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Review Article

Recent Advances in Sarcopenia Research in Asia: 2016 Update From the Asian Working Group for Sarcopenia

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A B S T R A C T

Sarcopenia was recently classified a geriatric syndrome and is a major challenge to healthy aging. Affected patients tend to have worse clinical outcomes and higher mortality than those without sarcopenia. Although there is general agreement on the principal diagnostic characteristics, initial thresholds for muscle mass, strength, and physical performance were based on data from populations of predominantly Europid ancestry and may not apply worldwide. The Asian Working Group for Sarcopenia (AWGS) issued regional consensus guidelines in 2014, and many more research studies from Asia have since been published; this review summarizes recent progress. The prevalence of sarcopenia estimated by the AWGS criteria ranges between 4.1% and 11.5% of the general older population; however, prevalence rates were higher in Asian studies that used European Working Group on Sarcopenia in Older People cut-offs. Risk factors include age, sex, heart disease, hyperlipidemia, daily alcohol consumption, and low protein or vitamin intake; physical activity is protective. Adjusting skeletal muscle mass by weight rather than height is better in showing the effect of older age in sarcopenia and identifying sarcopenic obesity; however, some Asian studies found no significant skeletal muscle loss, and muscle strength might be a better indicator. Although AWGS 2014 diagnostic cut-offs were generally well accepted, some may require further revision in light of conflicting evidence from some studies. The importance of sarcopenia in diverse therapeutic areas is increasingly evident, with strong research interest in sarcopenic obesity and the setting of malignancy. Pharmacologic interventions have been unsatisfactory, and the core management strategies remain physical exercise and nutritional supplementation; however, further research is required to determine the most beneficial approaches.

Sarcopenia has garnered increasing interest among clinicians over recent decades and is now classed as a geriatric syndrome; the current definition is age-associated loss of skeletal muscle mass as well as diminished muscle strength and/or physical performance, which is associated with reduced physical capability, impaired cardiopulmonary performance, disability, and mortality among older people.[1] Geriatric patients with sarcopenia may also have poorer outcomes of medical treatments; for example, surgery or chemotherapy for cancer.[2,3] In this era of rapid population aging, sarcopenia has become one of the most important challenges to healthy aging.[4]

To improve the early recognition, diagnosis, and management of sarcopenia, as well as to stimulate further research, several guidelines have been published. In 2010, the European Working Group on Sarcopenia in Older People (EWGSOP) introduced the first and most widely used consensus, which recommended cut-offs of muscle mass, muscle strength, and physical performance for diagnosing and assessing sarcopenia.[5] The following year, the International Working Group on Sarcopenia (IWGS) published a consensus similar to that of the EWGSOP.[6] The American Foundation for the National Institutes of Health (FNIH) Sarcopenia Project published their official consensus in

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2014.[7] To facilitate timely diagnosis of sarcopenia in community or clinical settings, rapid diagnostic tests have also been developed, for instance, SARC-F.[8]

As a result of differences in ethnicity, genetic background, and body size, the EWGSOP and IWGS criteria might not apply to Asians[9]; therefore, sarcopenia experts and researchers from Taiwan, Japan, Hong Kong, South Korea, China, Malaysia, and Thailand established the Asian Working Group for Sarcopenia (AWGS), which published guidelines for diagnosing sarcopenia in 2014.[10] The AWGS consensus aimed to foster further research and improve the clinical management of sarcopenia in Asian populations. Since then, many sarcopenia research studies from Asian countries have been published and contributed important new information to incorporate into an updated AWGS report. Therefore, the AWGS has reviewed research in Asian countries from October 2013 to October 2015 (2 years after the first AWGS consensus), on topics including epidemiology, screening and diagnosis, cut-off points, associations of sarcopenia and other diseases, and management. This report summarizes recent progress.

Methods

We reviewed literature on sarcopenia published by researchers from eight Asian countries, including those represented on the AWGS, from October 2013 until October 2015. We searched PubMed (United States National Library of Medicine, National Institutes of Health) database records on September 8, 2015, using the following search terms: "sarcopenia" AND ("China" OR "Hong Kong" OR "Japan" OR "Korea" OR "Malaysia" OR "Singapore" OR "Thailand" OR "Taiwan"). In order to recruit as many Asian studies as possible, the search only excluded articles with no English-language abstract. All original articles returned by the database search were investigated, and their titles and abstracts were screened against additional inclusion criteria: studies selected for detailed review were limited to articles that reported about sarcopenia epidemiology, assessment, diagnosis, association with other diseases, management, and interventions and their outcomes. Molecular studies, animal studies, and articles that were not focused on sarcopenia (eg, focus on physical activity or fragile geriatric population) were excluded, as were duplicate records, conference abstracts, or comments about another publication. Remaining full-text articles were retrieved and reviewed.

Literature Review Results

Figure 1 shows the literature selection process. From 314 potentially relevant publications, 239 that met the inclusion criteria were scrutinized: 25 from China, 18 from Hong Kong, 121 from Japan, 47 from South Korea, 3 from Malaysia, 1 from Thailand, and 24 from Taiwan. Article types included original research, brief reports, reviews, and letters. We summarized current research findings in each included topic area, as follows.

Epidemiology

Since 2013, epidemiologic studies in Asia have mainly used either the AWGS or the EWGSOP criteria (Table 1), with relatively higher reported prevalence of sarcopenia in countries and surveys that applied the latter. Among those using AWGS criteria, the estimated prevalence of sarcopenia among the general older population ranged between 4.1% and 11.5%.[11,13,14,23] In a study of older suburban Chinese, the prevalence of sarcopenia was 6.4% in men and 11.5% in women; associated factors included sex, age, daily consumption of alcohol, and peptic ulcer.[11] Among 2000 community-dwelling older Hong Kong men, the prevalence of sarcopenia was 9.4%: sarcopenia was more common in those who were older or had poorer cognitive function and lower protein or vitamin intake.[13] The reported prevalence rates

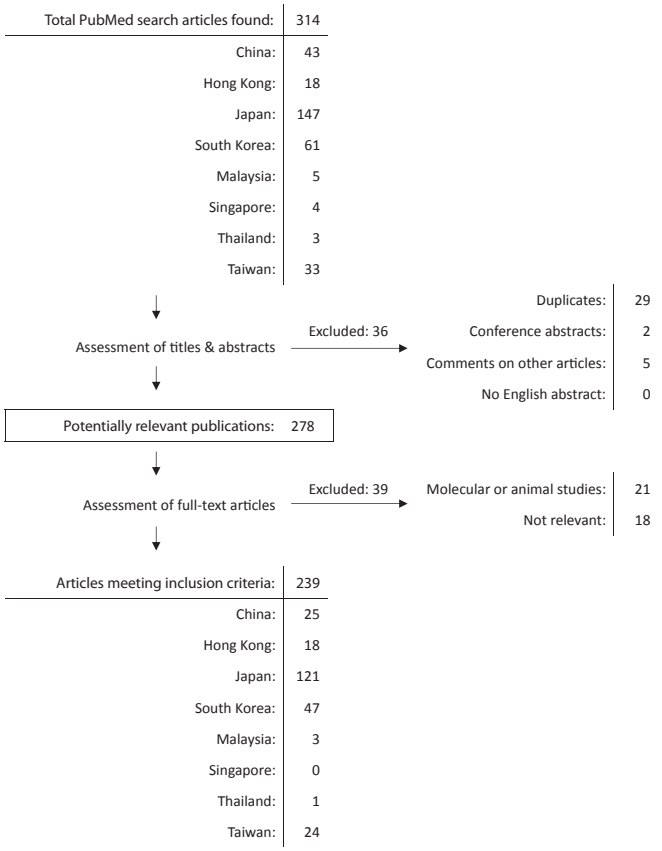

Fig. 1. Systematic literature review protocol.

of sarcopenia in 949 randomly selected older men and women from Japan were 9.6% and 7.7%, respectively,[14] and rates of 9.3% in Taiwanese men and 4.1% in women were similar to those of nearby countries. Further, sarcopenia in Taiwan was significantly associated with impaired verbal fluency but not with global cognitive function.[23]

Studies that applied the EWGSOP criteria produced higher estimated prevalence rates,[12,15–20] for example, 13.8% in men and 12.4% in women in the Research on Osteoarthritis/osteoporosis Against Disability study in Japan, in which exercise habit in middle age was a protective factor for sarcopenia in late life.[20] Similarly, a study of 1971 community-dwelling older adults in Kashiwa City, Japan, found 14.2% of men and 22.1% of women to be sarcopenic.[16] The baseline prevalence of sarcopenia in a longitudinal survey in Hong Kong was 9.0%, with the annual incidence of 3.1%; during the 4-year study period, 14.1% of initially sarcopenic participants returned to normal.[12] Another survey in Japan reported prevalence rates of 21.8% in men and 22.1% in women, which was age- and sex-dependent: although male participants younger than 75 were significantly less sarcopenic than women of the same age group (age 65–69 years: 2.8% vs 11.3%; age 70–74 years: 5.3% vs 11.8%), the prevalence of sarcopenia in men aged 85 years and above was significantly higher (75.0% vs 54.3%).[15] A study in Taiwan that recruited 353 older residents (mean age 82.7 ± 5.3 years) of a retirement community found 30.9% to have sarcopenia.[17] In a study of Japanese women aged 75 years and older, the prevalence rates of pre-sarcopenia, sarcopenia, and severe sarcopenia were 23.8%, 11.2%, and 4.6%, respectively; older age, lower body mass index (BMI), history of heart disease, and hyperlipidemia were all related to the development and progression of sarcopenia.[18]

Other investigators used neither AWGS nor EWGSOP criteria. Data from the Fourth Korean National Health and Nutrition Examination (2008–2009) showed that sarcopenia affected 12.1% of men and 11.9%

Table 1
National/Regional Prevalence Rates of Sarcopenia Among Elderly People, and Diagnostic Criteria

Country/ Region	Sample Size; Age (Years)	Diagnostic Criteria	Cut-Off Points			Prevalence Rate (%)	Data Source
			Appendicular Muscle Mass Index (kg/m^2)*	Handgrip Strength (kg)	Gait Speed (m/s)		
China	1076; ≥60	AWGS	♂: <7.0; ♀: <5.7 (HA-BIA)	♂: <26.0; ♀: <18.0	≤0.8	♂: 6.4; ♀: 11.5	Han 2016[11]
Hong Kong	4000; ≥65	EWGSOP	Lowest quintile. ♂: <6.52; ♀:<5.44 (HA-BIA)	♂: ≤28.0; ♀: ≤18.0	≤0.8	9.0	Yu 2014[12]
Hong Kong	2000; ♂ ≥65	AWGS	<7.0 (HA-BIA)	<26.0	≤0.8	9.4	Yu 2014[13]
Japan	949; ≥65	AWGS	♂: <7.0; ♀: <5.7 (HA-BIA)	♂: <26.0; ♀: <18.0	≤0.8	♂: 9.6; ♀: 7.7	Yuki 2015[14]
Japan	1882; 65–89	EWGSOP	Lowest quintile. ♂: <6.75; ♀: <5.07 (HA-BIA)	♂: <30.0; ♀: <20.0	≤0.8	♂: 21.8; ♀: 22.1	Yamada 2013[15]
Japan	1971; ≥65	EWGSOP	♂: <7.0; ♀: <5.8 (HA-BIA)	<Lowest quintile ♂: <30.0; ♀: <20.0	<Lowest quintile; ie, <1.26	♂: 14.2; ♀: 22.1	Ishii 2014[16]
Taiwan	353; ♂ ≥65†	EWGSOP	<8.87 (HA-BIA)	<22.5	≤0.8	30.9	Hsu 2014[17]
Japan	538; ♀ ≥75	EWGSOP	<6.42 (HA-BIA)	BMI ≤23: ≤17.0 BMI 23.1–26.0: ≤17.3 BMI 26.1–29.0: ≤18.0 BMI >29.0: ≤21.0	≤1.0	Pre-sarcopenia, 23.8; sarcopenia, 11.2; severe sarcopenia, 4.6	Kim 2015[18]
Taiwan	549; ≥65	EWGSOP	♂: <7.70; ♀: <5.67 (HA-BIA)	♂ BMI ≤24: ≤29.0 ♂ BMI 24.1–28.0: ≤30.0 ♂ BMI >28.0: ≤32.0 ♀ BMI ≤23.0: ≤17.0 ♀ BMI 23.1–26.0: ≤17.3 ♀ BMI 26.1–29.0: ≤18.0 ♀ BMI >29.0: ≤21.0	≤0.8	Sarcopenia, 7.1; severe sarcopenia, 5.6	Wu 2014[19]
Japan	1000; ≥65	EWGSOP	♂: <7.0; ♀: <5.8 (HA-BIA)	ND	≤0.8	♂: 13.8; ♀: 12.4	Akune 2014[20]
Korea	2264; ≥65	NA	< −2 SD of young reference group (WA-DXA)	ND	ND	♂: 12.1; ♀: 11.9	Ryu 2013[21]
China	1024; ≥70	NA	< −2 SD of young reference group (WA-DXA)	ND	ND	♂: 13.2; ♀: 4.8	Cheng 2014[22]

BIA, bioimpedance assay; DXA, dual-energy X-ray absorptiometry; HA, height-adjusted; ♂, ♀, male, female; NA, not applicable; ND, no data; SD, standard deviations; WA, weight-adjusted.
*Unless weight-adjusted.
†Resident in long-term care facilities.

of women and was significantly associated with physical activity among men.[21] The prevalence rates of sarcopenia among men and women aged 70 years and older in a Chinese study were 13.2% and 4.8%, respectively.[22] Because different diagnostic criteria may not produce markedly divergent results, a pooled analysis of cohorts from Taiwan estimated that the population prevalence of sarcopenia lay between 3.9% (men 5.4%; women 2.5%) and 7.3% (men 8.2%; women 6.5%).[24] Research in Hong Kong that compared the performance of current criteria in predicting the incident physical limitation and mortality of sarcopenia found that AWGS, EWGSOP, IWGS, FNIH, and SARC-F have similar capability[25]; however, results from the FNIH Sarcopenia Project have suggested that FNIH-defined sarcopenia may be less prevalent than that diagnosed using the EWGSOP or IWGS criteria.[26]

Assessment and Diagnosis

Effective assessment affords better opportunities for early detection, diagnosis, and management of sarcopenia. The competence, utility, and possible improvement of various assessment tools have been widely studied in recent years. In particular, evaluation of appendicular muscle mass is fundamental to diagnosing sarcopenia. Although the AWGS consensus recommends computed tomography, magnetic resonance imaging, or dual-energy X-ray absorptiometry for diagnosing sarcopenia, the AWGS considered bioimpedance analysis with height adjustment to be acceptable for muscle measurements.[10] However, several Korean studies preferred using weight-adjusted muscle mass, because of the extremely low prevalence of sarcopenia among older Korean women.[21,27] A study that compared the capability of height- versus weight-adjusted muscle indices showed that weight adjustment is better in showing the effect of older age in the prevalence of sarcopenia and facilitates the identification of potential sarcopenic obesity; the prevalence rates of height- and weight-adjusted sarcopenia were 5.7% and 9.7%, respectively, with corresponding prevalence of sarcopenic obesity of only 0.13% versus 7.1%.[28] Likewise, another study focused on extremely old Chinese subjects found higher prevalence rates of sarcopenia and sarcopenic obesity using weight adjustment rather than height adjustment (sarcopenia: 53.2% vs 45.7%; sarcopenic obesity: 11.5% vs 4.9%).[29] To date, Korean studies have most often used weight-adjusted muscle mass to define sarcopenia, and the associations with cardiometabolic health have been reported extensively.[21,27] Other investigators have proposed a mixed method using both height- and weight-adjusted muscle indices, because both approaches provide useful information about sarcopenia. Meng et al found that older adults with height-defined sarcopenia had lower weight, BMI, fat mass, and absolute muscle strength, whereas subjects with weight-adjusted sarcopenia had lower muscle strength; the best predictor for poor physical performance was an index that combined height and weight adjustment.[30] Korean researchers report that height-adjusted muscle index may be more practical for diagnosing sarcopenia in men whereas weight adjustment could be more appropriate for women.[31] To facilitate early

detection of sarcopenia in the older population, Japanese researchers have suggested that muscle mass loss in the legs, rather than the upper body, is a useful surrogate.[32]

Skeletal muscle loss was not a universal finding in Asian studies. A longitudinal study of 3952 community-dwelling Japanese aged 40–79 years detected only trivial decreases in skeletal muscle mass after 12 years, especially among women; however, leg extension power and handgrip strength per muscle mass had declined significantly, highlighting that diminished muscle strength was more age dependent than loss of muscle mass.[33] Furthermore, Korean researchers found that muscle strength predicted 5-year mortality and low physical performance better than muscle mass.[34] Based on a 3-year survey in Thailand, quadriceps strength below 18.0 kg for men and 16.0 kg for women aged 60 and older was considered to be sarcopenia.[35]

Simple sarcopenia assessment tools are preferable in community and clinical settings. SARC-F, which comprises 5 questions, is one of the earliest rapid assessment instruments[8]; this was found to be a practical means of identifying sarcopenia and impaired physical function among older Chinese people.[36] However, according to a Hong Kong survey, SARC-F was insufficiently sensitive in diagnosing sarcopenia.[37] Japanese researchers have proposed uncomplicated equations for evaluating appendicular muscle mass that can obviate imaging studies. For example, Yoshizumi et al found a good correlation between skeletal muscle area and body surface area among healthy adults, with skeletal muscle area (cm^2) equal to body surface area $\times$ 126.9 = 66.2 (males), and $\times$ 125.6 = 81.1 (females).[38] Another important surrogate is calf circumference, which Kawakami et al showed was positively correlated with skeletal muscle index.[39] Ishii et al have established a scoring system to calculate the probability of sarcopenia among older people, which comprises three easily obtainable variables—age, handgrip strength, and calf circumference—and has high predictive accuracy.[16]

Cut-off Points for Sarcopenia Diagnosis

The first AWGS consensus recommended 2 standard deviations below the mean value of a young reference group, or the lower quintile of the study population, as the cut-off points for low muscle mass; it also advocated using a height-adjusted index to estimate skeletal muscle mass in Asians: the recommended thresholds were 7.0 kg/m^2 for men and 5.4 kg/m^2 for women by dual-energy X-ray absorptiometry (the cut-off for women by bioimpedance assay was 5.7 kg/m^2). Handgrip strength less than 26.0 kg in men and 18.0 kg in women were regarded as low muscle strength, and for physical performance the cut-off value of gait speed (determined by 6-meter walk), was 0.8 m/s.[10] These recommendations were well accepted in recent studies.[31,40] Hong Kong authors reported that the strongest association of slow gait speed and mortality was observed at the cut-off of 0.8 m/s.[41]

However, not all studies concur on the determination of cut-off values for sarcopenia diagnosis. Analysis of pooled individual participant data from 5 study samples in Taiwan showed that the cut-off points for muscle mass were 6.76–7.09 kg/m^2 in men and 5.28–5.70 kg/m^2 in women. Muscle strength measured by handgrip strength should be stratified by BMI, and the authors determined the corresponding cut-offs for low handgrip strength for men with BMI <22.1, 22.1–24.3, 24.4–26.3, and >26.3 to be 25.0, 26.5, 26.4, and 27.2 kg, respectively. The cut-off values for women with BMI <22.3, 22.3–24.2, 24.3–26.8, and >26.8 were 14.6, 16.1, 16.5, and 16.4, respectively. Meanwhile, the cut-off points of gait speed varied with height, with values of 0.67–0.71 m/s for men and 0.57–0.67 m/s for women.[24] A study that investigated age-related differences in body composition and physical function associated with sarcopenia in elderly Chinese found that applying AWGS criteria would result in a limited prevalence of low muscle mass and slow gait speed; therefore, the suggested cut-offs for gait speed were 0.98 m/s in men and 0.88 m/s in women.[42] Researchers from Taiwan and Japan have also adopted 1.0 m/s as cut-off for slow walking speed.[43,44] These findings imply that the AWGS consensus cut-off points of handgrip strength and gait speed may need further revision.

Others have suggested lower cut-off points and country-specific criteria for muscle mass; Kwon et al analyzed data from 11,633 Korean women aged 10–97 years, and recommended the cut-off for low muscle mass to be 4.4 kg/m^2 for Korean females at any age, which is lower than that recommended by the AWGS or EWGSOP; this difference is probably because Korean women in their thirties and forties were taller than other Asian women of similar ages.[45] Other reports pointed out that 2 standard deviations below the mean of a young reference group would lead to low prevalence of inadequate muscle mass and argued that the lowest 20th percentile is a more suitable threshold for diagnosing sarcopenia.[31] Comorbidities status is another important associated factor for sarcopenia. A Taiwanese study reported that the combined association of chronic disease and low skeletal muscle mass with physical performance was stronger than the effect of either factor alone.[46]

Association of Sarcopenia and Other Diseases

Sarcopenia is an exigent geriatric syndrome because it is associated with adverse outcomes such as disability and mortality. The relationship between osteoporosis, falls and sarcopenia has already been well established,[13,47] and over recent years its importance in other therapeutic areas has been reported; these include endocrinology,[48] oncology,[49,50] cardiovascular diseases,[51] nephrology,[52] gastroenterology,[53,54] psychiatry,[55] and other geriatric syndromes.[44]

In endocrinology and metabolism, the novel entity of sarcopenic obesity has aroused great research interest. In theory, sarcopenic obesity inflicts a synergic impact of sarcopenia and obesity on the elderly.[56,57] Older people with sarcopenic obesity are usually less physically active,[21] with poorer functional performance[29] and higher risk of insulin resistance, dyslipidemia, cardiovascular and metabolic diseases.[27,58] However, this concept of a double burden in sarcopenic obesity remains highly controversial because of the favorable effect of overweight and obesity in the elderly population. Data from the Korea National Health and Nutrition Examination Survey showed that adults with sarcopenic obesity had higher systolic and diastolic blood pressure than those who did not, suggesting that abdominal obesity and sarcopenia may potentiate each other to induce hypertension.[59] People with sarcopenic obesity have greater likelihood of advanced arterial stiffness than those with sarcopenia or visceral obesity alone.[60] Japanese researchers have reported that preserved muscle fitness, especially of the lower extremities, may be beneficial for metabolic parameters (eg, serum lipid profile) and diminish associated risks for early mortality.[48]

Sarcopenia also independently predicts the prognosis of certain malignancies. In a Japanese study, sarcopenic patients had significantly higher liver cancer mortality than nonsarcopenic ones, regardless of the clinical stage and treatment. This higher mortality may relate to the positive association between insulin resistance, vitamin D deficiency, increased inflammatory cytokine levels (eg, interleukin 6), and sarcopenia, all of which usually worsen the prognosis of hepatocellular carcinoma.[61] Outcomes of malignancy treatment among sarcopenic patients were also poorer; in a Japanese study of hepatocellular carcinoma, the overall survival rate after partial hepatectomy was lower among those with sarcopenia.[49] Body composition was also an important factor affecting cancer outcomes after major surgery.[62] In another study, sarcopenic patients had shorter survival time after first-line chemotherapy for metastatic urothelial carcinoma.[63] Cancer patients with sarcopenia were also

more likely to have treatment complications such as postoperative respiratory problems and drug toxicities, and examination for pulmonary function before esophageal surgery was recommended for such patients.[64] A review of data from patients with stage III colon cancer who received adjuvant chemotherapy in Korea showed that decreased muscle mass was associated with increased risk of grade 3 to 4 toxicity and poor prognosis.[65] Patients with pancreatic cancer,[66] as well as renal cell carcinoma,[67] also had negative treatment outcomes. Some researchers investigating the association between sarcopenia and poorer prognosis of malignancy have proposed that sarcopenia may be a proxy for aggressive tumor biology that leads to systemic inflammation and muscle wasting. Sarcopenia may be the overall culmination of malnutrition and cancer cachexia, which impairs recovery after major treatment.[68–70]

Sarcopenia is associated with various geriatric syndromes. A 2-year cohort study found that 36.8% of men and 18.8% of women with sarcopenia became dependent in activities of daily living.[71] Diminished chewing ability and dysphagia were also more common among older people with sarcopenia,[44,72] perhaps because of decreased tongue pressure.[73] Older people with sarcopenia, especially among those with multiple comorbidities, also have higher risks for lower physical activity levels and fall-related injuries.[74,75] Sarcopenia is also related to psychological conditions such as depression and cognitive impairment; patients with depressive symptoms had a higher risk for sarcopenia than those without.[52] Older people with sarcopenia tended to consider themselves unhealthy and were more likely to have unstable sleep patterns.[76] Cross-sectional studies revealed sarcopenic obesity to be related to self-perceived stress, suicidal ideation, and poorer quality of life.[55]

Management for Sarcopenia

Physical activity and nutritional supplementation are the core strategies for sarcopenia management. Molecular studies have shown that exercise promotes the secretion of sex steroid hormones and has positive impacts on age-related syndromes, especially sarcopenia.[77] Japanese researchers reported that exercise benefits muscle synthesis and satellite-cell function.[78] However, exercises for older people should be designed with caution because inappropriate training may result in adverse outcomes such as musculoskeletal complaints. Recent evidence-based reports suggest that low-intensity exercise benefits older individuals. Eighteen healthy older Japanese participants in a 12-week program of very low intensity (defined as 30% of one repetition maximum) resistance training, with slow movement and generation of tonic force, significantly increased their muscle size and strength.[79] Exercise with nutritional support may produce better effects that may persist for years. In a study of 304 elderly sarcopenic women, moderate intensity of muscle-enhancing training with daily amino acids supplementation mitigated reductions in muscle mass, muscle strength, and walking speed; moreover, the beneficial effects persisted over a 4-year follow-up.[80] However, to date, a defined exercise prescription that maximizes the benefits for sarcopenia management has not yet been developed.

Numerous dietary supplements have been investigated for reducing muscle wasting, or increasing muscle mass and strength. The effect of essential amino acids has been well established.[81] Recent research has focused more on substances such as vitamin D,[82] vitamin E,[83] quercetin,[84] royal jelly,[85] coffee,[86,87] ghrelin,[88] Japanese herbal medicine,[89] among others. In vivo studies have revealed a direct effect of vitamin D on myoblast proliferation and differentiation.[90] Korean researchers also found an additive association of vitamin D insufficiency and sarcopenia with low femoral bone mineral density.[82] Adequate supplementation of active vitamin D could increase muscle mass, especially among osteoporotic patients.[91] Antioxidants, such as vitamin C and vitamin E, may also be beneficial and could facilitate the elimination of reactive oxygen species that cause membrane injury during muscle contraction.[83] Other experiments have shown promising effects of royal jelly, quercetin, caffeine, and Japanese traditional herbs (eg, Hachimijogan), on skeletal muscle myoblast proliferation, increasing muscle strength, and reducing levels of cytokines in skeletal muscle cells.[84–86,89]

Compared with exercise and nutritional supplementation, current pharmacologic interventions have proven unsatisfactory. A meta-analysis demonstrated that angiotensin-converting enzyme inhibitors have no noteworthy benefits in counteracting the age-related decline of muscle strength for older participants.[92] Androgens are of very little clinical use because of their considerable side effects (eg, prostate cancer), and less toxic selective androgen receptor modulators are currently under development; although these have similar benefits to muscle cells,[93,94] recent clinical trials did not detect any overall effect in reducing sarcopenia.

Conclusions and Future Challenges

Since the first AWGS consensus was issued, sarcopenia has become a very active field of research in Asia, with many published studies of epidemiology, assessment instruments, cut-off points, impacts on geriatric health, and beneficial management. Modified diagnostic cut-offs for handgrip strength and gait speed may be needed because of emerging evidence. Moreover, studies using FNIH criteria for sarcopenia diagnosis are also lacking in Asian countries. Although some intervention studies in Asian countries have been published, more are needed and the research interest in sarcopenic obesity also merits further pursuit.

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