



Prevalence and risk factors of sarcopenia among adults living in nursing homes



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ABSTRACT

Objectives: Sarcopenia is a progressive loss of skeletal muscle and muscle function, with significant health and disability consequences for older adults. We aimed to evaluate the prevalence and risk factors of sarcopenia among older residential aged care adults using the European Working Group on Sarcopenia in Older People (EWGSOP) criteria.

Study design: A cross-sectional study design that assessed older people ($n = 102$, mean age 84.5 ± 8.2 years) residing in 11 long-term nursing homes in Australia.

Main outcome measurements: Sarcopenia was diagnosed from assessments of skeletal mass index by bioelectrical impedance analysis, muscle strength by handheld dynamometer, and physical performance by the 2.4 m habitual walking speed test. Secondary variables were collected to inform a risk factor analysis.

Results: Forty one (40.2%) participants were diagnosed as sarcopenic, 38 (95%) of whom were categorized as having severe sarcopenia. Univariate logistic regression found that body mass index (BMI) (Odds ratio (OR) = 0.86; 95% confidence interval (CI) 0.78–0.94), low physical performance (OR = 0.83; 95% CI 0.69–1.00), nutritional status (OR = 0.19; 95% CI 0.05–0.68) and sitting time (OR = 1.18; 95% CI 1.00–1.39) were predictive of sarcopenia. With multivariate logistic regression, only low BMI (OR = 0.80; 95% CI 0.65–0.97) remained predictive.

Conclusions: The prevalence of sarcopenia among older residential aged care adults is very high. In addition, low BMI is a predictive of sarcopenia.

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1. Introduction

Sarcopenia is a geriatric syndrome associated with ageing that is characterised by a progressive loss of skeletal muscle mass and muscle function [1]. It is known to increase the risk of disability, falls and falls-related injuries, loss of independence, hospitalisation, and mortality [2–5].

In 2010, the European Working Group on Sarcopenia in Older People (EWGSOP) recommended that both low muscle mass and low muscle function (muscle strength or physical performance)

must be present for an individual to be diagnosed with sarcopenia [1]. Recently, the International Sarcopenia Initiative confirmed the applicability of the EWGSOP measurement tools for varied populations and highlighted a shortcoming in research looking at prevalence and risk factors among populations that are highly vulnerable to sarcopenia, such as within an acute or institutional setting [6].

Until the development of a consensus definition and measures, the prevalence of sarcopenia has varied widely from 7% to over 50% in middle to old aged adults [7]. A review of studies employing the EWGSOP criteria has shown prevalence to be from 1% to 29% in community living adults, and 14–33% among Dutch and Italian adults residing in nursing homes [6,8]. Among older adults living in Italian nursing homes, Landi et al. using the EWGSOP criteria reported a high prevalence of 33%, with body mass index (BMI), gender, daily exercise and osteoarthritis identified as predictive risk factors [8].

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Supporting this, Smoliner et al. confirmed BMI as a dominant risk factor to sarcopenia among in-patients in an acute geriatric hospital ward [9]. However, work in this area is still sparse, especially in populations of very old adults with low capacity in activities of daily living. The aim of the study was to assess the prevalence of sarcopenia, and identify the risk factors associated with sarcopenia among older adults permanently living in the long-term nursing home setting.

2. Methods

2.1. Study design and recruitment

A cross-sectional survey to measure the prevalence of sarcopenia and associated risk factors in older people permanently living in nursing homes located in Australia. The homes were within one large aged care provider. A detailed account of the recruitment and assessment methods has been published previously [10]. In brief, eleven facilities agreed to participate. Facility residents were included if they were (i) aged ≥ 60 years, (ii) residing in a nursing home and (iii) could provide informed consent, or if unable, proxy-informed consent could be obtained from their substitute decision maker. They were excluded if they (i) had a pacemaker, (ii) were end-stage palliative or terminal (iii), had difficult or dangerous behaviors or (iv), had medical or other issues that would limit data collection. Of all eligible residents, a representative sample was randomly selected to the study using a random number generator within the strata of level of care (low care, high care, or people with dementia residing in a secure dementia unit) to ensure a representative sample across strata. The levels of care are categorized according to the Australian Government Aged Care Funding Instrument (ACFI). Approval for the study was provided by the Human Research Ethics Committees of the participating aged care organization and Universities.

2.2. Measures

Data were collected in a single assessment at each facility by an accredited exercise physiologist (AEP). All measures have been validated for use among the older population [10]. Data collected from facility records included demographics, ACFI level of care, date of admission, and facility recorded history of falls over the previous six months, number and type of diseases and medications, hospital admissions over the previous 12 months, current and past smoking status. A fall was defined as 'an event resulting in a person coming to rest unintentionally on the ground or lower level' [11]. Body weight and height were measured using calibrated electronic scales and stadiometer to the nearest 0.1 kg and 0.1 cm, respectively. Body mass index (BMI, kg/cm^2) was calculated from weight and height.

2.2.1. Primary outcome: sarcopenia

Sarcopenia was defined according to the EWGSOP criteria. This requires the presence of both low muscle mass and low muscle function (muscle strength or physical performance) [1]. Under these criteria, sarcopenia can be categorized as pre-sarcopenia (low muscle mass alone), sarcopenia (low muscle mass with low muscle strength or physical performance) and severe sarcopenia (low muscle mass with low muscle strength and physical performance). The cut-off points for diagnosis are (1) low muscle mass ($\text{SMI} < 8.87 \text{ kg}/\text{m}^2$ in men and $< 6.42 \text{ kg}/\text{m}^2$ in women), (2) low muscle strength from handgrip strength ($< 30 \text{ kg}$ in men and $< 20 \text{ kg}$ in women), and (3) low physical performance assessed by the short physical performance battery (SPPB) 2.4 m walk test of $\leq 0.8 \text{ m/s}$ [1]. Body resistance ($\text{Ohms} - \Omega$) was measured using a Maltron BF-906 bioelectrical impedance analysis (BIA) device (Maltron Interna-

tional Ltd., UK). Body resistance was converted to skeletal muscle mass (SMM) using the Janssen et al. [12] validated equation:

$$\text{SMM (kg)} = [\text{height (cm)}^2 / \text{BIA resistance } (\Omega) \times 0.401] + (\text{gender} \times 3.825) + (\text{age (years)} \times -0.071) + 5.102.$$

The skeletal muscle mass index (SMI) was calculated by dividing SMM by height squared (kg/m^2) [1]. In addition, muscle mass (kg) and percent body fat data were generated by BIA assessment [13]. Muscle strength was measured by Jamar handgrip dynamometer (Sammons Preston Rolyan, IL). Physical performance was assessed using the SPPB 2.4 m walk (metres per second) [14].

2.2.2. Secondary outcomes

In addition to the 2.4 m walk, the remaining SPPB measures were collected, namely, the hierarchical test of standing balance, and the five-time repeated chair stand measures [14]. Nutritional status was assessed by the mini-nutritional assessment instrument (MNA) short form [15]. A score greater than 12 from 14 points were deemed to have normal nutritional status, 8–11 as risk of malnutrition, and less than 8 as malnourished [16,17]. Mood and cognitive status were rated using the Geriatric depression scale (GDS-15) [18] and the mini-mental state examination tool (MMSE) [19], respectively. The level of physical activity was assessed by the International Physical Activity Questionnaire-Short Form (IPAQ) which assesses four levels of activity (vigorous, moderate, walking, sitting) over a 7-day period [20]. Total physical activity (MET-minutes/week) was determined by summing the estimated metabolic equivalent energy expenditure within each activity level.

2.3. Statistical analysis

Assuming a proportion of 30% based on the study by Landi et al. [8], a precision of 10%, and an estimated design effect of 2 to account for differences between the nursing home facilities, a sample size of 161 participants was required. Participant characteristics were analyzed using descriptive statistics and presented as mean and SD for continuous variables, and counts and percentages for categorical variables. The characteristics of participants with sarcopenia and without sarcopenia were compared according to data distribution by one-way analysis of variance or the Mann-Whitney test. Categorical variables were compared using the Chi-square test. A $p < 0.05$ was considered to be statistically significant. Risk factors were determined by the use of logistic regression with sarcopenic status as the outcome. Univariable analysis was used initially to identify predictors of sarcopenia. Those factors that were significant at the 0.10 level were included in a multivariable model to determine which combination of factors best predicts sarcopenic status. Backwards stepwise regression was used, with a statistical significance level of $p < 0.05$ for the final set of factors. All analyses were conducted using Stata 11.2 (StataCorp).

3. Results

3.1. Recruitment and characteristics of study participants

Of the 709 adults living in the 11 participating facilities, 328 were ineligible due to having a fitted pacemaker (3%), end-stage disease (8%), dangerous behaviors (31%), medical or other problems that made participation challenging (58%). From the 381 eligible residents, 273 were randomly selected within the strata of high (58%) and low (29%) health care needs, and residing in a dementia unit (13%), and invited to participate, of which 102 individuals consented to participate, including 11 by proxy. A detailed overview of participant recruitment and characteristics has been presented elsewhere [10]. Participants were aged 84.5 ± 8.2 years with 70% female. On average, participants had resided for 39.8 ± 40.3 months with 85 individuals (83%) classified as high care by the ACFI. Over

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