

THE EFFECTS OF OSTEOPOROSIS AND SARCOPENIA IN ELDERLY: A LITERATURE REVIEW

OS EFEITOS DA OSTEOPOROSE E DA SARCOPENIA EM IDOSOS: UMA REVISÃO DE LITERATURA

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RESUMO

A osteoporose e a sarcopenia são patologias crônicas que comprometem a integridade da unidade musculoesquelética. A coexistência de ambas as condições caracteriza uma síndrome que aumenta o risco de fraturas e quedas em idosos. O objetivo deste estudo é compreender os efeitos da osteoporose e da sarcopenia na população idosa, analisando a deterioração de ambos os tecidos e seus impactos físico-funcionais. Realizou-se uma revisão da literatura utilizando a base de dados PubMed, restringindo-se a artigos publicados entre 2021 e 2026 que abordam as bases fisiopatológicas e as intervenções associadas à osteosarcopenia. As evidências científicas demonstraram que o declínio musculoesquelético ocorre devido a falhas na comunicação bioquímica bidirecional entre ossos e músculos, processo agravado pela resistência anabólica. O treinamento resistido, especialmente quando associado a uma terapia nutricional que inclua pelo menos 30 gramas de proteína de alto valor biológico por refeição e níveis adequados de vitamina D, mostra-se eficaz na reversão dos quadros clínicos. Conclui-se que a transição de tratamentos isolados para uma abordagem integrada, que considere músculo e osso como uma unidade única, é essencial para mitigar a fragilidade e preservar a autonomia funcional dos idosos; contudo, são necessários futuros ensaios clínicos controlados para refinar esses protocolos terapêuticos.

Palavras chave: OSTEOPOROSE, SARCOPENIA, IDOSO.

ABSTRACT

Osteoporosis and sarcopenia are chronic pathologies that jeopardize the integrity of the musculoskeletal unit. The coexistence of both conditions characterizes a syndrome that increases the risk of fractures and falls in older adults. The objective of this study is to comprehend the effects of osteoporosis and sarcopenia on elderly population by analyzing the deterioration of both tissues and its physical-functional impacts. A literature review

was conducted using the PubMed databases, limiting the articles published from 2021 to 2026, that address the pathophysiological bases and interventions associated with osteosarcopenia. Scientific finds demonstrated that the musculoskeletal decline occurs by failures on bidirectional biochemical communication between bones and muscles, a process aggravated by anabolic resistance. Resistance training, especially associated with a nutritional therapy of at least 30 grams of high-biological- value protein per meal and adequate vitamin D levels is effective in reverting the clinical cases. In conclusion, transitioning from isolate treatments for an integrated approach that views muscle and bone as a single unit is essential to mitigate the fragility and maintain functional autonomy in older adults, however, future controlled clinical trials are necessary to refine these therapeutics protocols.

Keywords: OSTEOPOROSIS, SARCOPENIA, AGED.

INTRODUCTION

Osteoporosis is recognized as a “silent disease” of the 21st century , meaning that it is a chronic condition that in many times keeps asymptomatic until a fracture happens¹. In 1993, World Health Organization (WHO) defined it as “a systemic skeletal disease characterized by low bone mass, the deterioration of the microarchitecture of bone tissue, a consequent increase in bone fragility and a susceptibility to fractures”¹. This pathology is a result of the disequilibrium between the bone formation (mediated by the activity of the osteoblasts) and the bone reabsorption (mediated by the activity of the osteoclast), which affects the whole cell line, including osteocytes¹. Furthermore, the loss of bone mineral density can represent specific symptoms such as chronic pains, spinal deformities (dorsal kyphosis) and a loss of height that can range from 10 to 20 cm. The development does not depend only on genetics and age, but also modifiable risk factors and life habits, such as sedentary lifestyle, smoking, excessive alcohol consumption, and nutritional deficiencies in calcium and vitamin D¹.

However, the fragility of the musculoskeletal system is not limited by the excessive resorption of the bone matrix, because it manifests critically through sarcopenia, characterized by the loss of mass and muscle power. The term derives from the Greek (sarx = flesh, penia = loss) and describes the generalized and progressive loss of mass, power and function of muscle by age². Characterized by a disequilibrium of protein turnover, the degradation of proteins supersedes the synthesis - similar to osteoporosis, which causes the loss of number of muscle

fibers, primarily affecting Type II (fast contraction) fibers. With aging, a key concept is “anabolic resistance” that means the ability to respond to stimuli that promotes growth - as protein intake and exercise does not happen on the aging muscle². The sarcopenia is connected to insulin resistance, obesity and a bad metabolic health, in these cases, the quality of life and autonomy is impacted².

In light of this, the pathologic convergence between the loss of bone density and muscle mass is defined in the literature as osteosarcopenia, a syndrome that is recognized as the coexistence of osteoporosis and sarcopenia. The concept of bone and muscle as a unit underpins this pathology, because both tissues are derived from a common mesenchymal stem cell progenitor and maintain constant bidirectional endocrine and mechanical communication³. This crosstalk is compromised by the altered secretion of biochemical factors, which exacerbate the liberation of cytokines and IGF-1 makes the resorption and degradation superior to the tissues synthesis³. As impacts of this disease, the increased risk of falls, fractures and physical disability are even more concerning when associated with socioeconomic factors³.

In view of this scenario of fragility, this study aims to understand the effects of osteoporosis and sarcopenia in older adults, by analyzing of the interaction of the loss of both tissues - bone and muscles and how it impacts the health-related quality of life of older people (>60 years old) and the process of aging, focusing on the physics aspects.

METHODS

This study consists of a literature review developed based on the question: "What are the effects of sarcopenia and osteoporosis in the elderly?". During the first weeks of August 2026, the search for these materials was conducted in the "PubMed" database. The search terms were selected from the DeCS databases and the descriptors used were "sarcopenia", "osteoporosis", and "elderly", combined with the Boolean operator "AND". The studies were published in the last 5 years (2021–2026), and the result was the identification and selection of three articles to summarize in this text. Specifically, the diagnostic criteria, bone biology, and therapeutic pathways of osteoporosis were analyzed based on the review by Aibar-Almazán et

al. (2022). The biochemical and metabolic mechanisms of muscle wasting and age-related anabolic resistance were evaluated through the framework established by Tezze et al. (2023). Finally, the synergistic effects of diet and physical activity on the prevention of muscle and bone loss, alongside the clinical definition of osteosarcopenia, were integrated using the narrative review by Papadopoulou et al. (2021) Together, these foundational papers served as the primary basis for synthesizing the clinical outcomes and lifestyle interventions in the elderly population

RESULTS

The analysis of the scientific literature reveals that the knowledge about the elderly muscle skeletal system is necessary to understand the mutual decline of both tissues. To present these results, the structure was organized into three main categories: (1) pathophysiopathologic and biocellular aspects; (2) the influence of anabolic resistance; (3) non-pharmacological interventions: exercise and nutrition.

The studies indicate that primary osteoporosis is determined by deterioration of intrinsic communication of osteoblasts, osteoclasts and osteocytes¹. With the aging and the decline of hormone levels (such as estrogen on menopause), there is an hyperactivity of osteoclasts - the cells responsible for bone resorption¹. The exam's golden standard is bone densitometry by dual-energy emission of X-ray (DEXA), which defines the pathology by a T-score equal or inferior to -2.5 standard deviations (SD)^{1,3}. Clinically, the consequences are most severe and increase the mortality when associated with fractures (specially vertebral and hip fractures)^{1,3}. The sarcopenia (recognized by the code CID-10 M62.84) develops from an imbalance in protein metabolism, which degradation supersedes the synthesis². This process promotes the loss of fast-twitch muscle fibers and atrophy of Type II fibers, that on elderly has a function of equilibrium and fast reaction, which compromises this important component².

A finding in literature is the concept of anabolic resistance, which describes the inability of aging muscle tissue to respond to protein synthesis, that in young people answers well by the ingestion of amino acids and the resistance exercises². The dysregulation of signaling pathways like IGF-1/PI3K/Akt/mTORC1 is associated by this resistance at the

cellular level. Furthermore, chronic low grade inflammatory states (characterized by cytokines as TNF-alpha) an inhibitory function on protein synthesis².

The results demonstrated that coexistence of osteoporosis and sarcopenia is not only an overlapping condition, but an integrated syndrome, that is underpinned by the unit bone-muscle, because both share the same stem cells origin - mesenchymal pluripotent cells^{2,3}. Additionally, there is a biochemical crosstalk: the muscle cells secrete cytokines that act on bone, while the bone cells release growth factors as the IGF-1, which regulates the muscles biology³. When the communication is interrupted, a vicious cycle of fragility of muscles and bones increases the risks of falls and functional incapacity^{2,3}.

Preventive interventions, mainly the power train (against progressive resistance) have been shown as the most beneficial strategy to mitigate the musculoskeletal loss^{2,3}. The mechanical stress by the muscle contractions acts on osteogenic stimulation at the same time on hypertrophy of skeletal muscles, reversing the anabolic resistance².

The ESPEN guidelines recommend increasing protein intake for healthy older adults (1.0 to 1.2 g/kg/day) and even bigger for elders who have chronic or acute pathologies (1.2 to 1.5 g/kg/day). The use of supplements, such as whey proteins - a fast absorption protein associated to vitamin D and metabolics such as the beta-hydroxy-beta-methylbutyrate (HMB) has demonstrated a good clinic attenuating the pathways of protein degradation and potentializing the muscle mass and muscle strong.

CONCLUSION

This review confirms that biological aging promotes synergistic deterioration of both tissues: muscles and bones. In this sense, the loss of muscle mass is driven by the anabolic resistance, a blunted response from the musculoskeletal system to stimuli such as protein ingestion and physical exercise. In this way, it contributes to scientific knowledge by changing the model of isolated treatment to a unified approach based on musculoskeletal units, connecting lifestyle practices and clinic nutrition within geriatrics.

The nutritional guidelines and physical exercise protocols must be synchronized by a diet with at least 30 grams of high biological value protein per meal and programs of training

with resistance and impacts, stimulating simultaneously the protein synthesis, muscle hypertrophy, osteogenesis and minimizing the risks of falls and fractures. Future search must focus on long-term, large-sample randomized controlled trials (RCTs), reducing the heterogeneity of current studies and defining the optimal time to interventions and benefits for the elderly.

BIBLIOGRAPHIC REFERENCES

1. Aibar-Almazán A, Voltes-Martínez A, Caballero YC, Afanador-Restrepo DF, Carcelén-Fraile MC, López-Ruiz E. Current Status of the Diagnosis and Management of Osteoporosis. *Int J Mol Sci.* 2022;23(16):9465. [https:// doi.org/10.3390/nu13124499](https://doi.org/10.3390/nu13124499)
2. Tezze C, Sandri M, Tessari P. Anabolic Resistance in the Pathogenesis of Sarcopenia in the Elderly: Role of Nutrition and Exercise in Young and Old People. *Nutrients.* 2023;15(18):4073. [https:// doi.org/10.3390/nu15184073](https://doi.org/10.3390/nu15184073)
3. Papadopoulou SK, Papadimitriou K, Voulgaridou G, Georgaki E, Tsoitidou E, Zantidou O, et al. Exercise and Nutrition Impact on Osteoporosis and Sarcopenia—The Incidence of Osteosarcopenia: A Narrative Review. *Nutrients.* 2021;13(12):4499. [https:// doi.org/10.3390/nu13124499](https://doi.org/10.3390/nu13124499)