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Sarcopenia: From Global Consensus to Korean Implementation — A Narrative Review and Standpoint

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Sarcopenia is a major geriatric syndrome characterized by progressive loss of muscle mass and strength, resulting in disability and mortality. This narrative review synthesizes international consensus recommendations and Korean evidence to guide context-specific sarcopenia management strategies. PubMed, Embase, Cochrane Library, and KoreaMed (January 2000–November 2025) were searched, focusing on randomized trials, meta-analyses, systematic reviews, clinical practice guidelines, and large observational studies. Global diagnostic frameworks have evolved from muscle mass-based definitions toward multidimensional models that incorporate muscle strength and physical performance. Exercise and nutrition remain the mainstay treatments, with resistance-based training and adequate protein intake. Currently, pharmacologic options with proven clinical benefit are limited. In Korea, growing evidence supports the effectiveness of community-based sarcopenia interventions, underscoring the need for standardized, integrated delivery models that bridge the fragmented healthcare system and enable sustainable implementation.

Key Words: Sarcopenia, Muscle strength, Exercise therapy, Dietary protein, Primary health care

INTRODUCTION

Sarcopenia is a generalized skeletal muscle disease characterized by reduced muscle mass and strength.[1)] It is increasingly recognized as a core geriatric syndrome associated with frailty, falls, hospitalization, and disability. Thus, addressing its management has become a pressing clinical and public health priority.[2,3)] Korea is among the fastest-aging countries worldwide, with demographic changes that pose significant challenges for healthcare and long-term care systems.[4,5)]

Globally, randomized controlled trials (RCTs) and meta-analyses have demonstrated the benefits of structured resistance exercise, protein supplementation, and multidomain interventions.[6-10)] Based on this accumulating evidence, international guidelines have been developed, all emphasizing early identification and multimodal treatment strategies.[11-13)] Beyond these global statements, some countries have issued contextualized guidelines that incorporate local evidence and healthcare priorities.[14-16)]

In 2023, the Korean Working Group on Sarcopenia (KWGS) proposed a consensus definition and screening algorithm tailored to the Korean population,[17] providing a framework for diagnosis and case finding; however, practical guidance for treatment delivery remains limited. Although international guidelines consistently recommend exercise and nutrition as first-line strategies, how these interventions can be effectively implemented within Korea's healthcare and community infrastructure remains unclear.

This narrative review synthesizes international sarcopenia guidelines with evidence derived from Korean studies. It examines how international sarcopenia guidelines can be translated into an effective, context-specific care pathway for older adults in Korea. Drawing on international diagnostic frameworks, we reviewed evidence supporting recommended interventions—with an emphasis on Korean observational studies and RCTs—and explored implementation challenges and future directions for building a continuous care system spanning community, primary care, and acute hospital settings.

METHODS

Current evidence on the management of sarcopenia was qualitatively synthesized, with an emphasis on its applicability to the Korean context. PubMed, Embase, the Cochrane Library, and KoreaMed were comprehensively searched for articles published in English or Korean and used combinations of key terms including "sarcopenia," "exercise," "nutrition," "multicomponent intervention," "pharmacological treatment," and "Korea" from January 2000 to November 2025.

Rather than applying a formal systematic review framework, studies were selected based on their relevance to the thematic domains of the review—namely, diagnosis, exercise, nutrition, multicomponent interventions, pharmacological therapy, and Korean healthcare delivery and implementation strategies. RCTs, meta-analyses, clinical practice guidelines, and large observational cohort studies were prioritized. Case reports, animal studies, and conference abstracts were excluded.

Authors selected studies and qualitatively synthesized key findings through consensus-based discussion. As this was a narrative review, no formal risk-of-bias assessment, certainty-of-evidence grading, or quantitative pooling was undertaken. Evidence was synthesized qualitatively and organized by thematic domains: diagnosis, exercise, nutrition, multicomponent interventions, pharmacological therapy, and Korean Delivery System and Implementation Strategies.

In addition, for the section on Korean Delivery System and Implementation Strategies, we additionally searched grey literature, including government white papers, municipal health center reports, and unpublished policy documents to provide contextual information on real-world implementation and healthcare delivery systems in Korea. Grey sources were identified through targeted web searches of municipal health bureaus, the Ministry of Health and Welfare, and professional society websites, and were included if they described program design, implementation, or evaluation of sarcopenia-related interventions. These sources were used descriptively to inform policy and practice considerations rather than to evaluate intervention efficacy.

Diagnosis of Sarcopenia

The conceptual understanding of sarcopenia has recently been clarified by the Global Leadership Initiative in Sarcopenia (GLIS).[1] They reached consensus that sarcopenia is a generalized, potentially reversible disease characterized by concurrent loss of muscle mass, muscle strength, and muscle-specific strength, which leads to impaired physical performance as an outcome. This global definition reflects a trajectory of diagnostic evolution over the past decade.

Separate clinical frameworks for diagnosis have gradually shifted from mass-centered models toward strength-first, hierarchical approaches with performance used for severity staging. The International Working Group on Sarcopenia (IWGS) linked poor physical function (slow gait speed) to subsequent dual-energy X-ray absorptiometry (DXA) assessment for low lean mass.[18] The European Working Group on Sarcopenia in Older People 2 (EWGSOP2) formalized a pathway in which low muscle strength indicates probable sarcopenia, reduced muscle quantity confirms the diagnosis, and impaired physical performance grades severity.[11] The Asian Working Group for Sarcopenia (AWGS) 2019 retained this stepwise logic but tailored thresholds to Asian populations—raising the gait-speed cutoff to < 1.0 m/s and recommending Short Physical Performance Battery (SPPB) ≤ 9.

In parallel, several countries have issued national consensus statements, clinical guidelines, or population-specific cutoffs to reflect their demographic and healthcare contexts, and a comparison of diagnostic criteria across international consensus statements and national guidelines is summarized in Table 1.[11-24]

Similar to the Singapore Clinical Practice Guideline (Singapore CPG) and the Taiwan Advisory Panel for Sarcopenia (TAPS), the KWGS adopted the AWGS 2019-based diagnostic algorithm, including the same cutoff values for muscle strength, physical performance, and muscle mass.[17] The AWGS 2019 emphasizes a two-step approach, with case-finding in community settings using simple tools such as the SARC-F questionnaire, SARC-CalF, or calf circumference, followed by confirmatory testing with bioelectrical

Table 1. Comparison of diagnostic criteria for sarcopenia across international consensus statements, national guidelines, and population-specific proposals

Source	Type	Muscle strength	Physical performance	Muscle mass	Staging	Key features/Notes
IWGS (2011)	International consensus	Not explicitly defined; weakness considered in context of poor function	Gait speed < 1.0 m/s (trigger for further assessment)	ASMI-DXA: M ≤ 7.23 kg/m^2, F ≤ 5.67 kg/m^2	No formal staging	First consensus definition; age-related loss of mass + function; recommended screening in those with mobility decline, falls, recent hospitalization
FNIH (2014)	International research consortium (evidence-based cutoffs)	HGS: M < 26 kg, F < 16 kg	Gait speed ≤ 0.8 m/s or chair stand inability	ALM/BMI: M < 0.789, F < 0.512 ALM: M < 19.75 kg, F < 15.02 kg	No formal staging	Large pooled analysis (> 26,000 adults); emphasized weakness; advocated ALM/BMI index
ICFSR (2018)	International clinical practice guideline	Handgrip recommended (population-specific cutoffs)	Gait speed, SPPB, TUG, 400-m walk	DXA preferred; BIA/CT/MRI acceptable	Did not propose staging; refers to EWGSOP/AWGS definitions	Annual screening ≥ 65 years or post-major health event; diagnosis can be made using any previously established international consensus definitions (EWGSOP, FNIH, IWGS, and AWGS)
EWGSOP2 (2019)	International consensus (Europe)	HGS: M < 27 kg, F < 16 kg	Gait speed ≤ 0.8 m/s SPPB ≤ 8 TUG ≥ 20 s Non-completion or ≥ 6 min 5-time CST > 15 s	ASMI-DXA: M < 7.0 kg/m^2, F < 5.5 kg/m^2 ASMI-BIA: M < 7.0 kg/m^2, F < 5.5 kg/m^2	Probable sarcopenia: low muscle strength. Confirmed sarcopenia: low muscle strength and low muscle mass. Severe sarcopenia: low muscle strength, low muscle mass, and poor physical performance.	Introduced hierarchical diagnostic model (strength → mass → performance)
AWGS (2019)	International consensus (Asia)	HGS: M < 28 kg, F < 18 kg	Gait speed ≤ 1.0 m/s SPPB ≤ 9 5-time CST ≥ 12 s	ASMI-DXA: M < 7.0 kg/m^2, F < 5.4 kg/m^2 ASMI-BIA: M < 7.0 kg/m^2, F < 5.7 kg/m^2	Possible sarcopenia: low strength or poor performance Sarcopenia: low muscle mass plus either low strength or poor performance Severe sarcopenia: low muscle mass plus both low strength and poor performance	Adjusted thresholds for Asians; emphasized case-finding in primary care
AWGS (2025)	International consensus (Asia)	≥ 65 y group: Same as AWGS 2019 50–64 y group: HGS: M < 34 kg, F < 20 kg	Removed from diagnostic criteria	≥ 65 y group: Same as AWGS 2019 but add BMI-adjusted cutoffs ASMI-DXA: M < 0.73, F < 0.52 ASMI-BIA: M < 0.83, F < 0.57 50–64 y group: ASMI-DXA: M < 7.2 kg/m^2, F < 5.5 kg/m^2 ASMI-BIA: M < 7.6 kg/m^2, F < 5.7 kg/m^2	Possible sarcopenia: low muscle strength Sarcopenia: low strength plus low muscle mass	Diagnosis expanded to middle-aged adults (50–64 years) Simplified algorithm (concurrent low mass and strength) aligned with GLIS Physical performance moved to outcomes Integration with WHO ICOPE framework severe sarcopenia

(Continued on the next page)

Table 1. Continued

Source	Type	Muscle strength	Physical performance	Muscle mass	Staging	Key features/Notes
				Add BMI-adjusted cutoffs: ASMI-DXA: M < 0.8, F < 0.55 ASMI-BIA: M < 0.9, F < 0.63		
ANZSSFR (2022)	Binational consensus guideline (Australia–New Zealand)	Adopted EWGSOP2 thresholds	EWGSOP2-based (SPPB, gait speed, TUG, 400-m walk)	EWGSOP2 thresholds; DXA/BIA/CT/MRI acceptable	Adopted EWGSOP2	First Oceania guideline; emphasized for feasibility; recommended CGA
KWGS (2023)	National expert consensus guideline (Korea)	Adopted AWGS thresholds	Gait speed ≤ 1.0 m/s SPPB ≤ 9 TUG ≥ 12 s 5-time CST > 10 s (standing position), > 11 s (sitting position) 400-m walk: non-completion or ≥ 6 min	Adopted AWGS cutoffs; FNIH complementary	AWGS-based diagnostic algorithm; additionally introduced the concept of functional sarcopenia, defined as impaired muscle strength and/or physical performance despite preserved muscle mass.	Focused on screening and diagnosis; introduced functional sarcopenia; recommended CGA
Singapore CPG (2022/24)	National clinical practice guideline (Singapore)	Adopted AWGS thresholds	Gait speed < 1.0 m/s SPPB ≤ 9 TUG, CST accepted	AWGS cutoffs (DXA, BIA); FNIH complementary	Adopted AWGS	Contextualized to Singapore healthcare
TAPS (2025)	National advisory consensus guideline (Taiwan)	Adopted AWGS thresholds	Gait speed < 1.0 m/s SPPB ≤ 9 5-time CST ≥ 12 s	AWGS cutoffs	Adopted AWGS	Emphasized feasibility of screening in Taiwanese clinical practice
Turkey (2020)	Population-specific cutoff	HGS: M < 28 kg, F < 14 kg	N/A	ASMI-BIA: M ≤ 8.3 kg/m^2, F ≤ 5.7 kg/m^2	Not staged	Derived from local elderly cohort
India (2020)	Population-specific cutoff	HGS: M < 27.5 kg, F < 18 kg	N/A	ASMI-DXA: M ≤ 6.1 kg/m^2, F ≤ 4.6 kg/m^2	Not staged	Sarco-CUBES cohort
Colombia (2023)	Population-specific cutoff	N/A	N/A	ASMI-BIA: M ≤ 8.0 kg/m^2, F ≤ 6.1 kg/m^2	Not staged	Compared Colombian cutoffs with other populations
Kosovo (2022)	Population-specific cutoff	HGS: M < 32.8 kg, F < 19.6 kg	Gait speed: M ≤ 1.14 m/s, F ≤ 1.03 m/s	ASMI-BIA: M ≤ 5.7 kg/m^2, F ≤ 4.8 kg/m^2	Not staged	Community-dwelling ≥ 60 years; emphasized demographic heterogeneity

IWGS, International Working Group on Sarcopenia; ASMI, appendicular skeletal muscle mass index; DXA, dual-energy X-ray absorptiometry; FNIH, Foundation for the National Institutes of Health; ALM, appendicular lean mass; BMI, body mass index; ICFSR, International Clinical Practice Guideline for Sarcopenia (International Clinical Frailty and Sarcopenia Research group); HGS, hand grip strength; TUG, Timed Up and Go test; BIA, bioelectrical impedance analysis; EWGSOP, European Working Group on Sarcopenia in Older People; EWGSOP2, European Working Group on Sarcopenia in Older People 2; AWGS, Asian Working Group for Sarcopenia; ANZSSFR, Australian and New Zealand Society for Sarcopenia and Frailty Research; KWGS, Korean Working Group on Sarcopenia; CGA, comprehensive geriatric assessment; Singapore CPG, Singapore Clinical Practice Guideline for Sarcopenia; TAPS, Taiwan Advisory Panel on Sarcopenia; SPPB, Short Physical Performance Battery.

impedance analysis (BIA) or DXA in hospital settings.[12] Individuals identified through case-finding but without confirmed low muscle mass are classified as having "possible sarcopenia," for whom lifestyle modification, including dietary optimization and regular exercise, is recommended.

However, beyond this framework, the KWGS proposed several important refinements.[17] First, the KWGS encouraged the use of a broader range of screening instruments. It expanded the range of screening instruments to include objective measures typically reserved for diagnosis, such as handgrip strength, gait speed, and the Timed Up and Go (TUG) test. Although this approach may introduce some overlap between screening tools and confirmatory diagnostic assessments and may limit direct comparability with other international guidelines, it reflects a pragmatic strategy intended to facilitate early case identification in real-world Korean clinical settings, where access to specialized equipment and familiarity with sarcopenia assessment vary widely.

Second, the KWGS recommended conducting a comprehensive geriatric assessment (CGA) after diagnosis to guide individualized, multidomain interventions. This is particularly relevant in Korea, where transitional care remains fragmented and access to rehabilitation services is limited,[5] making sarcopenia diagnosis and CGA during acute hospital admission a practical strategy to initiate integrated care. One recent post-hoc analysis has demonstrated that a multicomponent intervention—including not only exercise and nutritional support but also depression management, deprescribing, and home hazard reduction—based on unmet needs identified through CGA, significantly improved long-term institutionalization-free survival and physical function among older adults in Korea.[25]

Finally, the KWGS introduced the novel concept of "functional sarcopenia," defined as impaired muscle strength and/or physical performance despite preserved muscle mass. This refinement reflects accumulating evidence that functional parameters are more strongly associated with adverse outcomes than muscle mass.[26] Although this phenotype is unique to the KWGS guidelines and has not yet been adopted by other major international consensus statements, a recent study indicated that individuals with functional sarcopenia had significantly higher risks of mobility limitation (odds ratio [OR] = 3.461; 95% confidence interval [CI] 1.956–6.121) and mortality (hazard ratio [HR] = 1.775; 95% CI 1.229–2.564) compared with non-sarcopenic peers.[27] Subsequently, another study reported that individuals with functional sarcopenia exhibited greater frailty and had a comparable prognosis to those with non-severe sarcopenia—HR for institutionalization-free survival compared with no sarcopenia: 2.73 (1.72–4.31) vs. 3.15 (1.88–5.28).[28] Importantly, two independent community-based RCTs in Korea demonstrated that multicomponent interventions were effective for both sarcopenia (as defined by the AWGS 2019) and functional sarcopenia, utilizing the same intervention intensity for both phenotypes.[29,30] Thus, functional sarcopenia warrants active therapeutic intervention comparable to that for sarcopenia.

The AWGS published the 2025 consensus update, introducing significant shifts in sarcopenia management. First, the diagnostic scope was expanded to include middle-aged adults (50–64 years) to enable proactive muscle health promotion. Second, the consensus formally introduced body mass index (BMI)-adjusted muscle mass cutoffs to complement traditional height-adjusted metrics. Third, aligning with the World Health Organization Integrated Care for Older People framework, the guideline emphasizes a life-course approach to muscle health. Lastly, the diagnostic algorithm was simplified to require only concurrent low muscle mass and muscle strength; physical performance measures were reclassified as outcome indicators rather than diagnostic criteria.

These updates present new challenges for the KWGS guideline, which is fundamentally grounded in the AWGS 2019 framework. To maintain conceptual consistency and international comparability, future iterations of the Korean guideline will need to accommodate global shifts. Specifically, the adoption of diagnostic criteria and new thresholds for middle-aged adults should be considered to facilitate early intervention. Furthermore, given that both GLIS and AWGS 2025 focus on muscle health for diagnosis while reclassifying physical performance as an outcome, the definition of functional sarcopenia—currently a distinct phenotype in KWGS reliant on performance metrics—may also require revision to align with these evolving international standards.

Exercise Intervention

Resistance training

Exercise intervention is the cornerstone in the management of sarcopenia.[13] Among various exercise modalities, progressive resistance training has demonstrated the strongest evidence as an effective intervention for the treatment of sarcopenia. Resistance exercise has demonstrated consistent benefits across the three core domains of sarcopenia (muscle mass, muscle strength, and physical performance).[31-33] It requires muscles to contract against an external load—using resistance machines, free weights, elastic bands, or bodyweight. However, training protocols varied considerably across retrieved studies in terms of exercise type, frequency, intensity, and duration, and interventions were delivered either as standalone resistance programs or embedded within multicomponent approaches. Because of this heterogeneity, proposing a single universally applicable protocol is difficult.

Based on the current literature, optimal outcomes in older adults

with sarcopenia are generally achieved through resistance training performed 2–3 times per week, consisting of 8–12 repetitions per set, 1–3 sets per exercise, at moderate to high intensity (60%–80% of one repetition maximum). Exercise prescriptions should be individualized according to baseline capacity, comorbidities, and patient preferences.[34,35] Furthermore, a systematic review has indicated that supervised exercise programs yield approximately 1.5–2 times greater improvements in muscle strength compared to unsupervised self-directed programs.[36] However, direct comparative studies specifically examining optimal frequency, intensity, and repetition ranges in Korean sarcopenic populations are limited.

Complementary exercise training

Aerobic, balance, and flexibility exercises are recommended as adjunctive therapies to resistance training. Aerobic exercise effectively improves physical performance, cardiovascular health, functional capacity, and quality of life.[37,38] However, evidence consistently shows that aerobic exercise alone has limited effects on muscle strength and muscle mass, making it insufficient as a standalone treatment for sarcopenia.[8,38] In a recent network meta-analysis, adding aerobic exercise to resistance training produced only marginal additional benefits in physical performance compared with resistance training alone.[6] Thus, aerobic exercise should be viewed primarily as a supportive component, and general recommendations for older adults—such as moderate-intensity activity (e.g., brisk walking) for ≥ 150 minutes per week or vigorous-intensity for ≥ 75 minutes per week—can be applied.[39]

Balance training provides additional benefits when combined with resistance training. A network meta-analysis has demonstrated that resistance training alone significantly improved handgrip strength (+2.9 kg, 95% CI 1.5–4.3) and gait speed (+0.07 m/s, 95% CI 0.01–0.13) in older adults with sarcopenia. When combined with balance training, the improvements were greater, with handgrip strength increasing by +4.2 kg (95% CI 2.6–5.8) and gait speed by +0.16 m/s (95% CI 0.06–0.26).[6] Beyond functional gains, balance training is clinically important for fall prevention. A Cochrane systematic review of 39 trials (n = 7,920) has indicated that balance and functional exercises reduced the overall rate of falls by 24% (rate ratio = 0.76, 95% CI 0.70–0.81) and the risk of experiencing one or more falls by 13% (risk ratio [RR] = 0.87, 95% CI 0.82–0.91).[40] As a specific example, a recent meta-analysis of RCTs has demonstrated that Tai Chi significantly reduced the risk of falling (RR = 0.76, 95% CI 0.71–0.82) and lowered the number of falls per person (mean difference –0.26, 95% CI –0.39 to –0.13) in older adults.[41]

Flexibility training enhances joint range of motion, reduces pain, and supports activities of daily living.[42] Although flexibility alone has limited effects on sarcopenia, it complements resistance and aerobic exercise by lowering injury risk and improving exercise performance.[43-45] Therefore, static stretching at least twice weekly (≥ 30 seconds per muscle group), ideally after resistance or aerobic sessions, is recommended as an adjunct in sarcopenia management.[46]

Nutrition Intervention

Adequate protein intake

Adequate protein intake is essential for muscle protein synthesis and plays a central role in the management of sarcopenia.[47,48] A recent systematic review and meta-analysis pooling 32 observational studies (approximately 60,000 older adults worldwide) confirmed that higher protein intake was significantly associated with lower risk of sarcopenia (pooled OR = 0.62; 95% CI 0.47–0.81).[49] Korean evidence further supports this relationship. A cross-sectional analysis using Korea National Health and Nutrition Examination Survey data has indicated that individuals in the lowest quartile of daily protein intake (< 0.8 g/kg/day) had a significantly higher risk of low muscle mass compared with the highest quartile (≥ 1.2 g/kg/day), with an adjusted OR of 4.32 (95% CI 2.61–7.15).[50] Likewise, a Korean meta-analysis synthesizing 12 studies has reported that protein intake below 0.8 g/kg/day was associated with increased odds of sarcopenia compared with ≥ 1.2 g/kg/day (pooled OR = 1.25; 95% CI 1.05–1.50).[51]

The effectiveness of adequate protein intake in treating sarcopenia has been well-established. Umbrella and systematic reviews have consistently reported that nutritional supplementation increases muscle mass and generally improves muscle strength and physical performance.[47,49,52] Consistent with these findings, a Korean RCT demonstrated that older adults receiving 12 weeks of leucine-enriched whey protein (20 g protein + 3 g leucine/day), combined with resistance training, achieved greater improvements than resistance training alone: appendicular skeletal muscle mass (+0.82 kg; 95% CI 0.31–1.33), handgrip strength (+3.1 kg; 95% CI 1.0–5.2), and SPPB score (+1.7 points; 95% CI 0.6–2.8).[53] International expert consensus recommends at least 1.0–1.2 g/kg/day for older adults, increasing to 1.2–1.5 g/kg/day in situations involving acute or chronic illness, and up to 2.0 g/kg/day in cases of severe illness.[54,55] The 2018 consensus from the Korean Geriatric Society and Korean Nutrition Society also recommends protein intake of at least 1.2 g/kg/day for sarcopenia prevention.[56] A summary of recommended protein intake across international and national guidelines is provided in Table 2.

Essential amino acids (EAAs) are amino acids that cannot be synthesized by the human body and therefore must be obtained through diet or supplementation. Among EAAs, leucine is a key

Table 2. Comparison of protein intake recommendations for older adults across international consensus statements and national guidelines

Source	Type	Population	Recommended protein intake	Key features/Notes
PROT-AGE Study Group (2013)	International expert consensus	Community-dwelling and institutionalized older adults (≥65 y), general population	≥1.0–1.2 g/kg/day; up to 1.5 g/kg/day in illness; up to 2.0 g/kg/day in severe illness	First global position paper; emphasized higher needs with acute/chronic disease; stressed distribution across meals
ESPEN Expert Group (2014)	International expert consensus (Europe)	Older adults with acute or chronic illness, including frailty/sarcopenia risk	1.0–1.5 g/kg/day; up to 2.0 g/kg/day in severe illness	Highlighted protein-exercise synergy; clinical adjustment depending on comorbidities
ICFSR (2018)	International clinical practice guideline	Older adults with sarcopenia	No specific numerical intake provided	First international clinical practice guideline addressing treatment of sarcopenia; recommends protein supplementation or a protein-rich diet, ideally combined with resistance exercise
Korean Geriatric Society and Korean Nutrition Society (2018)	National expert consensus (Korea)	Korean community-dwelling older adults	≥1.2 g/kg/day	Targeted at Korean older adults with low habitual protein intake; preventive rather than therapeutic
ANZSSFR (2022)	Binational consensus guideline (Australia–New Zealand)	Older adults, with and without sarcopenia, in community and healthcare settings	1.0–1.5 g/kg/day; ideally ≥1.2 g/kg/day	Intake evenly across meals; caution in advanced CKD (eGFR <30)
Singapore CPG (2022/24)	National clinical practice guideline (Singapore)	Older adults in Singapore, both general and sarcopenia patients	≥1.0 g/kg/day for prevention; higher in illness	conditional for protein supplements; vitamin D if deficient
TAPS (2025)	National advisory consensus guideline (Taiwan)	Older Taiwanese adults with sarcopenia or at risk	1.2 g/kg/day	Recommended oral nutritional supplementation if diet inadequate; suggested HMB supplementation in selected cases

PROT-AGE, Protein Recommendations for Older People; ESPEN, European Society for Clinical Nutrition and Metabolism; ICFSR, International Conference on Sarcopenia and Frailty Research; ANZSSFR, Australian and New Zealand Society for Sarcopenia and Frailty Research; CPG, Clinical Practice Guideline; TAPS, Taiwan Advisory Panel on Sarcopenia; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; HMB, β-hydroxy-β-methylbutyrate.

molecule that directly stimulates muscle protein synthesis via activation of the mTOR signaling pathway.[57] Many studies involving older adults have shown that EAA supplementation can enhance muscle mass, improve muscle strength, and boost physical performance outcomes in this population.[58] However, most studies have combined EAA supplementation with increased total protein intake or exercise interventions, limiting the ability to assess the independent effects of EAAs alone.

The source of protein may have a limited influence on clinical outcomes in sarcopenia. Animal proteins such as whey have traditionally been considered superior owing to their higher leucine content.[59] However, recent meta-analyses have reported that plant proteins, including soy, provide comparable benefits for muscle mass, strength, and physical performance in older adults.[60-62] Thus, ensuring adequate total protein intake is more critical than emphasizing specific protein sources.

HMB supplementation

β-Hydroxy-β-methylbutyrate (HMB) is a metabolite of leucine that inhibits protein breakdown and stimulates protein synthesis through activation of the mTOR pathway.[63] Evidence from small RCTs and meta-analyses has shown improvements in muscle health, including gains in muscle strength, muscle mass, and physical function.[64-66] Based on these findings, the TAPS recommends daily HMB supplementation of up to 3 g for patients with sarcopenia, 1.5 g for those with possible sarcopenia, and 0.75 g for those at risk.[16] However, other major sarcopenia guidelines do not include HMB supplementation recommendations, likely reflecting the limited evidence base from small trials (50–200 participants) and modest clinical benefits observed to date. Large-scale, long-term studies—particularly in Asian populations, including Korea—are still lacking. Therefore, the clinical utility of HMB should be considered complementary.

Creatine supplementation

Creatine monohydrate supplementation increases intramuscular phosphocreatine stores, enhancing energy availability and muscle protein synthesis during resistance training.[67] Recent systematic reviews and meta-analyses involving older adults have indicated that creatine supplementation at 3–5 g/day combined with resistance training resulted in improvements in lean tissue mass and muscle strength.[68] However, the studies included in these meta-analyses were primarily small trials that combined creatine supplementation with resistance training and rarely included participants formally diagnosed with sarcopenia. Therefore, creatine supplementation can be considered a complementary intervention for older adults with sarcopenia who engage in resistance training, but

should not replace fundamental nutritional and exercise interventions.

Vitamin D

Vitamin D has well-established roles in bone health and muscle function, with vitamin D receptors present in muscle tissue, influencing muscle cell metabolism and growth.[69] A Korean national survey has indicated that older adults with sarcopenia had significantly lower 25(OH)D levels than those without sarcopenia. Additionally, the odds of sarcopenia were over 50% lower among participants in the highest vitamin D quartile compared to the lowest, indicating a strong inverse relationship between vitamin D deficiency and muscle mass among Korean older adults.[70] Supplementation benefits are mainly observed in older adults with vitamin D deficiency, with improvement in muscle mass and physical performance.[71,72] By contrast, vitamin D-replete populations generally show no additional benefit.[73,74] Therefore, correcting deficiency rather than universal supplementation is more relevant for sarcopenia management. Thus, the Singapore CPG conditionally recommends vitamin D supplementation only in the presence of insufficiency, defined as serum 25(OH)D < 30 ng/mL.[14]

Multicomponent Intervention

Multicomponent intervention, consisting of two essential components—exercise and nutrition—has been consistently emphasized in international guidelines as the cornerstone of sarcopenia management. Meta-analyses of RCTs in older adults have demonstrated that combining resistance exercise with protein supplementation yields greater benefits than exercise alone, with additional gains in muscle mass (0.56 kg, 95% CI 0.30–0.82), handgrip strength (2.1 kg, 95% CI 0.9–3.3), and gait speed (0.08 m/s, 95% CI 0.02–0.15).[75] Another meta-analysis has confirmed further improvements in muscle strength with adjunctive protein supplementation, showing a standardized mean difference of 0.32 (95% CI 0.08–0.56).[76]

The benefits of multicomponent interventions have also been demonstrated in Korean studies. A community-based trial in socioeconomically vulnerable older adults showed that a 24-week program of structured group exercise and daily protein supplementation significantly improved sarcopenia-related outcomes, including SPPB (1.3, 95% CI 0.8–1.8), grip strength (2.4 kg, 95% CI 1.0–3.8), and gait speed (0.11 m/s, 95% CI 0.05–0.18).[77] The 30-month follow-up further revealed a slower progression of disability in the intervention group ($\beta = -0.42$, 95% CI −0.74 to −0.10).[78] This effect persisted up to 66 months, during which participants maintained greater independence and demonstrated a cost-benefit ratio of 8.82.[79] More recent trials targeting older adults with functional sarcopenia have confirmed that combining exercise with high-protein supplementation (1.5 g/kg/day) led to additional improvements compared with exercise alone, with gains in muscle mass (0.48 kg/m^2, 95% CI 0.21–0.75), grip strength (3.1 kg, 95% CI 1.7–4.5), and SPPB (0.9, 95% CI 0.3–1.5).[30]

Recently, national guidelines and consensus statements have expanded the concept of multicomponent management beyond exercise and nutrition to include multidisciplinary and individualized approaches. The Australian and New Zealand Society for Sarcopenia and Frailty Research (ANZSSFR) consensus underscores the role of CGA and advocates a person-centered framework that integrates exercise and nutrition with tailored referrals, such as dietitian consultation, when appropriate.[15] Similarly, the Singapore CPG recommends systematic correction of the "4D" factors—drugs, diabetes, other diseases, and deficiency—and referral to multidisciplinary teams for individualized intervention.[14] The TAPS emphasizes personalized strategies that account for multimorbidity.[16] In Korea, the KWGS likewise recommends implementing CGA after diagnosis, underscoring the importance of tailoring interventions to comorbidities, functional status, and the care environment.

Pharmacological Treatment

Currently, pharmacological treatment for sarcopenia is not routinely recommended. Testosterone therapy may be considered only in cases accompanying hypogonadism in older adult men. Multiple RCTs have demonstrated increases in muscle mass and strength with testosterone therapy, and these findings have been consistently confirmed in recent meta-analyses.[80,81] However, the large Testosterone Trials (T Trials) have failed to demonstrate consistent or clinically meaningful improvements in physical performance.[82] Safety concerns, particularly regarding cardiovascular events, prostate-related complications, and erythrocytosis, remain debatable,[83-85] and international guidelines clearly recommend against prescribing testosterone in eugonadal older men.[86]

Other candidate agents, such as selective androgen receptor modulators (e.g., enobosarm), myostatin inhibitors (e.g., bimagrumab), and ghrelin agonists (e.g., capromorelin, ibutamoren), are being investigated in clinical trials.[87,88] However, the current evidence is insufficient, and no pharmacological therapy is yet available for routine use in clinical practice.

Korean Delivery System and Implementation Strategies

Effective sarcopenia management in Korea requires a continuous care system that bridges community, primary care, and acute hospital care. Among these, the role of community and primary care is particularly critical as they can provide both the first diagnostic as-

sessment and the initiation of treatment for older adults. Community and primary care should serve as the entry point, responsible for both early case finding and sustained intervention delivery. A wide range of validated and easy-to-use tools—including SARC-F, calf circumference, chair stand test, handgrip strength, gait speed, TUG, and SPPB—are available and have been validated in Asian and Korean populations.[12,89-94] For confirmatory diagnosis, assessment of muscle mass with BIA or DXA is required; importantly, BIA has now become a readily accessible modality even in community settings. Since exercise and nutritional interventions constitute the core treatment of sarcopenia, implementing them at the community level is feasible. Evidence from the Aging Study of Pyeongchang Rural Area (ASPRA) cohort demonstrated that public health centers offering group exercise, protein supplementation, and nutritional counseling significantly improved muscle strength and physical performance in older adults.[30,77,78,95] Furthermore, two RCTs conducted in primary care settings based on the KWGS guidelines have emphasized the effectiveness of community- and primary care-based sarcopenia interventions.[29,30] Such findings suggest that existing community infrastructure, including health centers, public exercise facilities, and senior centers, can be effectively leveraged to expand the reach of interventions. A summary of Korean intervention studies on sarcopenia is presented in Table 3.[96-99]

Acute hospitals represent another critical window, as rapid muscle loss is common during hospitalization.[100] Hospitals should systematically screen for sarcopenia at admission, confirm the diagnosis, and initiate CGA to guide multidisciplinary treatment planning. They also have a pivotal role in ensuring continuity by linking inpatient care with community-based follow-up after discharge.

However, implementation in Korea remains limited by low awareness of sarcopenia in primary care, underuse of validated screening tools, lack of standardized intervention protocols, and weak linkage between hospitals and community services. A nationwide survey has indicated that only 23.8% of primary care physicians were aware of diagnostic criteria, and 26.3% intended to diagnose sarcopenia in routine care. On the patient side, only 35% had heard of sarcopenia, and 48.8% were unaware of available community services.[101] In addition, the healthcare delivery system is fragmented, with acute hospitals, primary care, and community health services often operating separately without clear referral and feedback pathways.[5] Furthermore, the government's integrated care demonstration project for older adults is implemented differently across municipalities, which leads to variability in service content and may make it difficult to establish consistent links between hospital-based care and community programs. Local government reports indicate that some municipalities have introduced sarcopenia-related health promotion programs while others have not, and even when such programs exist, they are often short-term or discontinued.[102-105] This inconsistency across local governments makes it difficult to provide continuous care and limits effective referral between hospitals and community services.

In parallel with structural and system-level challenges, ethical considerations are essential when designing and implementing sarcopenia interventions in older adults. Given the frequent coexistence of frailty or cognitive impairment,[106,107] informed consent processes should be adapted to ensure patient-centered communication and, when appropriate, surrogate decision-making.[108] In addition, as community-based programs and digital health strategies are increasingly incorporated into care pathways, policies must ensure equitable access for socially disadvantaged groups, including individuals with limited financial resources or digital literacy.

Future work should prioritize overcoming fragmentation of care, developing standardized intervention protocols, and strengthening referral pathways between hospitals and community providers. Evaluations of cost-effectiveness, integration of digital health and remote monitoring strategies, and assessments of long-term sustainability will also be critical. As evidence supporting continuous care models remains scarce in Korea, these gaps should be addressed through systematic research to establish a delivery framework tailored to the Korean context.

LIMITATIONS

This review has some limitations that should be acknowledged. First, as a narrative review, it did not include quantitative meta-analysis or formal assessments of risk of bias or certainty of evidence. This approach was intentionally adopted to enable integrative synthesis of heterogeneous evidence spanning clinical trials, community-based studies, and health policy and implementation contexts, with a particular focus on care pathways. Second, although Korean evidence supporting exercise- and nutrition-based interventions is increasing, the number of large-scale RCTs remains limited, and intervention protocols vary across studies, which may limit the generalizability of specific intervention effects. Third, the inclusion of grey literature without formal critical appraisal may limit transparency; however, these sources were incorporated for contextual and descriptive purposes to reflect real-world healthcare delivery and policy environments, and should therefore be interpreted with caution. Finally, as international sarcopenia guidelines continue to evolve, the proposed care pathway and implementation strategies will require periodic refinement to maintain conceptual alignment and clinical relevance.

Table 3. Summary of Korean intervention studies for sarcopenia

Study, year	Study design	Setting	Population	Intervention	Comparison	Outcomes
Park et al.,[96] 2017	RCT	Community-based exercise program	n = 50 older women (mean age 74.1 y) with sarcopenic obesity	24-week combined aerobic + resistance training (5 × /week, 50–80 min/session)	Control (usual activity)	Significant reduction in carotid intima–media thickness (−0.01 mm, $p < 0.01$); increased carotid flow velocities ($p < 0.01$); improved wall shear rate (+10.5/s, $p < 0.05$); overall improvement in cardiovascular risk profile and physical function measures
Seo et al.,[97] 2021	RCT	Community-based exercise program	n = 22 older women with sarcopenia (≥ 65 y)	16-week resistance training (3 × /week, 60 min/session)	Control (usual activity)	Improved muscle quality, handgrip strength, walking speed, isokinetic strength ($p < 0.01$); ↑ follistatin ($p < 0.05$), no change in myostatin or activin A.
Oh et al.,[98] 2020	RCT	Hospital (post-hip fracture setting)	n = 38 (65–90 y) post-hip fracture patients with sarcopenia	Antigravity treadmill (AGT) 20 min + conventional rehabilitation (CR) 30 min, 10 consecutive weekdays	Conventional rehab only	Koval walking ability score improved significantly more with AGT (Δ3 weeks −1.78 vs −0.94; between-group diff −0.84, $p < 0.001$; 3 mo −1.21, $p = 0.006$).
Yun et al.,[99] 2021	RCT	Long-term care hospital	n = 26 women with moderate Alzheimer's disease with sarcopenia	12-week simple bedside exercise: therapist-supervised balloon-kicking while lying in bed (30 min/session, 5 × /week)	Control (usual care)	Significant improvement in lower limb muscle strength ($p < 0.05$); improved Barthel Index ($p < 0.05$); no adverse effects.
Ji et al.,[30] 2025	RCT	Community (public health center–based intervention)	n = 42 (mean age 78 y, 52% women); older adults with functional sarcopenia	12-week group exercise (resistance + aerobic) 2 × /week + protein supplement (13 g protein, twice daily)	Lifestyle education only	Walking speed +0.24 m/s ($p < 0.001$); SPPB +2.1 ($p < 0.001$); Grip strength +9.9 kg ($p < 0.001$); Quality of life (EQ-5D) +0.09 ($p < 0.001$); Frailty index −0.06 ($p < 0.001$);
Ji et al.,[29] 2025	RCT	Community (public health center-based intervention)	n = 42 (mean age 79 y, 56% women); older adults with sarcopenia (excluding functional)	12-week group exercise (resistance + aerobic) 2 × /week + protein supplement (13 g protein, twice daily)	Lifestyle education only	Walking speed +0.14 m/s ($p < 0.001$); SPPB +1.2 ($p < 0.001$); Grip strength +3.0 kg ($p = 0.005$); Quality of life (EQ-5D) +0.08 ($p < 0.001$); Frailty index −0.04 ($p = 0.003$)
Ji et al.,[25] 2025	Post-hoc analysis of non-randomized trial with propensity matching	Community (public health center-based intervention)	n = 283 older adults with sarcopenia (mean age 77.6 y; 82% women); socioeconomically vulnerable	24-week multicomponent program including group exercise, nutritional supplementation, depression management, deprescribing, and home hazard reduction	Propensity score-matched usual care group	Institutionalization-free survival improved (63.4% vs 87.2%, $p < 0.001$); SPPB +3.8 at 6 mo, +1.4 at 18 mo, +0.8 at 30 mo ($p < 0.05$); Gait speed +0.42 m/s at 6 mo, +0.24 at 18 mo, +0.28 at 30 mo ($p < 0.001$); Frailty index decreased −0.05 at 6 mo ($p < 0.001$)

RCT, randomized controlled trial; SPPB, Short Physical Performance Battery.

CONCLUSION

This narrative review addressed the question of how international sarcopenia guidelines can be translated into an effective, context-specific care pathway for older adults in Korea. We synthesized global consensus recommendations with evidence from Korean observational studies and RCTs. Exercise- and nutrition-based multicomponent programs are considered first-line interventions, with resistance training and adequate protein intake being essential components. Korean studies further support these strategies, demonstrating improvements in muscle mass, strength, and performance through structured exercise and nutritional supplementation.

In Korea, the primary challenge in sarcopenia management lies not in intervention efficacy but in delivery. Effective sarcopenia management in Korea requires a continuous care system that bridges community, primary care, and acute hospital services, with a particular emphasis on community-based delivery. Future research should evaluate pragmatic implementation models, assess cost-effectiveness, and develop sustainable delivery strategies to support effective sarcopenia care in rapidly aging societies.

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CONFLICT OF INTEREST

The researchers claim no conflicts of interest.

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AUTHOR CONTRIBUTIONS

Conceptualization, GYJ, HJ, SK; Data curation, GYJ; Funding acquisition, SJ; Investigation, GYJ, SJ; Methodology, HJ, SK; Project administration, GYJ, HJ, SK; Supervision, HJ, SK; Formal analysis, GYJ, HJ; Writing_original draft, GYJ; Writing_review & editing, all authors (GYJ, SJ, HJ, JYB, IYJ, KMK, MK, CYP, KL, DR, SYL, OHJ, SK)

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