Nutrition 41 (2017) 51–57

Contents lists available at ScienceDirect

Nutrition

journal homepage: www.nutritionjrnl.com

Applied nutritional investigation

Influence of nutritional status in the diagnosis of sarcopenia in nursing home residents

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ARTICLE INFO

Article history:
Received 25 July 2016
Accepted 6 March 2017

Keywords:
Sarcopenia
Malnutrition
Prevalence
Nursing home
Elderly

ABSTRACT

Objectives: Malnutrition and sarcopenia frequently coexist in elderly patients. The aim of this study was to assess the effect of nutritional status in the diagnosis of sarcopenia in nursing home residents.
Methods: A cross-sectional study was performed with data collected from 339 elderly patients living in five nursing homes. Sarcopenia was defined according to the consensus definition of the European Working Group on Sarcopenia in Older People. Body mass composition was assessed using bioimpedance analysis, handgrip strength using a dynamometer, and physical performance by 5-m gait speed test. The nutritional status of residents was assessed using the Mini Nutritional Assessment (MNA).
Results: Of 436 patients, 339 (77.8%) were included. The mean age of participants was 84.9 y and 64.3% were women. More than one-third (38.1%) of the population had sarcopenia, with a higher prevalence in women (39.4%). According to the MNA, 32.4% of participants were at risk for malnutrition and 42.5% were malnourished. When analyzed together, the presence of malnutrition plus malnutrition risk, there was no difference between individuals with or without sarcopenia. However, the presence of malnutrition was statistically higher in individuals with sarcopenia compared with those without it. The prevalence of malnutrition was highest in individuals with low handgrip strength (62.8%), and in participants with severe sarcopenia. There were no significant differences in calf circumference between sarcopenic and nonsarcopenic participants. In the multivariate logistic regression analysis, body mass index <22 kg/m^2 and age >80 y remained predictive of sarcopenia status after adjustment.
Conclusion: Prevalence of sarcopenia and malnutrition were significant in this population, especially in women. Approximately two-thirds of sarcopenic individuals were malnourished. A low body mass index may be a better predictor of sarcopenia in this population than a small calf circumference (<1 cm).

Introduction

Sarcopenia is a syndrome characterized by progressive and generalized loss of skeletal mass and strength with a risk for adverse outcomes such as physical disability, poor quality of life, and death [1–4]. It is a multifactorial process where nutrition, hormonal factors, lifestyle, and diseases exert an important role [5]. Apart from that, age-related loss of muscle mass is characterized by a 3% to 8% decline per decade after the age of 30 y, with a further decline in adults ≥60 y of age [6]. Epidemiologic data suggest that the prevalence of sarcopenia varies widely, depending on the population studied, sex, age, settings, and the diagnostic criteria used [4]. The prevalence of sarcopenia in

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http://dx.doi.org/10.1016/j.nut.2017.03.002
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nursing homes, according to the European Working Group on Sarcopenia in Older People (EWGSOP) criteria [7], is between 17 and 40.2% [5,8–12].

Malnutrition is one of the key pathophysiological causes of sarcopenia and it may be amenable to intervention. The prevalence of malnutrition also depends on multiple factors, including the definition used. A new definition of malnutrition has been proposed by ESPEN [13]. The best validated and most widely used test to measure nutritional status of older people is the Mini Nutritional Assessment (MNA). The MNA has been used in several studies of aged residents living in different settings, including institutionalized elderly [14]. Guigoz found a 5 to 71% prevalence of malnutrition among 6821 elderly individuals after a review of 32 studies using MNA, and reported that malnutrition risk was higher in those living in nursing homes than in those residing in the community [15].

Usually, older individuals admitted to nursing homes are screened or assessed for either malnutrition or sarcopenia, but rarely for both conditions concurrently, although many patients clinically present both conditions. Vanderwoude et al. proposed the term *malnutrition-sarcopenia syndrome*, which embodies the inherent association of both entities, highlighting their combined effect on clinical outcomes, with the aim of identifying patients and providing appropriately targeted interventions [1]. In fact, a diagnostic category of malnutrition-related sarcopenia has been proposed [7]. However, to our knowledge, research applying this definition to identify individuals in risk are still lacking in the literature.

Sarcopenia and malnutrition are both commonly occurring conditions in older adults. Both entities result in numerous and substantial negative outcomes to the patients and the health care system, including decreased quality of life and functionality, and increased health care costs, hospitalization rates, morbidity, and mortality [1]. Their clinical affect and the high direct and indirect costs prompt the need for health care systems to focus on these syndromes [2,3]. Therefore, the main objective of this study was to assess the influence of nutritional status in the diagnosis and prevalence of sarcopenia according to the EWGSOP diagnostic criteria in nursing home residents.

Methods

Study design and recruitment

All individuals (426) living in five public nursing homes in Zaragoza in a 12-mo period (January to December 2015) were assessed for inclusion in this study. Inclusion criteria included age ≥60 y, permanently living in the nursing home (minimum for 6 mo), having physical and motor integrity in at least one hand to perform a grip strength test, having the ability to perform a walking test without help from others (the use of crutches, canes, or similar devices was allowed), and a written informed consent (signed by participants or their legally authorized proxies). Exclusion criteria were acute infection, end-of-life status, active malignancy, or hospitalization in the previous 3 mo, or lack of signed informed consent.

Data were gathered on the participants' demographic characteristics including sex, birth date, length of stay in the nursing home, and health status.

Anthropometric measures

A trained person precisely carried out all anthropometric parameters to ensure reliability, according to standardized and recommended procedures and techniques [16–18]. Weight was measured in light clothing, with a floor calibrated scale (SECA 880, Seca, Chino, California, USA). Patient's height was measured using a fixed-wall stadiometer (SECA 220, Seca) and body circumferences were measured with a Lufkin W606 PM anthropometric tape measure (Lufkin, Minneapolis, Minnesota, USA), to the nearest 0.1 cm. Mid-arm circumference (MAC) was measured at the midpoint of the relaxed, nondominant arm between the tip of the acromion and the olecranon process. Triceps skinfold (TSF) was measured using a Holtain Tanner/Whitehouse skinfold caliper 610 ND (Crosswell, Crymych, Pembs., United Kingdom), at the level of the midpoint between the acromion and the radius on the midline of the posterior surface of the arm; the mean of three measurements was noted to the nearest 0.1 mm. Waist circumference (WC) was measured to the nearest 1 mm at the mid-level of the lower rib margin and the iliac crest, during mid expiration. The measurement of calf circumference (CC) was taken at the point of the greatest horizontal circumference, as recommended by Lohman [19]. CC values were recorded as the average of the measurements from two trials in the leg of nondominant side. A CC <31 cm is usually related to malnutrition in older people [14,15] and has been proposed as a marker of muscle mass for diagnosing sarcopenia [4]. Body mass index (BMI) was calculated according to body weight (kg) divided by height (m) squared. In 1994, Lipschitz proposed a different BMI cutoff for elderly people as underweight individuals with BMI <22 kg/m^2 and overweight individuals with BMI >27 kg/m^2 [20]. It was not possible to properly determine the real height in all patients because 11.2% of them had marked kyphosis. In those cases, Chumlea's equation to estimate height [21] was used.

Arm muscle circumference (AMC) was calculated with this formula:

$$\text{AMC (cm)} = \text{mid-arm circumference (cm)} - (\pi \times \text{triceps skinfold [cm]})$$ [22].

Definition of sarcopenia

Sarcopenia was defined according to the European consensus definition of the EWGSOP. This requires the presence of both low muscle mass and low muscle function (muscle strength or physical performance) [7]. Sarcopenia staging, which reflects the severity of the condition, is a concept that can help guide clinical management of the condition. The EWGSOP suggests a conceptual staging such as "presarcopenia," "sarcopenia," and "severe sarcopenia." The presarcopenia stage is characterized by low muscle mass without any effect on muscle strength or physical performance; the sarcopenia stage is characterized by low muscle mass plus low muscle strength or low physical performance; and severe sarcopenia is the stage identified when all three criteria of the definition are met (low muscle mass, low muscle strength, and low physical performance). In the present study, muscle mass was assessed by bioelectrical impedance analysis (BIA), muscle strength was measured by handgrip strength with a dynamometer, and physical performance was assessed by measuring gait speed over 5-m.

Estimation of muscle mass

Muscle mass was measured by BIA (Akern BIA 101 SMT device, Florence, Italy). Body resistance obtained with BIA was converted to skeletal muscle mass (SMM) using the validated equation by Janssen et al. [23]:

$$\text{SMM (kg)} = (\text{height [cm]}^2/\text{BIA resistance [ohms]} \times 0.401) + (\text{sex} \times 3.825) + (\text{age [y]} \times -0.071) + 5.102$$

Where height is measured in cm; BIA resistance is measured in ohms; for sex, male = 1 and women = 0; and age is measured in years. The skeletal muscle mass index (SMI) was calculated by dividing SMM by height squared (kg/m^2).

The following cutoff points were used: SMI based on 2 SD below the mean of young adult's low muscle mass (SMI <8.87 kg/m^2 in men and <6.42 kg/m^2 in women) [7].

Measurement of muscle strength

Muscle strength was assessed by handgrip strength, which was measured by a Jamar Hydraulic Dynamometer Hand Strength Meter, model 5030J1 (Sammons Preston Inc., Bolingbrook, IL, USA). The participants squeezed the dynamometer using maximum isometric effort. The measurement was taken three times on each side, following the Roberts protocol [24]. Low muscle strength was defined as handgrip strength <30 kg in men and 20 kg in women [7].

Measurement of physical performance

For all participants, physical performance was assessed by the 5-m gait speed walking test. In this test, participants were asked to walk 5 m at a comfortable pace. A stopwatch (model 810012, Sper Scientific, San Diego, California, USA) was used to record the time required to reach the 5-m point (marked on the course). A cutoff point <0.8 m/s identified participants with low physical performance [7].

Assessment of nutritional status

Nutritional status was assessed using the long version of the MNA. The MNA includes 18 questions regarding weight and dietary changes, gastrointestinal symptoms, mobility, physical assessment, and disease and its relationship with