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OSTEOSARCOPENIA: PREVALENCE AND RISK FACTORS. LITERATURE REVIEW.

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Abstract

Introduction. Osteosarcopenia is a recently recognized geriatric syndrome characterized by the coexistence of reduced bone mineral density (osteopenia/osteoporosis) and sarcopenia (decrease in muscle mass and physical strength). This syndrome is associated with an increased risk of falls, fractures, functional impairment, hospitalization, and mortality, which underscores its high clinical relevance in the context of population aging.

Aim. To analyze current literature on osteosarcopenia, summarizing data on the disease concept, pathogenetic mechanisms, prevalence, risk factors, and diagnostic criteria.

Search strategy. A systematic literature search was conducted in the PubMed and Google Scholar databases, covering studies published over the past 10 years. A total of 31 studies addressing the epidemiology, pathophysiology, and diagnosis of osteosarcopenia were included in the review.

Results. The results demonstrate substantial variability in the prevalence of osteosarcopenia across different populations, ranging from 1.5% to 19.6%, with a higher prevalence observed among older women. Osteosarcopenia develops through shared pathogenetic mechanisms, including chronic inflammation, hormonal imbalance, vitamin D deficiency, reduced physical activity, and disturbances in bone–muscle metabolism. Contemporary diagnostic approaches are based on the EWGSOP2 and AWGS criteria, incorporating assessments of muscle strength, muscle mass, physical performance, and bone mineral density.

Conclusions. Thus, osteosarcopenia is a multifactorial syndrome with a pronounced negative impact on prognosis and quality of life in older patients, highlighting the need for early diagnosis, comprehensive screening, and the development of interdisciplinary preventive and therapeutic strategies.

Keywords: *sarcopenia, osteosarcopenia, osteoporosis, muscle weakness, decreased muscle strength.*

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Резюме

ОСТЕОСАРКОПЕНИЯ: РАСПРОСТРАНЕННОСТЬ И ФАКТОРЫ РИСКА. ОБЗОР ЛИТЕРАТУРЫ.

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Актуальность. Остеосаркопения представляет собой недавно признанный гериатрический синдром, характеризующийся сочетанием снижения минеральной плотности костной ткани (остеопения/остеопороз) и саркопении (снижение мышечной массы и физической силы). Данный синдром ассоциирован с повышенным риском

падений, переломов, функциональных нарушений, госпитализации и смертности, что определяет его высокую клиническую значимость в условиях старения населения.

Цель. Анализ современных литературных источников, посвящённых остеосаркопении, с обобщением данных о концепции заболевания, патогенетических механизмах, распространённости, факторах риска и диагностических критериях.

Стратегия поиска. Проведён систематический поиск публикаций в базах данных PubMed и Google Scholar за последние 10 лет. В обзор включены 31 исследований, посвящённых эпидемиологии, патофизиологии и диагностике остеосаркопении.

Результаты анализа свидетельствуют о значительной вариабельности распространённости остеосаркопении в разных популяциях (от 1,5% до 19,6%), с более высокой частотой среди женщин пожилого возраста. Установлено, что остеосаркопения формируется на фоне общих патогенетических механизмов, включая хроническое воспаление, гормональный дисбаланс, дефицит витамина D, снижение физической активности и нарушения костно-мышечного метаболизма. Современные диагностические подходы основаны на критериях EWGSOP2 и AWGS с использованием оценки мышечной силы, массы, физической работоспособности и минеральной плотности кости.

Выводы. Таким образом, остеосаркопения является мультифакторным синдромом с выраженным негативным влиянием на прогноз и качество жизни пожилых пациентов, что подчёркивает необходимость ранней диагностики, комплексного скрининга и разработки междисциплинарных профилактических и терапевтических стратегий.

Ключевые слова: *саркопения, остеосаркопения, остеопороз, мышечная слабость, снижение мышечной силы.*

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Түйіндеме

ОСТЕОСАРКОПЕНИЯ: ТАРАЛУЫ ЖӘНЕ ӘСЕР ЕТУШІ ФАКТОРЛАР. ӘДЕБИЕТТІК ШОЛУ.

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Кіріспе. Остеосаркопения – сүйек тінінің минералдық тығыздығының төмендеуімен (остеопения/остеопороз) және саркопениямен (бұлшықет массасы мен физикалық күштің төмендеуі) қатар жүретін, жақында ғана мойындалған гериатриялық синдром. Бұл синдром құлау, сыну, функционалдық бұзылыстар, ауруханаға жатқызу және өлім-жітім қаупінің жоғарылауымен байланысты, бұл халықтың қартаюы жағдайында оның клиникалық маңыздылығын айқындайды.

Мақсаты. Остеосаркопенияға арналған заманауи ғылыми дереккөздерді талдау, ауру тұжырымдамасы, патогенетикалық механизмдері, таралуы, қауіп факторлары және диагностикалық критерийлері туралы мәліметтерді жинақтау.

Іздеу стратегиясы. Соңғы 10 жыл ішінде жарияланған зерттеулерді қамтитын PubMed және Google Scholar дерекқорларында жүйелі әдеби іздеу жүргізілді. Шолуға остеосаркопенияның эпидемиологиясына, патофизиологиясына және диагностикасына арналған 31 зерттеу енгізілді.

Нәтижелер. Талдау нәтижелері остеосаркопенияның әртүрлі популяциялардағы таралу жиілігінің айтарлықтай өзгермелі екенін көрсетті (1,5%-дан 19,6%-ға дейін), бұл көрсеткіш егде жастағы әйелдер арасында жоғары болды. Остеосаркопенияның дамуы созылмалы қабыну, гормоналдық теңгерімсіздік, D дәруменінің тапшылығы, физикалық белсенділіктің төмендеуі және сүйек-бұлшықет метаболизмінің бұзылыстары сияқты ортақ патогенетикалық механизмдермен байланысты. Қазіргі диагностикалық тәсілдер EWGSOP2 және AWGS критерийлеріне негізделіп, бұлшықет күші, бұлшықет массасы, физикалық жұмыс қабілеті және сүйек тінінің минералдық тығыздығын бағалауды қамтиды.

Қорытынды. Осылайша, остеосаркопения егде жастағы науқастардың өмір сүру болжамы мен өмір сапасына айқын теріс әсер ететін көпфакторлы синдром болып табылады, бұл ерте диагностика жүргізудің, кешенді скринингтің және пәнаралық профилактикалық әрі емдік стратегияларды әзірлеудің маңыздылығын көрсетеді.

***Түйінді сөздер*:** *саркопения, остеосаркопения, остеопороз, бұлшықет әлсіздігі, бұлшықет күшінің төмендеуі.*

Дәйексөз үшін: *Мадиева М.Р., Канапиянова Г.Б., Берсимбекова Г.Б., Кузнецова Т.В., Петряев И.С., Салықбаева К.С.* Остеосаркопения: таралуы және әсер етуші факторлар. Әдебиеттік шолу // Ғылым және Денсаулық сақтау. 2026. Vol.28 (1), Б. 209-215. *doi 10.34689/SH.2026.28.1.024*

Introduction

Osteosarcopenia (OS), a recently recognized syndrome characterized by the concurrent presence of osteopenia/osteoporosis and sarcopenia, has emerged as an important concept in clinical practice. This integrated concept provides a comprehensive view of the musculoskeletal system, addressing a previously underestimated aspect of muscle health. OS significantly increases the risk of falls, fractures, hospitalization, and mortality among older patients with chronic diseases [30]. As the global population ages, the prevalence of chronic diseases continues to rise. Sarcopenia and osteoporosis are two age-related conditions that share similar risk factors, including genetics, endocrine function, and mechanical factors. Moreover, bones and muscles are closely interconnected not only anatomically but also chemically and metabolically [15].

The prevalence of osteosarcopenia among community-dwelling older adults is substantially higher in women than in men. It has been reported that osteosarcopenia occurs in 64.3% of women compared with 8–11% of men among community-dwelling elderly individuals. Osteopenia/osteoporosis and sarcopenia share common risk factors such as aging, sex, physical inactivity, reduced levels of vitamin D, growth hormone, insulin-like growth factor I, and testosterone [1].

Sarcopenia has been officially recognized as a muscle disease with an ICD diagnostic code [28]. In 2010, the European Working Group on Sarcopenia in Older People (EWGSOP) published a definition of sarcopenia that has been widely used worldwide; this definition contributed to progress in identifying and managing individuals at risk of or affected by sarcopenia. In early 2018, the Working Group reconvened (EWGSOP2) to determine whether an update to the definition of sarcopenia was warranted. Over the decade since the initiation of EWGSOP, researchers and clinicians have investigated many aspects of sarcopenia [24].

In EWGSOP2, low muscle strength is considered the primary parameter for the diagnosis of sarcopenia. Specific cut-off values are proposed, including handgrip strength <27 kg for men and <16 kg for women, as well as chair stand time >15 seconds for five rises or usual gait speed ≤0.8 m/s as indicators of low physical performance. Cut-off values for muscle mass are defined relative to body size using height squared, body weight, or body mass index [6]. In addition, in 2014 the Asian Working Group for Sarcopenia (AWGS) defined sarcopenia as age-related loss of muscle mass accompanied by low muscle strength and/or low physical performance. AWGS 2019 retained the previous definition of sarcopenia but revised the diagnostic algorithm, protocols, and certain criteria [4].

Although sarcopenia has long been associated with aging and older adults, it is now recognized that its development begins earlier in life, and that the sarcopenia phenotype has multiple causes beyond aging alone. These findings have important implications for interventions aimed at preventing or delaying the development of sarcopenia [24].

Aim: To analyze current literature on osteosarcopenia (sarcopenia), including a summary of up-to-date concepts on the pathogenetic mechanisms underlying the syndrome, assessment of its prevalence and risk factors, review of current diagnostic criteria, and evaluation of its clinical significance for the health of the adult population.

Search strategy.

A systematic search was conducted in the electronic databases PubMed and Google Scholar using the following keywords: “sarcopenia,” “osteosarcopenia,” “osteoporosis,” “muscle weakness,” and “reduced muscle strength.” The search was limited to studies published in English over the past 10 years.

*The **inclusion** criteria* for the review were: (1) data on the prevalence of osteosarcopenia; (2) data on risk factors and the pathophysiology of osteosarcopenia; (3) studies published in English; and (4) studies addressing the diagnosis of osteosarcopenia.

*The **exclusion** criteria* were as follows: (1) studies that did not address osteosarcopenia; (2) lack of access to the full text of the article; (3) case reports and case series; and (4) studies published in languages other than English.

Overall, 31 sources were reviewed, describing the prevalence and risk factors of osteosarcopenia, as well as its diagnosis and diagnostic criteria.

Ethics statement.

This literature review was based on previously published studies by other authors; therefore, approval from an ethics committee or patient informed consent was not required.

Discussion.

According to international epidemiological studies, the prevalence of sarcopenia ranges from 5% to 13% among individuals aged 60–70 years and reaches up to 50% in those older than 80 years [19]. However, sarcopenia remains poorly studied in Kazakhstan. Sarcopenia, characterized by a loss of muscle mass accompanied by decreased muscle strength and/or physical performance, was first proposed by Rosenberg I. in 1989.

The concept of osteosarcopenia (OS) was first introduced by Duque G. and colleagues as the coexistence of low muscle mass and function (sarcopenia) with low bone mineral density (BMD), namely osteopenia or osteoporosis [11]. Osteoporosis is also a major health concern in the aging population worldwide and is characterized by an imbalance in bone remodeling, reduced bone mineral density, and an increased risk of fragility fractures. According to projections, the population of Kazakhstan aged over 50 years is expected to increase by 35% by 2035, while those aged over 70 years will increase by 95% [16]. Osteosarcopenia is a common condition among older adults and is associated with an increased risk of falls, fractures, functional impairment, and mortality. This conclusion was reached by Salech F. and colleagues, who conducted a study among individuals aged over 60 years living in Chile in 2020. The study included 1,119 participants (68.5% women) with a mean age of 72 years. At baseline, osteoporosis was identified in 23.2% of participants, osteopenia in 49.8%, sarcopenia in 19.5%, and osteosarcopenia in 16.4% of the sample.

The prevalence of osteosarcopenia increased with age, reaching 33.7% among individuals older than 80 years. Sarcopenia was detected in 34.4% of individuals with osteoporosis, while osteoporosis was present in 40.8% of those with sarcopenia. Falls, fractures, and functional

impairment were significantly more frequent among patients with osteosarcopenia. The authors therefore concluded that osteosarcopenia is a prevalent condition in older adults and is associated with an increased risk of falls, fractures, functional limitations, and mortality [23]. Kobayashi K. and colleagues (2020) conducted a study involving 427 healthy volunteers aged over 65 years, with a mean age of 71.4 years. Body mass index (BMI), calcaneal bone mineral density (%YAM), physical performance parameters, and skeletal muscle mass were assessed. Osteoporosis was diagnosed in 60 participants (14%), sarcopenia in 55 (13%), and osteosarcopenia in 36 (8%). The prevalence of osteosarcopenia was 8% among all participants, 12% among women, and 4% among men. Body mass index and back muscle strength were significantly lower in individuals with osteosarcopenia compared with those with sarcopenia ($p < 0.05$). In addition, body weight, BMI, body fat percentage, handgrip strength, and back muscle strength were significantly lower in participants with osteosarcopenia than in those with osteoporosis ($p < 0.05$). The authors concluded that osteosarcopenia was significantly associated with muscle weakness [14].

Nielsen B.R. and colleagues (2020) investigated the potential association between low bone mineral density (BMD) and muscle dysfunction in a Danish cohort of community-dwelling older adults. They also aimed to assess the prevalence of osteosarcopenia and how this prevalence varied according to the applied diagnostic thresholds. The results showed that osteoporosis was identified in 19.2% of participants, while sarcopenia was present in 2.7% when applying the EWGSOP2 and CSS cut-off values, respectively. Osteosarcopenia was detected in 1.5% of community-dwelling healthy older adults. Notably, individuals with sarcopenia exhibited lower bone mineral density and a higher risk of osteoporosis, whereas the reverse association—the prevalence of sarcopenia among individuals with osteoporosis—was less frequent. These findings highlight the need for simultaneous screening for sarcopenia and osteoporosis in older adults at high risk of falls and fractures [17]. According to a study by Reiss J. conducted in Austria (2019), which assessed the degree of sarcopenia and osteoporosis in hospitalized older adults and examined their association with nutritional and functional status, 148 patients were included. Of these, 15.6% had osteoporosis only, 13.5% had sarcopenia only, and 14.2% had osteosarcopenia. The prevalence of osteoporosis was higher among individuals with sarcopenia than among those without sarcopenia (51.3% vs. 21.6%, $p < 0.001$). Patients with sarcopenia, osteoporosis, and osteosarcopenia had lower BMI, MNA-SF (Mini Nutritional Assessment – Short Form) scores, handgrip strength, and gait speed ($p < 0.05$) compared with the control group (individuals without osteoporosis or sarcopenia, n = 80). The Barthel Index was lower in patients with sarcopenia and osteosarcopenia ($p < 0.05$), but not in patients with osteoporosis alone ($p = 0.07$). BMI and MNA-SF scores were lower in patients with osteosarcopenia compared with those with sarcopenia alone or osteoporosis alone ($p < 0.05$), while no differences in functional parameters were observed. The authors concluded that osteoporosis and sarcopenia are associated with nutritional deficiencies and reduced functional capacity in hospitalized older patients. Their coexistence (osteosarcopenia) is common and is associated with a higher degree of malnutrition than osteoporosis or sarcopenia alone [22]. Okamura H. and colleagues conducted a retrospective analysis of data from 276 consecutively examined patients with postmenopausal osteoporosis who regularly attended Showa University Hospital (Japan). Patients were divided into groups with osteosarcopenia and osteoporosis alone according to the diagnostic criteria of the Asian Working Group for Sarcopenia. Among the 276 patients with osteoporosis, 54 (19.6%) were diagnosed with osteosarcopenia. Low body mass index appeared to be the strongest factor associated with the development of osteosarcopenia, and none of the patients in the osteosarcopenia group were obese (BMI ≥ 27.5 kg/m²). Multivariate logistic regression analysis showed that patients aged 65–74 years with comorbid conditions such as renal dysfunction and elevated HbA1c levels were at increased risk of developing osteosarcopenia [18].

According to the study by Xiangfeng He et al. (2022), the overall prevalence of confirmed sarcopenia was 19.5% (17.1% in women and 23.1% in men). The aim of this study was to investigate the prevalence of sarcopenia and associated factors among older adults living in the Chongming District (China) based on the Asian Working Group for Sarcopenia 2019 diagnostic criteria. The results showed that increasing age, sex, and the presence of high body fat mass were associated with a higher likelihood of sarcopenia among all study participants [9].

Data on the global prevalence of osteosarcopenia and sarcopenia are presented in Table 1.

Table 1.

Prevalence of Sarcopenia and Osteosarcopenia

№	Author, year of publication	Country	Total sample	Prevalence	
				Osteosarcopenia	Sarcopenia
1.	Salech F, 2020r [23]	Chile	1119	16,4%	19,5%
2.	Kobayashi K, 2020[14]	Japan	427	8%	13%
3.	Nielsen BR, 2020[17]	Denmark	101	1,5%	-
4.	Reiss J,2019 [22]	Australia	148	14,2%	13,5
5.	Okamura H, 2020 [18]	Japan	276	19,6%	-
6.	Xiangfeng He,2022 [9]	China	1407	-	19,5%

The pathophysiology of osteosarcopenia is multifactorial. Both muscles and bones are highly plastic tissues and respond to external stimuli in a similar manner. Prolonged physical activity leads to a significant increase in muscle mass, strength, and physical function [13], as well as improvements in bone density and microarchitecture [7]. Conversely, periods of bed rest or physical inactivity result in a rapid decline in muscle mass and function,

accompanied by a slower reduction in bone density [2]. Recent studies confirm that the pathogenesis of sarcopenia is multifactorial, involving a combination of hormonal, inflammatory, metabolic, and neuromuscular disturbances, which together constitute a unified syndrome of muscle aging [25]. Although the exact pathogenesis of sarcopenia remains unclear, inflammation may play a key role. With aging, the body may experience a phenomenon known as "inflammaging," characterized by a chronic, low-grade inflammatory response. In this state, the body produces excessive amounts of pro-inflammatory cytokines, such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α). These pro-inflammatory cytokines are believed to promote muscle breakdown and inhibit muscle protein synthesis, accelerating the loss of muscle mass.

Chronic inflammation also disrupts the delicate balance between bone formation and resorption, leading to bone loss characteristic of osteoporosis and osteosarcopenia. Inflammatory cytokines reduce osteoblast activity and survival, limiting their ability to repair and regenerate bone tissue. Impaired bone remodeling contributes to decreased bone density and increased susceptibility to fractures. Furthermore, epidemiological studies have shown a positive association between osteoporosis and sarcopenia and elevated levels of C-reactive protein (CRP), a marker of active inflammation [3]. Biomarkers are crucial for the early detection, monitoring of progression, and evaluation of treatment efficacy in sarcopenia, providing a detailed assessment of muscle health. Vitamin D directly affects muscles through its receptor (VDR) located in muscle tissue. A meta-analysis of studies involving supplementation of at least 800 IU of vitamin D demonstrated that muscle mass significantly increases when vitamin D intake is combined with physical exercise. However, vitamin D supplementation alone, without accompanying physical activity or protein intake, appears to have little effect on muscle mass [29].

At the molecular level, a key factor is the imbalance between anabolic and catabolic processes. Reduced production of testosterone, estrogens, growth hormone, and insulin-like growth factor 1 (IGF-1) leads to suppression of muscle protein synthesis and atrophy of type II fibers. At the same time, the myostatin-dependent pathway is activated, inhibiting myogenesis and enhancing proteolysis. The development of chronic subclinical inflammation ("inflammaging") is accompanied by elevated levels of pro-inflammatory cytokines (IL-6, TNF-α, CRP), which activate NF-κB–dependent catabolic mechanisms [5]. Anabolic hormone deficiency may be a contributing factor in the development of musculoskeletal disorders. Over the past decade, remarkable progress has been made in understanding the functions of follicle-stimulating hormone (FSH) beyond fertility, particularly in bone metabolism. Its elevation during postmenopause plays a role in the pathogenesis of osteoporosis and sarcopenia. Serum FSH is generally considered to be inversely correlated with bone mineral density (BMD), while elevated FSH levels are positively associated with bone turnover [15].

Another hormone, estrogen, plays a critical role in maintaining bone and muscle health, and its deficiency is strongly linked to the pathogenesis of osteosarcopenia. Estrogen is essential for bone homeostasis, primarily due to its effects on bone remodeling. It regulates the balance between bone resorption and formation by acting on osteoclasts, osteoblasts, and osteocytes. Estrogen suppresses osteoclastogenesis by inhibiting the receptor activator of nuclear factor ligand (RANKL), a key promoter of osteoclast differentiation, while simultaneously increasing osteoprotegerin (OPG) levels, a decoy receptor for RANKL. This hormonal action helps preserve bone mass by limiting excessive bone resorption [21].

The relationship between parathyroid hormone (PTH) and sarcopenia is actively being studied in various countries. PTH contributes to the development of osteoporosis and sarcopenia through multiple mechanisms: stimulation of osteoblast precursor differentiation, inhibition of apoptosis in both osteoblasts and osteoclasts, and suppression of sclerostin production [1]. Chronic elevation of parathyroid hormone (PTH) levels (e.g., in secondary hyperparathyroidism, often associated with vitamin D deficiency) is associated with increased bone resorption (leading to osteoporosis and osteosarcopenia), enhanced calcium loss and impaired muscle contraction, elevated inflammatory cytokines (IL-6, TNF-α), and mitochondrial dysfunction in muscle cells. Consequently, elevated PTH levels are considered a negative prognostic factor for sarcopenia, particularly in older adults with vitamin D deficiency or osteoporosis [26]. Current evidence also indicates that thyroid dysfunction and changes in thyroid-stimulating hormone (TSH) levels may serve as hormonal predictors of sarcopenia, especially in older women [31]. According to the study by Qi X. et al. (2025), thyroid function in older adults with frailty was characterized by the following features: serum levels of free triiodothyronine (FT3) and thyroid-stimulating hormone (TSH) were decreased in frail patients, while serum free thyroxine (FT4) levels remained unchanged [20]. Hypothyroidism is associated with reduced muscle mass and function. Hyperthyroidism can lead to thyrotoxic myopathy, causing degeneration and weakening of muscle fibers, which may result in muscle mass loss and an increased risk of sarcopenia over time. It also accelerates protein turnover and muscle tissue catabolism [27]. Bone metabolism markers provide dynamic information on the status of the skeleton and skeletal muscles. During bone resorption, osteoclasts break down collagen and release the C-terminal telopeptide of type I collagen (CTX). Conversely, bone formation involves the production of osteoid, which is primarily composed of type I collagen—a key component also important for the formation of connective and muscle tissues. The assessment of such markers is currently relevant in both adult and aging populations [8]. The analysis of current literature indicates that osteosarcopenia is a clinically significant, multifactorial geriatric syndrome arising from the close pathogenetic interaction between bone and muscle tissues. Epidemiological data demonstrate considerable variability in the prevalence of osteosarcopenia across different populations, with a higher frequency observed among older women, which can be attributed to hormonal changes, age-related declines in physical activity, and nutritional deficiencies.

Recent studies confirm that the development of osteosarcopenia is driven by shared pathophysiological mechanisms, including chronic low-grade inflammation,

hormonal imbalances, vitamin D deficiency, disturbances in musculoskeletal metabolism, and reduced mechanical loading. Endocrine alterations (estrogens, androgens, growth hormone, IGF-1, parathyroid hormone, thyroid hormones), along with the activation of catabolic pathways and inhibition of anabolic processes at the molecular level, play a critical role in the syndrome's pathogenesis.

Currently, the diagnosis of osteosarcopenia is based on the integration of sarcopenia criteria (EWGSOP2, AWGS) with the assessment of bone mineral density, highlighting the necessity of a comprehensive approach to the evaluation of older patients. At the same time, the absence of unified international diagnostic criteria for osteosarcopenia and the limited availability of data from certain regions, including Kazakhstan, highlight persistent gaps in knowledge. Osteosarcopenia is therefore associated with a high risk of falls, fractures, functional dependency, and mortality, significantly worsening the prognosis and quality of life of older patients. This underscores the importance of early detection of the syndrome, the implementation of comprehensive screening programs, and the development of interdisciplinary preventive and therapeutic strategies aimed at preserving musculoskeletal health in aging populations.

Conclusion. Considering that osteosarcopenia is a recently recognized geriatric syndrome, its biological etiology and impact on clinical outcomes in older adults are only beginning to be explored. Further research is therefore needed to expand knowledge of this condition, including studies in the Kazakh population.

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