Original article

Factors associated with poor nutritional status among the oldest-old☆

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SUMMARY

Background & aims: Older adults are at increased risk for malnutrition. The aim was to investigate the prevalence of and risk factors for poor nutritional status in oldest-old Chinese.
Methods: Community-living Chinese aged 90 and over were included in the study. Nutritional status was evaluated by using the Mini Nutritional Assessment short-form (MNA-SF). Demographic and socioeconomic status, health status, cognitive, behavioral, and lifestyle factors were collected via structured questionnaires during face-to-face interviews.
Results: 632 individuals (424 F, 208 M, 94 ± 3 y) were included. We found that 36 (5.7%) participants were classified as being malnourished (MNA-SF < 7), 445 (70.4%) were classified as being at risk for malnutrition ($8 \leq$ MNA-SF ≤ 11), and 151 (23.9%) were considered as well-nourished (MNA-SF ≥ 12). Ordinal logistic regression showed that significant risk factors for poor nutritional status included older age, poor cognitive function, gastrointestinal (GI) system disease, poor self-rated health, and lower serum albumin level.
Conclusion: The findings suggest that the majority of the Chinese oldest-old were at risk for malnutrition. Nutritional assessment should be incorporated into regular geriatric screening among community-living oldest-old in China. Interventions targeting those at risk for malnutrition should be developed to improve health outcomes among this vulnerable population.

1. Introduction

Nutritional health is an essential component of quality of life among older adults. Malnutrition in the elderly has been described as a "silent crisis" because it often goes undetected.[1] Clinical studies have linked poor nutrition with adverse health outcomes in a growing elderly population.[2–4] Specifically, poor nutrition is one of the most important contributors to frailty, and early identification of individuals with poor nutritional status holds important implications for both prevention and treatment.[5,6] In addition, recent evidence from randomized controlled trial suggests that nutritional treatment of patients at risk of malnutrition is effective in preventing weight loss and improving ADL (Activity of Daily Living) functions in geriatric patients at risk of malnutrition.[7] Therefore, given the importance of nutritional health and the potential for effective clinical intervention, early detection of nutritional risk and timely interventions are critical for the maintenance of health in the elderly.

Earlier studies have found that malnutrition is prevalent among Chinese older adults. For example, a recent study reported that the prevalence of malnutrition was 41.6% among a sample of surgical patients.[8] Using Body Mass Index (BMI) less than 18.5 kg/m^2 as the cut-point, Lin and colleagues have shown that among individuals aged 60 and over, 7.1% of men and 7.5% of women in urban area, 17.7% of men and 20.0% of women in rural area were malnourished.[9] This represents almost a doubling of the risk as compared to that among middle-aged (45–60) adults in China. Therefore, timely nutrition screening in the older population should help detecting early signs of malnutrition and enable timely treatment.

A number of factors have been found to be associated with poor nutritional health. These factors include age, living alone, eating and oral health issues, loss in sensory function, low functional capacity, diminished cognitive function, depression, poor vision, and changes in body composition.[5,10,11] While age has been found to be a major risk factor for malnutrition,[12] most studies of nutritional status focus on younger elderly population. As such, the current understanding of risk factors associated with poor nutritional health among the oldest-old is very limited.[10] In

addition, previous studies have shown that community-living older adults tend to have poor nutritional knowledge, attitude, and behavior.[13] Because the majority of older Chinese live in the community, their access to nutrition screenings may be limited. Malnutrition identified by clinical examination after symptoms arises may miss the window of opportunity for correcting nutritional issues.[5] The purpose of this study is to describe the nutritional status in a sample of community-dwelling oldest-old Chinese and to examine risk factors associated with poor nutritional status in this population.

2. Materials and methods

2.1. Study population and settings

In July 2005, as part of the Project of Longevity and Aging in Dujiangyan (PLAD) study,[14] a census of individuals aged 90 and above was conducted in 21 towns of Dujiangyan, Sichuan Province, China. Of the total population of 621,980, a total number of 1401 were identified as age-eligible. Of these, 870 (62%) individuals participated in the PLAD study. For the purpose of the present study, 632 respondents who have completed the Mini Nutritional Assessment Short-Form (MNA-SF) were included in the analysis. Individual age was verified by individual identification card, and government maintained residential records ("Huko"). All participants provided informed consented before entering the study. Researchers from Sichuan University West China Hospital conducted the face-to-face interviews. Physical examinations were conducted by clinicians at the local municipal hospital. The questionnaire measured respondents' individual socio-demographic, physical health, physical functioning, mental health, social health, lifestyle, as well as nutritional status. If the respondent was cognitively-impaired, proxy respondents, usually a close relative, were used.

2.2. Nutritional status

We used the MNA-SF to measure nutritional status.[15,16] The MNA-SF includes the following six items: decline in food intake over the past three months, weight loss during the past three months, mobility, psychological stress or acute disease, neuropsychological problems, and BMI (or calf circumference). It has been validated in many studies in a variety of settings and was found to correlate with morbidity and mortality.[5,17] Calf circumference (CC) has been determined to be a valid alternative when BMI is not available.[18] The MNA-SF score ranges from 0 to 14. It classifies the elderly as having normal nutritional status (score of 12–14), at risk for malnutrition (score of 8–11) or having malnutrition (score of 0–7). Compared with full MNA, the revised MNA-SF provides a simple way of screening older adults for malnutrition in less than 5 min.[19]

2.3. Independent variables

Socio-demographic characteristics included age, gender, education, income, occupation before the age of 60, and living arrangements. Education attainment was classified as "no formal education" and "some formal education". For living arrangements, participants were classified as living alone or not. Behavioral and lifestyle factors included dietary behaviors, physical activity, smoking habits, and alcohol consumption.

Functional status was measured by the Activity of Daily Living (ADL)[20] and the Instrumental Activity of Daily Living (IADL).[21] The ADL index measures the individual's ability to perform activities of daily living while the IADL index measures the individual's ability to live independently in the community. A combined ADL/IADL index was used because of its better measurement property as demonstrated by a recent study.[22]

Cognitive status was measured by the 30-item Mini-Mental State Evaluation (MMSE),[23] adapted to the Chinese population.[24] The score of MMSE ranges from 0 to 30, with higher score indicates better cognitive ability (a score of less than 24 indicates cognitive impairment).[23] Because the majority of the study sample do not have formal education and education attainment has been shown to affect MMSE score in Chinese population, we used a cut-point of 10 for participants with no formal education and a cut-point of 13 for those with some formal education as suggested by previous studies.[24,25]

Regarding chronic conditions, participants were asked the question: "Have you been told by a physician that you have: high blood pressure, respiratory system disease, gastrointestinal system disease, fall, fracture, arthritis, bowel incontinence, cardiovascular disease, cerebrovascular disease, peripheral vascular disease, Parkinson disease, diabetes mellitus, chronic kidney disease, prostate disease, disease of ears or eyes, or cancer?"

Physician's examination of each participant's general health condition, laboratory testing of blood sample and anthropometric measures (mid-arm and calf circumferences) were measured according to the standard protocols at the local municipal hospital.

2.4. Statistical analysis

We first compared the descriptive statistics of the sample by gender and by nutritional status (normal, at risk for malnutrition, and malnourished). Comparison of individual characteristics between gender and among different levels of nutritional status was conducted using chi-square statistics for categorical variables. For continuous variables, t-tests were used for comparison by gender and one-way ANOVA for comparison by nutritional status. We then estimated ordinal logistic regression model to predict the three levels of nutritional status: normal, at risk for malnutrition, and malnutrition. In order to develop a relatively parsimonious model, independent variables that were associated with poorer nutritional status at $p < 0.20$ level in the bivariate analysis were included in the final model. The statistical significance level was set at $p < 0.05$. All statistical analyses were conducted using SAS system version 9.2 (SAS Institute, Inc., Cary, NC).

3. Results

The mean MNA-SF score of the sample was 10.3 (SD = 1.8, range: 4–14). A total of 36 participants (5.7%) were classified as malnourished (MNA-SF < 8), 445 (70.4%) were classified as at risk for malnutrition (MNA-SF between 8 and 11), and the remaining 151 (23.9%) were classified as having normal nutritional status.

Table 1 shows the baseline characteristics of the study sample by gender. The mean age of the sample was 93.5 years (range 90–104). The sample was predominately female (67.1%), most respondents reported no formal education (73.3%), being a farmer before the age of 60 (79.8%), and living with others (92.6%). Women were much more likely to report having no formal education (90.8%) as compared to men (37.5%). Only 7.4% of the sample was living alone and 71.2% had ADL or IADL impairment. About a third (31.5%) of the sample reported using prescription medications. Dietary habits were similar between men and women, with the exception that more men reported being vegetarians and more women reported low fluid consumption. Consistent with high prevalence of tobacco use in the general Chinese population, 69.3% of men and 31.4% of women reported current tobacco use. Alcohol drinking is also prevalent among both men (40.8%) and women