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Observational Study

Sarcopenia in geriatric patients from the plateau region of Qinghai-Tibet: A cross-sectional study

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Institutional review board statement: This cross-sectional study was approved by the Medical Ethics Committee of Qinghai Provincial People's Hospital and conducted in compliance with the guidelines stated in the World Medical Association Declaration of Helsinki.

Informed consent statement: All study participants, or their legal guardian, provided informed written consent prior to study enrollment.

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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. It has been reported that the prevalence of sarcopenia in non-hospitalized elderly people was 9.0%-18.5% in the lowland plains. However, epidemiological investigations of sarcopenia in plateau regions are limited. The city of Xining in Qinghai Province (altitude 2260 m) is the sole point of access to the Qinghai-Tibet plateau. We hypothesized that the diverse ethnicities or dietary habits of the people living in the plateau may influence the prevalence of sarcopenia.

AIM

To investigate the prevalence and risk factors of sarcopenia in geriatric patients from the Qinghai-Tibet plateau region.

METHODS

From October to December 2018, 150 hospitalized geriatric patients (72.4 ± 5.60 years) from Xining City (altitude 2260 m) in Qinghai Province were recruited. Collected data included demographics, history of fall, nutritional status, self-care ability, depression, handgrip, muscle mass, and 6-m gait speed. Sarcopenia was diagnosed based on the 2014 criteria of the Asian Working Group for Sarcopenia.

RESULTS

The overall rate of sarcopenia was 20% (8.7 and 11.3% in men and women, respectively). Binary logistic regression analysis indicated that widowhood was associated with sarcopenia, while higher body mass index and beef and mutton consumption were protective.

CONCLUSION

The prevalence of sarcopenia in hospitalized geriatric patients in the Qinghai-Tibet plateau region was higher than that in the plain region and in non-hospit-

conflict of interest.

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alized geriatric people (reported elsewhere). Specific cultural features of the region, including ethnicity, brewed tea and ghee consumption, were not significantly associated with sarcopenia. Higher body mass index and consumption of beef and mutton were protective, while patients who were widowed was at increased risk.

Key Words: Geriatric patient; Prevalence; Plateau; Risk factors; Sarcopenia

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Core Tip: The prevalence of sarcopenia in hospitalized geriatric patients in the Qinghai-Tibet plateau region is higher than that in the plain region and in non-hospitalized geriatric people (reported elsewhere). Specific cultural features of the region, including ethnicity, brewed tea and ghee consumption, were not significantly associated with sarcopenia. Higher body mass index and consumption of beef and mutton were protective. Widowed patients was at increased risk.

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INTRODUCTION

Sarcopenia is defined as an age-related decline in skeletal muscle mass with decreased strength, function, or both[1]. The clinical features of sarcopenia tend to be non-specific, but include weakness, falling easily, limited mobility, slow gait, slender limbs, and weakness, among others. Diagnosis depends on an assessment of muscle strength and muscle mass. There are potential detrimental consequences of sarcopenia to individuals and public health, such as increased mortality, falls, functional decline, fractures, length of hospital stay, and hospitalization[2]. To improve public health and the quality of life among the elderly, it is very important to identify and prevent sarcopenia through early screening.

Sarcopenia was first clearly described in 2009 by the European Working Group on Sarcopenia in Older People (EWGSOP)[3]. Therein, sarcopenia was characterized as a simultaneous decline in muscle mass and function, based on muscle strength or physical performance determined at an initial screening. In 2014, the Asian Working Group for Sarcopenia (AWGS)[4] changed the focus of sarcopenia diagnosis to muscle mass, reflected by slow gait and low muscle strength. These differences in diagnostic criteria affect screening for sarcopenia[5]. Studies of epidemiology in Asia currently use either the AWGS or EWGSOP criteria, but the latter tends to report higher rates[6].

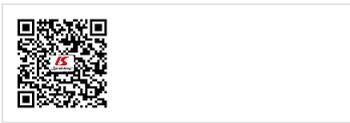
The populations in epidemiological studies on sarcopenia generally comprise elderly people residing in the community or hospitalized, mostly in the lowland plains. Epidemiological investigations of sarcopenia in plateau regions are limited.

The city of Xining in Qinghai Province (altitude 2260 m) is the sole point of access to the Qinghai-Tibet plateau. The present investigation of sarcopenia among hospitalized geriatric patients in the Xining area will likely provide reference data for this region. People of diverse ethnicities live in Xining, with dietary habits that include high salt and fat intake, brewed tea, and ghee, beef, and mutton. This study investigated associations between specific demographic and cultural factors and sarcopenia among hospitalized geriatric patients in Xining. We hypothesized that ethnicity or dietary habits may influence the prevalence of sarcopenia.

MATERIALS AND METHODS

Study design

This cross-sectional study was approved by the Medical Ethics Committee of Qinghai



Provincial People's Hospital and conducted in compliance with the guidelines stated in the World Medical Association Declaration of Helsinki.

Study population

From October to December 2018, participants were enrolled from a tertiary comprehensive hospital in Qinghai Province. All enrollees conformed to the following criteria: Aged > 60 years; residents of Xining City > 10 years; and voluntarily participated with signed informed consent. Potential participants with any of the following were excluded: persistent disturbance of consciousness or communication; caregivers when needed could not provide relevant information; mobility difficulty; metal implants (*e.g.*, pacemakers and heart stents); or unable to complete the grip strength test.

Measurements

General information form: General patient information was collected, including: Gender; age; ethnicity; birthplace; residence; duration at current residence; height; weight; marital status; education; history of smoking, drinking, and brewing tea; dietary consumption of ghee, beef, and mutton; history of falls; hospital admission date; and hospital discharge date. Dietary consumption of ghee, beef, or mutton was scored as: Never; occasional (1-2 times *per year*); sometimes (1-2 times *per month*); or frequent (1-2 times *per week*.)

Mental depression: Mental depression status was measured using the geriatric depression scale (GDS)[7] first developed by Yesavage *et al*[7] in 1982. The GDS covers 30 items, in which a score ≥ 10 points is considered as depression. The GDS has good reliability and validity in Chinese elderly people[8,9].

Nutritional status: The Mini Nutritional Assessment short form (MNA-SF)[10] was used to measure nutritional status. The MNA-SF collects information regarding the following 6 aspects within the previous 3 mo: Food intake and appetite reduction; weight changes; activity ability; acute illness or psychological trauma; psychological problems; and body mass index (BMI). The maximum possible MNA-SF score is 14 points, with scores ≤ 7 , 8-11, and 12-14 defined as malnutrition, risk of malnutrition, and good nutritional status, respectively.

Self-care ability: Self-care ability was evaluated using the Barthel index, with possible scores ranging from nil to 100 points[11]; higher scores indicate better self-care ability. The Barthel index covers the following 10 items: Eating; bathing; personal grooming; dressing; bowel control; urine control; toilet; bed chair transfer; walking; and walking up and down stairs.

Handgrip strength: A CAMRY-EH101 grip dynamometer (Shenzhen Tengfei Yu Technology) was used to measure handgrip strength. After adjusting the handle of the dynamometer to 0 kg, patients in the standing position held the device with their dominant hand, with arms at their sides, and the scale plate facing out. Participants were strongly encouraged to squeeze the dynamometer with their maximum isometric effort, and to keep squeezing for 5 s. Researchers consistently used the standard instructions, "hard, hard, hard, again," during this time, and were instructed to avoid visual feedback or incentives. No other body movement was allowed. Grip strength was measured 3 times at 1-min intervals between tests, and the highest value was recorded and included in the analyses.

Six-meter gait speed: Measurements of gait speed over 6 m were conducted on a 10-m outdoor walkway. Participants wore comfortable shoes, and when researchers gave the "start" command, subjects walked from the starting point with normal walking speed. The test was performed twice and the shortest time was recorded. Participants were allowed to use walking aids such as a cane to complete the test.

Muscle mass: An InBody720 Bioelectrical Impedance Analyzer was used to measure muscle mass. Before the test, the participants removed mobile phones, metal accessories, footwear, and heavy clothing. Their hands and feet were in close contact with 8 electrode points, shoulder joints were slightly abducted, and the angle between the trunk and upper limbs was 15°. Participants remained relaxed throughout the test and stayed in their initial position. Talking was not permitted.

Diagnostic criteria for sarcopenia

Sarcopenia was diagnosed based on the AWGS criteria[4], according to initial observations of handgrip strength and gait speed. If handgrip strength was low (men

< 26 kg, women < 18 kg) or gait speed was slow (< 0.8 m/s), muscle mass was measured. If muscle mass was also low (men < 7.0 kg/m², women < 5.7 kg/m²), then sarcopenia was diagnosed. If any of the above conditions were not met, sarcopenia was not diagnosed.

Statistical analysis

Data were analyzed with the SPSS 22.0 software package (IBM, Armonk, NY, United States). Descriptive statistics were applied for patient baseline characteristics. The independent-sample *t*-test and chi-squared test were used to evaluate differences between groups with and without sarcopenia. Factors associated with sarcopenia were determined by binary logistic regression analysis. A *P* value < 0.05 was considered a significant difference.

RESULTS

General information

Overall, 150 patients participated in this study (92 men and 78 women), aged 72.4 ± 5.6 years, with hospitalization lasting 12.6 ± 4.7 d (Table 1).

Prevalence of sarcopenia and results of univariate analyses

The overall rate of sarcopenia was 20% (*n* = 30/150), but differed significantly between the men (8.7%) and women (11.3%; *P* = 0.024; Table 2). Compared with patients without sarcopenia, those with sarcopenia were more likely to be older (*P* = 0.03) and BMI was significantly lower (*P* = 0.001). The rate of sarcopenia among widowed patients (44.4%) was significantly higher than that in married patients (14.6%; *P* < 0.001). Among the patients with (without) sarcopenia, the percentage with a fall history were 26.7% (15.0%), which were statistically similar (*P* = 0.13).

There were significant differences in the percentage of patients with sarcopenia with regard to the frequency of beef or mutton consumption, specifically 54.5, 14.6, 29.3, and 10.0% in groups who reported never, occasional, sometimes, and frequent consumption. In addition, scores for mental depression were significantly higher among patients with sarcopenia than among those without sarcopenia (*P* = 0.012).

The following factors showed no association with rate of sarcopenia: hospital stay, ethnicity, education level, smoking, drinking, brewed tea, eating ghee, history of falls, MNA-SF score, and Barthel index score.

Binary logistic analysis of factors associated with sarcopenia

The binary logistic regression analysis indicated that patients with lower BMI were more prone to experiencing sarcopenia compared with those with higher BMI (Table 3). Patients with higher BMI were less likely to develop sarcopenia. Risk factors for sarcopenia also included widowhood. Beef and mutton consumption were protective.

DISCUSSION

This was a cross-sectional study of sarcopenia among hospitalized geriatric patients in Xining. Among 150 participants, 20% had sarcopenia (8.7% of men; 11.3% of women). Higher BMI and beef/mutton consumption were protective factors against sarcopenia, while being widowed or having a history of falling were risk factors.

In this study, the detected rate of sarcopenia 20%, was higher than that of the general community (that is, outside Xining and non-hospitalized subjects at 9.0%-18.5%)[12-16]. This may be due to long-term bed rest and decreased physical function relative to community groups. The rate of sarcopenia increased with age in the current study, which is supported elsewhere[17]. The age of participants in this study was 72.4 (± 5.6) years, which is older than that reported in studies of community populations.

A survey of sarcopenia among 694 hospitalized patients reported rates of 45.9% and 36.7% for men and women, respectively[18], which are considerably higher than that detected in our study (8.7% and 11.3%). The large difference in rates between the studies is likely due to the different methods of muscle mass measurement. In the current study, bioimpedance analysis was used to measure muscle mass, while the previous study[18] used dual X-ray absorptiometry. These techniques differ significantly in consistency of results[19].

Table 1 General information of participants¹

		Total	Male	Female
Subjects		150 (100)	92 (61)	78 (39)
Age, yr		72.4 ± 5.6	72.9 ± 5.86	71.5 ± 5.2
BMI, kg/m ²		24.11 ± 3.85	24.25 ± 3.97	23.88 ± 3.68
Ethnicity	Han	113 (75.33)	64 (42.67)	45 (30)
	Minority	37 (24.67)	28 (18.67)	13 (8.67)
Education	Illiterate	47 (31.33)	20 (13.33)	27 (18)
	Primary	41 (27.33)	28 (18.67)	13 (8.67)
	Junior	25 (16.67)	18 (12)	7 (4.67)
	Senior	23 (15.33)	15 (10)	8 (5.33)
	Diploma	9 (6)	7 (4.67)	2 (1.33)
	≥ Undergraduate	5 (3.33)	4 (2.67)	1 (0.67)
Marital status	Married	123 (82)	79 (52.67)	43 (28.67)
	Widowed	27 (18)	12 (8)	15 (10)
Smoking	Never	114 (76)	58 (38.67)	56 (37.33)
	Previously	21 (14)	20 (13.33)	1 (0.67)
	Now	15 (10)	14 (9.33)	1 (0.67)
Drinking	Never	123 (82)	68 (45.33)	55 (36.67)
	Frequently	10 (6.67)	8 (5.33)	2 (1.33)
	Stopped	17 (11.33)	16 (10.67)	1 (0.67)
Brewed tea	Never	48 (32)	29 (19.33)	19 (12.67)
	Occasionally	40 (26.67)	21 (14)	19 (12.67)
	Sometimes	26 (17.33)	18 (12)	8 (5.33)
	Frequently	36 (24)	24 (16)	12 (8)
Ghee consumption	Never	74 (49.33)	45 (30)	29 (19.33)
	Occasionally	45 (30)	27 (18)	18 (12)
	Sometimes	19 (12.67)	12 (8)	7 (4.67)
	Frequently	12 (8)	8 (5.33)	4 (2.67)
Beef/mutton consumption	Never	11 (7.33)	4 (2.67)	7 (4.67)
	Occasionally	48 (32)	25 (16.67)	23 (15.33)
	Sometimes	41 (27.33)	25 (16.67)	16 (10.67)
	Frequently	50 (33.33)	38 (25.33)	12 (8)
Fall history	No	124 (82.67)	78 (52)	46 (30.67)
	Yes	26 (17.33)	14 (9.33)	12 (8)
MNA-SF, score		11.93 ± 2.35	11.78 ± 2.29	12.17 ± 2.45
Barthel index, score		96 ± 7.6	96.8 ± 5.96	95.5 ± 9.63
Depression	No	136 (90.67)	85 (56.67)	51 (34)
	Yes	14 (9.33)	7 (4.67)	7 (4.67)
Hand grip strength, kg		24.9 ± 9.47	28.52 ± 9.39	19.24 ± 6.32
Muscle mass, kg/m ²		6.95 ± 1.14	7.5 ± 0.97	6.08 ± 0.78
Six-meter gait speed, s/m		0.91 ± 0.23	0.94 ± 0.23	0.87 ± 0.24

¹Reported as *n* (%), unless indicated otherwise. BMI: Body mass index; MNA-SF: Mini Nutritional Assessment short form.

A systematic review found an independent correlation between sarcopenia and depression[20]. This is consistent with the current findings. This suggests there should be a primary focus on the psychological status of geriatric patients during hospitalization, with timely assessment and provision of psychological care and social support, to help prevent the development of sarcopenia.

The current univariate analysis showed that female gender, older age, low BMI, and widowhood were significantly associated with sarcopenia. This is consistent with the report by Han *et al*[16]. Our data also suggest that beef and mutton consumption is significantly protective against sarcopenia, possibly due to the high protein content of these foods. High protein intake was previously reported as protective against sarcopenia[21]. Therefore, geriatric hospitalized patients should receive beef and mutton, to reduce the prevalence of sarcopenia by increasing protein intake.

The participants in the present study included 113 individuals of Han ethnicity and 37 from minorities, and no significant association was detected between nationality and rate of sarcopenia. Studies with larger sample sizes and equal numbers of Han and minority individuals are warranted to investigate further any possible ethnic differences in sarcopenia. Brewed tea and ghee consumption, which are integral to the dietary culture of Xining, were not significantly associated with sarcopenia. This may be related to the components of brewed tea and ghee.

The results of the binary logistic analysis showed that high BMI was associated with less likelihood of developing sarcopenia (odds ratio 0.02, 95% confidence interval: 0.004-0.13). Low BMI is an indicator of reduced muscle mass[22], and slight increases in fat are associated with higher protein intake[17]. Hence, geriatric hospitalized patients should maintain a higher BMI to protect against sarcopenia.

The current results show that the rate of sarcopenia in widowed patients was 3.7-fold that of married patients. This may be because widowed patients are more often depressed[23], which is associated with sarcopenia[20]. In the present study, scores for mental depression were significantly higher among widowed patients compared with married patients, and higher depression levels were associated with sarcopenia relative to non-sarcopenia. Because sarcopenia and depression have some clinical, etiologic, and prognostic similarities, symptoms such as weakness, loss of appetite, reluctance, and reduced motivation linked to depression may contribute to the development of sarcopenia[24]. Hence, being widowed is a risk factor for sarcopenia. It is essential that widowed patients should be given additional psychological and social support, to reduce their depression levels as well as lower the risk of sarcopenia.

The current study showed that beef and mutton consumption can help prevent sarcopenia. Among the patients without sarcopenia, only 4.2% never ate beef or mutton, while this percentage was 20% of those with sarcopenia, a 4.8-fold difference. This suggests the importance of these high-protein foods for elderly patients, who should be encouraged to raise their protein intake appropriately.

CONCLUSION

This is the first investigation regarding sarcopenia in the Qinghai-Tibet plateau, and provides initial reference data for future studies. Geriatric hospitalized patients in Xining were screened for sarcopenia, and features specific to the diverse ethnic cultures and dietary habits of the Qinghai-Tibet plateau population were analyzed. Importantly, no association between brewed tea or ghee and sarcopenia was found, but consumption of beef and mutton appears to be preventative. However, there are also limitations in this study, for example, the sample was recruited from one hospital, which was unrepresentative. In the future, we will investigate the prevalence of sarcopenia in large areas of the plateau, and at different attitudes, and expand the sample size.

Table 2 Results of univariate analysis of factors associated with sarcopenia^a

		Sarcopenia			
		No	Yes	t/ χ^2	P value
Subjects		120	30	-	-
Age, yr		71.93 ± 5.42	74.37 ± 6.15	2.15	0.03
Hospital stay, d		12.37 ± 4.34	13.77 ± 5.92	-1.46	0.15
BMI, kg/m ²		24.95 ± 3.70	20.77 ± 2.36	5.89	0.001
BMI	Low	6 (5.0)	6 (20.0)	24.42	< 0.001
	Normal	44 (36.7)	21 (0.7)		
	High	70 (58.3)	3 (10.0)		
Gender	Male	79 (65.8)	13 (43.3)	5.15	0.024
	Female	41 (34.2)	17 (56.7)		
Ethnic	Han	89 (74.2)	24 (80.0)	0.44	0.64
	Minority	31 (25.8)	6 (20.0)		
Education	Illiterate	35 (29.2)	12 (40.0)	5.77	0.33
	Primary	34 (28.3)	7 (23.3)		
	Junior	20 (16.7)	5 (16.7)		
	Senior	17 (14.2)	6 (20.0)		
	Diploma	9 (7.5)	-		
	≥ Undergraduate	5 (4.2)	-		
Marital status	Married	105 (87.5)	18 (60.0)	12.30	< 0.001
	Widowed	15 (12.5)	12 (40.0)		
Smoking	Never	89 (74.2)	25 (83.3)	1.11	0.57
	Previously	18 (15.0)	3 (10.0)		
	Now	13 (10.8)	2 (6.7)		
Drinking	Never	98 (81.7)	27 (90.0)	1.24	0.54
	Frequently	9 (7.5)	1 (3.3)		
	Stopped	13 (10.8)	2 (6.7)		
Brewing tea	Never	41 (34.2)	7 (23.3)	3.04	0.39
	Occasionally	31 (25.8)	9 (30.0)		
	Sometimes	18 (15.0)	8 (26.7)		
	Frequently	30 (25.0)	6 (20.0)		
Ghee consumption	Never	58 (48.3)	16 (53.3)	7.16	0.07
	Occasionally	41 (34.2)	4 (13.3)		
	Sometimes	12 (10.0)	7 (23.3)		
	Frequently	9 (7.5)	3 (10.0)		
Beef/mutton consumption	Never	5 (4.2)	6 (20.0)	16.12	0.001
	Occasionally	41 (34.2)	7 (23.3)		
	Sometimes	29 (24.2)	12 (40.0)		
	Frequently	45 (37.5)	5 (16.7)		
Fall history	No	102 (85.0)	22 (73.3)	2.28	0.13
	Yes	18 (15.0)	8 (26.7)		
MNA-SF, score		11.87 ± 2.39	12.20 ± 2.20	-0.69	0.49

Barthel index, score	96.29 ± 8.16	96.5 ± 4.76	-0.13	0.89
Depression, score	2.51 ± 2.55	3.90 ± 3.22	-2.53	0.012

¹Reported as *n* (%), unless indicated otherwise. BMI: Body mass index; MNA-SF: Mini Nutritional Assessment short form.

Table 3 Results of binary logistic regression analysis for factors associated with sarcopenia

	B	SE	Wald	P value	OR (95%CI)
BMI					
Normal	-1.23	0.73	2.89	0.09	0.29 (0.07-1.19)
High	-3.80	0.93	16.83	< 0.001	0.02 (0.004-0.13)
Widowed	1.31	0.59	4.98	0.02	3.69 (1.17-11.67)
Beef/mutton consumption					
Occasionally	-2.01	0.86	5.49	0.02	0.14 (0.03-0.72)
Sometimes	-0.58	0.82	0.49	0.48	0.56 (0.11-2.81)
Frequently	-1.91	0.89	4.60	0.03	0.15 (0.03-0.85)

CI: Confidence interval; OR: Odds ratio; BMI: Body mass index.

ARTICLE HIGHLIGHTS

Research background

The prevalence of sarcopenia in non-hospitalized elderly people was 9.0%-18.5% in the plain region. However, epidemiological investigations of sarcopenia in plateau regions are limited. The city of Xining in Qinghai Province (altitude 2260 m) is the sole point of access to the Qinghai-Tibet plateau, where people live with diverse ethnicities and dietary habits including high salt and fat intake, brewed tea, and ghee, beef, and mutton.

Research motivation

We explored how diverse ethnicities and dietary habits affect the risk of sarcopenia. Beef and mutton have high protein content and high protein intake was previously reported as protective against sarcopenia.

Research objectives

To investigate the prevalence and risk factors of sarcopenia in geriatric patients from the Qinghai-Tibet plateau region.

Research methods

Data included demographics, history of falls, nutritional status, self-care ability, depression, handgrip, muscle mass, and 6-m gait speed. The independent-sample *t*-test and chi-squared test were used to evaluate differences between groups with and without sarcopenia. Factors associated with sarcopenia were determined by binary logistic regression analysis. A *P*-value < 0.05 was considered a significant difference.

Research results

The overall rate of sarcopenia was 20%. Widowhood was associated with sarcopenia, while higher body mass index and beef and mutton consumption were protective.

Research conclusions

The prevalence of sarcopenia in hospitalized geriatric patients in the Qinghai-Tibet plateau region was higher than that in the plain region and in non-hospitalized geriatric people. Ethnicity, and consumption of brewed tea or ghee have no significant effect on sarcopenia. Consumption of beef and mutton is protective against sarcopenia.

Research perspectives

We plan to explore diagnostic cut-off points in Xining City based on big data, and a risk assessment system will be developed.

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