BMJ Open

Prevalence of sarcopenia in older Chinese adults: a systematic review and meta-analysis

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ABSTRACT

Objective This meta-analysis was conducted to estimate the overall prevalence of sarcopenia in older Chinese adults.

Design Systematic review and meta-analysis.

Participants A literature research was conducted using the PubMed, Web of Science, China National Knowledge Infrastructure, CQVIP and Wanfang databases. The following search terms in the abstract were used: "sarcopenia" in combination with the terms "prevalence," "epidemiology" and "China." All studies published from January 2010 to November 2020 were included. The random-effect model was used to estimate the prevalence of sarcopenia. The sex-specific prevalence of sarcopenia at a 95% CI was also calculated using different criteria for defining sarcopenia.

Primary outcome measures The overall prevalence of sarcopenia in older Chinese adults.

Results In total, 23 articles were included in this meta-analysis involving 21 564 participants. On the basis of the Asian Working Group for Sarcopenia criterion, the overall prevalence of sarcopenia among the elderly in China was 14% (95% CI 11% to 18%); the prevalence was higher in Chinese women than in men (15% vs 14%).

Conclusions This systematic review is the first estimation of the pooled prevalence of sarcopenia in older Chinese adults. Our results suggest that China has a large number of patients with sarcopenia. These findings would be useful for sarcopenia prevention in China. There is a high degree of heterogeneity, and although there are a large number of cases and could be an emerging public health issue, more research is required to make these claims.

PROSPERO registration number CRD42020223405.

INTRODUCTION

Sarcopenia is characterised by the deterioration of muscle mass and function that occurs with ageing. Several studies have shown that as age increases, skeletal muscle mass and strength are lost at a rate of 1%–2% annually, possibly leading to the decline of physical function and increasing the disability and mortality rates of elderly people as well as bringing serious economic and social burdens.[1–4]

A practical clinical definition was reported by the European Working Group on Sarcopenia in Older People (EWGSOP) in 2010.[5]

Strengths and limitations of this study

► To our knowledge, this systematic review is the first estimation of the pooled prevalence of sarcopenia in Chinese older people.
► The search languages were limited to English and Chinese.
► We included limited number of high-quality studies.
► A high level of heterogeneity among included studies was observed.

Based on this EWGSOP criteria, slow walking speed ($0.8 \, m/s$) or low grip strength ($<30 \, kg$ for men and $<20 \, kg$ for women) are indications of muscle mass decline. Later in 2011, another consensus was published by the International Working Group on Sarcopenia (IWGS).[6] However, Asia is a vast region comprising different races, countries and cultures, and developing screening and diagnostic strategies for the Asian population is imperative. The Asian Working Group for Sarcopenia (AWGS) was established in 2013, and the consensus of AWGS was released based on 16 epidemiological reports on sarcopenia in six countries or regions, leading to the development of a diagnosis strategy for sarcopenia in Asia.[7] The diagnostic criteria recommended by AWGS and EWGSOP are similar, and both include muscle mass, muscle strength and activity measurements. The only difference lies in the specific cut-off value of muscle strength and muscle mass.

According to statistics, the elderly population (≥60 years old) includes 16.1% of China's total population, which is close to 250 million. In the face of a severe ageing situation, people are paying more attention to sarcopenia, but its prevalence is inconsistent across different studies.[8–12] At present, there is no large-scale epidemiological survey of sarcopenia in China. The purpose of this study is to systematically determine the prevalence of sarcopenia in older Chinese adults.

METHODS

Search strategy

We searched the PubMed, Web of Science, China National Knowledge Infrastructure (CNKI), CQVIP and Wanfang electronic databases. The search terms in the title or abstract included the following: "sarcopenia," "muscle mass" and "muscle strength" in combination with the terms "prevalence," "epidemiology" and "China." The complete search strategy is the following: PubMed: (((sarcopenia [Title/Abstract]) OR muscle mass[Title/Abstract]) OR muscle strength[Title/Abstract]) AND ((prevalence[Title/Abstract]) OR epidemi*[Title/Abstract]) AND ((Chinese[Title/Abstract]) OR China[Title/Abstract]); Web of Science: (((TS=sarcopenia) OR TS=muscle mass) OR TS=muscle strength) AND ((TS=prevalence) OR TS=epidemi*) AND ((TS=Chinese) OR TS=China); CNKI: (AB=sarcopenia OR AB=muscle mass OR AB=muscle strength) AND (AB=prevalence OR AB=epidemiology); CQVIP: (R=sarcopenia +R=muscle mass +R=muscle strength) *(R=prevalence +R=epidemiology); and Wanfang: Abstract: (sarcopenia +muscle mass+muscle strength) * (prevalence +epidemiology). All studies published from January 2010 to November 2020 were included. The references of the retrieved articles were examined to identify additional eligible studies, and unpublished studies were excluded. The search languages were limited to English and Chinese. This systematic review and meta-analysis was registered in PROSPERO. This meta-analysis was conducted to estimate the overall prevalence of sarcopenia in older Chinese adults.

Patient and public involvement
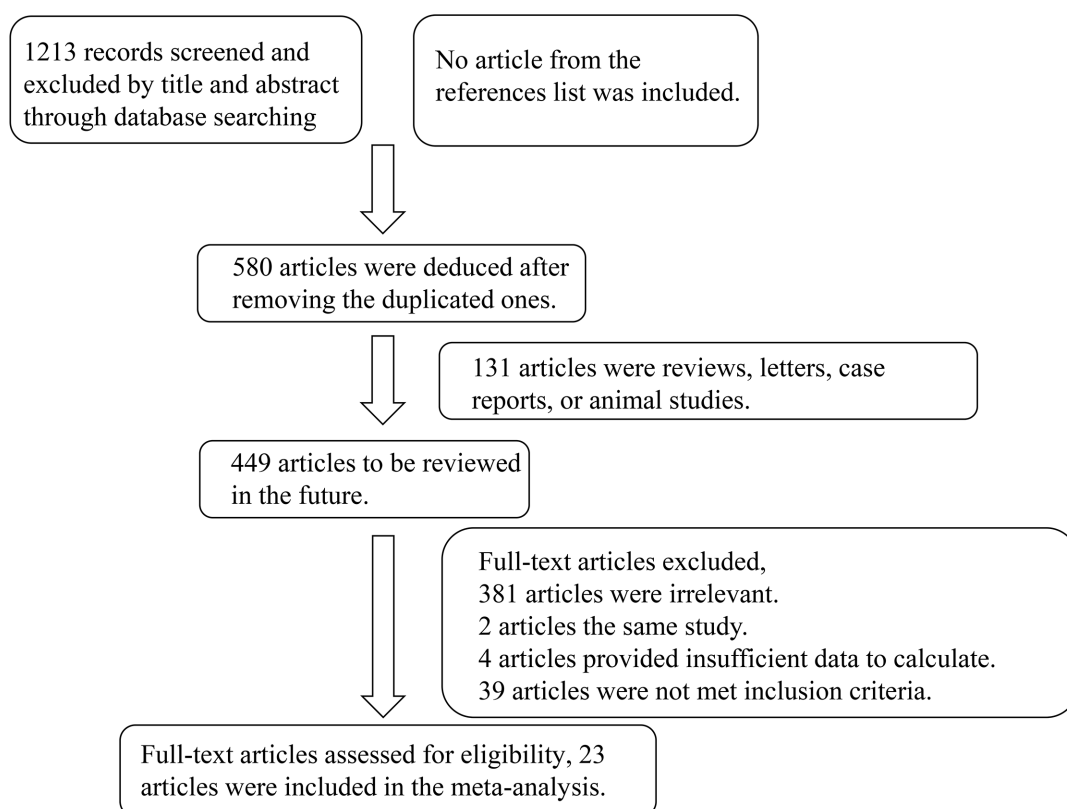
No patients were involved in this study.

Inclusion and exclusion criteria

Inclusion of the selected studies was based on the following criteria: (1) a cross-sectional study or retrospective study, (2) a sample size of ≥100 elderly Chinese participants (age ≥60 years), (3) sufficient information on sarcopenia at the corresponding 95% CI and p value and (4) the definition of sarcopenia in line with the AWGS, EWGSOP or IWGS standards.

Exclusion of the selected studies was based on the following criteria: (1) same data from different studies, (2) studies defining sarcopenia only as reduction of muscle mass or strength and (3) the subjects include a specific population, such as patients living in a nursing home or those with disability. Reviews, case reports, letters and animal researches were also excluded.

Data extraction and methodological quality assessment

Information from the selected studies was extracted by two independent researchers, including the first author's name, publication year, sample, diagnostic criteria, participants, setting and prevalence. Two independent reviewers who were not blinded to the authors or journals assessed the risk of bias in the included studies using the Newcastle-Ottawa Scale (NOS).[13] The NOS is

1213 records screened and excluded by title and abstract through database searching

No article from the references list was included.

580 articles were deduced after removing the duplicated ones.

131 articles were reviews, letters, case reports, or animal studies.

449 articles to be reviewed in the future.

Full-text articles excluded,
381 articles were irrelevant.
2 articles the same study.
4 articles provided insufficient data to calculate.
39 articles were not met inclusion criteria.

Full-text articles assessed for eligibility, 23 articles were included in the meta-analysis.

Figure 1 Flowchart of the detailed procedure for the inclusion or exclusion of selected studies.

Table 1 Study characteristics of the studies included in the meta-analysis

Author	Publication year	Participants (n)			Region	Setting	Measurement	Diagnostic criteria	Prevalence (%)			NOS
		Total	Man	Woman					Total	Man	Woman	
Lee et al[8]	2013	386	223	163	Taiwan	Urban community	DEXA	IWGS	11.1	10.8	11.7	6
								EWGSOP	16.6	14.9	19.0	
Wu et al[9]	2014	2155	1055	1100	Taiwan	Urban community	BIA	EWGSOP	3.9	5.4	2.5	6
Wu et al[10]	2014	549	285	264	Taiwan	Rural community	BIA	EWGSOP	12.7	8.1	17.8	6
Li et al[11]	2014	169	169	0	Beijing	Urban community	DEXA	EWGSOP	33.3	33.3	–	5
Meng et al[12]	2015	771	359	712	Taiwan	Urban community	DEXA	EWGSOP	9.7	0.7	12.5	6
Gao et al[17]	2015	612	254	358	Sichuan	Rural and urban community	Calf circumference	AWGS	9.8	6.7	12.0	6
Wen et al[15]	2015	286	136	150	Hangzhou	Urban community	DEXA	IWGS	6.0	7.4	4.7	5
								EWGSOP	0.4	0.8	0.01	
								AWGS	3.1	5.9	0.7	
Woo et al[19]	2015	4000	2000	2000	Hong Kong	Urban community	DEXA	IWGS	20.2	22.1	18.3	6
								EWGSOP	9.0	9.5	8.6	
								AWGS	7.3	5.3	9.3	
Zeng et al[16]	2015	395	199	196	Beijing	Rural and urban community	BIA	AWGS	24.3	18.1	30.6	5
Wang et al[18]	2015	316	164	152	Changsha	Urban community	DEXA	AWGS	29.7	26.2	33.6	6
Han et al[21]	2016	1069	467	602	Tianjin	Urban community	BIA	AWGS	9.3	6.4	17.5	5
Wang et al[20]	2016	636	316	320	Chengdu	Urban community	BIA	AWGS	10.4	8.2	12.5	5
Bai et al[25]	2016	415	212	203	Shanghai	Urban community	BIA	AWGS	28.7	33.5	23.6	6
Xia et al[23]	2016	683	239	444	Beijing	Urban community	BIA	AWGS	20.1	17.2	21.6	5
Chen et al[24]	2016	281	203	78	Chongqing	Urban community	BIA	IWGS	27.8	–	–	6
Han et al[22]	2016	878	402	476	Taiwan	Urban community	BIA	EWGSOP	9.8	4.5	14.3	6
Hai et al[26]	2017	834	415	419	Chengdu	Urban community	BIA	AWGS	10.6	11.3	9.8	6
Huang et al[29]	2017	193	65	128	Jinzhou	Urban community	BIA	AWGS	11.4	7.7	13.3	6
Yang et al[30]	2018	384	160	224	Chengdu	Urban community	BIA	AWGS	15.9	11.9	18.8	6
								IWGS	25.0	24.4	25.4	
								EWGSOP	11.7	10.6	12.5	
Du et al[34]	2019	631	213	418	Shanghai	Urban community	BIA	AWGS	12.2	19.2	8.6	5
Wang et al[35]	2019	947	465	482	Chengdu	Urban community	BIA	AWGS	7.7	6.5	8.9	5
Zhang et al[36]	2020	474	238	236	Chengdu	Urban community	BIA	AWGS	15.4	–	–	5
Liu et al[37]	2020	4500	1627	2873	Yunnan, Guizhou, Sichuan and Xinjiang	Urban community	BIA	AWGS	19.3	22.1	17.8	6

AWGS, Asia Working Group for Sarcopenia; BIA, bioelectrical impedance analysis; DEXA, dual-energy X-ray absorptiometry; EWGSOP, European Working Group on Sarcopenia in Older People; IWGS, International Working Group on Sarcopenia; NOS, Newcastle-Ottawa Scale.
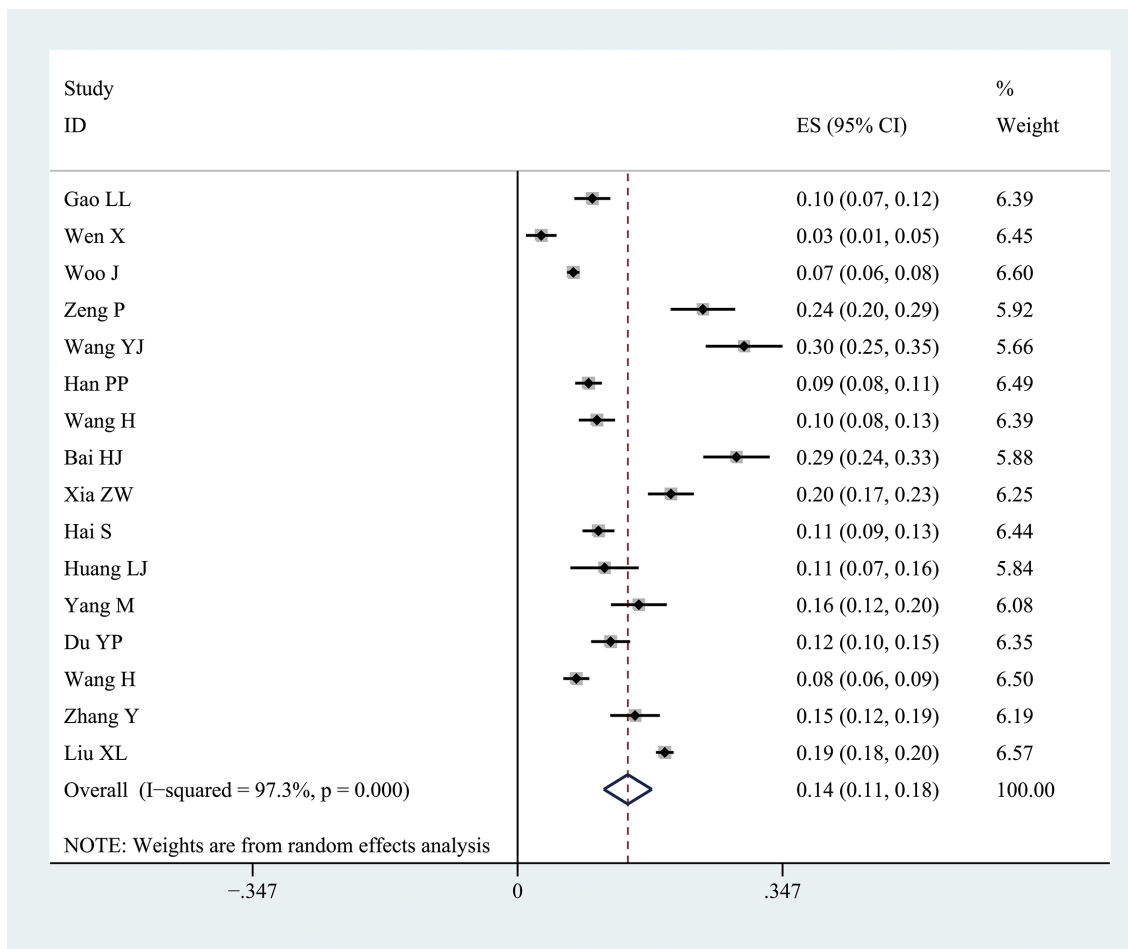
Figure 2 Forest plots for the total prevalence of sarcopenia among the elderly Chinese population according to the Asian Working Group for Sarcopenia standard. Diamond represents the pooled ES at 95% CI. ES, effect size.

recommended by the Cochrane Handbook for Systematic Reviews of Interventions.[14] Each included study was analysed in terms of three domains, namely, representativeness of the study group selection, group comparability and exposure or outcome ascertainment, using the "star system". NOS scores ranged from zero to nine stars. The two researchers independently assessed the studies by discussion, comparison of findings and resolution of differences through consensus formation. If no consensus was reached, a third researcher was commissioned to resolve the difference.

Statistical analysis

We used a systematic analysis approach to calculate the pooled prevalence of sarcopenia for all eligible studies, and heterogeneity among these studies was assessed using Cochran's Q test and I^2 Statistical Index. The random-effect model was used to combine the prevalence of sarcopenia. We additionally performed sensitivity analysis to evaluate the influence of any given study on the pooled estimate. Publication bias was evaluated using Egger's test. Subgroup analyses were also performed. The significance level was set at $p<0.05$. All statistical analyses were performed using Stata V.12.0.

RESULTS

Study characteristics

In total, 1213 studies were retrieved from the databases, and 580 articles remained after the exclusion of duplicates. After screening for eligibility based on the full text, a total of 23 articles were included as per the criteria shown in figure 1.[8–12 15–37] Altogether, the 23 articles included 21 564 participants in China between 2010 and 2020. The selected studies' characteristics are summarised in table 1. On the basis of the NOS, the score of selected studies was all above five stars; therefore, all articles were included.

Results of the meta-analysis

According to the AWGS standard, the total prevalence of sarcopenia among Chinese elderly people was 14% (95% CI 11% to 18%, figure 2), and total prevalence rates of sarcopenia among the elderly in China based on the IWGS and EWGSOP standards were 18% (95% CI 11% to 25%, figure 3) and 10% (95% CI 7% to 14%, figure 4), respectively.

Subgroup analyses were performed to determine the influence of sex on the prevalence of sarcopenia. Sarcopenia prevalence among elderly women was higher than that in men as per the AWGS and EWGSOP standards
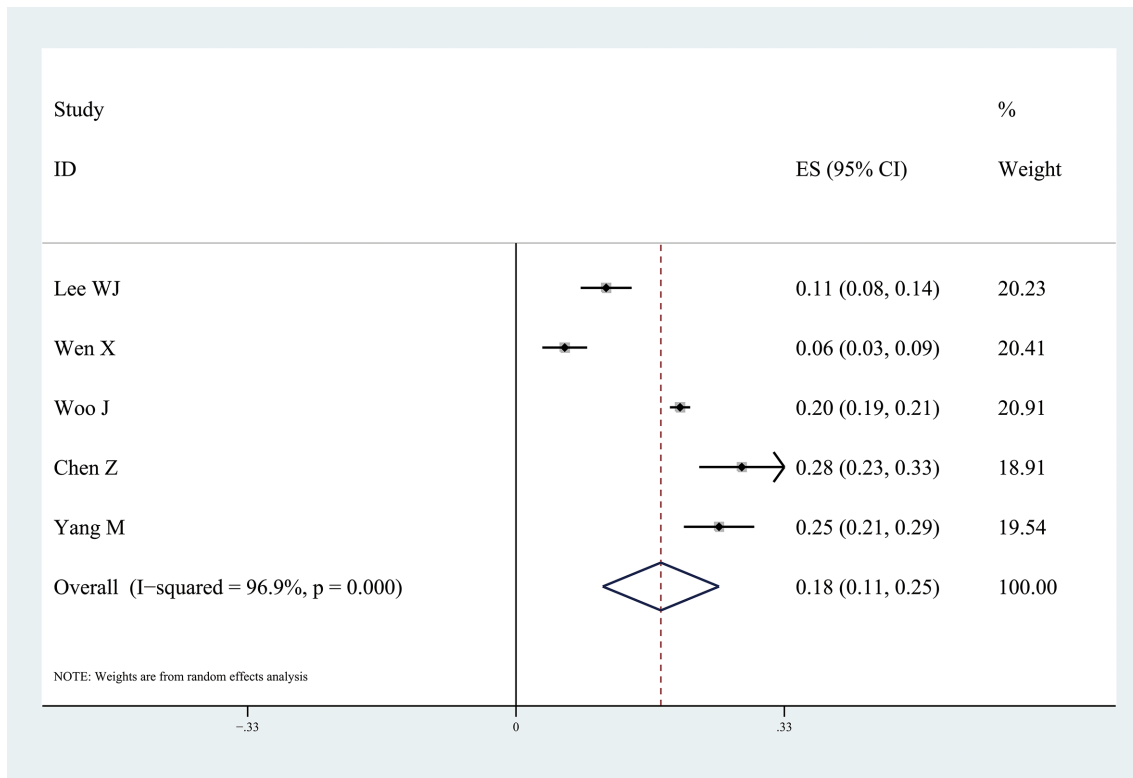
Figure 3 Forest plots for the total prevalence of sarcopenia among the elderly Chinese population according to the International Working Group on Sarcopenia standard. Diamond represents the pooled ES at 95% CI. ES, effect size.
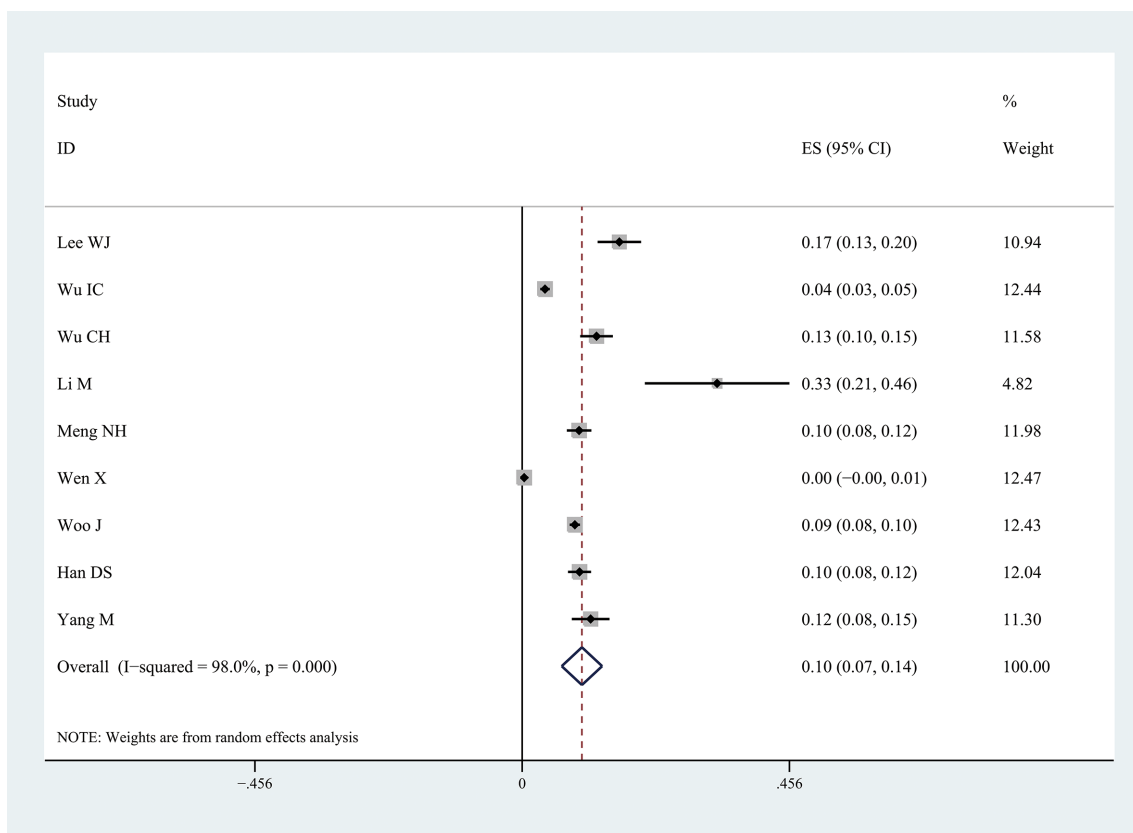
Figure 4 Forest plots for the total prevalence of sarcopenia among the elderly Chinese population according to the European Working Group on Sarcopenia in Older People standard. Diamond represents the pooled ES at 95% CI. ES, effect size.
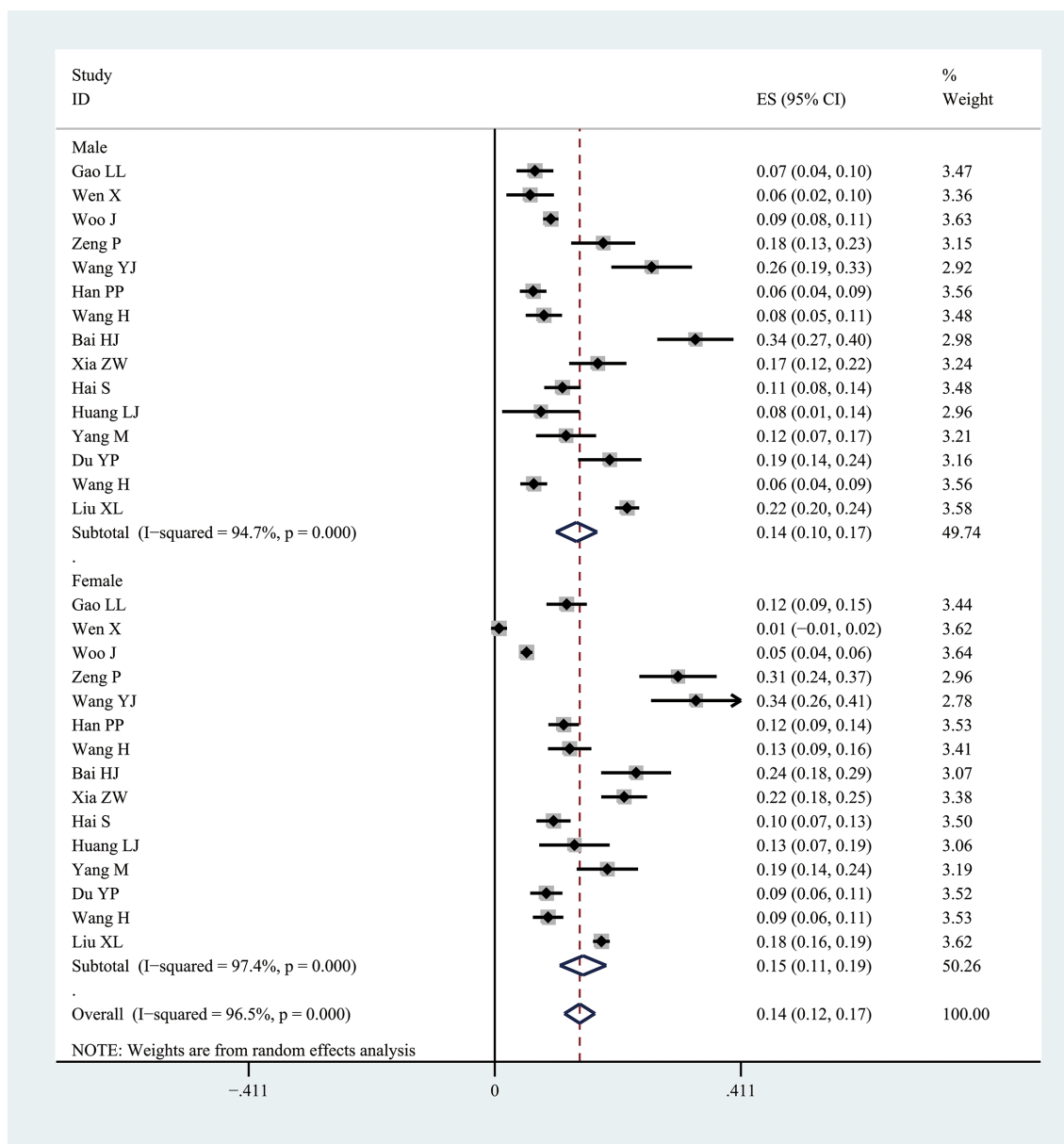
Figure 5 Forest plots for the prevalence of sarcopenia among male and female elderly people according to the Asian Working Group for Sarcopenia standard. Diamond represents the pooled ES at 95% CI. ES, effect size.

(figures 5–7). Table 2 shows the subgroup analyses results based on the different diagnostic criteria. The prevalence of sarcopenia estimated using the bioelectrical impedance analysis (BIA) method was higher than that estimated using the dual energy X-ray absorptiometry (DEXA) method as per the AWGS and IWGS standards.

Sensitivity analysis and publication bias

Sensitivity analysis was performed to examine the influence of each study. We found no significant difference between the results of the sensitivity analysis and our previous estimates, indicating that our statistical results were relatively credible (online supplemental figures S1–S3). The articles obtained from the databases were carefully and comprehensively searched. Additionally, Egger's test was conducted to determine whether potential publication bias existed in the reviewed literature. The results

(p>0.05) suggested that there was no publication bias (online supplemental figure S4–S6).

DISCUSSION

To the best of our knowledge, this study is the first meta-analysis of the prevalence of sarcopenia in older Chinese adults. Sarcopenia is an age-related disease characterised by progressive deterioration in skeletal muscle fibre quality, strength and function. Currently, sarcopenia has been internationally recognised as a new type of geriatric syndrome and has attracted worldwide attention. In 2017, Shafiee et al conducted a meta-analysis on the prevalence of sarcopenia. Their results showed that sarcopenia prevalence among the elderly in communities worldwide was approximately 10%; this was higher among non-Asian
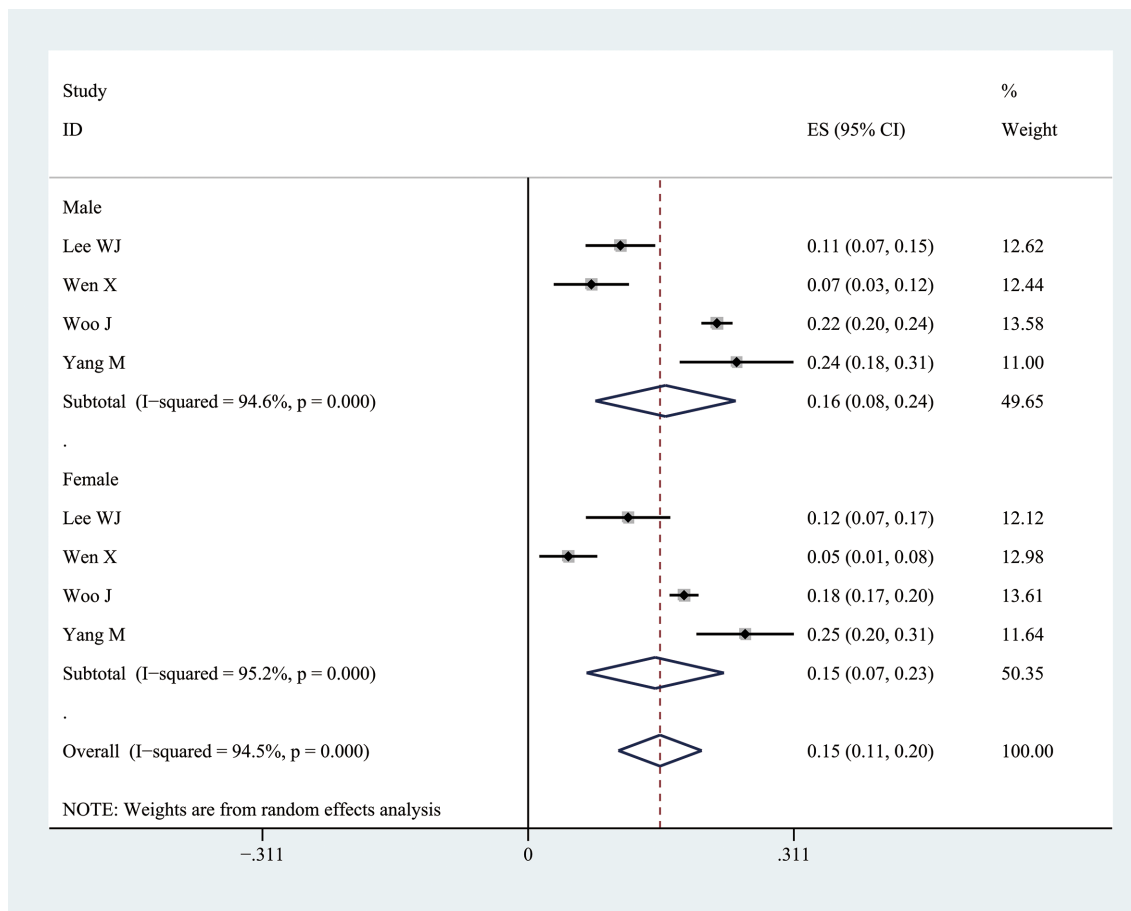
Figure 6 Forest plots for the prevalence of sarcopenia among male and female elderly people according to the International Working Group on Sarcopenia standard. Diamond represents the pooled ES at 95% CI. ES, effect size.

individuals than Asians in both sexes.[38] A similar study was performed in Japan, where sarcopenia prevalence among the elderly Japanese was 9.9% (95% CI 6.2% to 15.4%) according to the AWGS standard.[39] The results of our study showed that the prevalence of sarcopenia was 14% (95% CI 11% to 18%) in older Chinese adults, which was much higher than the results of the aforementioned studies.[40 41] This high prevalence may be related to the Chinese diet structure. Although protein is the raw material for muscle synthesis, Chinese people, particularly the older population, have higher carbohydrate intake and less protein intake.[42] Therefore, more attention should be given to the prevention and control of sarcopenia in older Chinese adults.

Here, we found that the prevalence of sarcopenia among women was higher than that in men, which was consistent with other meta-analyses.[38–40] This is mainly because men eat and exercise more than women; this supports muscle synthesis. Most of the studies included in our meta-analysis used the BIA method because of its affordability and portable equipment. BIA is a widely used non-invasive method for measuring human body composition. The principle behind this method is to record the different electrical resistances of different tissues using electrodes placed on the body surface and then to measure muscle mass using an image reconstruction method. DEXA is also commonly used to evaluate muscle mass. DEXA can accurately distinguish the whole body and local muscles as well as the fats and bones. However, the limited number of studies using DEXA included in this meta-analysis may influence our results. As is known, ageing increases the prevalence of sarcopenia; however, due to the different age classifications in the included studies, we cannot obtain any conclusion.

The meta-analysis results show that the heterogeneity is high, which may be related to factors such as age, race and living environment. In addition, there are differences in the prevalence of sarcopenia in rural and urban areas. China is a country with a vast territory and multiethnic people. The findings of this meta-analysis should be interpreted with caution.

First, the limitation of the present study is that the main data are from urban populations and that studies on the prevalence of sarcopenia in Chinese rural areas are rare; this impacts the calculation of the total sarcopenia prevalence. Second, the prevalence of sarcopenia in people aged 60–70 years and 70–80 years might be different. Not all studies presented their data according to age group, so we cannot accurately estimate the prevalence in terms of age subgroup. Third, most of the studies were performed in large cities or economically developed areas. All of
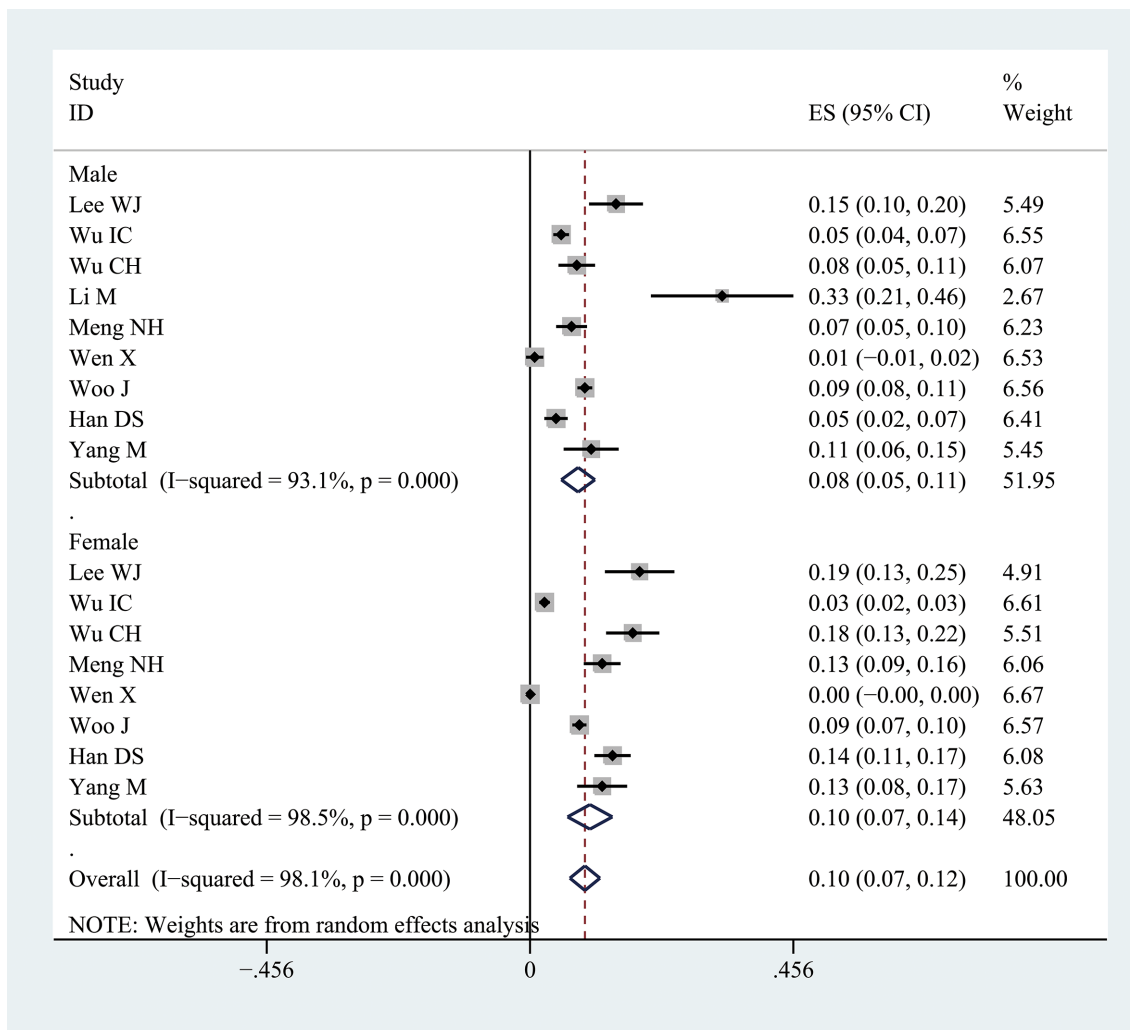
Figure 7 Forest plots for the prevalence of sarcopenia among male and female elderly people according to the European Working Group on Sarcopenia in Older People standard. Diamond represents the pooled ES at 95% CI. ES, effect size.

these factors affected our results, and as such, they should be interpreted cautiously as further research is needed.

CONCLUSIONS

To the best of our knowledge, the present systematic review is the first to estimate the pooled prevalence of sarcopenia in older Chinese adults. The results of the present systematic review reveal that China has a

large number of sarcopenia cases and sarcopenia is an emerging public health issue in China. There is a high degree of heterogeneity, and although there are a large number of cases and could be an emerging public health issue, more research is required to make these claims.

Table 2 The prevalence of sarcopenia diagnosed by different criteria using DEXA and BIA measurement (%)

	DEXA	BIA
AWGS	13 (5–21)	15 (12–19)
IWGS	12 (3–22)	26 (23–29)
EWGSOP	12 (6–18)	9 (5–14)

AWGS, Asia Working Group for Sarcopenia; BIA, bioelectrical impedance analysis; DEXA, dual-energy X-ray absorptiometry; EWGSOP, European Working Group on Sarcopenia in Older People; IWGS, International Working Group on Sarcopenia.

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REFERENCES

1 Cederholm T, Morley JE. Sarcopenia: the new definitions. *Curr Opin Clin Nutr Metab Care* 2015;18:1–4.
2 Frontera WR, Hughes VA, Fielding RA, *et al*. Aging of skeletal muscle: a 12-yr longitudinal study. *J Appl Physiol* 2000;88:1321–6.
3 Delmonico MJ, Harris TB, Lee J-S, *et al*. Alternative definitions of sarcopenia, lower extremity performance, and functional impairment with aging in older men and women. *J Am Geriatr Soc* 2007;55:769–74.
4 Woo J. Sarcopenia. *Clin Geriatr Med* 2017;33:305–14.
5 Cruz-Jentoft AJ, Baeyens JP, Bauer JM, *et al*. Sarcopenia: european consensus on definition and diagnosis: report of the european working group on sarcopenia in older people. *Age Ageing* 2010;39:412–23.
6 Fielding RA, Vellas B, Evans WJ, *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;12:249–56.
7 Chen L-K, Liu L-K, Woo J, *et al*. Sarcopenia in Asia: consensus report of the asian working group for sarcopenia. *J Am Med Dir Assoc* 2014;15:95–101.
8 Lee W-J, Liu L-K, Peng L-N, *et al*. Comparisons of sarcopenia defined by IWGS and EWGSOP criteria among older people: results from the I-Lan longitudinal aging study. *J Am Med Dir Assoc* 2013;14:528.e1–528.e7.
9 Wu I-C, Lin C-C, Hsiung CA, *et al*. Epidemiology of sarcopenia among community-dwelling older adults in Taiwan: a pooled analysis for a broader adoption of sarcopenia assessments. *Geriatr Gerontol Int* 2014;14 Suppl 1:52–60.
10 Wu C-H, Chen K-T, Hou M-T, *et al*. Prevalence and associated factors of sarcopenia and severe sarcopenia in older taiwanese living in rural community: the tianliao old people study 04. *Geriatr Gerontol Int* 2014;14 Suppl 1:69–75.
11 Li M, Hu Y, Dong HY. Compare different measurement for prevalence of sarcopenia in a cohort of healthy community dwellingely in Beijing area. *Chin. J. Health Care Med* 2014;16:426–9.
12 Meng N-H, Li C-I, Liu C-S, *et al*. Comparison of height- and weight-adjusted sarcopenia in a Taiwanese metropolitan older population. *Geriatr Gerontol Int* 2015;15:45–53.
13 Wells GA, Shea B, O'Connell D. The newcastle-ottawa scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Available: http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp [Accessed 05 Aug 2014].
14 Higgins JPT, Green S. *Cochrane handbook for systematic reviews of interventions version 5.1.0*, 2011. http://www.cochrane-handbook.org
15 Wen X, An P, Chen WC, *et al*. Comparisons of sarcopenia prevalence based on different diagnostic criteria in Chinese older adults. *J Nutr Health Aging* 2015;19:342–7.
16 Zeng P, Wu S, Han Y, *et al*. Differences in body composition and physical functions associated with sarcopenia in Chinese elderly: reference values and prevalence. *Arch Gerontol Geriatr* 2015;60:118–23.
17 Gao L, Jiang J, Yang M, *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.e1–1003.e6.
18 Wang Y-J, Wang Y, Zhan J-K, *et al*. Sarco-osteoporosis: prevalence and association with frailty in Chinese community-dwelling older adults. *Int J Endocrinol* 2015;2015:1–8.
19 Woo J, Leung J, Morley JE. Defining sarcopenia in terms of incident adverse outcomes. *J Am Med Dir Assoc* 2015;16:247–52.
20 Wang H, Hai S, Cao L, *et al*. Estimation of prevalence of sarcopenia by using a new bioelectrical impedance analysis in Chinese community-dwelling elderly people. *BMC Geriatr* 2016;16:216.
21 Han P, Kang L, Guo Q, *et al*. Prevalence and factors associated with sarcopenia in Suburb-dwelling older Chinese using the Asian Working group for sarcopenia definition. *J Gerontol A Biol Sci Med Sci* 2016;71:529–35.
22 Han D-S, Chang K-V, Li C-M, *et al*. Skeletal muscle mass adjusted by height correlated better with muscular functions than that adjusted by body weight in defining sarcopenia. *Sci Rep* 2016;6:19457.
23 Xia Z, Meng L, Man Q, *et al*. [Analysis of the dietary factors on sarcopenia in elderly in Beijing]. *Wei Sheng Yan Jiu* 2016;45:388–93.
24 Chen Z, Dai R, Gu XH. Prevalence of sarcopenia and quality of life in retired cadres of a military unit. *Chin. J. Osteopo. Rosis. & Bone Miner. Res* 2016;9:264–8.
25 Bai H-J, Sun J-Q, Chen M, *et al*. Age-related decline in skeletal muscle mass and function among elderly men and women in Shanghai, China: a cross sectional study. *Asia Pac J Clin Nutr* 2016;25:326–32.
26 Hai S, Wang H, Cao L, *et al*. Association between sarcopenia with lifestyle and family function among community-dwelling Chinese aged 60 years and older. *BMC Geriatr* 2017;17:187.
27 Ma Y, Bian AL, Wang XF. Difference of the prevalence rate of sarcopenia in elderly people with different gender and age in Tianjin. *Chin. General Practice* 2017;20:3267–71.
28 Wu ZN, Wang YB, Shu FQ. Epidemiological investigation of sarcopenia in the nursing homes in Fengxian district and analysis of their risk factors. *Shanghai Med* 2017;38:37–40.
29 Huang LJ, Liu YC, Wen YF. State and associated factors of sarcopenia in Jinzhou community elderly people. *Modern Preve. Med* 2017;44:4458–60.
30 Yang M, Hu X, Xie L, *et al*. Screening sarcopenia in community-dwelling older adults: SARC-F vs SARC-F combined with calf circumference (SARC-CalF). *J Am Med Dir Assoc* 2018;19:277.e1–277.e8.
31 Zeng Y, Hu X, Xie L, *et al*. The prevalence of sarcopenia in Chinese elderly nursing home residents: a comparison of 4 diagnostic criteria. *J Am Med Dir Assoc* 2018;19:690–5.
32 Wang YN, Xu JL, Song HL. Influencing factors of sarcopenia among elderly patients. *Modern Clinical Nursing* 2018;17:45–50.
33 Yang L-J, Wu G-H, Yang Y-L, *et al*. Nutrition, physical exercise, and the prevalence of sarcopenia in elderly residents in nursing homes in China. *Med Sci Monit* 2019;25:4390–9.
34 Du Y, Wang X, Xie H, *et al*. Sex differences in the prevalence and adverse outcomes of sarcopenia and sarcopenic obesity in community dwelling elderly in East China using the AWGS criteria. *BMC Endocr Disord* 2019;19:109.
35 Wang H, Hai S, Liu Y, *et al*. [Prevalence of sarcopenia and associated factors in community-dwelling elderly populations in chengdu china]. *Sichuan Da Xue Xue Bao Yi Xue Ban* 2019;50:224–8.
36 Zhang Y, Chen X, Hou L, *et al*. Prevalence and risk factors governing the loss of muscle function in elderly sarcopenia patients: a longitudinal study in China with 4 years of follow-up. *J Nutr Health Aging* 2020;24:518–24.
37 Liu X, Hao Q, Yue J, *et al*. Sarcopenia, obesity and sarcopenia obesity in comparison: prevalence, metabolic profile, and key differences: results from WCHAT study. *J Nutr Health Aging* 2020;24:429–37.
38 Shafiee G, Keshtkar A, Soltani 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.
39 Makizako H, Nakai Y, Tomioka K, *et al*. Prevalence of sarcopenia defined using the Asia working group for sarcopenia criteria in japanese community-dwelling older adults: a systematic review and meta-analysis. *Phys Ther Res* 2019;22:53–7.
40 Diz JBM, Leopoldino AAO, Moreira BdeS, *et al*. Prevalence of sarcopenia in older brazilians: a systematic review and meta-analysis. *Geriatr Gerontol Int* 2017;17:5–16.
41 Papadopoulou SK, Tsintavis P, Potsaki P, *et al*. Differences in the prevalence of sarcopenia in community-dwelling, nursing home and hospitalized individuals. A systematic review and meta-analysis. *J Nutr Health Aging* 2020;24:83–90.
42 Han A, Sun T, Ming J, *et al*. Are the Chinese moving toward a healthy diet? Evidence from macro data from 1961 to 2017. *Int J Environ Res Public Health* 2020;17:5294.