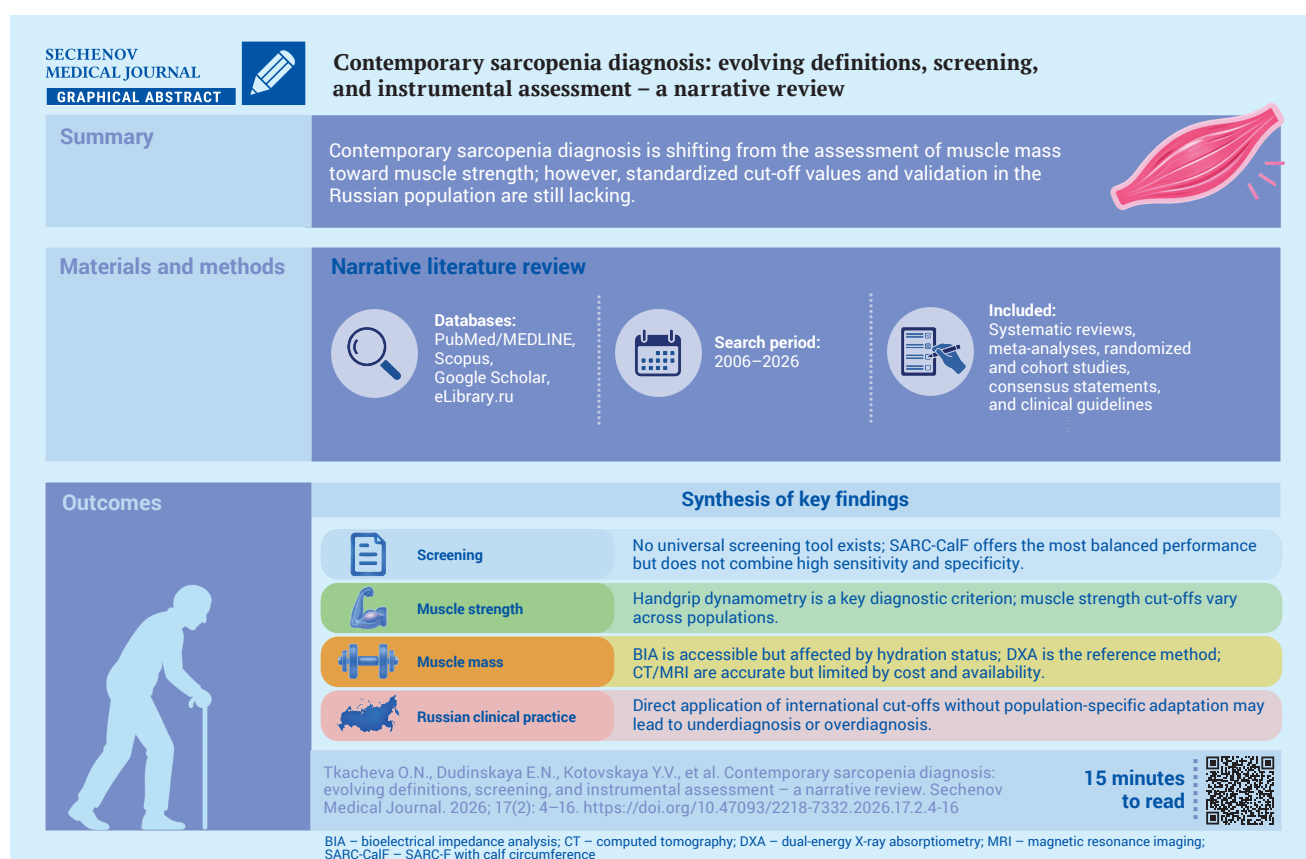


Contemporary sarcopenia diagnosis: evolving definitions, screening, and instrumental assessment – a narrative review

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Abstract

Sarcopenia currently affects 10–27% of people worldwide and 30–37% in the Russian Federation. Its social burden is considerable: the condition is associated with fractures, disability, and increased mortality. Sarcopenia nonetheless remains underdiagnosed. Diagnosis is hindered by the absence of universal criteria, standardized cutoff values, and widely available screening tools, while applying non-adapted foreign reference values to the Russian population may cause both under- and overdiagnosis.

Aim. To analyze the evolution of international and Russian approaches to sarcopenia diagnosis, assess the diagnostic value and limitations of available screening and instrumental methods, and formulate proposals for optimizing diagnostic strategies in clinical practice in the Russian Federation.

Materials and methods. A literature review on sarcopenia diagnosis was conducted using PubMed/MEDLINE, Scopus, Google Scholar, and eLibrary.ru for 2006–2026. Systematic reviews, meta-analyses, randomized controlled trials and cohort studies, consensus documents, and clinical guidelines were included.

Results. A shift was observed from the isolated assessment of muscle mass toward diagnostic models in which muscle strength serves as the primary criterion and physical performance as an indicator of disease severity.

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Handgrip dynamometry cutoff values varied across populations. In particular, muscle strength in Russians older than 65 years was at the lower limit of European reference values. No screening instrument demonstrated both high sensitivity and high specificity. The most balanced instrument, SARC-CalF, has not been validated in the Russian population. Instrumental methods are highly accurate; however, their use is limited by high cost, limited availability, dependence on hydration status, and the lack of standardized protocols.

Conclusion. To improve the effectiveness of sarcopenia diagnosis in Russia, national reference values should be developed, diagnostic protocols standardized, and screening instruments validated.

Keywords: muscle mass; muscle strength; physical performance; frailty; older age

MeSH terms:

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REVIEW

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Современная диагностика саркопении: эволюция определений, скрининг и инструментальная оценка – нарративный обзор

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Аннотация

В настоящее время распространенность саркопении в мире составляет 10–27%, в Российской Федерации – 30–37%. Данное состояние имеет большое социальное значение, ассоциируясь с переломами, утратой трудоспособности и увеличением риска смерти. Несмотря на это, саркопения остается недостаточно диагностируемым состоянием. Диагностика затрудняется отсутствием универсальных критериев, единых пороговых значений и широкодоступных инструментов скрининга, а применение к российской популяции неадаптированных зарубежных нормативов может привести как к гипо-, так и к гипердиагностике.

Цель. Проанализировать эволюцию международных и российских подходов к диагностике саркопении, оценить диагностическую ценность и ограничения доступных скрининговых и инструментальных методов,

сформулировать предложения по оптимизации диагностических стратегий в клинической практике Российской Федерации.

Материалы и методы. Проведен анализ литературы в базах PubMed/MEDLINE, Scopus, Google Scholar и eLibrary.ru за 2006–2026 гг. по вопросам диагностики саркопении. Включались систематические обзоры, мета-анализы, рандомизированные контролируемые и когортные исследования, консенсусные документы и клинические рекомендации.

Результаты. Прослежен переход от изолированной оценки мышечной массы к моделям, в которых мышечная сила служит первичным критерием, а физическая работоспособность – показателем тяжести. Показана вариабельность пороговых значений кистевой динамометрии между популяциями. В частности, у россиян старше 65 лет сила находится у нижней границы европейских норм. Ни один скрининговый инструмент не показал одновременно высокой чувствительности и специфичности. Наиболее сбалансированный из них – SARC-CalF – не валидирован на российской популяции. Инструментальные методы имеют высокую точность, однако их применение ограничено высокой стоимостью, доступностью, зависимостью от гидратационного статуса и отсутствием стандартизированных протоколов.

Заключение. Для повышения эффективности диагностики саркопении в России необходима разработка национальных референтных значений, стандартизация протоколов и валидация скрининговых инструментов.

Ключевые слова: мышечная масса; мышечная сила; физическая работоспособность; старческая астения; пожилой возраст

Рубрики MeSH:

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Соответствие принципам этики. Одобрение этического комитета и получение информированного согласия не требовались, поскольку статья представляет собой нарративный обзор ранее опубликованных исследований и не предполагает непосредственного участия людей или животных.

Конфликт интересов. Все авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с содержанием настоящей статьи.

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Abbreviations:

AMM – appendicular muscle mass

ASMI – appendicular skeletal muscle mass index

AUC – area under the ROC curve

AWGS – Asian Working Group for Sarcopenia

BIA – bioelectrical impedance analysis

BMI – body mass index

CT – computed tomography

DXA – dual-energy X-ray absorptiometry

EWGSOP – European Working Group on Sarcopenia in Older People

FNHIH – Foundation for the National Institutes of Health Sarcopenia Project

MRI – magnetic resonance imaging

MSRA – Mini Sarcopenia Risk Assessment
 MUAC – mid-upper arm circumference
 SARC-CalF – SARC-F with calf circumference

SARC-F – strength, assistance in walking, rise from a chair, climb stairs, falls
 SPPB – Short Physical Performance Battery

HIGHLIGHTS

The evolution of sarcopenia diagnostic criteria reflects a shift from muscle mass assessment to an integrative model in which muscle strength is the primary diagnostic criterion.

Among screening questionnaires, SARC-CalF shows the most balanced performance, yet its sensitivity does not exceed 53.3%.

Instrumental methods of muscle mass assessment are accurate but limited by cost, availability, and the absence of standardized protocols.

Transfer of European and Asian cutoff values to the Russian population without adaptation and validation may lead to systematic over- or underdiagnosis.

National reference values, unified measurement protocols, and validation of screening tools in Russian samples are required.

The relevance of sarcopenia research is determined by its direct impact on disability, hospitalizations, and mortality. Sarcopenia increases the risk of falls, fractures, and loss of independence in activities of daily living and is also associated with cardiovascular and respiratory diseases, as well as cognitive impairment [1, 2]. According to the United Nations, the proportion of people aged ≥ 65 years increased from 6% in 1990 to 9% in 2019 and is projected to reach 16% by 2050¹. The global prevalence of sarcopenia ranges from 10% to 27% [3], whereas in the Russian Federation it ranges from 30% to 37% [4, 5].

The aim of this review is to analyze the evolution of international and Russian approaches to sarcopenia diagnosis, assess the diagnostic value of available screening and instrumental methods, identify their limitations, and formulate proposals for optimizing diagnostic strategies in real-world clinical practice in the Russian Federation.

MATERIALS AND METHODS

For this narrative review, a literature search was conducted in the electronic databases PubMed/MEDLINE, Scopus, Google Scholar, and eLibrary.ru for the period from January 2006 to June 2026. The search strategy included combinations of the following terms in Russian and English: “sarcopenia”, “diagnosis”, “screening”, “muscle mass”, “muscle strength”, “physical performance”, “bioimpedance analysis”, “dual-energy X-ray absorptiometry”, “dynamometry”, “older adults”, and “frailty.”

The inclusion criteria comprised systematic reviews, meta-analyses, randomized controlled trials, large observational cohort studies, consensus documents, and clinical guidelines issued by the European Working Group on Sarcopenia in Older People (EWGSOP and EWGSOP2), Asian Working Group for Sarcopenia

(AWGS), Global Leadership Initiative in Sarcopenia (GLIS), Foundation for the National Institutes of Health Sarcopenia Project (FNIH), Sarcopenia Definition and Outcomes Consortium (SDOC), and the Russian Association of Gerontologists and Geriatricians (RAGG), as well as publications addressing the diagnosis, epidemiology, or pathogenesis of sarcopenia. The exclusion criteria were clinical case reports, animal studies, and publications not related to the diagnosis of sarcopenia.

Data extraction was performed independently by five authors, with disagreements resolved by consensus. For each included source, the following information was recorded: authors, year of publication, study design, study population, methods used for sarcopenia diagnosis, main findings, and limitations.

Evolution of sarcopenia diagnostic criteria: from muscle mass to function

The first step toward standardizing sarcopenia diagnosis was the EWGSOP consensus (2010), which defined sarcopenia as a syndrome characterized by progressive loss of skeletal muscle mass and strength [6]. In 2014, the FNIH, based on data from large cohort studies, proposed optimized cutoff values for muscle strength and muscle mass [7].

In 2016, sarcopenia received a separate M62.84 code in the International Classification of Diseases, Tenth Revision, Clinical Modification, used in the United States (ICD-10-CM); the code became effective on October 1, 2016, formally recognizing sarcopenia as a distinct disease entity rather than merely a syndrome [8]. This step not only emphasized the need for standardized diagnosis and treatment but also promoted convergence of diagnostic approaches at the global level. It should be noted that this refers specifically to the national clinical modification: in the core ICD-10 version of the World

¹ United Nations, Department of Economic and Social Affairs, Population Division. World Population Ageing 2019: Highlights. New York: United Nations; 2020. (ST/ESA/SER.A/444). <https://digitallibrary.un.org/record/3907988/files/WorldPopulationAgeing2019-Report.pdf> (access date: 26.07.2026).

Health Organization, which is also used in the Russian Federation, there is no separate category for sarcopenia, while code M62.8 denotes “Other specified disorders of muscle.”

In 2018, EWGSOP2 defined sarcopenia as a progressive and generalized skeletal muscle disorder [2]. In 2019, AWGS proposed ethnically adapted cutoff values [9]. SDOC emphasized the need to distinguish sarcopenia from cachexia and malnutrition [10], while GLIS (2024) separated diagnostic parameters into components and outcomes, including impaired physical performance, falls, and disability [11]. In 2025, AWGS published an updated consensus, extending the age range to 50–64 years, simplifying the diagnostic algorithm, and abandoning the category of “severe sarcopenia” in favor of “probable sarcopenia” [12].

In 2026, the clinical guidelines of the Russian Association of Gerontologists and Geriatricians defined sarcopenia as a progressive, age-associated, generalized, potentially reversible skeletal muscle disease associated with a high risk of falls, fractures, disability, and death².

Challenges in sarcopenia diagnosis

Despite substantial progress in understanding the pathogenetic mechanisms and clinical consequences of sarcopenia, its diagnosis remains challenging. This is due to the lack of universal diagnostic criteria, standardized cutoff values, and widely available screening tools.

According to the EWGSOP2, AWGS, and FNIH consensus recommendations, diagnosis follows a three-step approach: identification of reduced muscle strength, confirmation of low muscle mass, and, at the final stage, assessment of physical performance.

However, differences in the cutoff values used complicate interpretation of the results and comparison of data across populations.

Another major challenge is the lack of universal standards and readily accessible tools for diagnosing sarcopenia. Accurate methods for assessing muscle mass, including dual-energy X-ray absorptiometry (DXA), computed tomography (CT), and magnetic resonance imaging (MRI), are limited in routine use by their cost and technical requirements. Screening tools such as SARC-F (strength, assistance in walking, rise from a chair, climb stairs, falls) have low sensitivity at early stages.

Sarcopenia screening in primary care: opportunities and limitations

No universal screening test combines high sensitivity, specificity, and reproducibility [2, 13]. The SARC-F questionnaire is the most widely used screening tool;

a score of ≥ 4 points indicates a risk of sarcopenia [14]. However, its low sensitivity (21–61%, with a specificity of 86–91%) limits its use [15–20].

To improve diagnostic accuracy, several modifications incorporating anthropometric parameters have been developed. The most extensively studied is SARC-CalF (SARC-F with calf circumference), which includes measurement of calf circumference (cutoff values <34 cm in men and <33 cm in women; 10 additional points, with a total cutoff of ≥ 11) [21]. According to E.J. Kim et al. [22], the sensitivity of SARC-CalF is 53.3%, specificity is 87.3%, and the area under the ROC curve (AUC) is 0.78. Other modifications include SARC-F + MUAC (mid-upper arm circumference), SARC-F + EBM (elderly body mass) where age ≥ 75 years and body mass index (BMI) ≤ 21 kg/m², SARC-CalF + MUAC, and SARC-CalF + MUAC adjusted for BMI. Adding MUAC increases sensitivity while reducing specificity [23], whereas SARC-F + EBM improves identification of older patients with low body mass [24, 25]. These combined versions require further validation [23, 26].

Among non-questionnaire-based methods, the Ishii test, with cutoff values of ≥ 105 points for men and ≥ 120 points for women [27], showed the highest diagnostic accuracy in the study by A.B. de Lima et al. [23]: in men, sensitivity was 69.2%, specificity 97.1%, and AUC 0.831; in women, the corresponding values were 52.5%, 100%, and 0.762.

The MSRA (Mini Sarcopenia Risk Assessment) questionnaire, available in MSRA-7 and MSRA-5 versions, assesses age, hospitalizations, physical activity, nutritional status, and weight loss [28]. Cutoff values of ≤ 30 points for MSRA-7 and ≤ 45 points for MSRA-5 are associated with an increased risk of sarcopenia [28, 29]. MSRA has high sensitivity (80%) but comparatively lower specificity (50–60%); these diagnostic characteristics have been confirmed in validation studies conducted in different populations [28–31].

The choice of screening tool depends on the clinical setting and available resources. Amongst the Russian population, validation data for the tools discussed above remain limited: SARC-F has been studied mainly in selected disease-specific groups and showed a low diagnostic value [19], whereas data on SARC-CalF, the Ishii test, and MSRA are lacking. Moreover, the diagnostic accuracy of screening tools varies substantially across studies and populations [32], underscoring the need for their separate validation before widespread use in Russian clinical practice.

Table 1 presents a comparative overview of the main screening tools used to identify sarcopenia.

² Ministry of Health of the Russian Federation. Clinical Guidelines. Sarcopenia in Older and Very Old Patients (approved by the Ministry of Health of the Russian Federation, 2026). https://cr.minzdrav.gov.ru/preview-cr/1053_1/ (access date: 26.07.2026).

Table 1. Comparative characteristics of screening instruments for the detection of sarcopenia

Test	Components	Risk cutoff	Advantages	Limitations
SARC-F [14]	5 questions: muscle strength, walking, rising from a chair, climbing stairs, falls	≥4 points	Simple, rapid, and does not require equipment	Low sensitivity (21–61%); depends on cognitive status
SARC-CalF [21, 22]	SARC-F + CC	≥11 points; CC <34 cm in men, <33 cm in women	Higher diagnostic accuracy than SARC-F	Sensitivity ~53%; affected by edema and obesity
SARC-F + MUAC [23]	SARC-F + MUAC	≥12 points	Increases sensitivity by incorporating upper-arm anthropometry	Reduced specificity; possible false-positive results
SARC-F + EBM [24]	SARC-F + age ≥75 years + BMI ≤21 kg/m ²	≥12 points	Better identification of patients with low body mass	Depends on accurate assessment of BMI and age
SARC-CalF + MUAC [23]	SARC-F + CC + MUAC	≥12 points	Balance between sensitivity and specificity	Moderate accuracy; limited external validation
BMI-adjusted SARC-CalF + MUAC [23]	SARC-F + CC + MUAC adjusted for BMI	Not standardized	Potential applicability in patients with excess body weight	Requires further validation
Ishii test [27]	Age + handgrip strength + CC	≥105 points in men; ≥120 points in women	High diagnostic accuracy	Requires a dynamometer and calculator; population-specific cutoffs need clarification
MSRA 7/MSRA 5 [28]	Age, hospitalizations, physical activity, nutrition, weight loss	≤30 / ≤45 points	High sensitivity (~80%); takes nutritional and social factors into account	Low specificity (50–60%); depends on the accuracy of patient responses

Note: BMI – body mass index; CC – calf circumference; EBM – elderly body mass; MSRA – Mini Sarcopenia Risk Assessment; MUAC – mid-upper arm circumference; SARC-CalF – SARC-F with calf circumference; SARC-F – strength, assistance in walking, rise from a chair, climb stairs, falls.

Assessment of muscle strength: dynamometry as a key criterion

Handgrip dynamometry is a simple, inexpensive, and non-invasive method for assessing muscle strength and is widely used in geriatrics, rehabilitation, and epidemiological research. Low muscle strength is associated with an increased risk of functional limitations, hospitalization, cardiovascular events, and mortality [33, 34], which supports its inclusion in diagnostic algorithms for sarcopenia and frailty.

EWGSOP2 and AWGS 2025 identified low muscle strength as a central diagnostic parameter alongside muscle mass, with reduced strength regarded as a key early sign [2, 12]. However, the use of handgrip dynamometry is limited by variability in cutoff values, anthropometric differences, heterogeneity of measurement protocols, and differences between dynamometers [2, 35].

Historically, dynamometry has been developing since the nineteenth century, while the hydraulic Jamar dynamometer became a reference instrument in the 1950s [36, 37]. Analysis of the literature showed that even at that time measurement results were influenced by hand position, elbow flexion angle, number of attempts, and type of device [35, 37]. The standardized protocol of the American Society of Hand Therapists recommends measurements in a seated position, with the shoulders adducted and the elbows flexed at 90° [38]. V. Mathiowetz et al. [39] established early normative values and confirmed an age-related pattern, with peak strength around the age

of 30 years followed by a gradual decline. L.P. Fried et al. (2001) [40] included weakness in the frailty phenotype, considering handgrip strength a marker of vulnerability.

EWGSOP 2010 incorporated handgrip dynamometry into the diagnosis of sarcopenia, whereas EWGSOP2 substantially increased its diagnostic importance by defining low muscle strength as the primary criterion: values <27 kg in men and <16 kg in women indicate probable sarcopenia [2, 6]. AWGS 2019 proposed cutoff values of <28 kg for men and <18 kg for women in Asian populations [9]. AWGS 2025 requires concurrent reductions in muscle strength and muscle mass for the diagnosis of sarcopenia; the cutoff values are <28 and <18 kg for individuals aged ≥ 65 years and < 34 and < 20 kg for those aged 50–64 years, respectively [12].

There is no universal cutoff value for muscle strength. EWGSOP2 relies on the study by R.M. Dodds et al. (60,803 observations; a T-score approach using a value 2.5 standard deviations below peak strength) [41]. However, muscle strength depends on height, body mass, ethnicity, physical activity, and the measurement protocol. Historically, higher cutoff values have been used, including approximately 30 kg in men and 20 kg in women [42], as well as 37 kg in men and 21 kg in women for identifying the risk of mobility limitation [43], which highlights the dependence of cutoff values on the selected clinical outcome and population characteristics.

International differences are evident: in the PURE study (125,462 participants), handgrip strength was higher in Europe and North America and lower in South Asia and Africa [44]. A 2024 systematic review including 2.4 million adults from 69 countries showed that peak handgrip strength values were 49.7 kg in men and 29.7 kg in women aged 30–39 years, followed by a subsequent decline [45]. Comparison of Russian and Norwegian populations aged 40–69 years revealed persistent between-country differences in strength that could not be explained by protocol differences [46]. Russian data showed that muscle strength in individuals older than 65 years was at the lower end of European reference ranges; subsequently, Russian cutoff values of 24 kg for men and 17 kg for women were proposed, although the sample was limited to individuals up to 74 years of age [47, 48]. At the same time, the 2026 clinical guidelines for Russian practice adopted the EWGSOP2 cutoff values, making their validation in representative Russian cohorts a priority.

BMI-adjusted cutoff values are not intended for the diagnosis of sarcopenia [40]. A 2007 study found that muscle strength in Taiwanese individuals was 25–27% lower than the “consolidated norms,” which led to the development of regional reference values [49].

Methodological challenges include variability in measurement protocols, including patient position, number of attempts, and choice of hand [35], as well as differences between dynamometers.

Thus, muscle strength is not an independent diagnostic criterion for sarcopenia. Cutoff values depend on the population, age, sex, and the clinical outcome being assessed. Dynamometry requires standardization of the device, measurement protocol, and cutoff values. Otherwise, methodological variability may compromise the reproducibility of results.

Assessment of muscle mass: instrumental methods and their limitations

Bioelectrical impedance analysis (BIA) is an accessible method for assessing body composition based on the electrical resistance of tissues, allowing estimation of muscle mass, fat mass, and body water content. The main parameter used for diagnosing sarcopenia is the appendicular skeletal muscle mass index (ASMI; appendicular muscle mass / height²). According to AWGS 2019, the BIA cutoff values for ASMI are <7.0 kg/m² in men and <5.7 kg/m² in women [9].

However, not all devices are capable of separately estimating muscle mass in the arms and legs, which limits calculation of ASMI. In such cases, alternative indices are used, including the skeletal muscle index (total muscle mass / height²) or lean mass index, although their cutoff values are less standardized and require population-specific validation.

BIA also provides the phase angle as a marker of soft-tissue quality, reflecting metabolic characteristics and hydration status. Higher values are assumed to indicate greater cell membrane integrity [50, 51]. Results may be distorted in the presence of metal or silicone implants, cardiac pacemakers, and the use of certain medications. No universally accepted phase-angle cutoff values for sarcopenia diagnosis have been established, highlighting the need for further research.

DXA in whole-body mode is a key method for assessing muscle mass and is based on differential X-ray absorption by soft tissues. Particular importance is placed on the assessment of appendicular muscle mass (AMM; the sum of muscle mass in the limbs) and ASMI. EWGSOP2 defines low muscle mass as an ASMI <7.0 kg/m² in men and <5.5 kg/m² in women, corresponding to AMM values of ≤20 kg and ≤15 kg, respectively [2].

In obese patients, alternative indices are used, including AMM/BMI (<0.789 in men and <0.512 in women according to FNIH) or AMM/body weight, which correlate more closely with physical performance [7]. AWGS 2025 proposes age-specific ASMI cutoff values: <7.2 kg/m² in men and <5.5 kg/m² in women aged 50–64 years, and <7.0 kg/m² and <5.4 kg/m², respectively, in individuals aged ≥65 years [12].

A meta-analysis in professional athletes showed that BIA systematically overestimates lean mass compared with DXA, by an average of 2.78 kg. However, these findings cannot be directly extrapolated to the general population because of differences in body composition [52]. In addition, DXA cannot distinguish skeletal muscle tissue from other components of lean mass, such as fluid, glycogen, and connective tissue, which may lead to overestimation of muscle mass in the presence of edema. The method is also subject to projection-related errors, including tissue overlap, positioning artifacts, and the presence of implants. DXA provides primarily quantitative assessment and does not directly characterize muscle quality, architecture, or fatty infiltration, which limits its prognostic value.

Table 2 summarizes the key parameters of BIA, DXA, and imaging-based methods.

Specific considerations in defining reference values for muscle mass

One of the fundamental studies that established reference values for muscle mass in European populations was the Rosetta Study, a body composition research project. Its findings were used by R.N. Baumgartner et al. (1998) [53], who developed and validated an anthropometric equation for predicting AMM, using DXA as the reference method. The equation demonstrated high accuracy ($R^2 = 0.91$; standard error of the estimate = 1.58 kg), allowing its use in epidemiological studies when instrumental methods were unavailable. An

Table 2. Comparative characteristics of instrumental methods for muscle mass assessment

Method	Main parameters and cutoff values	Advantages	Limitations	Recommendations for use
BIA	ASMI: <7.0 kg/m ² in men, <5.7 kg/m ² in women (AWGS 2019) [9]; phase angle: <4.05° in men, <3.55° in women [51]	Accessibility, portability, absence of ionizing radiation, and low cost	Dependent on hydration status, unable to assess muscle quality, and limited accuracy in obesity	For screening and initial assessment of muscle mass when DXA is unavailable; hydration status must be taken into account
DXA	ASMI: <7.0 kg/m ² in men, <5.5 kg/m ² in women (EWGSOP2) [2]; AMM/BMI: <0.789 in men, <0.512 in women (FNIH) [7]	"Gold standard" for quantitative assessment of body composition; high reproducibility	Projection-related distortions, inability to assess muscle quality, ionizing radiation, high cost, and limited availability	Preferred method for diagnostic confirmation when available; reference method for quantitative assessment
CT / MRI	SMI at L3: <52.4 cm ² /m ² in men, <38.5 cm ² /m ² in women (CT) [57]; analogous protocols for MRI [58]	Direct visualization; assessment of cross-sectional muscle area and fatty infiltration (myosteatosis); absence of projection-related distortions	High cost, limited availability, radiation exposure with CT, long examination time, labor-intensive segmentation, and lack of standardized cutoff values	For in-depth assessment, including muscle quality and myosteatosis, as well as for research purposes

Note: AMM – appendicular muscle mass; ASMI – appendicular skeletal muscle mass index; AWGS – Asian Working Group for Sarcopenia; BIA – bioelectrical impedance analysis; BMI – body mass index; CT – computed tomography; DXA – dual-energy X-ray absorptiometry; EWGSOP2 – European Working Group on Sarcopenia in Older People 2; FNIH – Foundation for the National Institutes of Health Sarcopenia Project; L3 – third lumbar vertebra; MRI – magnetic resonance imaging; SMI – skeletal muscle index.

operational definition of sarcopenia was proposed based on the AMM/height² index, with sarcopenia defined as a value more than 2 standard deviations below the mean of a young reference population. The cutoff values were 7.26 kg/m² for men and 5.45 kg/m² for women [53]. This approach subsequently formed the basis for later consensus definitions, including EWGSOP and FNIH. The Health ABC Study confirmed the applicability of these reference values and contributed to the development of the EWGSOP 2010 criteria [54].

Asian studies that subsequently informed the AWGS 2014 consensus demonstrated poor agreement with the Baumgartner equation for identifying low muscle mass [55]. The limitations of height-adjusted muscle mass assessment were particularly evident in women, as the index did not adequately reflect age-related loss of muscle mass because of the substantial decline in height with age. A 2011 study in a Chinese population reported similar findings: the AMM/height² cutoff values for Chinese adults (5.85 kg/m² for men and 4.23 kg/m² for women) were substantially lower than those reported for the US population (7.26 and 5.45 kg/m², respectively), while the cutoff value for women was even lower than that reported in Hong Kong (4.82 kg/m²) [56]. These findings called into question the universality of this approach and highlighted the need for ethnicity-specific criteria in Asian populations.

Computed tomography and magnetic resonance imaging

CT and MRI are among the most reliable methods for assessing muscle mass because they provide three-dimensional measurements and avoid the

projection-related distortions inherent to DXA. CT allows assessment of muscle density in Hounsfield units and segmentation of muscle tissue on axial images, distinguishing it from adipose and connective tissue and enabling calculation of the skeletal muscle index. The conventional approach involves measuring the cross-sectional muscle area at the level of the third lumbar vertebra and normalizing it to the patient's height, which correlates with total body muscle mass [57, 58]. The routine use of CT and MRI for screening is limited by high cost, radiation exposure with CT, and the labor-intensive nature of manual image segmentation.

Assessment of physical performance: functional tests as indicators of sarcopenia severity

In current diagnostic algorithms, physical performance tests are used to stratify disease severity rather than to replace muscle mass assessment. According to EWGSOP2, severe sarcopenia is diagnosed when reduced muscle strength, low muscle mass, and impaired physical performance are present simultaneously. The most commonly used tests are the Timed Up and Go test, the 4-m gait speed test, and the Short Physical Performance Battery (SPPB), which assess mobility, balance, endurance, and lower-extremity function [2, 59].

A Timed Up and Go result of ≥20 s indicates poor physical performance and, when accompanied by reduced muscle strength and muscle mass, severe sarcopenia [2, 60]. Diagnostic accuracy varies across populations: in hospitalized older patients, a cutoff of ≥10.85 s showed a sensitivity of 67.0%, specificity of 88.7%, and AUC of 0.80 [61, 62]; in older women,

the AUC was 0.703, while a cutoff of 9.8 s yielded a sensitivity of 89.8% and specificity of 41.7% [63]. The advantages of the test include rapid administration and integrated assessment, whereas its limitations include the influence of neurological, vestibular, and cognitive impairment and the absence of a universally accepted cutoff [64].

The 4-m gait speed test, with a cutoff of ≤ 0.8 m/s, indicates impaired physical performance [2, 65]. According to a meta-analysis, each 0.1 m/s decrease in gait speed is associated with a 12% increase in mortality risk [66]. However, the test has limited diagnostic value for sarcopenia [64]. A five-repetition chair stand time >15 s is interpreted as reduced lower-extremity strength and may be used as an alternative to handgrip dynamometry [2, 59]. In the study by L.A. da Costa Teixeira et al. [63], the test demonstrated moderate diagnostic accuracy (AUC <0.7). Its limitations include the influence of joint pain, chair height, and performance technique.

The SPPB includes three components: balance tests, 4-m gait speed, and the five-repetition chair stand test; each component is scored from 0 to 4 points, with a total score ranging from 0 to 12 [67]. A score of ≤ 8 points indicates poor physical performance and can be used to confirm severe sarcopenia. In the study by S. Phu et al. [68], the SPPB demonstrated moderate diagnostic performance (AUC 0.644–0.770); a cutoff of ≤ 8 points showed high sensitivity (82–100%) but low specificity (36–41%). The limitations of the SPPB include the relatively longer administration time and moderate specificity.

Directions for future research in the Russian Federation

To advance toward personalized, evidence-based diagnosis of sarcopenia in Russia, a number of coordinated scientific and organizational measures are required:

1. Establishment of multicenter population-based cohorts to determine reference values for muscle strength and muscle mass, taking into account sex, age, ethnicity, region of residence, level of physical activity, and comorbidities. Studies should include not only older

adults (≥ 65 years) but also middle-aged individuals (50–64 years), in line with the current emphasis on early detection and prevention.

2. Development and validation of Russian screening tools or adaptation of existing instruments, with determination of optimal cutoff values for the Russian population. Particular interest lies in creating simple questionnaire-based tools that do not require specialized equipment and account for Russian sociocultural characteristics.

3. Standardization of dynamometry protocols at the national level, including mandatory specification of the device type, patient position, number of attempts, and method used to calculate the final result, as well as cross-calibration studies between different dynamometer models to ensure comparability of results.

4. Evaluation of the comparative performance of BIA and DXA in the Russian population and development of algorithms to correct systematic BIA measurement error for use in healthcare settings where DXA is unavailable.

5. Investigation of the prognostic value of diagnostic criteria in relation to clinically significant outcomes, including falls, fractures, hospitalizations, loss of independence, and mortality, in Russian cohorts in order to identify clinically meaningful cutoff values.

CONCLUSION

Sarcopenia represents a major global challenge for healthcare systems in the context of population ageing. However, its effective detection and management require population-specific epidemiological and clinical data. Direct application of international criteria to Russian clinical practice without appropriate adaptation and validation may reduce diagnostic accuracy and increase the risk of unnecessary healthcare expenditures.

An integrated diagnostic algorithm is needed that combines accessible screening tools, standardized dynamometry, and stepwise instrumental confirmation. Integration of international experience with national research will facilitate the development of a sarcopenia diagnostic system consistent with the principles of evidence-based medicine and the needs of the Russian healthcare system.

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REFERENCES / ЛИТЕРАТУРА

- Newman A.B., Kupelian V., Visser M., et al. Strength, but not muscle mass, is associated with mortality in the health, aging and body composition study cohort. *J Gerontol A Biol Sci Med Sci*. 2006 Jan; 61(1): 72–77. <https://doi.org/10.1093/gerona/61.1.72>. PMID: 16456196
- Cruz-Jentoft A.J., Bahat G., Bauer J., et al. Sarcopenia: revised European consensus on definition and diagnosis. *Age Ageing*. 2019 Jan; 48(1): 16–31. <https://doi.org/10.1093/ageing/afy169>. Erratum in: *Age Ageing*. 2019 Jul 1; 48(4): 601. <https://doi.org/10.1093/ageing/afz046>. PMID: 30312372
- Petermann-Rocha F., Balntzi V., Gray S.R., et al. Global prevalence of sarcopenia and severe sarcopenia: a systematic review and meta-analysis. *J Cachexia Sarcopenia Muscle*. 2022 Feb; 13(1): 86–99. <https://doi.org/10.1002/jcsm.12783>. Epub 2021 Nov 23. PMID: 34816624. EDN: TTXHLL
- Сафонова Ю.А., Зоткин Е.Г. Частота саркопении в старших возрастных группах: оценка диагностических критериев. *Научно-практическая ревматология*. 2020; 58(2): 147–153. <https://doi.org/10.14412/1995-4484-2020-147-153>. EDN: SPYYUX / Safonova Yu.A., Zotkin E.G. The frequency of sarcopenia in older age groups: evaluation of diagnostic criteria. *Rheumatology Science and Practice*. 2020; 58(2): 147–153 (In Russian). <https://doi.org/10.14412/1995-4484-2020-147-153>. EDN: SPYYUX
- Бочарова К.А., Герасименко А.В., Жабоева С.Л. Изучение распространенности саркопении у пациентов в системе первичной медико-санитарной помощи. *Современные проблемы науки и образования*. 2014; 6: 1149 / Bocharova K.A., Gerasimenko A.V., Zhaboeva S.L. Studying of prevalence of sarcopenia at patients in outpatient health care system. *Modern problems of science and education*. 2014; 6: 1149. EDN: TGQWIX
- Cruz-Jentoft A.J., Baeyens J.P., Bauer J.M., et al. Sarcopenia: European consensus on definition and diagnosis: report of the European working group on sarcopenia in older people. *Age Ageing*. 2010 Jul; 39(4): 412–423. <https://doi.org/10.1093/ageing/afq034>. Epub 2010 Apr 13. PMID: 20392703
- McLean R.R., Shardell M.D., Alley D.E., et al. Criteria for clinically relevant weakness and low lean mass and their longitudinal association with incident mobility impairment and mortality: The Foundation for the National Institutes of Health (FNIH) sarcopenia project. *J Gerontol A Biol Sci Med Sci*. 2014 May; 69(5): 576–583. <https://doi.org/10.1093/gerona/glu012>. PMID: 24737560
- Cao L., Morley J.E. Sarcopenia is recognized as an independent condition by an international classification of disease, tenth revision, clinical modification (ICD-10-CM) code. *J Am Med Dir Assoc*. 2016 Aug; 17(8): 675–677. <https://doi.org/10.1016/j.jamda.2016.06.001>. PMID: 27470918
- Chen L.K., Woo J., Assantachai P., et al. Asian working group for sarcopenia: 2019 consensus update on sarcopenia diagnosis and treatment. *J Am Med Dir Assoc*. 2020 Mar; 21(3): 300–307. e2. <https://doi.org/10.1016/j.jamda.2019.12.012>. Epub 2020 Feb 4. PMID: 32033882. EDN: BZZZWA
- Bhasin S., Travison T.G., Manini T.M., et al. Sarcopenia definition: the position statements of the sarcopenia definition and outcomes consortium. *J Am Geriatr Soc*. 2020 Jul; 68(7): 1410–1418. <https://doi.org/10.1111/jgs.16372>. Epub 2020 Mar 9. PMID: 32150289. EDN: WQVAGI
- Kirk B., Cawthon P.M., Arai H., et al. The conceptual definition of sarcopenia: delphi consensus from the global leadership initiative in sarcopenia (GLIS). *Age Ageing*. 2024 Mar; 53(3): afae052. <https://doi.org/10.1093/ageing/afae052>. PMID: 38520141. EDN: ZMUGAQ
- Chen L.K., Hsiao F.Y., Akishita M., et al. A focus shift from sarcopenia to muscle health in the Asian working group for sarcopenia 2025 consensus update. *Nat Aging*. 2025 Nov; 5(11): 2164–2175. <https://doi.org/10.1038/s43587-025-01004-y>. Epub 2025 Nov 4. PMID: 41188603. EDN: VUIWLO
- Dent E., Morley J.E., Cruz-Jentoft A.J., et al. International clinical practice guidelines for sarcopenia (ICFSR): screening, diagnosis and management. *J Nutr Health Aging*. 2018; 22(10): 1148–1161. <https://doi.org/10.1007/s12603-018-1139-9>. PMID: 30498820. EDN: TMQBEV
- Malmstrom T.K., Morley J.E. SARC-F: a simple questionnaire to rapidly diagnose sarcopenia. *J Am Med Dir Assoc*. 2013 Aug; 14(8): 531–532. <https://doi.org/10.1016/j.jamda.2013.05.018>. Epub 2013 Jun 25. PMID: 23810110
- Nishikawa H., Asai A., Fukunishi S., et al. Screening tools for sarcopenia. *In Vivo*. 2021 Nov-Dec; 35(6): 3001–3009. <https://doi.org/10.21873/invivo.12595>. PMID: 34697131
- Malmstrom T.K., Miller D.K., Simonsick E.M., et al. SARC-F: a symptom score to predict persons with sarcopenia at risk for poor functional outcomes. *J Cachexia Sarcopenia Muscle*. 2016 Mar; 7(1): 28–36. <https://doi.org/10.1002/jcsm.12048>. Epub 2015 Jul 7. PMID: 27066316
- Lu J.L., Ding L.Y., Xu Q., et al. Screening accuracy of SARC-F for sarcopenia in the elderly: a diagnostic meta-analysis. *J Nutr Health Aging*. 2021; 25(2): 172–182. <https://doi.org/10.1007/s12603-020-1471-8>. PMID: 33491031. EDN: YJLGZC
- Ida S., Kaneko R., Murata K. SARC-F for screening of sarcopenia among older adults: a meta-analysis of screening test accuracy. *J Am Med Dir Assoc*. 2018 Aug; 19(8): 685–689. <https://doi.org/10.1016/j.jamda.2018.04.001>. Epub 2018 May 31. PMID: 29778639
- Торопцова Н.В., Добровольская О.В., Ефремова А.О., Никитинская О.А. Диагностическая значимость опросника SARC-F и тестов оценки мышечной силы для выявления саркопении у больных ревматоидным артритом. *Научно-практическая ревматология*. 2020; 58(6): 678–682. <https://doi.org/10.47360/1995-4484-2020-678-682>. EDN: QGKYYP / Toroptsova N.V., Dobrovolskaya O.V., Efremova A.O., Nikitinskaya O.A. Diagnostic value of the SARC-F questionnaire and muscle strength tests for the detection of sarcopenia in patients with rheumatoid arthritis. *Rheumatology Science and Practice*. 2020; 58(6): 678–682 (In Russian). <https://doi.org/10.47360/1995-4484-2020-678-682>. EDN: QGKYYP
- Barbosa-Silva T.G., Menezes A.M.B., Bielemann R.M., et al. Enhancing SARC-F: improving sarcopenia screening in the clinical practice. *J Am Med Dir Assoc*. 2016 Dec; 17(12): 1136–1141. <https://doi.org/10.1016/j.jamda.2016.08.004>. Epub 2016 Sep 17. PMID: 27650212
- Bahat G., Oren M.M., Yilmaz O., et al. Comparing SARC-F with SARC-CalF to screen sarcopenia in community living older adults. *J Nutr Health Aging*. 2018; 22(9): 1034–1038. <https://doi.org/10.1007/s12603-018-1072-y>. PMID: 30379299. EDN: MQKXYP
- Kim E.J., Hong S., Kim D.Y., Son Y.J. Diagnostic accuracy of the SARC-CalF in community-dwelling older adults: a systematic review and meta-analysis. *Gerontologist*. 2025 Nov; 65(12): gnaf258. <https://doi.org/10.1093/geront/gnaf258>. PMID: 41270807. EDN: QRAZNS
- de Lima A.B., Merchant R.A., Henriques-Neto D. Diagnostic accuracy of sarcopenia screening tools in low-income older adults in Amazonas, Brazil. *Aging Clin Exp Res*. 2025 Oct; 37(1): 307. <https://doi.org/10.1007/s40520-025-03180-8>. PMID: 41165917. EDN: JBWJUV
- Kurita N., Wakita T., Kamitani T., et al. SARC-F validation and SARC-F+EBM derivation in musculoskeletal disease: the SPSS-OK study. *J Nutr Health Aging*. 2019; 23(8): 732–738.

- <https://doi.org/10.1007/s12603-019-1222-x>. PMID: 31560031. EDN: UJSZOG
25. Krzyżnińska-Siemaszkó R., Deskur-Śmielecka E., Kalużniak-Szymanowska A., et al. Comparison of diagnostic performance of SARC-F and its two modified versions (SARC-CalF and SARC-F+EBM) in community-dwelling older adults from Poland. *Clin Interv Aging*. 2020 Apr; 15: 583–594. <https://doi.org/10.2147/CIA.S250508>. PMID: 32425513. EDN: UJSSFC
 26. Nascimento T.G., Fayh A.P.T., Silva F.M., et al. SARC-F and six modified versions: prognostic role for prolonged hospital stay and 1-year mortality in older inpatients. *BMC Geriatr*. 2026 Jan; 26(1): 220. <https://doi.org/10.1186/s12877-026-07012-w>. PMID: 41572171. EDN: WIBBXN
 27. Ishii S., Tanaka T., Shibasaki K., et al. Development of a simple screening test for sarcopenia in older adults. *Geriatr Gerontol Int*. 2014 Feb; 14 Suppl 1: 93–101. <https://doi.org/10.1111/ggi.12197>. PMID: 24450566
 28. Rossi A.P., Micciolo R., Rubele S., et al. Assessing the risk of sarcopenia in the elderly: the mini sarcopenia risk assessment (MSRA) questionnaire. *J Nutr Health Aging*. 2017; 21(6): 743–749. <https://doi.org/10.1007/s12603-017-0921-4>. PMID: 28537342. EDN: WMXJMM
 29. Krzyżnińska-Siemaszkó R., Deskur-Śmielecka E., Styszyński A., Wieczorowska-Tobis K. Polish translation and validation of the mini sarcopenia risk assessment (MSRA) questionnaire to assess nutritional and non-nutritional risk factors of sarcopenia in older adults. *Nutrients*. 2021 Mar; 13(4): 1061. <https://doi.org/10.3390/nu13041061>. PMID: 33805185
 30. Akarapornkrailert P., Muangpaisan W., Boonpeng A., Daengdee D. Validation of the Thai version of SARC-F, MSRA-7, and MSRA-5 questionnaires compared to AWGS 2019 and sarcopenia risks in older patients at a medical outpatient clinic. *Osteoporos Sarcopenia*. 2020 Dec; 6(4): 205–211. <https://doi.org/10.1016/j.afos.2020.11.006>. Epub 2020 Nov 26. PMID: 33426310. EDN: LODXYC
 31. Yang M., Hu X., Xie L., et al. Validation of the Chinese version of the mini sarcopenia risk assessment questionnaire in community-dwelling older adults. *Medicine (Baltimore)*. 2018 Sep; 97(37): e12426. <https://doi.org/10.1097/MD.00000000000012426>. PMID: 30213020
 32. Huang L., Shu X., Ge N., et al. The accuracy of screening instruments for sarcopenia: a diagnostic systematic review and meta-analysis. *Age Ageing*. 2023 Aug; 52(8): afad152. <https://doi.org/10.1093/ageing/afad152>. PMID: 37596923. EDN: XFWZEV
 33. Cooper R., Kuh D., Hardy R. Objectively measured physical capability levels and mortality: systematic review and meta-analysis. *BMJ*. 2010 Sep; 341: c4467. <https://doi.org/10.1136/bmj.c4467>. PMID: 20829298
 34. Wu Y., Wang W., Liu T., Zhang D. Association of grip strength with risk of all-cause mortality, cardiovascular diseases, and cancer in community-dwelling populations: a meta-analysis of prospective cohort studies. *J Am Med Dir Assoc*. 2017 Jun; 18(6): 551.e17–551.e35. <https://doi.org/10.1016/j.jamda.2017.03.011>. PMID: 28549705
 35. Roberts H.C., Denison H.J., Martin H.J., et al. A review of the measurement of grip strength in clinical and epidemiological studies: towards a standardised approach. *Age Ageing*. 2011 Jul; 40(4): 423–429. <https://doi.org/10.1093/ageing/afr051>. PMID: 21624928
 36. Bohannon R.W., Peolsson A., Massy-Westropp N., et al. Reference values for adult grip strength measured with a Jamar dynamometer: a descriptive meta-analysis. *Physiotherapy*. 2006 Mar; 92(1): 11–15. <https://doi.org/10.1016/j.physio.2005.05.003>
 37. Sousa-Santos A.R., Amaral T.F. Differences in handgrip strength protocols to identify sarcopenia and frailty – a systematic review. *BMC Geriatr*. 2017 Oct; 17(1): 238. <https://doi.org/10.1186/s12877-017-0625-y>. PMID: 29037155. EDN: YILXPS
 38. MacDermid J., Solomon G., Valdes K., eds. *Clinical assessment recommendations*. 3rd ed. Mount Laurel, NJ: American Society of Hand Therapists; 2015. 80 p. ISBN: 978-0-69252-515-9
 39. Mathiowetz V., Kashman N., Volland G., et al. Grip and pinch strength: normative data for adults. *Arch Phys Med Rehabil*. 1985 Feb; 66(2): 69–74. PMID: 3970660
 40. Fried L.P., Tangen C.M., Walston J., et al. Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci*. 2001 Mar; 56(3): 146–157. <https://doi.org/10.1093/gerona/56.3.m146>. PMID: 11253156
 41. Dodds R.M., Syddall H.E., Cooper R., et al. Grip strength across the life course: normative data from twelve British studies. *PLoS One*. 2014 Dec; 9(12): e113637. <https://doi.org/10.1371/journal.pone.0113637>. PMID: 25474696
 42. Lauretani F., Russo C.R., Bandinelli S., et al. Age-associated changes in skeletal muscles and their effect on mobility: an operational diagnosis of sarcopenia. *J Appl Physiol* (1985). 2003 Nov; 95(5): 1851–1860. <https://doi.org/10.1152/japphysiol.00246.2003>. PMID: 14555665
 43. Sallinen J., Stenholm S., Rantanen T., et al. Hand-grip strength cut points to screen older persons at risk for mobility limitation. *J Am Geriatr Soc*. 2010 Sep; 58(9): 1721–1726. <https://doi.org/10.1111/j.1532-5415.2010.03035.x>. PMID: 20863331
 44. Leong D.P., Teo K.K., Rangarajan S., et al. Reference ranges of handgrip strength from 125,462 healthy adults in 21 countries: a prospective urban rural epidemiologic (PURE) study. *J Cachexia Sarcopenia Muscle*. 2016 Dec; 7(5): 535–546. <https://doi.org/10.1002/jcsm.12112>. Epub 2016 Apr 12. PMID: 27104109
 45. Tomkinson G.R., Lang J.J., Rubin L., et al. International norms for adult handgrip strength: a systematic review of data on 2.4 million adults aged 20 to 100+ years from 69 countries and regions. *J Sport Health Sci*. 2025 Dec; 14: 101014. <https://doi.org/10.1016/j.jshs.2024.101014>. Epub 2024 Dec 6. PMID: 39647778. EDN: BSSCKI
 46. Cooper R., Shkolnikov V.M., Kudryavtsev A.V., et al. Between-study differences in grip strength: a comparison of Norwegian and Russian adults aged 40–69 years. *J Cachexia Sarcopenia Muscle*. 2021 Dec; 12(6): 2091–2100. <https://doi.org/10.1002/jcsm.12816>. Epub 2021 Oct 3. PMID: 34605224. EDN: DPAEFR
 47. Турушева А.В., Фролова Е.В., Дегриз Я.М. Расчет возрастных норм результатов кистевой динамометрии для здоровых людей старше 65 лет в Северо-Западном регионе России: результаты проспективного когортного исследования «Хрусталь». *Российский семейный врач*. 2017; 21(4): 29–35. <https://doi.org/10.17816/RFD2017429-35>. EDN: YMQKLK / Turusheva A.V., Frolova E.V., Degryse J. Development of reference ranges of handgrip strength among healthy adults 65+ in Northwest Russia: a prospective population-based cohort Crystal study. *Russian Family Doctor*. 2017; 21(4): 29–35 (In Russian). <https://doi.org/10.17816/RFD2017429-35>. EDN: YMQKLK
 48. Капустина А.В., Шальнова С.А., Куценко В.А. и др. Оценка мышечной силы с помощью кистевой динамометрии в российской популяции среднего и пожилого возраста и ее ассоциации с показателями здоровья. *Кардиоваскулярная терапия и профилактика*. 2023; 22(8S): 3792. <https://doi.org/10.15829/1728-8800-2023-3792>. EDN: LSHNBA / Kapustina A.V., Shalnova S.A., Kutsenko V.A., et al. Assessment of muscle strength using handgrip test in a middle-aged and elderly Russian population and its association with health characteristics. *Cardiovascular Therapy and Prevention*. 2023; 22(8S): 3792 (In Russian). <https://doi.org/10.15829/1728-8800-2023-3792>. EDN: LSHNBA

49. Wu S.W., Wu S.F., Liang H.W., et al. Measuring factors affecting grip strength in a Taiwan Chinese population and a comparison with consolidated norms. *Appl Ergon.* 2009 Jul; 40(4): 811–815. <https://doi.org/10.1016/j.apergo.2008.08.006>. Epub 2008 Oct 23. PMID: 18947819
50. Uemura K., Doi T., Tsutsumimoto K., et al. Predictivity of bioimpedance phase angle for incident disability in older adults. *J Cachexia Sarcopenia Muscle.* 2020 Feb; 11(1): 46–54. <https://doi.org/10.1002/jcsm.12492>. Epub 2019 Aug 22. PMID: 31436391
51. Yamada M., Kimura Y., Ishiyama D., et al. Phase angle is a useful indicator for muscle function in older adults. *J Nutr Health Aging.* 2019; 23(3): 251–255. <https://doi.org/10.1007/s12603-018-1151-0>. PMID: 30820513. EDN: EYAYOI
52. Dzator S., Weerasekara I., Shields M., et al. Agreement between dual-energy X-ray absorptiometry and bioelectric impedance analysis for assessing body composition in athletes: a systematic review and meta-analysis. *Clin J Sport Med.* 2023 Sep; 33(5): 557–568. <https://doi.org/10.1097/JSM.0000000000001136>. Epub 2023 Feb 28. PMID: 36853902. EDN: PLRBZJ
53. Baumgartner R.N., Koehler K.M., Gallagher D., et al. Epidemiology of sarcopenia among the elderly in New Mexico. *Am J Epidemiol.* 1998 Apr; 147(8): 755–763. <https://doi.org/10.1093/oxfordjournals.aje.a009520>. Erratum in: *Am J Epidemiol* 1999 Jun 15; 149(12): 1161. PMID: 9554417. EDN: IKMFOZ
54. Newman A.B., Kupelian V., Visser M., et al. Sarcopenia: alternative definitions and associations with lower extremity function. *J Am Geriatr Soc.* 2003 Nov; 51(11): 1602–1609. <https://doi.org/10.1046/j.1532-5415.2003.51534.x>. PMID: 14687390. EDN: EUBPTN
55. Kim Y.S., Lee Y., Chung Y.S., et al. Prevalence of sarcopenia and sarcopenic obesity in the Korean population based on the Fourth Korean National Health and Nutritional Examination Surveys. *J Gerontol A Biol Sci Med Sci.* 2012 Oct; 67(10): 1107–1113. <https://doi.org/10.1093/gerona/gls071>. Epub 2012 Mar 19. PMID: 22431554
56. Wen X., Wang M., Jiang C.M., Zhang Y.M. Are current definitions of sarcopenia applicable for older Chinese adults? *J Nutr Health Aging.* 2011 Dec; 15(10): 847–851. <https://doi.org/10.1007/s12603-011-0088-3>. PMID: 22159771. EDN: LQTHMO
57. Prado C.M., Lieffers J.R., McCargar L.J., et al. Prevalence and clinical implications of sarcopenic obesity in patients with solid tumours of the respiratory and gastrointestinal tracts: a population-based study. *Lancet Oncol.* 2008 Jul; 9(7): 629–635. [https://doi.org/10.1016/S1470-2045\(08\)70153-0](https://doi.org/10.1016/S1470-2045(08)70153-0). Epub 2008 Jun 6. PMID: 18539529
58. Yao R., Gao B.L., Hu J., et al. Characteristics of mDIXON-Quant and proton magnetic resonance spectroscopy imaging of thigh skeletal muscles in patients with stroke-related sarcopenia: a prospective case-control study. *J Yeungnam Med Sci.* 2025; 42: 49. <https://doi.org/10.12701/jyms.2025.42.49>. Epub 2025 Aug 28. PMID: 40874399. EDN: DZKTAE
59. Ryu J.Y., Kim M., Kim K.S., et al. Chair stand test as a proxy for physical performance and muscle strength in sarcopenia diagnosis: the Korean frailty and aging cohort study. *Aging Clin Exp Res.* 2022 Oct; 34(10): 2449–2456. <https://doi.org/10.1007/s40520-022-02172-2>. Epub 2022 Aug 2. PMID: 35918606. EDN: EVLXBY
60. Podsiadlo D., Richardson S. The timed “Up & Go”: a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc.* 1991 Feb; 39(2): 142–148. <https://doi.org/10.1111/j.1532-5415.1991.tb01616.x>. PMID: 37050485
61. Martinez B.P., Gomes I.B., Oliveira C.S., et al. Accuracy of the Timed Up and Go test for predicting sarcopenia in elderly hospitalized patients. *Clinics (Sao Paulo).* 2015 May; 70(5): 369–372. [https://doi.org/10.6061/clinics/2015\(05\)11](https://doi.org/10.6061/clinics/2015(05)11). Epub 2015 May 1. PMID: 26039955
62. Pérez-Santiago L., Garzón-Hernández L.P., Martín-Arévalo J., et al. Accuracy of the Timed Up and Go Test for predicting low muscle mass in a preoperative prehabilitation program for colorectal cancer. *J Clin Med.* 2025 Mar; 14(6): 2088. <https://doi.org/10.3390/jcm14062088>. PMID: 40142896. EDN: LBUOVU
63. da Costa Teixeira L.A., Soares L.A., de Moura Oliveira M.C., et al. Diagnostic accuracy of sit-to-stand chair test and timed up and go test with proposed cutoff point for identifying sarcopenia in community-dwelling older women: a cross-sectional study. *BMC Musculoskelet Disord.* 2026 Jan; 27(1): 111. <https://doi.org/10.1186/s12891-025-09470-6>. PMID: 41507879. EDN: NJZGTQ
64. Looijaard S.M.L.M., Oudbier S.J., Reijnierse E.M. Single physical performance measures cannot identify geriatric outpatients with sarcopenia. *J Frailty Aging.* 2018; 7(4): 262–267. <https://doi.org/10.14283/jfa.2018.19>. PMID: 30298176
65. Ткачева О.Н., Котовская Ю.В., Рункина Н.К. и др. Клинические рекомендации «Старческая астения». Российский журнал гериатрической медицины. 2025; 1(21): 6–48. <https://doi.org/10.37586/2686-8636-1-2025-6-48>. EDN: JCMOSK / Tkacheva O.N., Kotovskaya Yu.V., Runikhina N.K., et al. Clinical Guidelines on Frailty. Russian Journal of Geriatric Medicine. 2025; 1(21): 6–48 (In Russian). <https://doi.org/10.37586/2686-8636-1-2025-6-48>. EDN: JCMOSK
66. Veronese N., Stubbs B., Volpato S., et al. Association between gait speed with mortality, cardiovascular disease and cancer: a systematic review and meta-analysis of prospective cohort studies. *J Am Med Dir Assoc.* 2018 Nov; 19(11): 981–988.e7. <https://doi.org/10.1016/j.jamda.2018.06.007>. Epub 2018 Jul 25. PMID: 30056008. EDN: BWXUVN
67. Guralnik J.M., Simonsick E.M., Ferrucci L., et al. A short physical performance battery assessing lower extremity function: association with self-reported disability and prediction of mortality and nursing home admission. *J Gerontol.* 1994 Mar; 49(2): 85–94. <https://doi.org/10.1093/geronj/49.2.M85>. PMID: 8126356. EDN: HJAWDD
68. Phu S., Kirk B., Bani Hassan E., et al. The diagnostic value of the Short Physical Performance Battery for sarcopenia. *BMC Geriatrics.* 2020 Jul; 20(1): 242. <https://doi.org/10.1186/s12877-020-01642-4>. PMID: 32660438. EDN: FWMQPA

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