Original Study

Frailty and Malnutrition: Related and Distinct Syndrome Prevalence and Association among Community-Dwelling Older Adults: Singapore Longitudinal Ageing Studies

Kai Wei PhD [a], Ma Shwe Zin Nyunt PhD [b], Qi Gao PhD [b], Shiou Liang Wee PhD [a,c], Tze-Pin Ng MD [a,b,*]

[a] Geriatric Education and Research Institute, Singapore
[b] Gerontology Research Programme, Department of Psychological Medicine, National University of Singapore, Singapore
[c] Faculty of Health and Social Sciences, Singapore Institute of Technology, Singapore

Keywords:
Frailty
malnutrition
nutritional risk
prevalence
association

ABSTRACT

Objective: The association between frailty and malnutrition is widely noted, but the common and distinct aspects of this relationship are not well understood. We investigated the prevalence of prefrailty/frailty and malnutrition/nutritional risk; their overlapping prevalence; compared their sociodemographic, physical, and mental health risk factors; and assessed their association, independently of other risk factors.
Methods: Cross-sectional study of population-based cohort (Singapore Longitudinal Ageing Study [SLAS]-1 [enrolled 2003–2005] and SLAS-2 [enrolled 2010–2013]) of community-dwelling older Singaporeans aged ≥55 (n = 6045).
Measurements: Mini Nutritional Assessment (MNA)–Short Form (SF), Nutritional Screening Initiative (NSI) Determine Checklist, Fried physical frailty phenotype.
Results: The overall prevalence of MNA malnutrition was 2.8%, and at risk of malnutrition was 27.6%; the prevalence of frailty and prefrailty were 4.5%, and 46.0% respectively. Only 26.5% of participants who were malnourished were frail, but 64.2% were prefrail (totally 90.7% prefrail or frail). The prevalence of malnutrition among frail participants was 16.1%, higher than in other studies (10%); nearly one-third of the whole population sample had normal nutrition while being prefrail (27.7%) or frail (1.5%). The prevalence of risk factors for prefrailty/frailty and malnutrition/nutritional risk were remarkably similar. MNA at risk of malnutrition and malnutrition were highly significantly associated with prefrailty (odds ratio [OR] 2.11 and 6.71) and frailty (OR 2.72 and 17.4), after adjusting for many other risk factors. The OR estimates were substantially lower with NSI moderate and high nutritional risk for prefrailty (OR 1.39 and 1.74) and frailty (OR 1.27 and 1.93), but remain significantly elevated.
Conclusion: Frailty and malnutrition are related but distinct conditions in community-dwelling older adults. The contribution of poor nutrition to frailty in this population is notably greater. Both frail/prefrail elderly and those who are malnourished/at nutritional risk should be identified early and offered suitable interventions.

© 2017 AMDA – The Society for Post-Acute and Long-Term Care Medicine.

Frailty and malnutrition are important geriatric syndromes that are commonly present in older people, especially among the oldest old (80+). Both conditions are associated with similarly increased risk of functional decline, poor quality of life, loss of independence, deterioration in health status, increased length and cost of hospital stay, and increased mortality.[1–3] The association between frailty and malnutrition is widely noted. However, the common and distinct aspects of this relationship, in terms of etiology, risk factors, identification, treatment strategies, and interactions on health outcomes, are just beginning to receive attention, and are still not well understood.[4]

Malnutrition and physical frailty in community-dwelling older adults are related, but distinct geriatric syndromes.[4] The 2 conditions share some common pathophysiologic pathways. The loss of body tissues, resulting in wasting, is a common phenotype of frailty (or sarcopenia)

and malnutrition, although the etiology of this tissue loss differs.[5] In malnutrition, muscle wasting results from inadequate food intake or unmet increased protein and calorie demand. Sarcopenia and frailty may result from malnutrition, but also from other causes such as physical inactivity; hormonal, cytokine, or metabolic imbalances; or chronic diseases and polypharmacy.[5] As both conditions share common socio-demographic, physical, and cognitive risk factors,[6] it is more than coincidental to find individuals presenting with both frailty and malnutrition.

Estimates of the prevalence of frailty and malnutrition are highly variable, because many different measurement tools were used to assess these conditions. There are many similarities in assessment tools for malnutrition and frailty, and in particular the lack of agreement with regard to defining and measuring malnutrition makes it difficult to gain a clear picture of the overlap in prevalence of malnutrition and frailty, and the scope for potentially more successful interventions.[4]

A recent systematic review and meta-analysis[7] of 10 studies (n = 5447) that uniformly assessed malnutrition using the Mini Nutritional Assessment (MNA) and physical frailty using the Fried criteria among community-dwelling older adults (mean age: 77.2 years) have reported the prevalence of malnutrition at 2.3%, and much higher prevalence of physical frailty at 19.1%. Notably, 2 of 3 malnourished older adults were physically frail, whereas only approximately 1 in 10 of the physically frail population was malnourished. The MNA and Fried criteria share some common measurement items, such as weight loss, low body mass index (BMI), and impaired physical and mental function. It has been reported that there were significant associations between 12 of the 18 MNA items and frailty status, including anorexia, weight loss, impaired mobility, and psychological problems.[8] Studies that used other nutritional screening tools that are not focused on the malnutrition phenotype but on nutritional risk and, in particular, inadequate food intake, the root cause of malnutrition, are lacking. Furthermore, information is lacking on the overlapping prevalence of nutritional risk and prefrailty, which are reversible and define a population at risk for earlier identification and more amenable interventions.

In this study among community-dwelling older adults in a large population-based cohort (n = 6045) in the Singapore Longitudinal Ageing Study (SLAS), we reported the prevalence of prefrailty and frailty based on the Fried physical phenotype, and at risk of malnutrition (at-risk) and malnutrition using the MNA. At the same time, we used the Nutritional Screening Initiative (NSI) Determine Your Nutritional Health Checklist that describes personal and behavioral factors related to inadequate or poor-quality food and nutrient intake among older persons. We estimated the overlapping prevalence of prefrailty/frailty with nutritional risk/malnutrition; compared their sociodemographic, physical, and cognitive risk factors; and assessed the strength of their association using both the MNA and the NSI, independently of other known and potential risk factors.

Methods

Participants

As previously described,[9–11] the SLAS is a population-based longitudinal study of aging and health of community-dwelling Singaporeans aged ≥55 years, excluding individuals who were not able to participate because of severe physical or mental disability. The first cohort (SLAS 1 baseline, n = 2804) recruited residents in the southeast region of Singapore between 2003 and 2005, and the second cohort (SLAS 2 baseline, n = 3241) used identical methodologies to recruit residents in the southwest and south-central regions of Singapore between 2010 and 2013. This cross-sectional study comprised SLAS 1 and 2 cohorts of 6045 participants. Subjects without frailty scores (n = 360) were excluded from the analysis. The study had ethical approval from the National University of Singapore Institutional Review Board. Written informed consent was obtained from all participants.

Measurements

Frailty

Frail status of the participants was assessed based on the 5 criteria by Fried and colleagues in the Cardiovascular Health Study (CHS),[12] with operational modifications:

1. Shrinking was defined as BMI of less than 18.5 kg/m^2 and/or unintentional weight loss of ≥4.5 kg (10 pounds) in the past 6 months.
2. Weakness was defined as the lowest quintile of performance on rising from chair test in the sitting position with arms folded, based on the Performance Oriented Mobility Assessment (POMA) battery.[13]
3. Slowness was assessed by POMA gait tests (subjects walked 6 meters and returned to the starting point quickly),[13] which include 7 gait items: initiation of gait, step length and height, step symmetry, step continuity, path, trunk, and walking stance. The total POMA gait score has a range from 0 to 12, and a score of less than 9 denotes slowness.
4. Exhaustion was determined by response of "not at all" to the question from SF-12 quality of life scale: "Do you have a lot of energy?"
5. Low activity was determined by self-report of "none" for participation in any physical activity (walking or recreational or sports activity).

One point was assigned for the presence of each component, and total score categorized participants as frail (3–5 points), prefrail (1–2 points), and robust (0 point).

Nutrition

NSI Determine Your Nutritional Health checklist[14] was developed jointly for the NSI by the American Dietetic Association, the American Academy of Family Physicians, and the National Council on Aging in the United States to aid health professionals and providers of nutritional support services in identifying older adults at risk for malnutrition. It assesses nutritional risk using a 10-item questionnaire describing personal and behavioral factors related to inadequate or poor quality food and nutrient intake among older persons: Not enough money to buy needed food, Eat alone most of the time, Physically unable to shop, cook and/or feed myself, Tooth or mouth problem causes difficulty eating, Fewer than 2 meals eaten per day, Few milk products (less than once a day), Few fruit or vegetables (less than 2 portions per day), Unintended loss of 10 lb/4 kg or more in past 6 months, Illness/condition that changes kind/amount of food eaten, Take 3 or more different drugs a day, and Alcohol: 3 or more drinks almost every day. The total weighted scores ranged from 0 to 21; 6 or more indicated high nutritional risk, 3 to 5 indicated moderate nutritional risk, and 0 to 2 indicated good nutritional status.

The Mini Nutritional Assessment[15]–short form (MNA-SF)[16] is a widely used nutrition screening scale. We derived MNA-SF data from available data collected in the SLAS cohort (see Appendix Table 1 for a comparison and overlap with the NSI Determine Checklist). MNA-SF total score (maximum = 14): 12 to 14 = normal nutritional status, 8 to 11 = at risk of malnutrition, and 7 or less = malnourished.

Covariates

Sociodemographic data included age, gender, race, education, housing type (an indicator of socioeconomic status), marital status, and living arrangement. The self-report of a medical disorder diagnosed and treated by a physician was recorded for 22 named diagnoses and other disorders. The number of *comorbidities* was estimated from the total count of medical disorders in the past 1 year. *Polypharmacy* was defined as the use of 5 or more medications. *Cognitive function* was assessed with the Mini-Mental State Examination (MMSE). With a maximum score of