CROSS SECTIONAL STUDY OF NUTRITIONAL STATUS IN OLDER HAN WOMEN

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Abstract. Malnutrition is one of the most prevalent problems in older people, but there is little information about the nutritional status of the older women in China. Therefore, this study was conducted to investigate the nutritional status and clinically correlated factors for malnutrition in older Han women in China. In total, 2,556 hospital- and community-based Han women aged 60 years or older were recruited between May 2007 and December 2014. All women completed comprehensive geriatric assessment, and the Mini Nutritional Assessment Short Form (MNA-SF) was used to assess the nutritional status. The clinically correlated factors for malnutrition were also analyzed, including social factors, health status, and dietary behavior. The average age of these women was 75.9±9.4 years, and 63.8% women lived in urban areas. Of the total respondents, 344 and 716 women were classified as malnutrition and at risk of malnutrition, respectively. Five factors were independently and positively correlated with poor nutrition, including chronic obstructive pulmonary disease (COPD), gastrointestinal disease, depression, cognitive impairment, and comorbidity (≥2). Three factors were independently and negatively correlated with poor nutrition, including economic status, meat intake, and fish intake. The older Han women with these five health problems should be given more attention with regards to their nutritional status. Improving economic status, eating more meat and fish were recommended for preventing poor nutrition in older women.

Keywords: elderly, Han ethnicity, malnutrition, nutritional status, women, China

INTRODUCTION

According to the World Health Organization (WHO), the number of older people in the world will reach 800 million by 2025, and more than half of them will live in the developing countries. The health of these people will become one of the most important issues for health care systems (Payahoo *et al*, 2013). Malnutrition, as one of the most prevalent problems in older people, affects 13%-78% of this population around the world (Kubrak and Jensen, 2007). Previous studies reported that the prevalence of malnutrition was 2%-12%, 21%-71%, and 18%-35% among the older people living in community dwelling, special housing, and receiving home care, respectively (Saletti *et al*, 1999; van Bokhorst-de van der Schueren *et al*, 2013).

One-out-of-every six older people in the world will suffer from this geriatric

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syndrome by 2020. However, malnutrition in the older people is still easily overlooked. Partly because the nutritional status of the older people is threatened by many factors, such as tooth loss, habitual drinking, depressive symptoms, living alone, physiological function deterioration, and psychological factors (Brownie, 2006). Malnutrition can lead to unfavorable outcomes for older people (Persson *et al*, 2002; Smoliner *et al*, 2009), such as decreasing quality of life, impairing cognitive function (Daradkeh *et al*, 2014), and increasing mortality/morbidity (Wahlqvist and Savige, 2000).

Researchers reported that the clinical and nutritional interventions might be effective in the treatment of malnutrition in the older people (Nykanen *et al*, 2014). However, by some accounts, less than half of the malnutrition patients were actually treated in clinical practice (Fang *et al*, 2013). Therefore, it is urgently needed to identify the risk of malnutrition in the older people.

Although a previous study reported that multiple factors were related to nutritional status (Saletti *et al*, 2000), there is still less information on the prevalence of malnutrition and clinical correlated factors of nutritional status in the older Han women in China. Therefore, in this study, we recruited the Han women aged 60 years or older to investigate the prevalence of malnutrition in the older people and evaluate the risk factors for malnutrition.

MATERIALS AND METHODS

Respondents

The respondents were Han women who lived in Shanghai. First, we collected their home address and transformed these addresses into numbers. Then, we sampled the participants according to the randomly selected number. Between May 2007 and December 2014, the Han women in Shanghai were recruited. All recruited women finished the Comprehensive Geriatric Assessment (CGA). Women who met the following criteria were included: i) Han women living in Shanghai for more than ten years, ii) aged 60 years or older, iii) living at home before the visit. The women were excluded if they had organ failure, dementia, blindness, deafness, or severe mental disorders.

Ethical considerations

The institutional review board approved this research (Ref Nº 2007-52; 2007 Feb 26). Before the recruitment, the respondents were told about the design and purpose of this research. Written informed consents were obtained from all the recruited participants. The data from the questionnaire were collected each week.

Comprehensive geriatric assessment

The CGA was completed through face-to-face interviews by two trained geriatricians. The CGA investigation included the following items: demographic characteristics, nutritional status, chronic diseases, level of education, mental problems, diet habit, activities of daily living (ADL), social support, physical examination, economic status, marital status, and lab examinations [such as blood routine, kidney function, serum lipid, liver function, blood sugar, hemoglobin A1c (HbA1c), abdominal ultrasound, chest X-ray, echocardiography and electrolyte].

Nutritional status assessment

The Mini Nutritional Assessment Short Form (MNA-SF) is a validated questionnaire for nutritional screening of the older people (Wang and Tsai, 2013).

Compared to Mini Nutritional Assessment (MNA), MNA-SF had similar accuracy and sensitivity (and could screen the nutrition status of each individual in less than five minutes. Therefore, the MNA-SF was particularly suitable for a large-scale study. This form consisted of six items: appetite, BMI value, depression, health status, mobility, and weight. A score of <8, 8-11, and >11 indicated malnutrition, malnutrition risk, and good nutritional status, respectively. In this study, two kinds of nutritional status ('poor nutrition,' MNA-SF≤11; and 'good nutrition,' MNA-SF>11) were used to perform statistic analysis.

General data

Body mass index (BMI) was defined as the body mass (kg) divided by the square of the body height (m^2) (kg/m^2). According to the Asian standard, women with BMI score <18.5 kg/m^2, 18.5-22.9 kg/m^2, 23.0-24.9 kg/m^2, and ≥25.0 kg/m^2 were defined as 'underweight,' 'normal,' 'overweight,' and 'obese', respectively. Women receiving more than 9 years, 1-9 years, and 0 years of education were defined as 'high', 'low,' or 'illiterate' level of education, respectively. Marital status was divided into two categories ('married' or 'divorced/widowed'). Economic status at home was categorized as 'low' or 'high.' The type of work before 60 years old was categorized as 'manual labor,' 'light manual labor' and 'heavy manual labor'. The dietary intake (eggs, fish, and meat) was categorized as >5 times per week, 2-4 times per week, and 0-1 time per week.

Health data

Self-rated health was divided into 'good,' 'fair,' and 'poor'. ADL was used to assess the functional status. Common chronic diseases of the older people, such as hypertension, liver disease, coronary artery disease, senile vaginitis, diabetes, chronic obstructive pulmonary disease (COPD), cerebrovascular disease, osteoarthritis, and cataracts, were considered. The number of these chronic diseases was used to assess comorbidity. The kinds of oral medication were also considered. The Geriatric Depression Scale with 30 items (GDS-30) was used to examine the emotional status. A score of ≥12 indicated depressive symptoms. The clinical dementia rating (CDR) and Mini Mental State Examination (MMSE) were used to assess global cognitive function. The modified Petersen criteria were used to diagnose mild cognitive impairment (Petersen, 2004).

Statistical analyses

Student's *t*-test, chi-square test, one-way analysis of variance (one-way ANOVA), and multivariate logistic regression analysis were used when appropriate. A *p*-value of <0.05 was considered to be statistically significant. Univariate analysis was used to identify the significantly different variables. Multivariate analysis was further used to analyze the variables with $p<0.05$ as the level of significance. All analyses were conducted using SPSS® (version 19.0; IBM, Armonk, NY).

RESULTS

Respondents

Firstly, 2,748 Han women who met the aforementioned inclusion criteria underwent CGA. Among these, 142 women were excluded due to the incomplete CGA data, and 50 additional women were excluded due to the incomplete MNA-SF data. Therefore, a total of 2,556 women were included to evaluate the risk factors for malnutrition.

The age of these women ranged from 60-to-92 years old, and the average age

Table 1
Characteristics of recruited women, *N*=2,556.

Variable	Respondents, *n* (%)
Age (years)	75.9 ± 9.4
Education (years)	
0	760 (29.7)
1-9	1,298 (50.8)
>9	498 (19.5)
Residence	
Urban	1,632 (63.8)
Rural	812 (31.8)
Economic status	
Low	1,382 (54.1)
High	1,174 (45.9)
Marital status	
Married	1,740 (68.1)
Divorced/widowed	816 (31.9)
Work type	
Heavy manual	1,324 (51.8)
Light physical	834 (32.6)
Mental labor	398 (15.6)
Residence	
Living with others	1,710 (66.9)
Living alone	846 (33.1)
MNA-SF	10.9 ± 3.6
MMSE	26.5 ± 3.9
GDS-30	9.3 ± 8.2
BMI	26.1 ± 6.9

MNA-SF, Mini Nutritional Assesment Short Form; MMSE, Mini Mental State Examination; GDS-30, Geriatric Depression Scale with 30 items; BMI, body mass index.

was 75.9 years, with a standard deviation (SD) of 9.4. The percentage of women living in urban areas was 63.8%. The average MNA-SF, MMSE, and GDS scores were 10.9 (SD=3.6), 26.5 (SD=3.9), and 9.3 (SD=8.2), respectively. The average of BMI (ranging from 15.3-to-41.8) was 26.1 (SD=6.9). The most frequent chronic diseases were osteoarthritis (67.6%), senile vaginitis (64.8%), hypertension (52.9%), cataract (31.9%), and depression (30.3%). Of the total number of respondents, 344 and 716 women were classified as 'malnutrition' and 'at risk of malnutrition,' respectively. Therefore, 1,060 women were categorized as poor nutrition (Table 1).

Univariate analysis

Univariate analysis of the demographic characteristics showed that the factors contributing to poor nutrition (MNA-SF≤11) included age, economic status, living alone, meat intake, and fish intake ($p<0.05$) (Table 2). Univariate analysis of the health condition showed that the factors contributing to poor nutrition (MNA-SF≤11), included self-rated health, ADL, COPD, stroke, cerebrovascular disease, gastrointestinal disease, depression, cognitive impairment, and comorbidity (Table 3).

These results indicated that a Han woman with one or more of the following characteristics was more likely to progress to poor nutrition: older age, dependent economic status, living alone, seldom or never having meat or fish intake, poor self-rated health, dependent ADL, suffering from one or more of these diseases (COPD, stroke, cerebrovascular disease and gastrointestinal disease), depression, cognitive impairment, and comorbidities (≥2).

Multivariate analysis

Multifactorial logistic regression analysis was used to conduct multivariate analysis. The 14 factors identified by univariate analysis were used as independent variables, and the nutritional status (poor or good nutrition) of women were used as dependent variables. The analysis showed that only eight factors had independent correlation with poor nutrition, including economic status,

Table 2
Univariate analysis of the demographic characteristics.

Variable	MNA-SF≤11 (*N*=1,060) *n* (%)	MAF-SF>11 (*N*=1,496) *n* (%)	*p*-value
Age (years)			
60-69	254 (24.0)	490 (32.8)	0.0003
70-79	344 (32.4)	500 (33.4)	
≥80	462 (43.6)	506 (33.8)	
Education (years)			
0	350 (33.0)	410 (27.4)	0.0680
1-9	502 (47.4)	796 (53.2)	
>9	208 (19.6)	290 (19.4)	
Residence			
Urban	662 (62.5)	970 (64.8)	0.3820
Rural	398 (37.5)	526 (35.2)	
Economic status			
Low	758 (71.5)	624 (41.7)	<0.0001
High	302 (28.5)	872 (58.3)	
Marital status			
Married	704 (66.4)	1,036 (69.3)	0.2840
Divorced/widowed	356 (33.6)	460 (30.7)	
Work type			
Heavy manual	556 (52.5)	768 (51.3)	0.8350
Light physical	336 (31.7)	498 (33.3)	
Mental labor	168 (15.8)	230 (15.4)	
Residence			
Living with others	548 (51.7)	1,162 (77.7)	<0.0001
Living alone	512 (48.3)	334 (22.3)	
Meat intake			
≥5/week	184 (17.4)	802 (53.6)	<0.0001
2-4/week	250 (23.6)	472 (31.6)	
0-1/week	626 (59.0)	222 (14.8)	
Egg intake			
≥5/week	346 (32.6)	522 (34.9)	0.7040
2-4/week	360 (34.0)	492 (32.9)	
0-1/week	354 (33.4)	482 (32.2)	
Fish intake			
≥5/week	112 (10.6)	990 (66.2)	<0.0001
2-4/week	204 (19.2)	324 (21.6)	
0-1/week	744 (70.2)	182 (12.2)	

meat intake, fish intake, COPD, gastrointestinal disease, depression, cognitive impairment, and comorbidity (≥2) (Table 4). These results indicated that economic status, meat intake and fish intake were negatively correlated with poor nutrition, and the other five factors were positively correlated with poor nutrition.

Table 3
Univariate analysis of the health condition.

Variable	MNA-SF≤11 (*N*=1,060) *n* (%)	MAF-SF>11 (*N*=1,496) *n* (%)	*p*-value
Age (years)			
Self-rated health			
Good	224 (21.1)	484 (32.4)	<0.0001
Fair	350 (33.1)	720 (48.1)	
Poor	486 (45.8)	292 (19.5)	
ADL			
Dependence	540 (50.9)	380 (25.4)	<0.0001
Independence	520 (49.1)	1,116 (74.6)	
Hypertension	542 (51.1)	810 (54.1)	0.288
Liver disease	72 (6.8)	108 (7.2)	0.769
Coronary artery disease	304 (28.7)	458 (30.6)	0.456
Senile vaginitis	704 (66.4)	952 (63.6)	0.306
Gastrointestinal disease	286 (27.0)	284 (19.0)	0.001
Diabetes	264 (24.9)	374 (25.0)	0.969
COPD	288 (27.2)	112 (7.5)	<0.0001
Cerebrovascular disease	102 (9.6)	74 (4.9)	0.001
Osteoarthritis	722 (68.1)	1,006 (67.2)	0.747
Stroke	270 (25.5)	292 (19.5)	0.011
Cataract	356 (33.6)	460 (30.7)	0.284
Depression	406 (38.3)	368 (24.6)	<0.0001
Cognitive impairment	392 (35.1)	226 (15.1)	<0.0001
Comorbidity			
<2	304 (28.7)	582 (38.9)	0.0002
≥2	756 (71.3)	914 (61.1)	
Oral medication			
<4	536 (50.6)	808 (54.0)	0.224
≥4	524 (49.4)	688 (46.0)	

ADL, activities of daily living; COPD, chronic obstructive pulmonary disease.

DISCUSSION

MNA-SF and CGA were used to investigate the prevalence of malnutrition in the women aged ≥60 years. To our knowledge, this was the first study to assess the nutritional status and its correlation factors in the older Han women from Shanghai. In this study, we found that among the 2,556 respondents, 536 (21.0%) women were defined as malnutrition, and 524 (20.5%) were defined as malnutrition risk. Economic status, meat intake, and fish intake were the three protective factors against poor nutrition, and COPD, gastrointestinal disease, depression, cognitive impairment, and comorbidity (≥2) were the risk factors for poor nutrition.

A previous study found that only 3.2% of older Chinese were defined as malnutrition, and 19.3% were defined as malnutrition risk (Shi *et al*, 2015). Ji *et al* (2012) reported that the percentages of malnutrition and malnutrition risk were

Table 4
Multivariate analysis of the variables with $p<0.05$ (MNA-SF≤11).

Variable	B (SE)	Wald	*p*-value	OR (95% CI)
Age	0.025	0.011	0.542	1.012 (0.958-1.051
Economic status (high)	-0.347	6.514	0.004	0.659 (0.511-0.876)
Living alone	0.501	3.650	0.088	1.552 (0.944-2.134)
Meat intake (≥2/wk)	-0.472	8.946	0.002	0.558 (0.443-0.715)
Fish intake (≥2/wk)	-0.631	10.821	0.001	0.462 (0.387-0.654)
Self-rated health (poor)	0.288	4.772	0.087	1.366 (0.967-1.863)
ADL (dependence)	0.259	3.112	0.107	1.294 (0.983-1.785)
COPD	0.557	9.574	0.001	1.861 (1.276-2.860)
Stroke	0.312	2.857	0.154	1.278 (0.935-1.916)
Cerebrovascular disease	0.422	2.187	0.351	1.108 (0.811-1.425)
Gastrointestinal disease	0.334	3.824	0.011	1.392 (1.032-1.956)
Depression	0.487	2.944	0.037	1.562 (1.127-2.003
Cognitive impairment	0.401	4.928	0.022	1.427 (1.108-1.934)
Comorbidity(≥2)	0.351	4.463	0.017	1.467 (1.071-1.894)

5.7% and 70.4%, respectively. Saletti *et al* (2005) found that 8% and 41% of the elderly were defined as malnutrition or malnutrition risk, respectively. These results seemingly indicated that the prevalence of malnutrition was relatively low in the older people.

However, Drescher *et al* (2010) reported that the prevalence of malnutrition in elderly was up to 22.1%. These inconsistent results could be the result of many factors. One of the most important factors could be the different sex ratio of the respondents in these studies, because compared to men, women were usually in a relatively low socioeconomic status (especially in China) and at higher risk of depression, which might make them at higher risk of malnutrition. Therefore, our study only recruited women and found a higher percentage of malnutrition (21.0%) than the similar studies from China did (Shi *et al*, 2015).

Our study indicated that the high economic status contributed to good nutrition. Economic status impacts food choices and the nutritional status of individuals (Bowman, 2007). Thus, community health workers and clinicians should give special attention to the older Han women of low economic status. Fish intake (≥2 times/week) was found to have a protective effect for the nutritional status of the elderly in this study, which was similar with the results of a previous study (Shi *et al*, 2015). Moreover, another study reported that people with age >75 years old could have lower mortality by eating more fish (Iimuro *et al*, 2012). Meat is a good source of high quality protein, iron, zinc, and most of B-vitamins (Speedy, 2003). A previous study reported that meat intake was not a protective factor for poor nutrition (p=0.086) (Shi *et al*, 2015), but our study reached a different conclusion (p=0.002). Our study only focused on the nutritional status of the older Han women. Therefore, fish and meat should be recommended as good nutrient for the older Han women in China to prevent

poor nutrition.

Generally speaking, there is a close relation between chronic disease and poor nutrition. Our study found that women with more than two chronic diseases were at higher risk of poor nutrition. COPD often resulted in appetite loss for patients, which affected their nutritional status (Breyer *et al*, 2011). COPD was found to have positive relationship with poor nutrition, which was consistent with the previous studies (Pirabbasi *et al*, 2012; Shi *et al*, 2015). Gastrointestinal disease commonly resulted in malnutrition and increased mortality and morbidity (O'Keefe, 1996), which was an independent risk factor for poor nutrition in this study.

Depression and malnutrition are highly prevalent among the older people; depression is associated with worsening of the nutritional status of people (Ahmadi *et al*, 2013). Some studies have reported that depression might exacerbate the risk of poor nutrition in the elderly (Smoliner *et al*, 2009). Cognitive function was associated with the nutritional risk level of the older people (Pearson *et al*, 2001). Our results indicated that cognitive impairment was associated with poor nutrition, which is in agreement with the findings reported in a study of 2,934 older people (Lee *et al*, 2009).

Several limitations should be noticed here: 1) the ethnic and site-specific biases could not be eliminated, because all women came from the same ethnicity (Han) and site; 2) all subjects were women; therefore, future studies are needed to explore whether or not these findings are appropriate for men; 3) no follow-up data were collected to show the change of nutritional status; 4) the number of recruited women was moderate. Therefore, future studies with larger sample sizes are still needed to support our conclusion.

In conclusion, COPD, gastrointestinal disease, depression, cognitive impairment, and comorbidity (≥2) were independently and positively correlated with poor nutrition among the older Han women in China. Women with these health problems should be given more attention as to their nutritional status. Meanwhile, the economic status, meat intake, and fish intake were independently and negatively correlated with poor nutrition.

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