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ABOUT COVER

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Observational Study

Comparison of the prevalence of sarcopenia in geriatric patients in Xining based on three different diagnostic criteria

Shi-Qin Pan, Xiao-Fang Li, Ming-Qin Luo, Yue-Mei Li

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Abstract

BACKGROUND

Sarcopenia is an age-related decline in skeletal muscle mass, which depends on an assessment of muscle strength and muscle mass. The diagnostic definition of sarcopenia varies by region.

AIM

To determine the optimal diagnostic criteria for sarcopenia in a plateau population. Cut off values for the components of diagnostic algorithms for sarcopenia in plateau populations should consider altitude.

METHODS

One hundred and fifty subjects aged > 60 years attending a tertiary comprehensive hospital in the city of Xining (elevation: 2260 m) between October and December 2018 were enrolled. Handgrip strength, muscle mass, and physical performance were measured. Sarcopenia was diagnosed according to the Asian Working Group for Sarcopenia (AWGS) 2019 criteria, Beijing criteria, and Lasha criteria.

RESULTS

Across diagnostic criteria, there were significant differences in the prevalence of sarcopenia in the overall population and stratified by gender. The prevalence of sarcopenia measured by the AWGS 2019 or Lasha criteria was significantly higher in female compared to male subjects. In males, the prevalence of sarcopenia measured by the Beijing criteria was significantly higher in subjects who identified as Han compared to Minority. In females, there were no significant differences in the prevalence of sarcopenia by ethnicity according to any criteria.

CONCLUSION

The Lasha criteria provided a lower prevalence of sarcopenia (males, 8.7%; females, 22.41%; overall, 14%) and were able to differentiate between males and

females. The Lasha criteria are likely most appropriate for detection of sarcopenia in this plateau population. We recommend the Lasha criteria for detection of sarcopenia in Xining.

Key Words: Ethnic; Diagnostic criteria; Sarcopenia; Prevalence; Plateau

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Core Tip: Cutoff values for the components of diagnostic algorithms for sarcopenia in plateau populations should consider altitude. We found the Lasha criteria provided a lower prevalence of sarcopenia (males, 8.7%; females, 22.41%; overall, 14%) and were able to differentiate between males and females. The Lasha criteria are likely most appropriate for detection of sarcopenia in this plateau population. We recommend the Lasha criteria for detection of sarcopenia in Xining.

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INTRODUCTION

Sarcopenia was first defined in 1988 by Rosenberg, representing an age-related loss of skeletal muscle mass and strength[1]. Sarcopenia affects approximately 10% of individuals aged > 60 years worldwide, and an estimated 10.5%-28.8% of elderly individuals in China[2-5]. Sarcopenia is associated with an increased risk of falling, osteoporosis, fracture, disability, insulin-resistance, and all-cause mortality[6]. Globally, sarcopenia is gaining importance as a major public health issue in an aging society, and there is an unmet need for detection, prevention, and treatment of sarcopenia through early and systematic screening[2].

The diagnostic definition of sarcopenia varies by region. In 2009, the European Working Group on Sarcopenia in Older People (EWGSOP) defined sarcopenia according to three parameters: Muscle mass, muscle strength and physical performance[7]. In 2014, the Asian Working Group for Sarcopenia (AWGS) updated the definition of sarcopenia proposed by the EWGSOP to an "age-related loss of muscle mass, plus low muscle strength, and/or low physical performance," and specified a sarcopenia diagnostic algorithm with cutoffs for each component[8]. In 2018 and 2019, respectively, the EWGSOP and AWGS consensus on the definition and diagnosis of sarcopenia were updated[7,9]. The EWGSOP2 definition focused on muscle strength as the main parameter for diagnosing sarcopenia, while AWGS 2019 retained the previous definition of sarcopenia, but revised the diagnostic algorithm, protocols, and some criteria[10].

According to the AWGS, cutoffs for each component of the sarcopenia diagnostic algorithm vary by ethnicity, body size, lifestyle, and cultural background[9]. After adjusting for ethnicity, the diagnosis of sarcopenia may also be influenced by local sociodemographic, health-related, and lifestyle factors[11, 12]. As estimates of the prevalence of sarcopenia in different populations can be affected by the sarcopenia diagnostic criteria used, some regions in China have developed their own diagnostic criteria for sarcopenia[11,13,14].

The city of Xining in Qinghai Province is the only point of access to the Qinghai-Tibet plateau. A previous study showed that diagnostic reference values for sarcopenia suggested by the AWGS, EWGSOP and Beijing criteria were higher than those for Tibetans in Lhasa and Shigatse[13]. In Lasha and Shigatse, the diagnostic reference values were < 6.53 kg/m² each for men and < 5.62 kg/m² and < 6.0 kg/m² for women, respectively, for the skeletal muscle mass index (SMI); and < 26.7 kg and < 13.3 kg for men and < 15.8 kg and < 8.9 kg for women, respectively, for handgrip strength.

The mass and function of skeletal muscle may be influenced by hypoxia at high altitudes. Hypoxia can lead to a decrease in muscle mass and strength by inhibiting protein synthesis and enhancing protein breakdown[15]. Therefore, cutoff values for the components of a diagnostic algorithm for sarcopenia should consider altitude[13]. Xining has an average elevation of 2260 m, which is lower than Lasha (3600 m) and Shigatse (4200 m). It is unclear whether the Lasha criteria for sarcopenia are suitable for Xining. The objective of this study was to determine optimal diagnostic reference values for sarcopenia in residents of Xining, and provide evidence-based clinical practice guidelines for sarcopenia screening in Xining.

MATERIALS AND METHODS

Study design

The protocol for this observational study was reviewed by the Medical Ethics Committee of Qinghai Provincial People's Hospital. The study was conducted according to the World Medical Association Declaration of Helsinki.

Study participants

Subjects attending a tertiary comprehensive hospital in the city of Xining, Qinghai, China between October and December 2018 were eligible for this study. Inclusion criteria were: (1) Aged > 60 years; (2) Residents of Xining City for > 10 years; and (3) Voluntary participation after providing written informed consent. Exclusion criteria were: (1) Cognitive impairment; (2) Caregivers unable to provide relevant information, if needed; (3) Mobility difficulties; (4) Metal implants (*e.g.*, pacemakers and heart stents); or (5) Unable to complete the handgrip strength test.

Data collection

Subject demographics: Subject demographics, including gender, age, ethnicity, height, and weight were recorded.

Handgrip strength: Handgrip strength was measured with a CAMRY-EH101 hand grip dynamometer (Shenzhen Tengfei Yu Technology). The handle of the dynamometer was adjusted to 0 kg. Subjects stood with their arms by their sides and held the device in their dominant hand with the digital readout visible. Researchers verbally encouraged subjects to squeeze the dynamometer with their maximum isometric effort for 5 s. Grip strength was measured 3 times with 1-min intervals between tests. The highest value was used in the analyses.

Muscle mass: Muscle mass was measured with an InBody 720 Bioelectrical Impedance Analyzer (BIA). Subjects stood on the foot electrodes barefoot and grasped the hand electrodes with their fingers and thumbs. Subjects remained still with their shoulder joints slightly abducted and a 15° angle between the trunk and upper limbs for approximately 30 sec.

Physical performance: Physical performance was assessed by estimating gait speed (GS). Subjects walked in a straight line for 10 meters at their usual speed, using walking aids if needed. GS for the middle 6-meters of the course was calculated. The test was performed twice, and the shortest time was used in the analyses.

Diagnostic criteria for sarcopenia: Sarcopenia was diagnosed according to the AWGS 2019 criteria, Beijing criteria, and Lasha criteria[4,11,13].

Statistical analysis

Data analysis was performed with SPSS 22.0 (IBM, Armonk, NY, United States). Demographics and measured variables were characterized using descriptive statistics (*i.e.*, mean \pm SD and proportions). Differences in continuous variables were evaluated using the independent-sample t-test and chi-squared test. $P < 0.05$ was considered significant.

RESULTS

Study subjects

Overall, 150 subjects aged > 60 years were enrolled in this study. Subjects resided at middle and high elevations in different parts of Qinghai: 83 subjects resided at an altitude of 1500-2499 m, 45 subjects resided at an altitude of 2500-3499 m, and 21 subjects resided at an altitude of > 3500 m (Table 1). The demographic and clinical characteristics of subjects are summarized in Table 2.

Sarcopenia diagnostic criteria and prevalence stratified by gender

Across the diagnostic criteria, there were significant differences in the prevalence of sarcopenia in the overall population (AWGS 2019: 19.33% *vs* Beijing: 49.14% *vs* Lasha: 14%; $\chi^2 = 46.77$; $P < 0.001$) and stratified by gender (male, AWGS 2019: 14.13% *vs* Beijing: 42.39% *vs* Lasha: 8.70%; $\chi^2 = 27.47$; $P < 0.001$; female: AWGS 2019: 27.59% *vs* Beijing: 56.25% *vs* Lasha: 22.4%; $\chi^2 = 15.09$; $P = 0.001$).

The prevalence of sarcopenia measured by the AWGS 2019 ($\chi^2 = 4.13$, $P = 0.042$) or Lasha ($\chi^2 = 5.56$, $P = 0.018$) criteria was significantly higher in female subjects compared to male subjects, but there was no significant difference in the prevalence of sarcopenia by gender according to the Beijing criteria ($\chi^2 = 0.25$, $P = 0.617$) (Figure 1A).

Table 1 Sarcopenia diagnostic criteria

Variable		AWGS 2019	Beijing	Lasha
Muscle Strength	Male	< 28 kg	< 27 kg	< 26.7 kg
	Female	< 18 kg	< 16 kg	< 15.8 kg
Muscle mass (BIA)	Male	< 7.0 kg/m ²	< 7.61 kg/m ²	< 6.53 kg/m ²
	Female	< 5.7 kg/m ²	< 6.43 kg/m ²	< 5.62 kg/m ²
Performance	Male	< 1.0 m/s	< 0.98 m/s	< 0.87 m/s
	Female		< 0.88 m/s	

AWGS: Asian Working Group for Sarcopenia; BIA: Bioelectrical Impedance Analyzer.

Table 2 Subjects demographic and clinical characteristics stratified by gender and ethnicity (n = 150)

Variable	Gender		Ethnicity	
	Male (n = 92)	Female (n = 58)	Han (n = 113)	Minority (n = 37)
Age (yr)	72.93 ± 5.86	71.59 ± 5.21	72.37 ± 5.69	72.54 ± 5.55
Height (m)	1.69 ± 0.06 ^a	1.57 ± 0.06	1.64 ± 0.08	1.64 ± 0.09
Weight (kg)	68.99 ± 12.54 ^a	59.14 ± 9.57	63.90 ± 10.99	69.22 ± 15.51 ^a
BMI (kg/m ²)	24.25 ± 3.97	23.88 ± 3.65	23.66 ± 3.59	25.48 ± 4.29 ^a
Handgrip (kg)	28.52 ± 9.39 ^a	19.24 ± 6.32	25.26 ± 9.83	23.93 ± 8.29
Muscle mass (kg/m ²)	7.51 ± 0.97 ^a	6.08 ± 0.78	6.84 ± 1.04	7.29 ± 1.37 ^a
6-meter gait speed (m)	0.94 ± 0.23	0.87 ± 0.24	0.93 ± 0.25	0.86 ± 0.18

^aP < 0.05.

Sarcopenia diagnostic criteria and prevalence stratified by ethnicity

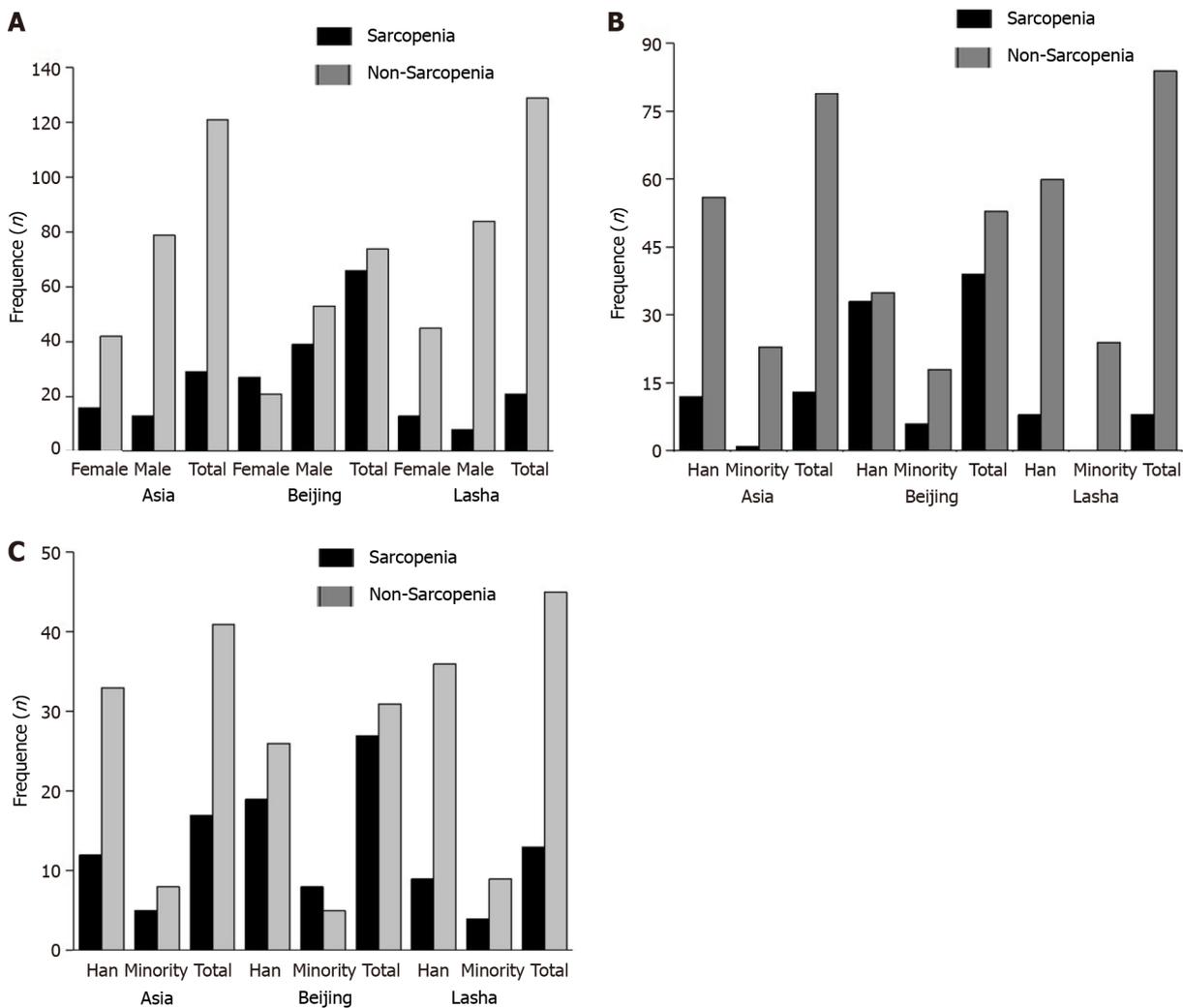
In male subjects, across the diagnostic criteria, there were significant differences in the prevalence of sarcopenia stratified by ethnicity (Han, AWGS 2019: 17.65% *vs* Beijing: 48.53% *vs* Lasha: 11.76%; $\chi^2 = 27.58$; $P < 0.001$; Minority, AWGS 2019: 4.17% *vs* Beijing: 25.00% *vs* Lasha 0%; $\chi^2 = 9.81$; $P = 0.007$). The prevalence of sarcopenia measured by the Beijing criteria ($\chi^2 = 4.02$, $P = 0.045$) was significantly higher in subjects who identified as Han compared to subjects who identified as Minority, but there were no significant differences in the prevalence of sarcopenia by ethnicity according to the AWGS 2019 ($\chi^2 = 2.66$, $P = 0.103$) or Lasha ($\chi^2 = 3.09$, $P = 0.079$) criteria (Figure 1B).

In female subjects, across the diagnostic criteria, there were no significant differences in the prevalence of sarcopenia stratified by ethnicity (Han, AWGS 2019: 26.67% *vs* Beijing: 42.22% *vs* Lasha: 20.00%; $\chi^2 = 5.61$; $P = 0.06$; Minority: AWGS 2019: 38.46% *vs* Beijing: 61.53% *vs* Lasha: 30.77%; $\chi^2 = 2.71$; $P = 0.258$). There were no significant differences in the prevalence of sarcopenia by ethnicity according to the AWGS 2019 ($\chi^2 = 0.67$; $P = 0.411$), Beijing ($\chi^2 = 1.51$; $P = 0.219$) or Lasha ($\chi^2 = 0.67$; $P = 0.412$) criteria (Figure 1C).

DISCUSSION

The objective of this study was to determine optimal diagnostic reference values for sarcopenia in residents of Xining, which is located on the Qinghai-Tibet Plateau at an average elevation of 2260 m. Sarcopenia diagnostic criteria are based on muscle mass, muscle strength and physical function, but may vary due to ethnicity, body size, and lifestyle and cultural factors. As chronic exposure to hypoxia at high altitudes can induce muscle atrophy and decrease physical performance, there is an unmet need to establish specific cut-off values for sarcopenia diagnostic criteria in plateau populations[16,17].

Consistent with other studies, among residents of Xining aged > 60 years, there were statistically significant differences in handgrip strength between males and females and in muscle mass between subjects who identified as Han or Minority ethnicities[5,18]. According to AWGS 2019 and Beijing criteria, in Xining, there was a high prevalence of sarcopenia in males (14.13%/42.39%), females (27.59%/56.25%) and overall (19.33%/49.14%). As the Lasha criteria provided a lower prevalence of



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Figure 1 Sarcopenia diagnostic criteria and prevalence. A: Stratified by gender; B: Stratified by ethnicity in male subjects; C: Stratified by ethnicity in female subjects.

sarcopenia (males, 8.7%; females, 22.41%; overall, 14%) and were able to differentiate between males and females, they are likely more appropriate for detection of sarcopenia in this plateau population.

China is a multi-ethnic country, and the prevalence of sarcopenia varies among different ethnic groups and across cultures[5]. In the present study, across the AWGS 2019, Beijing, or Lasha criteria, there were significant differences in the prevalence of sarcopenia stratified by ethnicity (Han and Minority) in male subjects. However, in male subjects, there were no significant differences in the prevalence of sarcopenia by ethnicity according to the AWGS 2019 criteria, and in female subjects, there were no significant differences in the prevalence of sarcopenia by ethnicity according to the AWGS 2019, Beijing or Lasha criteria. This may be explained by the following: First, in this study, subjects who identified as the Minority included the Hui, Zang, Sarah, and Mongols. These populations generally have a high protein diet, which may be preventative for sarcopenia[19]. Second, the Hui and Sarah dance actively in church each day. Exercise can improve muscle health as it may induce autophagy, which regulates the fate of stem cells and satellite cell differentiation into muscle fibers[20-22].

This study was associated with some limitations. First, the sample size was small, especially for female subjects and those who identified as Minority. Second, the sample was recruited from a single site, which limits the generalizability of our findings. Future research will explore diagnostic cut-off values for sarcopenia in Xining based on data collected from a larger number of hospitalized and community-dwelling subjects. A comparison of the values with the Lasha criteria will help explain the effectiveness of the three diagnostic criteria (Asia/ Beijing/ Lasha) for sarcopenia in this population.

CONCLUSION

The prevalence of sarcopenia in subjects aged > 60 years in Xining differed across three diagnostic

criteria. We recommend the Lasha criteria are the most appropriate for detection of sarcopenia in Xining.

ARTICLE HIGHLIGHTS

Research background

Sarcopenia is an age-related decline in skeletal muscle mass, which depends on an assessment of muscle strength and muscle mass. The diagnostic definition of sarcopenia varies by region.

Research motivation

The mass and function of skeletal muscle may be influenced by hypoxia at high altitudes. It is unclear whether the Lhasa criteria for sarcopenia are suitable for Xining.

Research objectives

To determine the optimal diagnostic criteria for sarcopenia in a plateau population.

Research methods

Handgrip strength, muscle mass, and physical performance were measured. Sarcopenia was diagnosed according to the Asian Working Group for Sarcopenia (AWGS) 2019 criteria, Beijing criteria, and Lasha criteria.

Research results

Across diagnostic criteria, there were significant differences in the prevalence of sarcopenia in the overall population and stratified by gender. The prevalence of sarcopenia measured by the AWGS 2019 or Lasha criteria was significantly higher in female compared to male subjects. In males, the prevalence of sarcopenia measured by the Beijing criteria was significantly higher in subjects who identified as Han compared to Minority. In females, there were no significant differences in the prevalence of sarcopenia by ethnicity according to any criteria.

Research conclusions

The Lasha criteria are likely most appropriate for detection of sarcopenia in this plateau population. We recommend the Lasha criteria for detection of sarcopenia in Xining.

Research perspectives

Future research will explore diagnostic cut-off values for sarcopenia in Xining based on data collected from a larger number of hospitalized and community-dwelling subjects.

FOOTNOTES

Author contributions: Pan SQ and Li XF designed and performed the research; Luo MQ and Li YM contributed new reagents and analytic tools; Pan SQ analyzed the data; Pan SQ wrote the paper.

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