Prevalence of sarcopenia defined using the Asia Working Group for Sarcopenia criteria in Japanese community-dwelling older adults: A systematic review and meta-analysis

Hyuma MAKIZAKO, PhD, PT1, Yuki NAKAI, MS, PT1,2, Kazutoshi TOMIOKA, MS, PT2,3 and Yoshiaki TANIGUCHI, PT2,4

1) Department of Physical Therapy, School of Health Sciences, Faculty of Medicine, Kagoshima University
2) Graduate School of Health Sciences, Kagoshima University
3) Department of Rehabilitation, Tarumizu Municipal Medical Center Tarumizu Chuo Hospital
4) Department of Physical Therapy, Kagoshima Medical Professional College

ABSTRACT. The aim of this systematic review and meta-analyses was to calculate the pooled prevalence of sarcopenia based on the Asia Working Group for Sarcopenia (AWGS) criteria among Japanese community-dwelling older adults. Data from 8 studies were used to determine the prevalence of sarcopenia in the overall population and in men; data from 9 studies were used to determine that of women. The pooled prevalence rates of sarcopenia using random-effects models were 9.9% (95% confidence interval [CI], 6.2%-15.4%) overall; 9.8% (95% CI, 6.2%-15.2%) among men; and 10.1% (95% CI, 6.4%-15.5%) among women. These findings would be useful to inform community-based strategies and advanced research addressing sarcopenia prevention.

Key words: sarcopenia, muscle mass, muscle strength, aging

(Phys Ther Res 00: 00-00, 0000)
review, and a meta-analysis was not performed. In addition, the prevalence of sarcopenia among Japanese community-dwelling older adults was not evaluated.

Therefore, this systematic review and meta-analyses aimed to calculate the pooled prevalence of sarcopenia based on the AWGS criteria among Japanese community-dwelling older adults.

**Methods**

**Protocol**

The AWGS published their consensus report for recommended diagnostic algorithm in Asian population. We reviewed the literature on sarcopenia published by researchers from Japan, including articles represented by the AWGS, from February 2014 to October 2018. We searched PubMed (United States National Library of Medicine, National Institutes of Health) database records on October 31, 2018 using the following search terms: “sarcopenia” AND “prevalence” AND “Japan.” Inclusion criteria were studies that had enrolled community-dwelling participants aged ≥60 years among the general population and those that were published in English or Japanese. The titles and abstracts of all retrieved records were screened. Studies were excluded if they were conference abstracts or commentaries, diagnosed sarcopenia using criteria other than those of the AWGS, or included patients with confirmed illnesses (e.g., Alzheimer’s disease and diabetes mellitus). The remaining full-text articles were retrieved and reviewed. Those that reported prevalence data for sarcopenia based on AWGS criteria among community-dwelling Japanese older adults were retained for analyses.

**Statistical analyses**

The Cochran’s Q test was used to assess the presence of heterogeneity across studies, which was indicated by p < 0.05. I² statistic values of 25%, 50%, and 75% indicated low, moderate, and high degrees of heterogeneity, respectively. Pooled prevalence and 95% confidence intervals (CI) of sarcopenia were calculated using a fixed-effects model if heterogeneity was absent. Prevalence values were calculated among the overall, male, and female participants. Statistical analyses were completed using Comprehensive Meta-Analysis (Version 3; Biostat, Englewood, NJ, USA) software.

**Results**

**Literature review results**

The literature review process is shown in Fig. 1. From among 101 potential citations identified through Pub-
Prevalence of sarcopenia in Japanese community-dwelling older adults

Figure 2. Forest plots of the prevalence of sarcopenia among the overall participants (n = 7,974)

Footnote: CI, confidence interval.

Med and 4 additional citations found through other sources, 72 were excluded on the basis of title and abstract screening. Full-text review of the remaining 33 citations was conducted, among which 24 were excluded as follows: studies that included patients aged <60 years (n = 3); or patients with Alzheimer’s disease (AD), diabetes mellitus (DM), or other illnesses (n = 11); studies that used criteria other than those of the AWGS (n = 5); studies that did not define sarcopenia (n = 1); reviews and other article types (n = 3); and duplicates (n = 1). The remaining 9 studies were included in the meta-analysis, among which 1 included only older women. The total number of participants was 7,974 (3,723 men and 4,367 women).

Prevalence of sarcopenia

Data from 8 studies were synthesized to determine the prevalence of sarcopenia in the overall and male participants, and data from 9 studies were synthesized to determine that in female participants. The prevalence of sarcopenia in the overall, male, and female participants based on individual studies ranged from 4.7% to 25.7%, 4.9% to 25.0%, and 4.5% to 26.1%, respectively. Among all 3 groups, high degrees of heterogeneity were found across studies ($I^2 = 92.6\%$ to $97.0\%$, $p < 0.01$); therefore, random-effects models were used. The pooled prevalence of sarcopenia based on AWGS criteria in Japanese community-dwelling older adults was $9.9\%$ (95% CI, 6.2% to 15.4%) overall, $9.8\%$ (95% CI, 6.2% to 15.2%) among men, and $10.1\%$ (95% CI, 6.4% to 15.5%) among women (Fig. 2, 3).

Discussion

This systematic review and meta-analysis identified 9 studies including 7,974 Japanese community-dwelling older adults, among which 8 were used to calculate the overall prevalence of sarcopenia. The pooled prevalence of sarcopenia based on the AWGS criteria among Japanese community-dwelling older adults was $9.9\%$ overall, $9.8\%$ among men, and $10.1\%$ among women.

The prevalence of sarcopenia using the EWGSOP definition in a previous systematic review ranged from $1\%$ to $29\%$ in community-dwelling populations, $14\%$ to $33\%$ in long-term care populations, and $10\%$ in an acute hospital-care population, with regional and age-related variations. In addition, a high prevalence of sarcopenia was reported in nursing home residents (more than $40\%$) based on EWGSOP criteria. The estimated prevalences of sarcopenia based on EWGSOP, AWGS, or the International Working Group on Sarcopenia (IWGS) among Asian individuals was $10\%$ in men and $11\%$ in women, which are similar to the findings of this study. A previous study including Japanese community-dwelling older adults demonstrated a higher prevalence of sarcopenia in women than men among the young old, whereas prevalence was lower in women than men among those aged above 85 years. Although additional analyses are required, such as those stratified by age, the pooled prevalence rate among Japanese community-dwelling older adults in this meta-analysis are acceptable by comparison with previous results from studies of populations in Europe and Asia.

Recently, a corrected definition of sarcopenia was proposed by EWGSOP2, which included recommendations aimed to increase awareness of sarcopenia and its risk at earlier ages. Muscle quantity and quality, and low muscle strength, were emphasized as key characteristics, and the clinical algorithm that can be used for case-finding, diagnosis and confirmation, and severity determination of sarcopenia was updated. EWGSOP2 recommended that poor physical performance with clear cut-off points was a useful indicator of severe sarcopenia. Measures of physical functioning, such as walking speed and the timed up and go test, assessments of mobility, such as the 400 m walking test, and comprehensive measures of physical function, such as the Short Physical Performance Battery, which
A) Men (n = 3,723)

| Study name               | Event rate | Lower limit | Upper limit |
|--------------------------|------------|-------------|-------------|
| Yuki et al, 2015         | 0.096      | 0.073       | 0.126       |
| Iwasaki M et al, 2017    | 0.250      | 0.172       | 0.348       |
| Yoshimura et al, 2017    | 0.085      | 0.061       | 0.118       |
| Kim et al, 2017          | 0.078      | 0.052       | 0.116       |
| Matsumoto et al, 2017    | 0.068      | 0.026       | 0.167       |
| Yuki et al, 2017         | 0.049      | 0.031       | 0.077       |
| Yamada et al, 2017       | 0.250      | 0.175       | 0.344       |
| Uemura et al, 2018       | 0.050      | 0.041       | 0.061       |
| Total                    | 0.098      | 0.062       | 0.152       |

B) Women (n = 4,367)

| Study name               | Event rate | Lower limit | Upper limit |
|--------------------------|------------|-------------|-------------|
| Yuki et al, 2015         | 0.077      | 0.056       | 0.104       |
| Iwasaki M et al, 2017    | 0.261      | 0.202       | 0.330       |
| Yoshimura et al, 2017    | 0.080      | 0.063       | 0.103       |
| Kim et al, 2017          | 0.161      | 0.115       | 0.221       |
| Kusaka et al, 2017       | 0.086      | 0.047       | 0.153       |
| Matsumoto et al, 2017    | 0.049      | 0.020       | 0.111       |
| Yuki et al, 2017         | 0.045      | 0.028       | 0.072       |
| Yamada et al, 2017       | 0.227      | 0.179       | 0.283       |
| Uemura et al, 2018       | 0.061      | 0.052       | 0.073       |
| Total                    | 0.101      | 0.064       | 0.155       |

Figure 3. Forest plots of the prevalence of sarcopenia stratified by sex. Footnote: A: men, B: women. CI, confidence interval.

The results of this meta-analysis indicated high heterogeneity, which may be related to various factors, such as differences in age, living environment, and muscle mass measurement methods among included studies. Studies included in this meta-analysis reported different muscle mass measurement methods (dual X-ray absorptiometry and bioimpedance analysis). In addition, differences in the prevalence rates of sarcopenia have been observed in rural (13.1%) and urban (7.0%) areas; however, this variable was not investigated in the present study.

The findings of this meta-analysis should be interpreted with caution. The pooled prevalence of sarcopenia among community-dwelling older adults calculated in this study may be underestimated. Data from several cohort studies were analyzed, which included participants with access to community-setting such as community centers, public halls, and hospital outpatient units. In addition, there were high degrees of heterogeneity among the included studies. Although the participant recruitment processes differed between each cohort study, most included participants had high levels of physical function and could live independently in the community. Therefore, community-dwelling older adults at greater risk of sarcopenia, such as those who require care or support, might not be represented in our findings, contributing to an underestimated prevalence.

In summary, this review and meta-analysis found a pooled prevalence of sarcopenia based on AWGS criteria among Japanese community-dwelling older people of 9.9%. Similar prevalence rates in older men (9.8%) and women (10.1%) were found. These findings could be used to inform community-based strategies and advance research addressing sarcopenia prevention.

Conflict of Interest: There is no conflict of interest to
Prevalence of sarcopenia in Japanese community-dwelling older adults

disclose.

References
1) Rosenberg IH: Summary comments: epidemiological and methodological problems in determining nutritional status of older persons. Am J Clin Nutr. 1989; 50: 1231-1233.
2) Woo J: Sarcopenia. Clin Geriatr Med. 2017; 33: 305-314.
3) Cruz-Jentoft AJ, Baeyens JP, et al.: Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. Age Ageing. 2010; 39: 412-423.
4) Chen LK, Liu LK, et al.: Sarcopenia in Asia: consensus report of the Asian Working Group for Sarcopenia. J Am Med Dir Assoc. 2014; 15: 95-101.
5) Fielding RA, Vellas B, et al.: Sarcopenia: an undiagnosed condition in older adults. Current consensus definition: prevalence, etiology, and consequences. International working group on sarcopenia. J Am Med Dir Assoc. 2011; 12: 249-256.
6) McLean RR, Shardell MD, 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 (NIH) sarcopenia project. J Gerontol A Biol Sci Med Sci. 2014; 69: 576-583.
7) Morley JE, Abbatecola AM, et al.: Sarcopenia with limited mobility: an international consensus. J Am Med Dir Assoc. 2011; 12: 403-409.
8) Muscaritoli M, Anker SD, et al.: Consensus definition of sarcopenia, cachexia and pre-cachexia: joint document elaborated by Special Interest Groups (SIG) “cachexia-anorexia in chronic wasting diseases” and “nutrition in geriatrics.”. Clin Nutr. 2010; 29: 154-159.
9) Chen LK, Lee WJ, et al.: Recent Advances in Sarcopenia Research in Asia: 2016 Update From the Asian Working Group for Sarcopenia. J Am Med Dir Assoc. 2016; 17: 767 e1-7.
10) Higgins JP, Thompson SG, et al.: Measuring inconsistency in meta-analyses. BMJ. 2003; 327: 557-560.
11) Kojima G, Iliffe S, et al.: Prevalence of frailty in Japan: A systematic review and meta-analysis. J Epidemiol. 2017; 27: 347-353.
12) Yamada M, Kimura Y, et al.: Differential characteristics of skeletal muscle in community-dwelling older adults. J Am Med Dir Assoc. 2017; 18: 807 e9-e16.
13) Yoshimura N, Muraki S, et al.: Is osteoporosis a predictor for future sarcopenia or vice versa? Four-year observations between the second and third ROAD study surveys. Osteoporos Int. 2017; 28: 189-199.
14) Kusaka S, Takahashi T, et al.: Large calf circumference indicates non-sarcopenia despite body mass. J Phys Ther Sci. 2017; 29: 1925-1928.
15) Kim M and Shinkai S: Prevalence of muscle weakness based on different diagnostic criteria in community-dwelling older adults: A comparison of grip strength dynamometers. Geriatr Gerontol Int. 2017; 17: 2089-2095.
16) Iwasaki M, Kimura Y, et al.: The association between dentition status and sarcopenia in Japanese adults aged >/=75 years. J Oral Rehabil. 2017; 44: 51-58.
17) Yuki A, Ando F, et al.: Sarcopenia based on the Asian Working Group for Sarcopenia criteria and all-cause mortality risk in older Japanese adults. Geriatr Gerontol Int. 2017; 17: 1642-1647.
18) Matsumoto H, Tanimura C, et al.: Sarcopenia is a risk factor for falling in independently living Japanese older adults: A 2-year prospective cohort study of the GAINA study. Geriatr Gerontol Int. 2017; 17: 2124-2130.
19) Uemura K, Makizako H, et al.: The impact of sarcopenia on incident homebound status among community-dwelling older adults: A prospective cohort study. Maturitas. 2018; 113: 26-31.
20) Yuki A, Ando F, et al.: Epidemiology of sarcopenia in elderly Japanese. J Phys Fitness Sports Med. 2015; 4: 111-115.
21) Komai S, Watanabe Y, et al.: Association between the nutritional status and the severity of sarcopenia among community-dwelling elderly Japanese people. Nihon Ronen Igakkai Zasshi. 2016; 53: 387-395.
22) Cruz-Jentoft AJ, Landi F, et al.: Prevalence of and interventions for sarcopenia in ageing adults: a systematic review. Report of the International Sarcopenia Initiative (EWGSOP and IWGS). Age Ageing. 2014; 43: 748-759.
23) Shen Y, Chen J, et al.: Prevalence and associated factors of sarcopenia in nursing home residents: a systematic review and meta-analysis. J Am Med Dir Assoc. 2019; 20: 5-13.
24) Shafiee G, Keshtkar A, et al.: Prevalence of sarcopenia in the world: a systematic review and meta-analysis of general population studies. J Diabetes Metab Disord. 2017; 16: 21.
25) Yamada M, Nishiguchi S, et al.: Prevalence of sarcopenia in community-dwelling Japanese older adults. J Am Med Dir Assoc. 2013; 14: 911-915.
26) Cruz-Jentoft AJ, Bahat G, et al.: Sarcopenia: Revised European consensus on definition and diagnosis. Age Ageing. 2019; 48: 16-31.
27) Bischoff HA, Stahelin HB, et al.: Identifying a cut-off point for normal mobility: a comparison of the timed ‘up and go’ test in community-dwelling and institutionalised elderly women. Age Ageing. 2003; 32: 315-20.
28) Newman AB, Simonsick EM, et al.: Association of long-distance corridor walk performance with mortality, cardiovascular disease, mobility limitation, and disability. JAMA. 2006; 295: 2018-2026.
29) Guralnik JM, Ferrucci L, et al.: Lower-extremity function in persons over the age of 70 years as a predictor of subsequent disability. N Engl J Med. 1995; 332: 556-561.
30) Pavasini R, Guralnik J, et al.: Short physical performance battery and all-cause mortality: systematic review and meta-analysis. BMC Med. 2016; 14: 215.
31) Yoshida D, Suzuki T, et al.: Using two different algorithms to determine the prevalence of sarcopenia. Geriatr Gerontol Int. 2014; 14: 46-51.
32) Gao L, Jiang J, et al.: Prevalence of sarcopenia and associated factors in Chinese community-dwelling elderly: comparison between rural and urban areas. J Am Med Dir Assoc. 2015; 16: 1003 e1-6.