JAMDA 18 (2017) 374–382

JAMDA

journal homepage: www.jamda.com

Review Article

High Prevalence of Physical Frailty Among Community-Dwelling Malnourished Older Adults—A Systematic Review and Meta-Analysis

Sjors Verlaan MSc [a,b,*], Gerdien C. Ligthart-Melis PhD [b,c], Sander L.J. Wijers PhD [b], Tommy Cederholm MD, PhD [d], Andrea B. Maier MD, PhD [e,f], Marian A.E. de van der Schueren PhD [g,h]

[a] Department of Internal Medicine, Section of Gerontology and Geriatrics, VU University Medical Center, Amsterdam, The Netherlands
[b] Nutricia Research, Nutricia Advanced Medical Nutrition, Utrecht, The Netherlands
[c] Department of Health and Kinesiology, Center for Translational Research in Aging and Longevity, Texas A&M University, College Station, TX
[d] Department of Public Health and Caring Sciences/Clinical Nutrition and Metabolism, Department of Geriatric Medicine, Uppsala University Hospital, Uppsala, Sweden
[e] Department of Medicine and Aged Care, Royal Melbourne Hospital, University of Melbourne, Melbourne, Australia
[f] Department of Human Movement Sciences, MOVE Research Institute Amsterdam, VU University, Amsterdam, The Netherlands
[g] Department of Internal Medicine, Section Nutrition and Dietetics, VU University Medical Center, Amsterdam, The Netherlands
[h] Department of Nutrition, Sports and Health, Faculty of Health and Social Studies, HAN University of Applied Sciences, Nijmegen, The Netherlands

Keywords:
Malnutrition
frailty
community-dwelling

A B S T R A C T

Background: Malnutrition and frailty are two geriatric syndromes that significantly affect independent living and health in community-dwelling older adults. Although the pathophysiology of malnutrition and physical frailty share common pathways, it is unknown to what extent these syndromes overlap and how they relate to each other.

Methods: A systematic review was performed resulting in a selection of 28 studies that assessed both malnutrition and frailty in community-dwelling older adults. Furthermore, a meta-analysis was performed on 10 studies that used Mini- Nutritional Assessment and the Fried frailty phenotype to estimate the prevalence of malnutrition within physical frailty and vice versa.

Results: In the systematic review, 25 of the 28 studies used the Mini-Nutritional Assessment (long or short form) for malnutrition screening. For frailty assessment, 23 of the 28 studies focused on the physical frailty phenotype, of which 19 followed the original Fried phenotype. Fifteen studies analyzed the association between malnutrition and frailty, which was significant in 12 of these. The meta-analysis included 10 studies with a total of 5447 older adults. In this pooled population of community-dwelling older adults [mean (standard deviation) age: 77.2 (6.7) years], 2.3% was characterized as malnourished and 19.1% as physically frail. The prevalence of malnutrition was significantly associated with the prevalence of physical frailty ($P < .0001$). However, the syndromes were not interchangeable: 68% of the malnourished older adults was physically frail, whereas only 8.4% of the physical frail population was malnourished.

Conclusions: The systematic review and meta-analysis revealed that malnutrition and physical frailty in community-dwelling older adults are related, but not interchangeable geriatric syndromes. Two out of 3 malnourished older adults were physically frail, whereas close to 10% of the physically frail older adults was identified as malnourished.

As the global population ages, there is increasing attention for geriatric syndromes, which significantly impact independent living, quality of life, and healthcare consumption. Malnutrition and frailty are two important geriatric syndromes in community-dwelling older adults, and both have a clear nutrition-related component.

Malnutrition is defined by the European Society for Clinical Nutrition and Metabolism as "a state resulting from lack of uptake or intake of nutrition causing altered body composition (decreased fat

S.V. and S.L.J.W. are employees, and G.C.L.-M. is contractor of Nutricia Research, Nutricia Advanced Medical Nutrition. The authors declare no conflicts of interest.

* Address correspondence to Sjors Verlaan, MSc, Department of Internal Medicine, Section of Gerontology and Geriatrics, VU University Medical Center, De Boelelaan 1117, Amsterdam 1081 HV, The Netherlands.
E-mail address: G.Verlaan@vumc.nl (S. Verlaan).

http://dx.doi.org/10.1016/j.jamda.2016.12.074

free mass and body cell mass), leading to diminished physical and mental function and impaired outcome from disease."[1,2] In older adults, malnutrition has been shown to contribute to loss of autonomy, lower quality of life, higher frequency of hospital admissions, and mortality.[3] Several nutritional screening tools are being used to detect malnutrition. Among the most commonly used tools are the Malnutrition Universal Screening Tool,[4] Mini-Nutritional Assessment (MNA),[3] Subjective Global Assessment,[5] Short Nutritional Assessment Questionnaire,[6] and Nutritional Risk Screening-2002.[7]. Weight loss and nutritional intake are common domains in most tools. For free-living older populations, the MNA is a well-established and widely used tool[3] that assesses nutritional intake, involuntary weight loss, mobility, psychological stress or acute disease, neuropsychological problems, and body mass index or calf circumference. Patients are categorized into 1 of 3 categories: normal nutritional status, at risk of malnutrition, or malnourished.

Frailty is the cumulative decline across multiple physiological systems, which increases an individual's vulnerability for developing dependency, morbidity, and/or mortality when exposed to a stressor.[8,9] Several domains within the frailty context can be distinguished, among others physical and cognitive impairment, psychological risk factors, and social determinants.[10,11] Some of the frailty tools exploit a more holistic approach, including comorbidities and mental characteristics (eg, the Rockwood Frailty Index[10] or the Tilburg Frailty Index[12]). Specifically, physical frailty has been defined as "a medical syndrome with multiple causes and contributors that is characterized by diminished strength, endurance, and reduced physiologic function that increases an individual's vulnerability for developing increased dependency and/or death."[9] The most studied physical frailty model is the Physical Frailty Phenotype developed by Fried et al,[13] consisting of 5 domains: weight loss, exhaustion, weakness, slowness, and reduced physical activity. This tool classifies patients as either robust (none of the domains below threshold), prefrail (1 or 2 domains below threshold), or frail (3 or more domains below threshold). Several scales have been developed that are derived from this phenotype model, including the Study of Osteoporotic Fractures scale[14] and the FRAIL scale.[15]

Malnutrition and physical frailty share common pathophysiology and screenings tools include overlapping items, such as weight loss and impaired physical function. Furthermore, malnutrition holds an important place within the conceptual physical frailty phenotype developed by Fried et al.[13] Weight loss is seen as a modifiable risk factor for physical frailty.[16] Therefore, debate exists about how close the link between both syndromes is, and to what extent they coexist or are overlapping phenomena.

Our aim was to assess whether malnutrition and frailty in community-dwelling older adults are associated and/or interchangeable syndromes. Therefore, we systematically reviewed studies that assessed both syndromes. Furthermore, we performed a meta-analysis to estimate the prevalence of malnutrition within physical frailty and vice versa, based on the studies that used MNA and Fried physical frailty phenotype.

Methods

Literature Search

We searched for studies (both full text and abstracts) assessing both malnutrition and frailty in community-dwelling older adults. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) principles were followed in the systematic review and meta-analysis.[17] Records were retrieved through PubMed (1900–2016), Medline (1946–2016), Embase (1947–2016), and CAB Abstracts (1910–2016). Records from Medline, Embase, and CAB Abstracts were retrieved using the following search terms: Ti,ab [(malnutrition OR malnourish* OR "nutritional status" OR undernourish*) AND (frailty OR frail OR physical* p/0 frail* OR "pre-frail" OR "pre-frailty") AND (elderly OR "older people" OR "older adults" OR aged OR aging OR ageing OR "old age" OR retired OR pensioner* OR geriatric*)], whereas records from Pubmed were retrieved using the following search terms: Ti,ab[(malnutrition OR malnourish OR malnourished OR "nutritional status" OR undernourish OR undernourished) AND (frailty OR frail OR "physically frail" OR "physical frailty" OR "pre-frail" OR "pre-frailty") AND (elderly OR "older people" OR "older adults" OR aged OR aging OR ageing OR "old age" OR retired OR pensioner OR pensioners OR geriatric OR geriatrics OR geriatrician)]. The search was limited to titles and abstracts only, without restriction for language or publication date. The last search was run on May 4, 2016 (Medline, Embase and CAB Abstracts) and on May 30, 2016 (PubMed). Duplicate records were removed. The search and selection process is summarized in Figure 1.

Systematic Review

A total of 727 unique records were retrieved using the search strings described above. The first selection was made by 2 investigators (S.L.J.W., D.S.) independently in a standardized manner, by screening titles and abstracts. Inclusion criteria for the first selection were containing both 1) screening for malnutrition and 2) frailty assessment. Based on these criteria, 89 potentially eligible records were identified. Subsequently, full text articles or abstracts, if the results were not published as full articles, were reviewed independently in a standardized manner by 3 authors (S.V., S.L.J.W., and G.C.L.-M.). Disagreements between reviewers were resolved by consensus. Articles were excluded in this second step if they focused on 1) study populations selected for a specific disease, 2) institutionalized study populations, 3) hospitalized study populations, or if 4) no results were available on frailty and/or malnutrition status, and if 5) the same population was described in other articles.

A total of 28 studies were included in the systematic review.[18–45] One of the authors (G.C.L.-M.) extracted data regarding study design, country, selection method, sample size and sex, age, malnutrition tool and status, frailty tool and status, and results on association regarding malnutrition and frailty, as presented in Table 1. This was checked independently by S.L.J.W. and S.V.; any disagreement was resolved through discussion.

Meta-Analysis

Selection

Studies were excluded if participants were preselected for malnutrition or frailty (6 studies,[22,31,35,40,42,45]) because the aim of the current study was to analyze a general "representative" community-dwelling population. Moreover, it was shown that different or adapted screening tools introduce variation, which made it impossible to compare prevalence rates among studies.[46] Because most studies applied the MNA (long or short form) and Fried phenotype to classify nutritional status and physical frailty, respectively, we decided that only the 13 studies that applied the MNA, together with the Fried phenotype were eligible for inclusion in the quantitative meta-analysis.[19,20,24,25,28,29,32–34,36,38,39,43]

For selected studies, additional data were requested from the authors if not provided in the original article. We asked for absolute numbers of participants in nutritional status categories "normal," "at risk of malnutrition," and "malnourished" and the physical frailty categories "robust," "prefrail," and "frail"[19,25,28,32–34,36,38,39,43] and mean age (±standard deviation) of the population.[20,24,43] Three authors provided data of more[36] or fewer[38,43] participants than included in the article. In those cases, the numbers provided by the authors were used for the meta-analysis (Table 2) and explicated in the