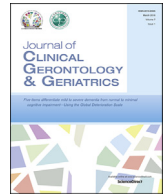




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Review article

Sex differences of sarcopenia in Asian populations: The implications in diagnosis and management

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ABSTRACT

Sarcopenia, a well-known geriatric syndrome, is defined as the age-related loss of muscle mass plus declined muscle function (muscle strength and/or physical performance). Sarcopenia is associated with a number of adverse outcomes, including poor quality of life, falls, disability, and mortality. The clinical impact of sarcopenia on older people will escalate along with the rapid growth of elderly population in Asia. Moreover, the differences of ethnic backgrounds between Asian people and Westerners have triggered the need for specific diagnostic criteria for Asian populations. After the publication of Asian Working Group for Sarcopenia consensus, sarcopenia has gained even more extensive research attention in Asia. In general, the reported prevalence of sarcopenia in Asia was lower than Western countries, ranging from 2.5% to 45.7%. Asian people tend to have lower muscle mass, weaker grip strength, slower gait speed, and higher body fat mass with central distribution. Compared to Western populations, the rate of age-related muscle mass decline in older Asian people remain relatively unchanged, but the decline rate in muscle strength or physical performance was more significant along with aging. With aging, Asian people presented with greater increase in fat mass and higher prevalence of central obesity, especially in women. Due to the great impact of sarcopenia, a life course program for good nutrition and physical activities would be of great benefit. However, various research challenges remain to be resolved in the future and more outcome-based trials are needed to formulate the most optimal strategy for sarcopenia in Asia.

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1. Introduction

Sarcopenia, first described by Rosenberg in 1989,¹ has become an important challenge for the health of older people over recent decades. Originally, sarcopenia, which was derived from the Greek for *poverty of the flesh*, and focused on age-related loss of lean body mass. Although several subsequent studies have been based on this definition, some challenges gradually emerged. Many epidemiological studies showed that age-related decline in muscle strength far exceeded the loss of muscle mass, so sarcopenia defined by loss of muscle mass alone became inadequate to identify older people at risk of sarcopenia-related conditions.² The International Working

Group on Sarcopenia³ and European Working Group on Sarcopenia in Older People (EWGSOP)⁴ have proposed operational definitions for sarcopenia diagnosis. Both combine measurements of muscle function (physical performance or muscle strength) and muscle mass in the diagnostic criteria. To date, researchers have defined sarcopenia as coexistence of muscle mass loss as well as muscle function decline and have demonstrated a close association of sarcopenia with poor health status. Once older adults are diagnosed as having sarcopenia, they may face the risk of various adverse health outcomes, including poor quality of life,⁵ falls,⁶ disability,⁷ and mortality.⁸ Therefore, the research into its etiology, pathogenesis, and risk factors are growing rapidly worldwide, especially in Asia.⁹

Asia is the fastest aging region in the world and sarcopenia will result in a greater impact on Asian populations than in other continents.^{9,10} However, Asian populations are composed of people

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with a wide range of ethnicities, culture, religious backgrounds, and lifestyles. Considering the large heterogeneity of Asian countries and the compelling need to reach an Asia-wide consensus, experts and researchers of sarcopenia from China, Hong Kong, Japan, South Korea, Malaysia, Taiwan, and Thailand organized the Asian Working Group for Sarcopenia (AWGS) and established a diagnostic algorithm of sarcopenia based on currently available evidence in 2014.¹⁰ Since the consensus, sarcopenia has gained extensive research attention in Asia, and more Asia-specific questions on this issue were discovered as well. Therefore, in the present article, we will summarize the prevalence and characteristics of sarcopenia in Asia and discuss the current challenges on sarcopenia research.

2. The prevalence of sarcopenia in Asian populations

The prevalence in Asia varied greatly according to different population, sex, instruments of measurements, method of determining cutoff values, and definition of sarcopenia (Table 1). Before the AWGS consensus, most Asian researchers followed the diagnostic algorithm of EWGSOP and used appendicular skeletal muscle mass divided by height squared ($ASM/height^2$), derived from either dual-energy X-ray absorptiometry (DXA) or bioelectrical impedance analysis (BIA), to define muscle mass.⁹ In Japan, the prevalence of sarcopenia in the community was 8.2–21.8% in men and 6.8–22.1% in women, using the $ASM/height^2$ in the EWGSOP-suggested algorithm.^{11–13} In Korea, the data from the Fourth Korean National Health and Nutritional Examination Surveys (KHANES IV)¹⁴ revealed that the prevalence, defined only by low muscle mass ($ASM/height^2$ value was 2 standard deviations below the mean for young healthy adults aged 20–39 years) but not considering muscle strength or physical performance, was 12.4% in men and 0.1% in women. The extremely low prevalence of low muscle mass in older Korean women has raised some research concerns. However, by using the weight-adjusted appendicular skeletal muscle mass ($ASM/weight \times 100$), the prevalence of sarcopenia in Korean men and women was 9.7% and 11.8%, respectively, which was a little lower than but much closer to the prevalence in Japan.

In Taiwan, the reported prevalence from several community studies was about 5.4–10.8% in men and 2.5–7.8% in women by using height-adjusted skeletal muscle index in EWGSOP definition.^{15,16} When using percentage skeletal muscle index ($SMM/weight = total\ skeletal\ muscle\ mass/weight \times 100$) in EWGSOP definition, the prevalence was 14.9% in men and 19% in women.¹⁵ The prevalence in Taiwan women was similar to Korean older women when muscle mass was obtained by height-adjusted muscle index. In previous studies, researchers have demonstrated that low muscle mass adjusted by height ($ASM/height^2$) or weight ($SMM/weight \times 100$ or $ASM/weight \times 100$) revealed different obesity status. Low muscle mass identified by height-adjusted muscle index was mostly observed in lean people and that adjusted by weight was mostly in overweight and obese people.¹⁵ The main differences in epidemiological studies from Taiwan and Korea may be caused by the relatively higher adiposity of older women than Western older women.

In Hong Kong, the prevalence of sarcopenia in the community was 9%.¹⁷ The prevalence in men was around 10.2% at age 70–74 years and 15.4% at age 75–79 years; the prevalence in women was 10.1% at age 70–74 years and 6.2% at age > 75 years if sarcopenia was only defined by low muscle mass.¹⁸ In Beijing, a community study using height-adjusted muscle index in EWGSOP definition showed a high (45.7%) prevalence of sarcopenia in men aged > 80 years (mean age, 88.8 ± 3.7 years).¹⁹ Even so, the overall prevalence of sarcopenia in Asia was lower than in the Caucasian and Hispanic populations.^{14,18,20}

Several possibilities may explain the lower prevalence of sarcopenia in Asian populations.^{15,18} First, the cutoff for low skeletal muscle mass was mostly defined according to young reference adults. Due to rapid economic growth in Asia, older adults with active lifestyle may keep more muscle mass and better muscle strength than the youth. Therefore, the reference data from young people may result in a lower threshold and thus fewer older people meet the criteria of sarcopenia. Second, although height-adjusted muscle index was the most common measurement to quantify muscle mass, it may underestimate the prevalence of sarcopenia in obese people with low muscle mass. The Asian population, especially women, is known to have higher central adiposity than Caucasians, so certain adjustments in defining muscle mass in Asia may be needed.²¹

3. Age-related loss of muscle mass in Asian populations

According to several Asian epidemiological studies, muscle mass index using height adjustment was around 6.7–7.58 kg/m^2 and 5.7–6.18 kg/m^2 in community-dwelling men and women aged > 40 years, respectively.^{14,22,23} When using weight-adjusted muscle mass indices, low muscle mass (skeletal muscle mass over body weight) in the population older than 50 years was 35.7% in men and 28.4% in women¹⁵ and was 33.2% in men and 26.1% in women among people aged 65 years and older (appendicular muscle mass over body weight).¹⁴ Compared to reports from white and black people, Asian people had relative lower muscle mass in both sexes.^{24–26} Additionally, DXA and BIA were the most commonly used instruments to estimate the skeletal muscle mass in previous studies, but they could not precisely differentiate lipid, water, and fibrous tissue within muscle mass.^{27,28} In obese older people with high intramuscular lipid infiltration, water accumulation, and fiber deposition, DXA or BIA may overestimate their muscle mass. Due to the higher adiposity of Asian people, the muscle mass measured by DXA or BIA may be overestimated.

Evidence revealed that the two commonly used muscle mass indices, height-adjusted and weight-adjusted, actually defined two different entities of sarcopenia.^{14,15} Some studies have shown that height-adjusted muscle mass index had a close correlation with age and was a better predictor of physical function decline than the weight-adjusted one,²⁹ whereas other studies revealed that muscle mass, evaluated by weight-adjusted definition but not by height-adjusted definition was associated with functional impairment, disability, and metabolic syndrome.^{30–32} Therefore, a new concept, combined sarcopenia, defining low muscle mass by either height-adjusted or weight-adjusted definition, has been proposed and showed better correlation with poor physical performance than by only one of these definitions.³³

With regard to age-related decline in muscle mass, the Asian population showed different results in cross-sectional and longitudinal studies. In cross-sectional studies, Asian men tend to lose muscle mass gradually with aging, but not Asian women.^{18,29} In Japan and Taiwan, the decline of muscle mass with age was insignificant or slightly significant in women, either by height-adjusted or weight-adjusted definition.^{22,29} A Korean study revealed age-related decline in women only by weight-adjusted definition but not the height-adjusted one.¹⁴ These findings may result from (1) the cohort effect: older Asian adults with active living have better muscle mass preservation than the youth so the age-related muscle decline seems vague; and (2) higher adiposity in Asian women: height-adjusted definition would underestimate the prevalence in obese people.

In longitudinal analyses, study results showed a decreasing trend in both sexes with the modest to strong age-cohort effect (decline rate accelerated in advancing age). Shimokata et al²²

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