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NUTRITIONAL STATUS OF AN ELDERLY POPULATION IN SOUTHWEST CHINA: A CROSS-SECTIONAL STUDY BASED ON COMPREHENSIVE GERIATRIC ASSESSMENT

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Abstract: *Objective:* Few data is available on the nutritional status of old Chinese. The present study aimed to describe the nutritional status and clinical correlates for malnutrition risk in the older people. *Design:* Cross-sectional study. *Setting:* Hospital- and community-based older people were recruited in the region of Chongqing, China. *Participants:* 558 individuals aged 60 years old or over between April 2011 and October 2012. *Measurements:* Comprehensive geriatric assessment was performed and nutritional status was assessed by the Mini Nutritional Assessment Short Form (MNA-SF). Nutrition-associated factors were analyzed, including health status (chronic diseases, depression, cognition, function impaired), social factors (education status, marital status, the type of work before 60 years old) and life style factors (smoking, drinking, diet). *Results:* The mean age was 73.1±8.0 years and 43.9% were men. Prevalence of malnutrition and risk for malnutrition were 3.2% and 19.3 %, respectively. Several factors increased poor nutrition independently including self-rated health, comorbidity, chronic obstructive pulmonary disease, gastrointestinal disease and cognitive impairment. Fish decreased the risk of poor nutrition. *Conclusions:* The prevalence was relatively low in older people of Chongqing, Southwest China. Poor nutrition was found to be increased due to the common health problems. Thus the patients with these problems should pay more attention on nutritional status. The older people should often have fish because of their nutritional benefit.

Key words: Risk factors of poor nutrition, MNA-SF, older people, Chinese.

Introduction

Geriatric syndrome is very common in older population, refers that one symptom and/or a complex of symptoms result from multiple diseases and multiple risk factors, affecting the living quality of old people seriously (1). Malnutrition as a common geriatric syndrome is affecting 13-78% of older people around the world based on various populations (2). For instance, the prevalence of malnutrition is 2-12% among the elderly living in community dwelling, but rise considerably in older individuals receiving homer care (18-35%) or in special housing (21-71%) (3, 4). It is estimated that one in every six people will suffer from malnutrition by 2020 according to the report of World Health Organization (WHO). Aging may come with an accumulation of diseases and impairment all of which may directly influence the balance between nutritional needs and intake (5). Dietary behavior of older people may change because of health or social reasons, decrease in taste and smell, or a reduced ability to purchase and prepare food. This combination of symptoms or conditions put older people at a higher risk of malnutrition (6). Therefore, malnutrition is worth to concern in geriatric practice. Malnutrition is strongly associated with negative health outcome, including the length of hospitalization, frailty, mortality and morbidity, and all of these increase the cost for patient and society (7, 8, 9). Even the treatment of malnutrition in the elderly may be effective if clinical and nutritional interventions are performed (10, 11), only 47.6% malnutritional patients are treated (12). Thus, the identification of the risk of malnutrition plays a pivotal role in the older people.

According to previous literature reports, multiple factors are related to nutritional status including age, gender, education level, marital status, cognitive and physical impairment (3, 4, 8, 13). However, there is less data on the prevalence of poor nutrition and clinical correlates of nutritional status of older Chinese.

In the present study, we investigated the prevalence of malnutrition in older population (aged 60 years and over) in Chongqing, Southwest China, and risk factors of poor nutrition was also evaluated.

Methods

Participants

All participants were recruited to finish comprehensive geriatric assessment (CGA) from Department of Geriatrics, The First Affiliated Hospital of Chongqing Medical University and Nanqiaosi community health center, both located in the urban area, between April 2011 and October 2012. Inclusion criteria were as follows: (1) aged 60 years or older, (2) living at home before the visit, (3) living in Chongqing more than one year. Exclusion criteria included: (1) organ failure or dementia, (2) deafness, blindness or severe mental disorders.

Comprehensive geriatric assessment

The multidimensional CGA investigation included demographic characteristics, chronic diseases, nutritional

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status, mental problems (depression, cognitive deficits), life style (smoking, alcohol use, diet), social support, activities of daily living (ADL), physical examination, laboratory examination (blood routine, liver function, kidney function, serum lipid, blood sugar, electrolyte, HbA1C, chest x-ray, echocardiography, abdominal ultrasound). CGA was performed by two geriatricians trained professionally face to face at the study site.

Nutritional status assessment

Mini Nutritional Assessment Short Form (MNA-SF) has similar sensitivity and accuracy as Mini Nutritional Assessment (MNA) for older people (14). Therefore, MNA-SF is a validated questionnaire of nutritional screening for older people. Compared with MNA, MNA-SF provides a simple way to screen the nutrition status of the elderly in less 5 min. Thus it is particularly suitable for the large-scale. It consists of 6 items: appetite, weight, mobility, health status, depression, and BIM value. If the individual was not able to give reliable answers, the questionnaire was confirmed by proxy. A score below 8 indicates malnutrition, and 8-11 scores for malnutrition risk and 12 or higher scores for good nutritional status. For statistic analysis, two categories of nutritional status were used, including poor nutrition (MNA-SF≤11, included malnutrition risk and malnutrition) and good nutrition (MNA-SF>12).

Data collection

General conditions

Age was calculated from birth date. Height was obtained using a non-electronically scale with participants standing upright without shoes. Weight was assessed in light clothing without shoes. If height or weight could not be measured due to physical impairments, they were obtained from a recent physical examination as reported by participants. Body mass index (BMI) was used to examine "obesity" with scores≥25.0kg/m^2, "overweight" with scores=24.9-23.0kg/m^2, 18.5-22.9kg/m^2 for "normal" and BMI<18.5kg/m^2 for "underweight" according to the WHO Asian adult body weight standard. Level of education was defined as "higher" for participants with more than 9 years, "lower" for those who attended school 1-9 years and "illiteracy" for those who did never attend school. Marital status was categorized as "married" and "divorced/widowed". The type of work before 60 years old was divided into "heavy manual labor", "light manual labor" and "mental labor". The intake of diet (fish, meat, egg) was divided into every day, 2-3 times per week and seldom/never. Processed food was excluded such as dried fish, jerky, eggs cake. The situation of smoking/drinking was divided into never, past and current.

Health condition

Self-rated health categorized as "good or very good", "fair" and "poor or very poor". Functional status was assessed with ADL. Common chronic diseases of older people were categorized as hypertension, coronary artery disease, chronic obstructive pulmonary disease (COPD), gastrointestinal disease, liver disease, kidney disease, stroke, cerebrovascular disease, diabetes, osteoarthrosis, cancer, and cataract. Disease situation of the individual was obtained from physical examination or medical records as reported by participants. Comorbidity was assessed by summing the numbers of underlying chronic diseases of a person. It was classified as having < 2 chronic diseases vs. ≥2 chronic diseases (divided by median number of co-morbidities). The number of oral medication included both prescription drugs and over-the counter-drugs. It was classified as using<4 drugs vs. ≥4 drugs (4 being the median number of drugs taken). Emotional status was examined by the Geriatric Depression Scale with 30 items (GDS-30) with scores≥12 denoting depressive symptoms. Global cognitive function was assessed with the Mini Mental State Examination (MMSE) and clinical dementia rating (CDR). Mild cognitive impairment was diagnosed according to according to the modified Petersen criteria (15).

Table 1

characteristic of study participants (mean± SD and percentages)

Variable	All subjects (n=558)
Age (year)	73.08±8.04
Gender	
Male	43.9%(245)
Female	56.1%(313)
Education(year)	
Illiteracy (0)	5.7%(32)
Lower (1-9)	50.2%(280)
Higher education (>9)	44.1%(246)
Residence	
Living in the downtown	93.9%(524)
Living in the rural	6.1%(34)
Home style	
Living with families	64.3%(359)
Living alone	35.7%(199)
Marriage	
Married	73.5%(410)
Divorce/widow	26.5%(148)
Work type	
Heavy manual labour	7.0%(39)
Light physical labor	34.8%(194)
Mental labour	58.2%(325)
Household income RMB/monthe	2950.10±1845.60
Body mass index (kg/m^2)	24.18±4.90
MNA-SF score	12.51±1.88
MMSE score	27.10±4.11
GDS score	7.73±5.64
Comorbidity	2.49±1.98
Oral medication	4.17±5.06
MNA-SF score	
>11 (good nutrition status)	22.6%(126)
≤11 (malnutrition or malnutrition risk)	77.4%(432)

RMB: Renminbi, the official currency of China

Table2
Demographic characteristics of the study population (N=558) according to categories of nutritional status

Variable (n, %)	MNA-SF≤11 n=126	MAF-SF≥12 n=432	p value
Gender			
Male(n=245)	45(35.7%)	200(46.3%)	0.035*
Female(n=313)	81(64.3%)	232(53.7%)	
Age (year)			
Young older (60-69) (n=200)	29(23.0%)	171(39.6%)	0.000*
Middle older(70-79) (n=220)	46(36.5%)	174(40.3%)	
Old older(≥ 80) (n=138)	51(40.5%)	87(20.1%)	
Education(year)			
Illiteracy (0) (n=32)	12 (9.5%)	20(4.6%)	0.057
Lower (1-9) (n=280)	55 (43.7%)	225(52.1%)	
Higher (>9) (n=246)	59 (46.8%)	187(43.3%)	
Marriage			
Married (n=410)	75 (59.5%)	335 (77.5%)	0.000*
divorce/widow (n=148)	51 (40.5%)	97 (22.5%)	
Work type			
Heavy manual labor (n=39)	12 (9.5%)	27 (6.3%)	0.462
Light physical labor (n=194)	44 (34.9%)	150(34.7%)	
Mental labor (n=325)	70 (55.6%)	255(59.0%)	
Household income RMB/month	1663.35±149.98	1890.37±91.60	0.177

*: p<0.05 represents statistical significance

Statistical analyses

All data were analyzed by SPSS 19.0. According to the data types, chi square test or independent samples t test was used in the study. The items which have a statistically significant difference (P<0.05) were analyzed by multivariate logistic regression.

Results

In this study, a total of 609 individuals underwent CGA. The data of 49 individuals were incomplete and 2 individuals aged less than 60 years. Only individuals with complete MNA-SF data were included in the analysis. In total, 558 individuals were analyzed in this study. Age of the total population was 73.1 (SD=8.0, range: 60-95) years and 43.9% were male. The average MNA-SF score was 12.5 (SD=1.9, range: 4-14). The mean MMSE score was 27.1 (SD=4.1, range: 10-30) and the mean GDS score was 7.7 (SD=5.6, range: 0-28). The average of BMI was 24.2 (SD=4.9, range: 14.6-42.8). The characteristic of the participants was presented in Table 1. The most frequently occurring diseases were hypertension (55.6%), coronary artery disease (29.0%), cataract (28.3%). 389 individual showed functional independence based on ADL scores, 169 were partial dependence, and no one was completely dependence. According to BMI, 7.0% of the older people were underweight, 25.3% were overweight and 34.2% were obesity. Only 18 subjects (3.2%) were classified as malnutrition (these subjects were then included in the malnutrition risk group for further analyses), 108 (19.3%) individuals were at malnutritional risk. Hence a total of 126 participants (22.5%) were classified as poor nutrition and the remaining 432 (77.5%) were classified as good nutritional status.

Univariate analysis showed that several factors contributed to poor nutrition including gender, age, marital status, fish and meat intake, self-rated health, comorbidity, ADL dependence, COPD, gastrointestinal disease, stroke, cataract, mild cognitive impairment, depression. Detail data was showed in the tables 2-4. Multifactorial logistic regression analysis indicated that independent correlates for poor nutrition were fair or poor self-rated health, comorbidity (more than two diseaeses), COPD, gastrointestinal disease and mild cognitive impairment; fish was negatively correlated with poor nutrition (Table 5).

In addition, compared to individuals with good nutrition, nutritional markers, included serum concentrations of albumin, pre-albumin, lymphocyte count and BMI were significantly lower in the poor nutrition group. Although 92.1% underweight participants suffering from poor nutrition, in the poor nutritional group 72.2% of participants had BMI greater than 18.5kg/m^2. Data about BMI distribution is showed in Figure 1.

Discussion

This study used the MNA-SF to determine the prevalence of malnutrition or malnutrition risk in the older people (60 years and over) who presented to CGA. To our knowledge, this is first report to describe prevalence of malnutrition risk and correlation factor in the older Chinese by comprehensive

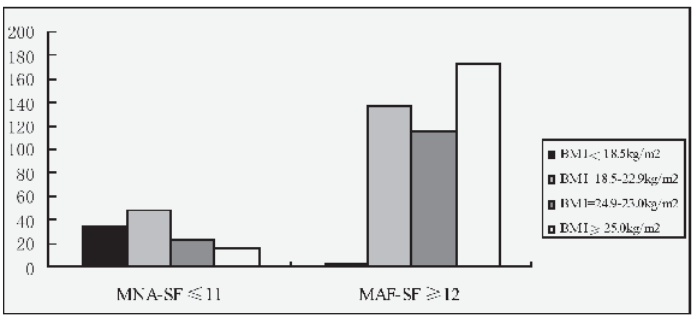
Table 3
Life style of the study population (N=558) according to categories of nutritional status

Variable (n, %)	MNA-SF≤11 n=126	MAF-SF≥12 n=432	p value
Meat intake			
Every day (n=336)	54(42.9%)	282(65.3%)	0.000*
2-3 times per week (n=122)	32(25.4%)	90(20.8%)	
Seldom or never (n=100)	40(31.7%)	60(13.9%)	
Fish intake			
Every day (n=40)	4(3.2%)	36(8.3%)	0.001*
2-3 times per week (n=176)	27(21.4%)	149(34.5%)	
Seldom or never (n=342)	95(75.4%)	247(57.2%)	
Egg intake			
Every day (n=292)	69(54.8%)	223(51.6%)	0.667
2-3 times per week (n=137)	27(21.4%)	110(25.5%)	
Seldom or never (n=129)	30(23.8%)	99(22.9%)	
Smoking			
Never (n=410)	93(73.8%)	317(73.4%)	0.908
Current (n=58)	14(11.1%)	44(10.2%)	
Past (n=90)	19(15.1%)	71(16.4%)	
Drinking			
Never (n=450)	99(78.6%)	351(81.3%)	0.383
Current (n=57)	13(10.3%)	44 (10.2%)	
Past (n=51)	14(11.1%)	37 (8.6%)	

*: p<0.05 represents statistical significance

geriatric assessment. We found 3.2% of the study population was defined as malnutrition and 19.3% were malnutrition risk. The incidence of overweight and obesity is 59.1%, 34.1% respectively. Fair or poor self-rated health, comorbidity (more than two diseaeses), COPD, gastrointestinal disease and mild cognitive impairment are independently associated with an increased risk of poor nutrition. Fish intake is a protective factor of nutritional status.

Figure 1
BMI distribution and nutritional status



The prevalence of poor nutrition status (malnutrition or malnutrition risk) in the study sample was relatively low (4, 16). Luxi and colleagues found that 5.7% of participants were classified as being malnourished and 70.4% were ere classified as being at a risk for malnutrition in the older Chinese (17). It is not surprising by analyze the participant composition of the present study. Firstly, the recruited participants are in the stable status of body condition, no emergency or acute diseases has been included, thus the nutritional status of current study partly represents the profile of relative healthy elderly. Secondly, most of the older people live at home and are well-groomed by family, thus nutritional status has a tendency to be better. Saltetti and colleagues found that only 8% the older living at home were assessed as malnourished (18). Finally, the most participants come from the downtown in Chongqing, and better economic condition compared to rural areas might affect the results.

Chronic diseases have been genrally considered to have positive relationship with poor nutrition, although some studies show different results (19, 20). Our results indicate that more than two chronic diseases are associated with poor nutrition that suggests diseases contribute to malnutrition. Moreover, poor self-rated health is a major risk factor for poor nutrition in this study, which is coincident with the previous reports (16, 21, 22).

COPD is another independent risk factor for poor nutrition (23). Approximately 10-60% patients with COPD have malnutrition based on different periods of disease (24). Moreover, the clinical outcome of COPD patients with malnutrition can be improved by diet and enteral nutrition. Body weight, muscle mass, fat mass and grip strength are increased by nutritional treatment (25, 26, 27). There are two mechanisms about the relationship between COPD and nutrition status. Firstly, the consumption and supply of energy

Table 4
Health condition of the study population

Variable (n, %)	MNA-SF≤11 n=126	MAF-SF≥12 n=432	p value
Self-rated health			
Good and very good(n=143)	26(20.6%)	117(27.1%)	0.000*
Fair(n=284)	50(39.7%)	234(54.2%)	
Poor and very poor(n=131)	50(39.7%)	81(18.8%)	
Oral medication			
<4 (n=295)	62(49.2%)	233(53.9%)	0.400
≥4 (n=263)	64(50.8%)	199(46.1%)	
Comorbidity			
<2 (n=195)	34(27.0%)	161(37.3%)	0.030*
≥2 (n=363)	92(73.0%)	271(62.7%)	
Chronic disease			
Hypertension(n=310)	70(55.6%)	240(55.6%)	1.000
Coronary artery disease(n=162)	34(27.0%)	128(29.6%)	0.565
COPD(n=56)	26(20.6%)	30(6.9%)	0.000*
Gastrointestinal disease(n=83)	32(25.4%)	51(11.8%)	0.001*
Liver disease(n=38)	6(4.8%)	32(7.4%)	0.300
Kidney disease(n=30)	7(5.6%)	23(5.3%)	0.919
Stroke(n=81)	30(23.8%)	51(11.8%)	0.001*
Cerebrovascular disease(n=22)	8(6.3%)	14(3.2%)	0.121
Diabetes(n=133)	30(23.8%)	103(23.8%)	0.994
Osteoarthrosis(n=123)	32(25.4%)	91(21.1%)	0.302
Cancer(n=25)	7(5.6%)	18(4.2%)	0.507
Cataract(n=158)	48(38.1%)	110(25.5%)	0.006*
Cognitive impairment (n=105)	41(32.5%)	64(14.8%)	0.000*
Depression (n=142)	43(34.1%)	99(22.9%)	0.011*
ADL			
Independence(n=389)	60(47.6%)	329(76.2%)	0.000*
Dependence(n=169)	66(52.4%)	103(23.8%)	
Nutrition marker			
BMI(kg/m2)	20.4±4.91	24.80±3.56	0.000*
Albumin (g/l)	39.37±6.36	43.69±6.18	0.000*
pre-albumin (g/l)	220.48±66.04	249.63±56.09	0.000*
lymphocyte count(×109/l)	1.37±0.600	1.67±0.64	0.000*

COPD: chronic obstructive pulmonary disease; *: p<0.05 represents statistical significance

is imbalance. In patients with COPD, high resistance and low compliance of the trachea are increased by 15-20%, the resting energy expenditure is thus increased; however, the daily energy intake does not increase, finally leading to increased consumption of energy. Secondly, appetite loss is often occurred in patients with COPD, and then affects the nutritional status (28, 29).

Cognitive impairment is also a risk factor of poor nutrition in our study. Other researches also report the nutritional risk level of the elderly is associated with cognitive function (30, 31). Moreover, various cognitive function scales show the cognitive ability of older people in malnutrition group is worse than the participants in good nutrition group (32). Although many studies have been recently reported malnutrition is associated with cognitive decline, at present there is still a lack of knowledge about the interaction of malnutrition and cognitive decline. Unfortunately, we do not have further analyses due to limited samples.

Our result shows that poor nutrition is associated with gastrointestinal disease. Ferdous and colleagues have found that gastrointestinal disorders are associated with lower MNA scores among the rural older adults with substantial undernutrition (33, 34). This may simply due to the important role that the gastrointestinal disorders play in absorption and digestion from the gastrointestinal tract.

Our study indicates that fish intake contributes to good nutrition, another cross-sectional study also find that persons with 75 years old or over who eat more fish have lower mortality (35). Therefore, Fish intake has a protective effect for nutritional status. We recommend that older people take fish as good nutrient. There are several reasons for recommendation. Firstly, fish oil may improve the mid upper arm muscle circumference of older people (36). Secondly, fish as common food is the good protein source in which the ratio of essential

Table 5
The characteristics and poor nutrition (MNA –SF≤11)

	B (SE)	Wald Chi-square	p value	OR(95%CI)
Age	0.001	0.005	0.946	1.001(0.962-1.042)
Male	0.508	3.372	0.066	1.661(0.966-2.856)
divorce/widow	0.094	0.440	0.507	1.098(0.832-1.450)
Fair or poor self rated health[a]	0.319	5.120	0.024*	1.375(1.044-1.812)
Co-morbidity≥2	0.367	4.850	0.028*	1.444(1.041-2.002)
COPD	0.666	12.878	0.000*	1.947(1.353-2.801)
Gastrointestinal disease	0.357	4.749	0.029*	1.429(1.037-1.971)
Stroke	0.297	2.995	0.084	1.346(0.961-1.884)
Cataract	0.173	1.423	0.233	1.189(0.894-1.582)
Mild cognitive impairment	0.395	5.305	0.021*	1.484(1.061-2.075)
Depression	-0.001	0.000	0.995	0.999(0.759-1.316)
ADL dependence	0.272	3.300	0.069	1.313(0.979-1.761)
Fish intake [b]	-0.569	13.671	0.000*	0.566(0.419-0.765)
Meat intake [b]	-0.361	2.941	0.086	0.697(0.461-1.053)

a. compared with poor and very poor; b. compared with seldom or never intake; *: p<0.05 represents statistical significance

amino acids is suited for human. Thirdly, the nutriment of fish is easy to be absorbed due to short muscle fiber, high moisture content and tender. Finally, less fat and unsaturated fatty acids in fish reduce cholesterol and prevent cardiovascular and cerebrovascular diseases.

It is reported that smokers have worse nutritional status and higher risk of malnutrition in geriatric outpatients and patients with COPD (4, 37). Tobacco may play a role in reducing appetite and promoting the inflammatory reaction. Interestingly, paternal smoking influences the nutrition status of their children in Indonesia rural families (38). One reason is that cigarette cost reduces the purchase for food (39). If the cost of cigarette is replaced by food, each child will increase 500 calorie diet (40). However, our study shows that smoking has no influence on nutritional status. Only around 10% of participants in our cohort smoke currently in both undernourished and normal nutritional subgroups; therefore, the small percentage of smokers makes it difficult to draw a conclusion on smoking and malnutrition from the present study.

Although the prevalence of poor nutrition is low in relatively healthy elderly according to our report, older people are prone to poor nutrition with age and chronic diseases. Therefore, it is essential to inspect the nutritional status of the elderly. BMI as a nutritional indicator in clinic and a part of the MNA-SF scale can partly evaluate nutritional status. In our study, only 6.8% of the older people were underweight and more than 20% were determined as poor nutrition. Approximately four fifths of the poor nutrition group have a BMI>23.0 kg/m^2, putting them in the overweight category. Thus, BMI solo evaluation of the nutritional status may result in missed diagnosis.

There are some limitations in this study. This is only a cross-sectional study, and no follow-up data shows the change of nutritional status. The present study is limited by relatively smaller number of patients; the prevalence of malnutrition might be a statistical bias. Further investigations with large sample size in various populations across the regions need to be required.

Conclusion

The prevalence of poor nutrition is relatively low in the older population of Chongqing, Southwest China. Poor nutrition is independently associated with self-rated health, comrbidity, COPD, gastrointestinal disease and congnitive impairment. The patients with these health problems should pay more attention to the nutritional status. Fish decrease the risk of poor nutrition. We recommend the older people intake fish because of their nutritional benefit.

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Ethics: Written informed consent was obtained from all participants or their family members. This study was approved by the Ethical Committee of The First Affiliated Hospital of Chongqing Medical University on human research.

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