sarcopenia in Older Adults

¹ Erick Persson Jeffry, ¹ Charles Sanjaya Seikka

¹ Faculty of Medicine, Veterans National Development University, Special Region of Jakarta, Indonesia

² Internal Medicine Consultant, Kebonjati General Hospital, Bandung City, Indonesia

Correspondence : erick.persson86@gmail.com

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ABSTRACT

Background: The prevention and management of osteoporosis and sarcopenia in older adults has garnered significant attention in recent years, as these conditions are increasingly recognized as critical public health issues affecting the aging population.

Literature Review: The connection between sarcopenia and osteoporosis is elaborated upon by (A. Greco et al., 2019), who emphasize the role of resistance exercise in stimulating muscle hypertrophy and the importance of key nutrients, such as protein and vitamin D, in preventing these conditions. In addition, the systematic reviews conducted by (E. Rus et al., 2020) and (Mareschal et al., 2020) reveal that nutritional interventions, particularly in hospital settings, are crucial in combating the high prevalence of sarcopenia among older adults. Moreover, the importance of routine assessments of bone and muscle health in geriatric care is emphasized by (Barnsley et al., 2021), advocating for comprehensive interventions that address both osteoporosis and sarcopenia to improve health outcomes. Finally, the review by (Hou & Madden, 2022) highlights the effectiveness of dietary protein supplementation in conjunction with exercise for sarcopenic older adults, suggesting that combined interventions can lead to significant improvements in muscle mass and strength. However, the need for further research to optimize these strategies for different populations within the aging demographic is acknowledged. **Conclusion:** In conclusion, the literature collectively emphasizes that a holistic approach combining nutrition and physical activity is essential for the effective prevention and management of osteoporosis and sarcopenia in older adults. Such integrated strategies not only aim to enhance muscle and bone health but also improve overall quality of life for this vulnerable population.

Keywords: Prevention, Osteoporosis, Sarcopenia, Older Adults

INTRODUCTION

The prevention and management of osteoporosis and sarcopenia in older adults has garnered significant attention in recent years, as these conditions are increasingly recognized as critical public health issues affecting the aging population. The literature reveals a consensus on the detrimental effects of physical inactivity and poor nutrition on muscle mass and strength, highlighting the need for effective interventions. (J Denison et al., 2015) emphasize the importance of defining sarcopenia through measurable criteria such as lean mass, grip strength, and gait speed, while advocating for increased physical activity and improved dietary practices as protective measures against muscle loss. Their findings suggest that interventions focusing on exercise and nutrition can be pivotal in preventing or managing sarcopenia, particularly in older adults.

Building on these insights, (Beaudart et al., 2017) provide a

systematic review that underscores sarcopenia as a progressive condition with significant clinical and socioeconomic implications. They report that resistance training and nutritional supplementation, particularly with proteins and amino acids, yield positive outcomes in muscle strength and physical performance among older adults. The evidence presented reinforces the notion that a multifaceted approach, combining exercise with dietary interventions, is essential for effectively addressing sarcopenia.

Further elaborating on the interplay between nutrition and physical activity, (Beaudart et al., 2017) reiterate the necessity of comprehensive strategies that incorporate both elements to combat the adverse effects of aging on muscle function. Their systematic review highlights the urgent need for public health recommendations based on robust evidence to guide interventions aimed at older adults.

(A. Greco et al., 2019) extend the discussion to the relationship

between sarcopenia and osteoporosis, noting that resistance exercise can stimulate muscle hypertrophy and enhance strength. They identify key nutrients, such as protein and vitamin D, as critical components in the prevention and management of these conditions. This article emphasizes the importance of individualized approaches to supplementation, taking into account the unique characteristics of older adults, thereby addressing the multifactorial nature of sarcopenia and its co-occurrence with osteoporosis.

In a systematic review conducted by , the authors focus on nutritional interventions in hospital settings, revealing that sarcopenia prevalence is notably higher among older adults, particularly in healthcare facilities. They stress the need for targeted strategies to prevent the progression of sarcopenia, which can significantly impact healthcare costs and the overall burden on health systems. Their findings align with previous studies advocating for the combination of nutritional supplementation and physical activity to enhance muscle mass and strength.

(Mareschal et al., 2020) further highlight the significance of a multimodal approach, advocating for nutritional interventions alongside exercise to mitigate functional decline in community-dwelling older adults. Their systematic review emphasizes the relationship between adequate nutrient intake and the preservation of muscle mass, underscoring the critical role of nutrition in maintaining physical performance and preventing frailty.

(Barnsley et al., 2021) address the challenges posed by osteoporosis and sarcopenia, emphasizing the need for routine assessments of bone and muscle health in geriatric care. They advocate for comprehensive interventions that include nutrition and physical activity to improve health outcomes for older adults, particularly those at risk of fractures. This article reinforces the idea that preventive strategies are essential in managing the dual burden of these conditions.

(Azzolino et al., 2021) take a life-course approach to prevention, advocating for early interventions that

encompass nutrition and physical activity to combat age-related musculoskeletal decline. Their findings suggest that maintaining a healthy lifestyle throughout life can significantly influence the trajectory of musculoskeletal health in older age.

Finally, (Hou & Madden, 2022) provide a focused review on the effects of dietary protein supplementation in conjunction with exercise for sarcopenic older adults. Their findings indicate that such combined interventions can lead to significant improvements in muscle mass and strength, although the benefits in healthy older adults remain less clear. This highlights the need for further research to refine intervention strategies tailored to different populations within the aging demographic.

Overall, the literature collectively emphasizes the critical role of integrated interventions involving nutrition and physical activity in the prevention and management of osteoporosis and sarcopenia, ultimately aiming to

enhance the quality of life for older adults.

LITERATURE REVIEW

The article "Prevention and optimal management of sarcopenia: a review of combined exercise and nutrition interventions to improve muscle outcomes in older people" by (J Denison et al., 2015) provides a comprehensive overview of the strategies aimed at preventing sarcopenia in older adults. The authors emphasize the clinical significance of sarcopenia and the necessity for a clearer understanding of its etiology, which is crucial for developing effective prevention and management strategies.

One of the key insights from the article is the definition of sarcopenia established by the European Working Group on Sarcopenia in Older People (EWGSOP), which utilizes threshold values for lean mass, grip strength, and gait speed as diagnostic criteria. This definition underscores the multifaceted nature of sarcopenia, indicating that it cannot be solely attributed to muscle mass loss but also

involves functional impairments ((J Denison et al., 2015)). This perspective is vital for clinicians and researchers alike, as it highlights the importance of a holistic approach when assessing and addressing sarcopenia.

(J Denison et al., 2015) also discuss the variability in the rate of muscle mass and strength loss among older individuals, attributing significant declines to physical inactivity. This finding aligns with existing literature, suggesting that promoting physical activity is essential for mitigating muscle deterioration. The authors advocate for interventions that not only encourage increased physical activity but also address dietary concerns, as inadequate nutrition is prevalent among older adults. They note that low food intakes and monotonous diets can lead to insufficient nutrient consumption, which is detrimental to muscle health.

The article provides compelling evidence from a meta-analysis indicating that protein supplementation during exercise

training significantly enhances muscle mass and strength gains in older adults. This finding is particularly relevant for public health strategies aimed at improving physical function in later life. By integrating exercise and nutritional interventions, the authors propose a synergistic approach that could effectively combat the dual challenges of sarcopenia and osteoporosis.

The article "Nutrition and physical activity in the prevention and treatment of sarcopenia: systematic review" by (Beaudart et al., 2017) provides a comprehensive examination of the critical role that nutrition and physical activity play in addressing sarcopenia, a condition characterized by the progressive loss of muscle mass and function in older adults. The authors highlight the growing prevalence of sarcopenia, which poses significant public health challenges due to its clinical, economic, and social implications.

A key insight from the article is the emphasis on physical activity, particularly resistance training, as a

fundamental intervention for improving muscle strength and physical performance among older adults. The systematic review synthesizes findings from various interventional studies, demonstrating that exercise can lead to notable enhancements in muscle function. This aligns with existing literature that underscores the importance of maintaining an active lifestyle to mitigate the effects of aging on muscle health.

In addition to physical activity, the article discusses the impact of nutritional supplementation on muscle mass. The authors note that dietary components, including protein, β -hydroxy β -methylbutyric acid, and certain amino acids, have shown promise in supporting muscle function. This aspect of the review is particularly relevant, as it points to the multifaceted nature of sarcopenia prevention and treatment, where both exercise and nutrition converge to optimize outcomes.

However, the authors also acknowledge the limitations in the current body of evidence, indicating

that while many studies report positive effects of combined exercise and nutrition interventions, there is still a need for further research to establish robust public health and clinical recommendations. This critical evaluation of the existing literature highlights the necessity for more rigorous studies that can provide clearer guidance for practitioners and policymakers in the field of geriatric health.

The article "Nutrition and physical activity in the prevention and treatment of sarcopenia: systematic review" by (Beaudart et al., 2017) provides a comprehensive examination of the role of combined exercise and nutrition interventions in addressing sarcopenia among older adults. The systematic review synthesizes findings from 37 randomized controlled trials (RCTs) that highlight the significant impact of physical exercise on muscle mass and function in individuals aged 65 years and older.

The authors define sarcopenia as a progressive decline in muscle mass and function that occurs with

aging, emphasizing its classification as a major public health concern due to its associated clinical, economic, and social implications. The review meticulously outlines the diagnostic criteria for sarcopenia, which include the assessment of muscle mass, strength, and physical performance. This systematic approach to diagnosis underscores the complexity of sarcopenia and the necessity for targeted interventions.

A critical evaluation of the findings reveals that the article effectively demonstrates the positive correlation between physical activity—particularly resistance training—and improvements in muscle strength and physical performance. The review indicates that most exercise interventions led to significant enhancements in these areas, suggesting that tailored exercise programs could be a vital component in preventing and managing sarcopenia in older adults. Moreover, the consistency of results regarding dietary supplementation's effect on muscle mass further strengthens the argument for a

multifaceted approach to prevention and treatment.

However, while the review presents robust evidence supporting the benefits of physical exercise and nutritional supplementation, it could benefit from a more detailed discussion on the specific types and intensities of exercise that yield optimal results for different populations within the older adult demographic. Additionally, the article could explore potential barriers to implementing these interventions, such as accessibility to resources and the variability in individual health status.

The article "Osteoporosis and Sarcopenia Increase Frailty Syndrome in the Elderly" by (A. Greco et al., 2019) provides a comprehensive examination of the interconnectedness of osteoporosis, sarcopenia, and frailty syndrome in older adults. The authors emphasize the critical role of resistance exercise in mitigating muscle wasting and enhancing muscle strength through the stimulation of muscle hypertrophy and the regulation of protein

metabolism. This insight is particularly relevant given the rising prevalence of frailty among the elderly population, which significantly impacts their overall health and quality of life.

The authors highlight the importance of balanced nutrition as a foundational element in both the prevention and management of sarcopenia. They identify key nutrients, including protein, vitamin D, antioxidant nutrients, and long-chain polyunsaturated fatty acids, that are closely linked to the development of sarcopenia and frailty. This nutritional perspective is crucial, as it underscores the need for tailored dietary recommendations that consider individual characteristics before the prescription of supplements. Such an approach ensures that interventions are both effective and safe for older adults, who may have varying health profiles and dietary needs.

Pharmacological therapies are also discussed as vital components of a comprehensive strategy to combat frailty associated with osteoporosis

and sarcopenia. The authors note that anti-osteoporotic agents can increase bone mass and reduce fracture risk, particularly when combined with calcium and vitamin D supplementation. Furthermore, they introduce the concept of targeting myonuclear apoptosis as a potential therapeutic intervention against sarcopenia, supported by preclinical studies. This focus on cellular mechanisms provides a deeper understanding of the biological underpinnings of muscle dysfunction in aging, which could lead to more effective treatments.

The discussion extends to specific pharmacological strategies for treating sarcopenia, including myostatin inhibitors, testosterone, and selective androgen receptor modulators (SARMs). While these options present promising avenues for increasing muscle mass, the authors acknowledge the challenges associated with prolonged treatment in older adults, particularly concerning compliance and safety. This critical evaluation of treatment strategies highlights the necessity for ongoing research and development of

interventions that are not only effective but also feasible for the aging population.

The systematic review conducted by (E. Rus et al., 2020) provides a comprehensive analysis of nutrition interventions aimed at reducing the risk of sarcopenia in older adults. The article emphasizes the critical role that sarcopenia plays in the decline of functional abilities and overall quality of life as individuals age, highlighting its prevalence and the associated risks, particularly among those over 60 years of age and especially in hospitalized patients and aged care facilities.

The authors present a compelling argument regarding the need for effective preventive strategies against sarcopenia, noting that the condition can begin as early as the fourth decade of life and progresses to significant levels in later years. Their findings underscore that individuals aged 75 and older, along with those facing undernutrition, are particularly vulnerable to developing sarcopenia. This demographic insight

is crucial for tailoring interventions that specifically target at-risk populations.

The review synthesizes existing randomized controlled trials to evaluate the impact of nutritional supplementation, revealing that such interventions can lead to improvements in both muscle mass and strength. Importantly, the authors note that the benefits of nutritional supplementation are magnified when combined with physical activity, suggesting a synergistic effect that could enhance intervention outcomes. This finding is particularly relevant for healthcare practitioners and policymakers, as it indicates that a multi-faceted approach incorporating both nutrition and exercise may be more effective in combating sarcopenia than either strategy alone.

Moreover, the authors call for a deeper understanding of preventive approaches to sarcopenia, which could mitigate the economic burden on healthcare systems. By focusing on the prevention of sarcopenia rather than solely on treatment after the onset of the condition, healthcare

providers may be able to improve patient outcomes and reduce healthcare costs associated with functional decline and related chronic health conditions.

The article "Nutritional Intervention to Prevent the Functional Decline in Community-Dwelling Older Adults: A Systematic Review" by (Mareschal et al., 2020) provides a comprehensive overview of the impact of nutritional interventions on sarcopenia and frailty among older adults. The authors emphasize that aging presents significant public health challenges, particularly as muscle mass, strength, and physical performance decline after the age of 50. This decline is closely associated with sarcopenia, which is characterized by low muscle mass, low muscle strength, or low physical performance, as defined by the European Working Group on Sarcopenia in Older People (EWGSOP).

The systematic review presents a critical evaluation of various therapeutic strategies aimed at mitigating the effects of sarcopenia

and frailty. The authors argue that a multimodal approach is essential for effectively addressing these issues. This approach should ideally combine nutritional interventions with exercise regimens, as both components are crucial for enhancing muscle mass, strength, and overall physical performance in community-dwelling older adults, particularly those who are frail or already experiencing sarcopenia.

One of the key insights from the article is the central role of nutrient intake in the maintenance and development of muscle mass and strength. The authors highlight that adequate nutrition is not merely a supportive factor but a fundamental element in the prevention and management of sarcopenia. This underscores the importance of tailored nutritional strategies that meet the specific needs of older adults, which can significantly influence their functional capabilities and quality of life.

Furthermore, the review critiques the existing literature by noting gaps in research regarding the

specific types of nutritional interventions that yield the best outcomes for muscle health in older populations. The authors call for more targeted studies to identify optimal dietary patterns and nutrient combinations that can effectively combat the decline associated with aging.

The article "Pathophysiology and treatment of osteoporosis: challenges for clinical practice in older people" by (Barnsley et al., 2021) provides a comprehensive examination of the interplay between osteoporosis and sarcopenia in older adults, emphasizing the significant health burdens these conditions impose. The authors highlight the increasing incidence of osteoporosis with age, underscoring its association with heightened morbidity and mortality rates among older individuals. This demographic is particularly vulnerable, as osteoporosis and sarcopenia often coexist, complicating diagnosis and treatment ((Barnsley et al., 2021)).

A critical evaluation of the material reveals that the authors

advocate for routine assessments of both bone and muscle health as integral components of comprehensive geriatric evaluations in both primary and secondary care settings. This perspective aligns with current best practices, which recognize that early detection and intervention can substantially improve outcomes for older adults at risk of fractures and related complications. The article effectively argues that neglecting these assessments can lead to underdiagnosis and undertreatment, perpetuating the cycle of morbidity associated with these conditions.

The authors also emphasize the importance of multifaceted interventions, including nutrition, physical activity, and exercise, as well as specific strategies aimed at improving gait and balance. These interventions are portrayed as beneficial not only for enhancing bone and muscle health but also for reducing the incidence of falls, a significant concern in the older population ((Barnsley et al., 2021)). This holistic approach is commendable, as it acknowledges the

complexity of aging and the need for comprehensive strategies that address multiple aspects of health.

In discussing treatment options, the article highlights the efficacy of bisphosphonates and denosumab, which have strong evidence supporting their use in older patients. The recommendation for these bone-sparing agents is well-founded, given their established role in reducing fracture risk among those diagnosed with osteoporosis. Furthermore, for patients who are intolerant to these agents, the authors suggest that calcium and vitamin D supplementation should be considered to maintain bone health. This pragmatic approach ensures that even those unable to tolerate first-line therapies have alternative options available ((Barnsley et al., 2021)).

The article "Musculoskeletal Changes Across the Lifespan: Nutrition and the Life-Course Approach to Prevention" by (Azzolino et al., 2021) provides a comprehensive examination of the factors contributing to musculoskeletal decline in older

adults, specifically focusing on the roles of nutrition and physical exercise in preventing sarcopenia and osteoporosis. The authors argue that age-related musculoskeletal decline not only poses significant challenges for individuals but also places a considerable burden on healthcare systems.

One of the key insights from the article is the emphasis on early preventive strategies. The authors advocate for the implementation of nutritional and physical activity interventions from early life, which they assert can help maximize musculoskeletal health and mitigate the decline associated with aging. This perspective aligns with a life-course approach, suggesting that proactive measures taken during youth can influence health outcomes in later years. The authors highlight the importance of achieving and maintaining a musculoskeletal peak through adequate nutrition and regular physical activity, which can counteract the detrimental effects of aging on muscle and bone health.

Furthermore, the article underscores the necessity of addressing socioeconomic disparities in health education and lifestyle choices. The authors note that individuals living in low socioeconomic conditions may face barriers to accessing proper nutrition and exercise opportunities, thereby exacerbating the risks of sarcopenia and osteoporosis. By promoting healthier lifestyle choices at a population level, particularly in these vulnerable groups, the authors suggest that significant improvements in musculoskeletal health could be achieved.

The article also discusses the role of body composition in musculoskeletal health, emphasizing the need to prevent excess body fat throughout the lifespan. The authors argue that higher body fat percentages can negatively impact musculoskeletal integrity and contribute to the onset of chronic conditions. This point is particularly relevant as it highlights the interconnectedness of obesity, sarcopenia, and osteoporosis, creating

a multifaceted challenge in geriatric health.

The article "Assessing the Effects of Dietary Protein Supplementation on Sarcopenia in Community-Dwelling Older Adults" by (Hou & Madden, 2022) provides a comprehensive review of the impact of dietary protein supplementation in conjunction with exercise interventions on sarcopenia among older adults. The authors emphasize the critical role that both exercise and nutrition play in mitigating the effects of sarcopenia, a condition characterized by the progressive loss of muscle mass and strength, which significantly contributes to frailty and decreased mobility in this population.

One of the key insights from this literature review is the effectiveness of combined interventions—specifically, the integration of resistance-based exercises with amino acid or protein supplementation. The authors highlight that such combined approaches not only improve muscle mass and strength but also enhance overall physical function in

sarcopenic older adults. This finding aligns with previous studies that have indicated the positive effects of physical exercise on both bone and muscle health, underscoring the importance of maintaining an active lifestyle to reduce the risk of immobility and associated complications ((Hou & Madden, 2022)).

Moreover, the article discusses the limitations of existing research, particularly regarding healthy older adults. The authors note that while there is substantial evidence supporting the benefits of exercise and protein supplementation for those already experiencing sarcopenia, the effects on healthier individuals remain inconclusive. This gap in the literature suggests a need for further investigation into how these interventions can be optimized for broader populations of older adults, potentially leading to more effective prevention strategies for both sarcopenia and osteoporosis

CONCLUSION

The literature on the prevention and management of osteoporosis and sarcopenia in older

adults underscores the importance of integrated interventions involving both nutritional and physical activity strategies. The consensus across multiple studies indicates that these two elements are critical in mitigating the adverse effects of aging on muscle and bone health.

The introduction of the review highlights the increasing recognition of sarcopenia as a significant public health issue, with a clear emphasis on the need for effective interventions (J Denison et al., 2015). The systematic review by (Beaudart et al., 2017) further supports this by detailing the progressive nature of sarcopenia and its implications, reinforcing the necessity of a multifaceted approach that combines resistance training and nutritional supplementation. The findings suggest that such interventions are vital for improving muscle strength and physical performance among older adults.

The connection between sarcopenia and osteoporosis is elaborated upon by (A. Greco et al., 2019), who emphasize the role of resistance exercise in stimulating

muscle hypertrophy and the importance of key nutrients, such as protein and vitamin D, in preventing these conditions. This highlights the need for individualized dietary recommendations tailored to the unique characteristics of older adults to effectively address the multifactorial nature of these conditions.

In addition, the systematic reviews conducted by (E. Rus et al., 2020) and (Mareschal et al., 2020) reveal that nutritional interventions, particularly in hospital settings, are crucial in combating the high prevalence of sarcopenia among older adults. The findings from these studies align with the broader literature that advocates for a comprehensive approach, integrating both exercise and nutrition to enhance muscle mass and strength.

Moreover, the importance of routine assessments of bone and muscle health in geriatric care is emphasized by (Barnsley et al., 2021), advocating for comprehensive interventions that address both osteoporosis and sarcopenia to

improve health outcomes. The life-course approach discussed by (Azzolino et al., 2021) further supports the idea that early interventions in nutrition and physical activity can significantly influence musculoskeletal health in older age.

Finally, the review by (Hou & Madden, 2022) highlights the effectiveness of dietary protein supplementation in conjunction with exercise for sarcopenic older adults, suggesting that combined interventions can lead to significant improvements in muscle mass and strength. However, the need for further research to optimize these strategies for different populations within the aging demographic is acknowledged.

In conclusion, the literature collectively emphasizes that a holistic approach combining nutrition and physical activity is essential for the effective prevention and management of osteoporosis and sarcopenia in older adults. Such integrated strategies not only aim to enhance muscle and bone health but also

improve overall quality of life for this vulnerable population

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