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Research Article

Prevalence and Factors Associated With Sarcopenia in Suburb-dwelling Older Chinese Using the Asian Working Group for Sarcopenia Definition

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Abstract

Background. Sarcopenia is a common condition in older people. The aim of the present study was to examine the prevalence and factors associated with sarcopenia in an elderly Chinese suburb-dwelling population.

Methods. This study was conducted on 1,069 Chinese suburb-dwelling participants aged ≥60 years to evaluate sarcopenia using the Asian Working Group for Sarcopenia criteria. Sociodemographic and behavioral characteristics, as well as medical conditions, were considered independent variables to determine factors associated with sarcopenia using a logistic regression model.

Results. The prevalence of sarcopenia was 6.4% in men and 11.5% in women. Age was a significant factor in both sexes. In addition, presence of sarcopenia was inversely associated with BMI for both sexes. The odds ration and 95% confidence interval for factors statistically significantly associated with sarcopenia were 5.04 (1.70–14.89) and 2.36 (1.06–5.25) for diabetes in males and females, respectively; 10.60 (1.75–64.24) for daily consumption of alcohol (daily drinkers), 5.58 (2.13–14.59) for peptic ulcer in female (not statistically significant in males).

Conclusions. The Asian Working Group for Sarcopenia criterion is useful for defining sarcopenia, and our data suggest that the prevalence of sarcopenia in the general elderly suburb-dwelling Chinese population is high. Moreover, we find that high body mass index is inversely associated with the likelihood of being sarcopenic and that several others factors such as diabetes, peptic ulcer, and drinking habits increase the prevalence of sarcopenia.

Key Words: AWGS—Chinese—Factors—Prevalence—Sarcopenia—Suburb-dwelling.

China is facing serious challenges related to aging of the population. The number of elderly population aged 65 and older has increased to 202 million, or approximately 14.8% of the total population (1). The aging process influences a decline in skeletal muscle mass and function and therefore contributes to sarcopenia, a syndrome characterized by progressive and generalized loss of skeletal muscle mass and strength (2). Multiple factors contribute to the aging process, including early life developmental influences, malnutrition, bed rest or immobility, chronic diseases, and certain drug treatments. In addition, sarcopenia is associated with increased risk of falls and fractures, an impaired

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ability to perform activities associated with daily living, physical disabilities, loss of independence, poor quality of life, and an increased risk of death (3,4), which denotes the importance of sarcopenia diagnosis and prevention in the health care of older people.

Despite this clinical importance, data on the prevalence and epidemiology of sarcopenia in the Chinese population are sparse. Although Shanghai (5), Hong Kong (6), and Taiwan (7) have each reported some data related to sarcopenia, the prevalence of sarcopenia in these regions varies due to differences in diagnostic methods. As yet, we do not know the prevalence of sarcopenia in China; more accurate methods and more data are needed to determine the cutoff values for diagnosing sarcopenia in different regions and environments within China.

Recently, the Asian Working Group for Sarcopenia (AWGS), who followed the diagnostic approach of the European Working Group on Sarcopenia in Older People (EWGSOP) and added some Asian perspectives with respect to sarcopenia diagnosis and research (8), has proposed a diagnostic algorithm based on currently available evidence in Asia (9). The AWGS proposal agrees with previous reports suggesting that sarcopenia should be described as low muscle mass, as well as low muscle strength and/or low physical performance. In addition, the AWGS also recommended cutoff values for muscle mass measurements, handgrip strength, and usual gait speed. AWGS may yield more accurate measurements relevant for sarcopenia research using a more comprehensive approach involving measurement of changes in muscle mass, strength, and physical performance, rather than traditional methods that rely solely on measurements of muscle mass. As far as we know, few studies have examined the phenomenon of sarcopenia using the AWGS definition in a Chinese population.

Several factors associated with sarcopenia have been reported. In one recent study, Yu et al. (10), using data from a population in Chinese by EWGSOP criteria, found that age, sex, chronic obstructive pulmonary disease, stroke, physical activity levels, instrumental activities of daily living impairments, and body mass index (BMI) were associated with incident sarcopenia. Differences in population, ethnicity, genetic background, and living environment have effects on the prevalence of sarcopenia; however, the precise factors associated with sarcopenia are not well defined. Most likely, defining factors associated with sarcopenia will provide a solid foundation for its clinic treatment. Thus, the aim of this study is to estimate the prevalence of and factors associated with sarcopenia in China, specifically in suburb-dwelling elderly populations. This is a particularly significant study population since in China, as of 2012, more than 70% of elderly individuals in suburban areas (11).

Methods

Study Participants

Our study population included residents from three areas (Hougu, East Chadian, and West Chadian) of Tianjin, China. A total of 1,076 older individuals (age ≥ 60) in these areas joined the national free physical examination program from March 2013 to August 2014; all 1,076 subjects were invited to participate in a comprehensive geriatric assessment. Participants with the following conditions were excluded from the study: (i) unable to communicate with interviewers or to grant informed consent; (ii) unable to perform the handgrip strength test or the 4-meter walking test; and (iii) unable to stand for measurement of body composition, weight, and height. The final study population comprised 1,069 subjects after excluding 7 subjects. All participants provided informed consent prior to participation. The study was approved by the Ethics Committee of Tianjin Medical University.

Covariates

Data regarding sociodemographic variables, behavioral characteristics, and medical conditions were obtained as previously (via face-to-face questions) (12). Sociodemographic variables, including age, gender, marital status, educational level, and occupation, were assessed. Marital status was classified as married (living together, divorced, separated, or widowed) or not married/single. Educational level was defined as age at completion of schooling and divided into four categories: illiterate, 1–6 years, 7–12 years, and ≥13 years. Behavioral characteristics included smoking and drinking habits, and history of falls. Information on smoking (never, former smoker, or current smoker) and drinking (never, former drinker, occasional drinker, or everyday drinker) was also obtained from the questionnaire. Physical activity was assessed using the short form of the International Physical Activity Questionnaire. We have described the methods of International Physical Activity Questionnaire and the history of falls in detail in a previous study (12). Depressive symptoms were assessed using the Geriatric Depression Scale. Participants with a score of ≥11 were considered to have depressive symptoms (13). The prevalence of specific medical conditions was established using standardized criteria that combined information from history of physical illness evaluated on the basis of participants' response (yes or no) to questions, physician diagnosis, and taking corresponding medication or undergoing other treatment now or in the past.

Assessment of Sarcopenia

Muscle mass was measured using a direct segmental multifrequency bioelectrical impedance analysis (BIA) (In-Body720; Biospace Co., Ltd, Seoul, Korea). Appendicular skeletal muscle mass (ASM) was calculated as the sum of skeletal muscle in the arms and legs. Relative skeletal muscle mass index (ASM/Ht^2) was defined as ASM divided by body height in meters squared. Low muscle mass was classified as ASM/Ht^2 less than 7.0 kg/m^2 and 5.7 kg/m^2 in men and women, respectively.

Muscle strength was assessed by grip strength, measured using a dynamometer (GRIP-D; Takei Ltd, Niigata, Japan). Participants were asked to exert maximum effort twice using their dominant hand (12), and the result from the strongest hand was used for analysis. Low handgrip strength was defined as <26 kg and <18 kg for males and females, respectively.

Usual walking speed (m/s) on a 4-meter course was used as an objective measure of physical performance (12); slow walking speed was defined as a walking speed slower than 0.8 m/s. Although AWGS recommends using 6-m usual walking speed, this research was performed prior to publication of the AWGS, and so we measured 4-meter walking speed instead. We are confident that this is an accurate representation of ability; numerous previous studies, including our own, have used 4-meter walking speed to evaluate the physical performance of sarcopenia (14).

Statistical Analysis

Participants with sarcopenia were identified using the algorithm developed and suggested by AWGS for sarcopenia case determination and screening in practice (Figure 1). The continuous International Physical Activity Questionnaire variables were reported as medians ± 25–75 percentiles; all other continuous variables were presented as mean and standard deviation; classification

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variables were reported as percentages. Differences in the characteristics according to sarcopenia status were analyzed using *t*-test, χ^2 test, and Kruskal–Wallis rank test. Logistic regression analysis was used to analyze the factors associated with sarcopenia. Based on previous research, we considered age, marital status, illiteracy, living conditions, farming, fall history, drinking, BMI, and comorbidity status (diabetes, peptic ulcer, and pulmonary disease) as factors potentially associated with sarcopenia and included them as independent variables in our models. We provided estimates of association while adjusting for potential confounders by deriving crude and adjusted odds ratios (ORs) and the corresponding 95% confidence intervals (CIs) from these models. All statistical analyses were performed using SPSS version 19.0.

Result

Data from 1,069 participants were used for analysis (Figure 1) using the AWGS algorithm. Mean age ± standard deviation of the participants was 67.29 ± 6.00 years; of these, 56.3% were females. Ninety-nine subjects (9.3%) were identified as being affected by sarcopenia; 30 (6.4%) were males and 69 (11.5%) were females. Among these 99, 64 (6.0%) were sarcopenic because of low gait speed (n = 20, 1.9%; 10 males and 10 females) or poor grip strength (n = 44, 4.1%; 14 males and 30 females), whereas 35 (3.3%, 6 males and 29 females) had concomitant presence of reduced muscle strength and slow gait speed. Prevalence of sarcopenia increased steeply with age (Figure 2).

Clinical Characteristic of the Study Population

Table 1 presents the clinical characteristics of participants by gender and sarcopenia status. Subjects with sarcopenia had a statistically significant lower ASM/Ht^2, handgrip strength, and usual walking speed compared with participants without sarcopenia (p < .001). Compared with subjects without sarcopenia, those diagnosed with sarcopenia were more likely to be older and had lower BMI (p < .001). Peptic ulcer and pulmonary disease were slightly more prevalent in the female sarcopenic group, whereas diabetes was more common in sarcopenic men relative to nonsarcopenic participants.

Socioeconomic Status and Health Behavior

Socioeconomic status and health behaviors of participants are presented in Table 1. The proportion of widowed individuals was much higher in the study group without sarcopenia compared with those with sarcopenia for both genders (p < .05). In men, the proportion of fall history was higher in the sarcopenic group. In women, participants who were living alone, illiterate, who smoked, and/or drank were more common in the sarcopenia group.

Univariate and Multivariate Analysis of Associated Factors for Sarcopenia

Results from univariate and multivariate logistic regression models for factors related to sarcopenia in males and females are reported in Tables 2 and 3, respectively. After adjusting for potential confounders, an increased prevalence of sarcopenia was found in the older subjects for both genders (OR = 10.18, 95% CI = 2.93–35.29 for those aged 80 years in male; OR = 6.39, 95% CI = 3.15–12.95 for those aged 70–79 years; OR = 135.74, 95% CI = 27.29–675.15 for those aged 80 years in female). Sarcopenia was inversely associated with BMI for both genders, with a BMI higher than 24.0 kg/m^2 showing a lower prevalence of sarcopenia compared with those with a BMI between 18.5 and 23.9 kg/m^2. The OR and 95% CI in the adjusted model for the factors statistically significantly associated with sarcopenia were 5.04 (1.70–14.89) and 2.36 (1.06–5.25) for diabetes in males and females respectively; 10.60 (1.75–64.24) for daily drinkers; and 5.58 (2.13–14.59) for females with peptic ulcers (but not male).

Discussion

In this study, we estimated the prevalence of sarcopenia and the factors associated with sarcopenia in suburb-dwelling population of elderly persons aged 60 and older in China. The overall prevalence

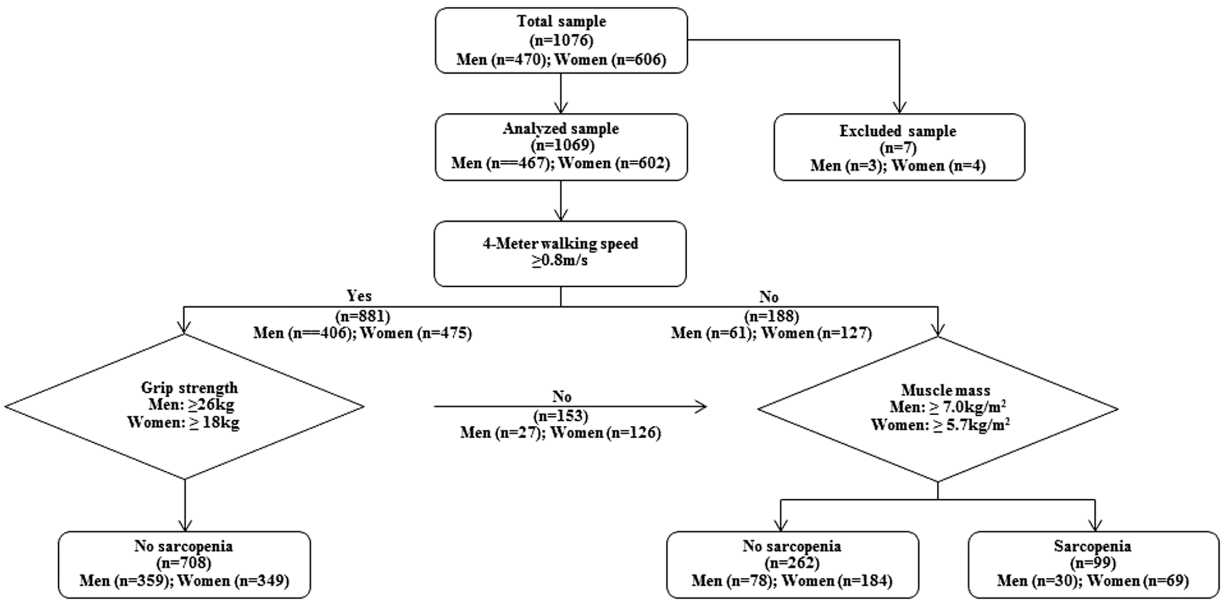

Figure 1. Application of the Asian Working Group for Sarcopenia algorithm for the case finding of sarcopenia.

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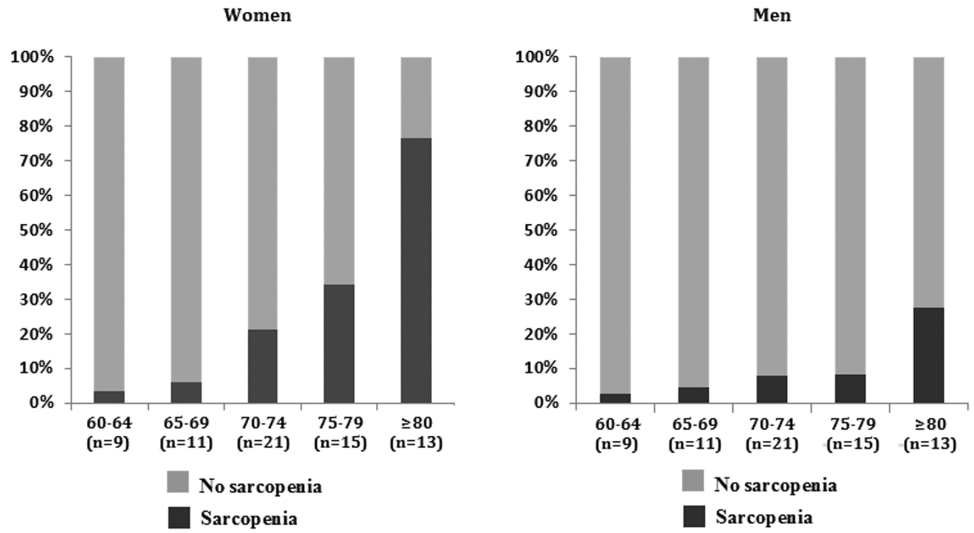

Figure 2. Prevalence of sarcopenia in women (left) and men (right) according to age decades: "*n*" means the number of people with sarcopenia for each age groups.

of sarcopenia using the AWGS definition was 9.3%, with 6.4% in men and 11.5% in women. After adjustment for potential confounders, age, BMI, and diabetes were directly associated with the prevalence of sarcopenia in men and women. In addition, increased drinking and peptic ulcers were also associated with sarcopenia in women.

Prevalence of Sarcopenia in Suburb-dwelling Residents

A few previous surveys have attempted to estimate sarcopenia prevalence in diverse community-dwelling populations. Consistently, the majority of studies suggest that the prevalence of sarcopenia increases with age (14–16). A recent systematic review by Cruz-Jentoft et al. (17) showed that the prevalence of sarcopenia in the community using a definition consistent with EWGSOP was 1–33% (up to 68% in men). These large differences in prevalence are likely due to variable susceptibilities related to age, gender, and ethnicity. For example, using the EWGSOP recommendation in a Chinese octogenarian population, Lin et al. (18) found that the prevalence of sarcopenia was 13.3% in women and 12.7% in men in Taiwan, which was higher than that determined by the present study. One possible reason is that age structure of the population is lower in our study. In the study by Lin et al. (18), 41.9% of the population was older than 75. However, in the present study, only 13.9% of participants are older than 75. In another study, Volpato et al. (14) also adopted the EWGSOP criteria and found a sarcopenia prevalence of 2.6% and 1.2%, respectively, in Italian women and men aged 70–74, values much lower than the present study. This high variability can be to some extent attributed to differences in characteristics and living conditions of the study sample. For example, Baumgartner et al. (19) showed that low income is associated with sarcopenia; in the present study, nearly 70% of respondents had low income, whose monthly income was lower than 1,000 yuan. Similarly, Volpato et al. (14) reported that number of years of education was inversely associated with likelihood of being sarcopenic; in that study, the mean number of education years was 5, whereas in our study nearly 30% of participants were illiterate.

Modifiable Lifestyle Factors Related to Sarcopenia in Suburb-dwelling Residents

Our finding is in line with a previous study in Caucasian women that found participants who were overweight had a significantly reduced risk of developing sarcopenia compared with their normal weight counterparts (20). It has been pointed out that fat mass can have several age-rated effects on lean mass, and individuals with higher fat mass might have a higher protein intake, which is a protective factor against sarcopenia (5). Given this, we postulated that higher BMI might serve as a protective buffer by countering losses in muscle performance in the elderly.

As we show here, sarcopenia is also significantly associated with daily drinking in women. Studies demonstrating the adverse effects of alcohol on skeletal muscle suggest that chronic consumption may promote loss of muscle mass and strength in old age (21). Previous studies have indicated that alcohol-induced muscle damage might result from impaired synthesis of muscle protein (22,23). Interestingly, this result was not observed in males. This difference could be attributed to the fact that alcohol consumption suppresses plasma estrogens in females (24), which increases sarcopenia risk in postmenopausal women. Suppression of plasma estrogens could have a direct effect on muscle mass since it has been shown that skeletal muscle cells express estrogen beta-receptors, which localize to the cell membrane, cytoplasm, and nuclear membrane (25).

Specific Diseases Associated With Sarcopenia in Suburb-dwelling Residents

The underlying mechanisms that link diabetes and sarcopenia remain unclear; however, one factor may be hormonal changes associated with diabetes (26). For example, anabolic hormones are important for the maintenance of muscle mass, since they activate the phosphatidylinositol-3-kinase system; insulin resistance has been shown to decrease the activity of this pathway (27). Based on the above, we postulate that metabolic abnormalities associated with diabetes negatively affect muscle mass. Further research is required to identify the precise mechanisms linking sarcopenia and rapid loss of skeletal muscle mass in older diabetic adults.

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Table 1. Characteristics of Study Participants According to the Presence of Sarcopenia

Characteristic	Male (n = 467)			Female (n = 602)		
	No Sarcopenia	Sarcopenia	p	No Sarcopenia	Sarcopenia	p
	(n = 437)	(n = 30)		(n = 533)	(n = 69)	
Age (y)	67.68 ± 6.33	73.40 ± 7.81	<.001	65.94 ± 4.83	72.55 ± 6.40	<.001
BMI (kg/m^2)	25.29 ± 3.08	23.12 ± 2.79	<.001	25.79 ± 3.64	22.12 ± 3.09	<.001
ASM/Ht^2 (kg/m^2)	7.80 ± 0.77	6.58 ± 0.74	<.001	6.57 ± 0.92	5.17 ± 0.59	<.001
Grip strength (kg)	34.60 ± 7.35	25.45 ± 7.09	<.001	20.94 ± 5.19	14.99 ± 4.07	<.001
4-meter walking test (m/s)	1.03 ± 1.92	0.85 ± 0.23	<.001	0.95 ± 0.17	0.78 ± 0.19	<.001
IPAQ (Met/wk)	2506.0 (1315.0, 6118.0)	2153.0 (903.0, 4158.0)	.303	2370.7 (594.0, 4053.0)	1779.7 (411.0, 2919.0)	.242
Widowed (%)	9.8	23.3	.021	17.6	36.2	<.001
Living alone (%)	9.2	13.3	.448	10.5	21.7	.006
Illiteracy (%)	18.3	20.0	.817	33.2	46.4	.031
Farming (%)	81.5	86.7	.475	92.8	95.7	.384
Fall history (%)	16.1	30.0	.049	25.6	24.6	.868
Depression (GDS ≥ 11) (%)	5.7	3.3	.578	11.8	13.0	.768
Drinking (%)			.582			.087
Never or former	41.6	50.0		93.6	88.4	
<7 d/wk	24.9	16.7		5.6	4.3	
Daily	33.4	33.3		0.8	7.2	
Smoking (%)			.361			.004
Never	25.5	26.7		54.4	19.7	
Former	39.8	46.7		15.2	26.4	
Current	34.7	26.7		30.4	53.9	
Number of diseases	1.86 ± 1.25	2.07 ± 1.07	.319	2.46 ± 1.52	2.81 ± 1.65	.374
Diabetes (%)	8.7	23.3	.009	15.0	20.3	.256
Hypertension (%)	40.3	50.0	.295	52.7	55.1	.713
Hyperlipidemia (%)	21.1	16.7	.512	33.6	27.5	.314
Heart disease (%)	17.2	10.0	.309	31.3	31.9	.926
Peptic ulcer (%)	8.0	6.7	.792	4.9	15.9	<.001
Pulmonary disease (%)	2.7	3.3	.850	3.4	10.1	.008
Stroke (%)	7.6	16.7	.077	6.0	5.8	.946
Gout (%)	1.4	0.0	.518	1.5	1.4	.973
Kidney disease (%)	3.0	0.0	.338	3.4	5.8	.313
Hepatic disease (%)	3.0	3.3	.911	1.1	1.4	.814
Biliary tract disease (%)	3.7	3.3	.926	4.5	2.9	.537
Thyroid disease (%)	0.7	0.0	.649	1.9	1.4	.803
Osteoarthritis (%)	17.8	13.3	.529	24.0	23.2	.880
Anemia (%)	1.4	0.0	.518	1.7	0.0	.277

Notes: ASM = appendicular skeletal muscle mass; BMI = body mass index; GDS = geriatric depression scale; Ht = height; IPAQ = international physical activity questionnaire; MET/wk = metabolic equivalent task minutes per week.

Women with peptic ulcer disease had a greater than 5-fold risk of developing sarcopenia. Accumulating data demonstrate that peptic ulcer patients often develop protein-energy malnutrition at a rate of 25.1–65.5% (28). In the elderly population, presence of peptic ulcers might exacerbate malnutrition. Peptic-ulcer-associated protein-energy malnutrition occurs in combination with poor dietary intake, malabsorption, increased gastrointestinal protein loss, and decreased protein synthesis. Low nutrient intake (particularly, low protein intake) is known to be a key causative factors for sarcopenia (26). Individuals with protein-energy malnutrition typically suffer from a loss of skeletal muscle volume and muscle weakness; this condition is classified as sarcopenia (29). Once again, we did not observe this in males. The reason for this difference might be related to varied estrogen levels in women and men. For example, one study has demonstrated that estrogen can stimulate duodenal bicarbonate secretion, which might reduce the severity and/or incidence of ulcers (30).

Strengths and Limitations of the Study

This study has a number of strengths. First, this study is one of the first studies to use AWGS criteria describing the prevalence of sarcopenia in Asia. Second, the study was conducted on a relatively large sample of well-characterized suburb-dwelling older men and women living in a defined geographical area. Finally, participants were recruited from a suburban area and were leading a more physically active lifestyle, which might be different from subjects in other geographical areas. But researches for suburban area were relatively less.

Despite extensive efforts to curb them, some limitations exist. First, this study used a cross-sectional design, so it is not possible to determine causal relationships. Second, all participants in the present study were relatively healthy as we did not include participants who were unable to participate in the free annual national physical examination (e.g., those bedridden or with serious disease). Due to this, our results might in fact be an underestimate of the prevalence

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Table 2. Unadjusted and Adjusted Model for Factors Related to Sarcopenia in the Male

Variable	Univariate Odds Ratio (95% CI)	*p*	Adjusted Model* Odds Ratio (95% CI)	*p*
Age (y)				
60–69	1.0 (referent)		1.0 (referent)	
70–79	2.28 (1.01–5.64)	.048	2.19 (0.86–5.60)	.102
≥80	10.15 (3.69–27.93)	<.001	10.18 (2.93–35.29)	<.001
BMI (kg/m²)				
18.5–23.9	1.0 (referent)		1.0 (referent)	
24.0–27.9	0.44 (0.20–0.96)	.041	0.40 (0.17–0.95)	.037
≥28.0	0.21 (0.46–0.91)	.037	0.11 (0.02–0.65)	.015
Widowed	2.79 (1.13–6.88)	.026	2.91 (0.58–14.60)	.195
Living alone	1.53 (0.51–4.60)	.451	3.68 (0.62–21.79)	.151
Illiteracy	1.12 (0.44–2.82)	.817	1.33 (0.46–3.85)	.604
Farming	1.48 (0.50–4.36)	.478	1.34 (0.41–4.40)	.633
Fall history	2.25 (0.99–5.11)	.053	1.81 (0.73–4.51)	.203
Drinking				
Never or Former	1.0 (referent)		1.0 (referent)	
<7 d/wk	0.56 (0.20–1.57)	.269	0.81 (0.27–2.49)	.718
Daily	0.83 (0.36–1.90)	.662	0.84 (0.34–2.07)	.698
Diabetes	3.20 (1.29–7.93)	.012	5.04 (1.70–14.89)	.003
Peptic ulcer	0.82 (0.19–3.59)	.793	0.95 (0.20–4.45)	.944
Pulmonary disease	1.22 (0.15–9.72)	.850	2.14 (0.19–23.61)	.535

Notes: BMI = body mass index; CI = confidence interval.

Table 3. Unadjusted and Adjusted Model for Factors Related to Sarcopenia in the Female

Variable	Univariate Odds Ratio (95% CI)	*p*	Adjusted Model* Odds Ratio (95% CI)	*p*
Age (y)				
60–69	1.0 (referent)		1.0 (referent)	
70–79	7.18 (4.40–12.92)	<.001	6.39 (3.15–12.95)	<.001
≥80	68.74 (20.56–229.84)	<.001	135.74 (27.29–675.15)	<.001
BMI (kg/m²)				
18.5–23.9	1.0 (referent)		1.0 (referent)	
<18.5	2.23 (0.87–5.68)	.093	1.05 (0.29–3.82)	.946
24–27.9	0.34 (0.19–0.67)	<.001	0.32 (0.16–0.63)	.001
≥28.0	0.03 (0.01–0.21)	.001	0.03 (0.01–0.21)	.001
Widowed	2.65 (1.55–4.55)	<.001	1.26 (0.48–3.31)	.635
Living alone	2.37 (1.25–4.45)	.008	1.12 (0.38–337)	.838
Illiteracy	1.74 (1.05–2.89)	.032	1.01 (0.51–2.01)	.984
Farming	1.69 (0.51–5.63)	.393	1.58 (0.39–6.37)	.518
Drinking				
Never or former	1.0 (referent)		1.0 (referent)	
<7 Days/wk	0.82 (0.24–2.76)	.746	1.24 (0.30–5.09)	.770
Daily	10.23 (2.67–39.11)	.001	10.60 (1.75–64.24)	.010
Diabetes	1.44 (0.77–2.72)	.258	2.36 (1.06–5.25)	.036
Peptic ulcer	3.70 (1.74–7.82)	.001	5.58 (2.13–14.59)	<.001
Pulmonary disease	3.23 (1.30–8.04)	.012	2.50 (0.74–8.46)	.140

Notes: BMI = body mass index; CI = confidence interval.
*Adjusted simultaneously for all variables listed in Tables 2 or 3.

of sarcopenia and its associated health impact. Third, the use of BIA for muscle mass assessment presents a drawback mainly due to hydration problems often observed in older persons—these may result in an underestimation of body fat and an overestimation of fat-free mass, especially in the severely obese. BIA is not good standard, but it is well correlated with magnetic resonance imaging predictions and dual energy X-ray absorptiometry. Besides, BIA is inexpensive, rapid, noninvasive, radiation-free, and convenient and is thus considered to be a portable alternative to dual-energy X-ray absorptiometry. Furthermore, in our study, there were only 30 males and 64 females, whose BMI were greater than 30 kg/m². Of these, seven were severely obese (BMI > 35 kg/m²). The recomputed result when these 94 subjects were excluded is not statistically different to the results obtained when they are included.

In summary, we examined the prevalence of sarcopenia and determined several associated factors in an elderly suburb-dwelling population in Tianjin, China, using the AWGS definition. We find that the prevalence of sarcopenia is higher and increases with diabetes, and peptic ulcers and drinking (in women); and that a higher BMI is inversely associated with the likelihood of being sarcopenic. This present study

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demonstrates that sarcopenia is affected by multiple domains and that elderly individuals would be ideal candidates for prevention strategies. Further studies with a longer follow-up period are needed to confirm these associations, examine other lifestyle behaviors that might contribute to sarcopenia, and, importantly, determine cutoff values for identifying sarcopenia in different regions and ethnic groups.

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