RBCDH Revista Brasileira de CINEANTROPOMETRIA e Desempenho Humano

DOI: http://dx.doi.org/10.5007/1980-0037.2015v17n4p460

original article

Prevalence and factors associated with sarcopenia in elderly women living in the community

Prevalência e fatores associados a sarcopenia em mulheres idosas residentes em comunidade

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Abstract – The objective of this study was to identify the prevalence of sarcopenia and factors associated with it in a population of elderly women living in the community in the Northeast of Brazil. This was a cross-sectional study of 173 women aged 60 years or older living in the urban zone of the municipality of Lafaiete Coutinho, Bahia, Brazil. Associations between sarcopenia (defined as reduced muscle mass plus reduced muscle strength and/or reduced muscle performance) and independent variables including sociodemographic characteristics, behavioral variables and health status were tested using logistic regression techniques. The significance level was set at 5%. The prevalence of sarcopenia in the study population was 17.8%. The logistic regression technique only identified the variables advanced age (p = 0.005) and hospital admission during the previous 12 months (p = 0.009) as statistically significant. It was concluded that there was a significant prevalence of sarcopenia among elderly women resident in a community with unfavorable health conditions and the findings showed that the strongest associations were with age over 80 years and hospital admission during the previous 12 months.

Key words: Aging; Health of the elderly; Sarcopenia; Women.

Resumo – *O presente estudo objetivou identificar a prevalência e fatores associados a sarcopenia em uma população idosa residente em comunidade do nordeste Brasileiro. Trata-se de estudo transversal tendo como participantes 173 mulheres com idade igual ou superior a 60 anos, residentes na zona urbana do município de Lafaiete Coutinho-Bahia, Brasil. As associações entre sarcopenia (definida através da diminuição da massa e força muscular e/ou performance) e as variáveis independentes incluindo características sócio-demográficas, comportamentais e condições de saúde, foram testadas por meio da técnica de regressão logística. O nível de significância adotado foi de 5%. A prevalência de sarcopenia da população estudada foi de 17,8%. A técnica de regressão logística apontou que apenas as variáveis idade avançada (p = 0,005) e hospitalização nos últimos 12 meses (p = 0,009) apresentaram significância estatística. Conclui-se que há significante prevalência de sarcopenia em idosos residente em comunidade com condições de saúde desfavoráveis; e apontou maior relação com idade superior a 80 anos e hospitalização nos últimos 12 meses.*

Palavras-chave: *Envelhecimento; Mulheres; Sarcopenia; Saúde do idoso.*

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Received: 27 October 2014
Accepted: 14 January 2015

INTRODUCTION

The aging process triggers changes to body composition that are reflected in increased fat mass and reduced muscle mass[1]. The resulting progressive and generalized loss of skeletal musculature, strength and physical performance characterize sarcopenia[2], which is a syndrome that predisposes people to adverse consequences such as declining functional capacity[3] and even increased risk of death[4]. In view of this, aging-induced sarcopenia is considered a risk factor for fragility and reduced functionality and its high prevalence means it is seen as an important public health problem.

There are a variety of methods for inferring the degree of sarcopenia in elderly people, ranging from imaging exams to tests of motor performance and the resulting estimates of prevalence vary depending on the criterion employed[5]. A recently-published study conducted to estimate the prevalence of sarcopenia in the 60 to 70-year-old population of the United Kingdom reported that 6.8% had sarcopenia[5]. A cross-sectional study undertaken in the United States by Melton et al. reported rates varying from 6% to 15% among participants aged 65 or older and showed that the rate was dependent on the parameter employed to diagnose sarcopenia[6]. Studies conducted in Brazil, also with elderly people, found that 34%[7] and 15.9%[8] of these individuals had sarcopenia. Against this background, the consensus on definition and diagnosis criteria developed by the European Working Group on Sarcopenia[2] stands out as offering a definition of practical clinical criteria based on just three elements, muscle mass, muscle strength and performance, thus facilitating its application to epidemiological studies.

Considering the high prevalence of sarcopenia, the important implications of the pathology for elderly individuals[9] and the high cost of its consequences, studies of this type should help to monitor the phenomenon in communities living in unfavorable conditions for health and for quality of life. To date, there have been few investigations of the prevalence of sarcopenia and its determinants in Latin American countries that have employed the criteria laid out in the European Consensus[2]. The results of a literature search indicate that just two studies have been conducted employing representative samples from countries in the region[10,11]. The first is a study conducted by Arango-Lopera et al.[10], using data from a Mexican population to estimate the prevalence of sarcopenia in elderly people aged 70 or older. The second was carried out by Alexandre et al.[11] using data from the Health, Wellbeing and Aging study (SABE - *Saúde, Bem-Estar e Envelhecimento*) to estimate the prevalence of sarcopenia and factors associated with it in elderly people from a large city in Brazil.

In view of the above, this study is intended to contribute to expanding knowledge on the subject, thereby facilitating preventative actions, by identifying which of these people's characteristics are associated with sarcopenia and, as such, should help to improve health. The objective of this study was to identify the prevalence of sarcopenia and factors associated with it in elderly women living in the community in a town in the Northeast of Brazil.

METHODOLOGICAL PROCEDURES

This was an observational analytical study with a cross-sectional design analyzing data from an epidemiological population study with data collection by home visits that investigated the nutritional status, risk behaviors and health status of the elderly population in Lafaiete Coutinho, BA, Brazil (*Estado nutricional, comportamentos de risco e condições de saúde dos idosos de Lafaiete Coutinho-BA*). Details of the location, study population and data collection methodology have been published elsewhere. [12] Briefly, the study population comprised all women aged ≥ 60 years residing in the urban zone of the municipality (n = 195). Of this population of 195 elderly women, 173 (88.7%) took part in the study, 10 refused (5.1%) and 12 (6.2%) were not located after three home visits, on alternate days, and were considered lost to the sample.

The study was designed and conducted in compliance with the World Medical Association's Helsinki Declaration and was approved by the Human Research Ethics Committee at the Universidade Estadual do Sudoeste da Bahia (protocol 064/2010).

Sarcopenia (dependent variable)

Sarcopenia was estimated using the criteria set out in the European consensus on definition and diagnosis[2], which recommends using three elements: muscle mass, muscle strength and physical performance. In this study, muscle mass was estimated using an anthropometric equation; muscle strength was assessed using the handgrip strength test (HST); and physical performance was measured by gait velocity.

Muscle mass component: total muscle mass (TMM) was estimated using an equation originally proposed by Lee et al.[13] and later validated for use with elderly Brazilians[14]: TMM (kg) = (0.244 x body mass) + (7.8 x height) - (0.098 x age) + (6.6 x sex) + (ethnicity - 3.3). The variables are represented by the following values: 1 = male and 0 = female; ethnicity: 0 = white (white, indigenous, and mixed race white with indigenous), -1.2 = Asian and 1.4 = African Brazilian (black and mixed race including black). Ethnicity was self-reported and the procedures and the instruments employed to measure body mass (kg) and height (m) have been described elsewhere[12].

The TMM result was used to calculate a muscle mass index (MMI = muscle mass total/height^2), which was then classified according to the cutoff points proposed by Janssen et al.[15]: MMI ≤ 5.75 kg/m2 = high risk; 5.76 < MMI ≤ 6.75 kg/m2 = moderate risk; MMI > 6.75 = low risk. For the purposes of analysis, MMI was recategorized as a dichotomous variable: MMI ≤ 6.75 kg/m2 = insufficient muscle mass; MMI > 6.75 kg/m2 = adequate muscle mass.

Muscle strength component: Muscle strength was assessed using a handgrip strength test, the instruments and procedures for which have been described elsewhere[16]. Weakness was defined according to the body mass index [BMI = body mass (kg) / height^2 (m)], using a criterion adapted

from work by Fried et al.[17] First BMI was classified into three categories[18]: < 22 kg/m^2 = underweight; 22.0 ≤ BMI ≤ 27 kg/m^2 = healthy weight; > 27 kg/m^2 = overweight. For each category the HST cutoff point (in kg) for weakness was fixed at the 25th percentile, as follows: underweight, HST = 11 kg; healthy weight, HST = 21 kg; and overweight, HST = 14 kg. Individuals who met the weakness criterion and those who were unable to perform the test because of physical limitations were considered to have insufficient muscle strength.

Physical performance component: Physical performance was assessed using a 2.44 m walking test, the procedures for which have been described elsewhere[16]. Poor performance was defined according to height, which was classified into one of two categories using a criterion adapted from work by Guralnik et al.[19] First the sample was divided according to median the height of 1.49 m (the 50th percentile, i.e. ≤ 1.49 m = less than or equal to the median; > 1.49 m = greater than the median). Next the 75th percentile of the distribution of gait results was calculated for each category (the third quartile) and used as the cutoff point, as follows: ≤ median height = 6 seconds; > median height = 4 seconds. Individuals who met the criterion for poor performance and those who were unable to perform the tests because of physical limitations were defined as having insufficient physical performance.

Outcome: After each of the three components had been measured, the elderly women were initially classified as follows[2]: free from sarcopenia = adequate muscle mass, adequate muscle strength and adequate physical performance; pre-sarcopenia = insufficient muscle mass, but adequate muscle strength and adequate physical performance; sarcopenia = insufficient muscle mass plus either insufficient muscle strength or insufficient physical performance; and severe sarcopenia = insufficient muscle mass plus both insufficient muscle strength and insufficient physical performance. For the purposes of analysis, sarcopenia was then recategorized as a dichotomous variable: free from sarcopenia + pre-sarcopenia = no sarcopenia; sarcopenia + severe sarcopenia = sarcopenia.

Independent variables

The sociodemographic characteristics collected included age (60-69, 70-79 and ≥ 80 years), literacy sufficient to read and write a message (yes or no), marital status (has partner or single) and participation in religious activities (yes or no).

Behavioral characteristics included consumption of alcoholic beverages (≤ 1 day/week or > 1 day/week), smoking (never smoked, ex-smoker or smoker) and habitual physical activity level, assessed by the International Physical Activity Questionnaire (IPAQ), long form[20] (≥ 150 minutes of moderate or vigorous physical activity per week = active and < 150 minutes per week = insufficiently active).

Health status was assessed using the following variables: self-reported number of chronic diseases (none, one or two or more) including hyper-

tension, diabetes, cancer (except tumors of the skin), chronic pulmonary disease, heart disease, circulatory diseases, rheumatic diseases and osteoporosis; hospital admissions during the previous year (none or one or more); number of medications currently taking (one or none versus two or more); depressive symptoms, assessed using the short form, 15-item Geriatric Depression Scale (GDS)[21] (≤ 5 points = free from depressive symptoms and > 5 points = presence of depressive symptoms); falling episodes during the previous year (yes or no); and functional capacity, measured using the Katz et al.[22] scale, which assesses activities of daily living (ADLs) related to self-care such as feeding, washing and dressing oneself, grooming and toilet hygiene. The variable ADLs was dichotomized[23], using the cutoff point 4/5, so that elderly people were defined as dependent in terms of ADLs if they scored four points or less and independent if they scored more than four points.

Statistical procedures

Variables were initially subjected to descriptive analysis. Associations between sarcopenia and explanatory (independent) variables were tested by calculating crude and adjusted odds ratios, by points and by 95% confidence intervals (95%CI), using logistic regression modeling. In the crude analyses, the prevalence of sarcopenia was calculated for each category of explanatory variables and the significance level was tested using the Wald test of heterogeneity. Variables that exhibited statistical significance to at least 20 % ($p \leq 0.20$) in the crude analyses were included in the adjusted analysis, following the sequence of a hierarchical model for determination of the outcome (Figure 1). In this model, the higher level variables (distal) interact with and determine the lower level variables (proximal). The effect of each explanatory variable on the outcome was controlled by the other variables at the same level and by higher levels in the model. The statistical criterion for retention in the model was 20 % ($p \leq 0.20$). The significance level adopted for the study was 5% ($\alpha = 0.05$). Data were tabulated and analyzed using IBM SPSS Statistics for Windows (IBM SPSS. 21.0, 2012, Armonk, NY: IBM Corp.).

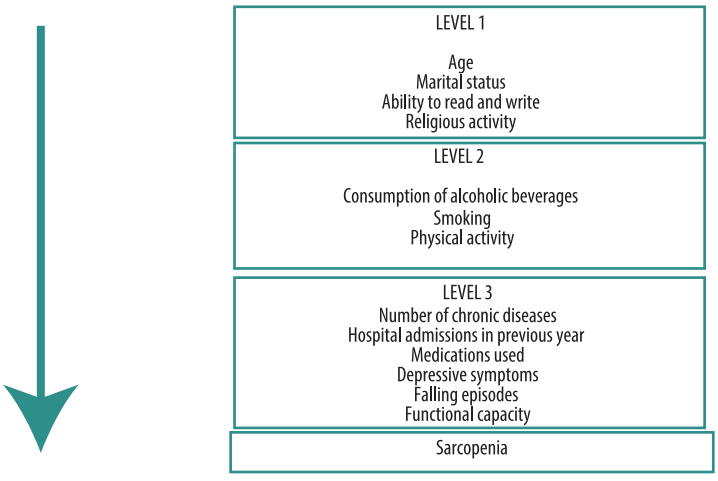

Figure 1. Conceptual model of outcome determination used for multiple analysis. Lafaiete Coutinho, Brazil, 2011.

RESULTS

A total of 173 women with mean age of 74.8 ± 9.9 (range: 60 to 103 years) took part in the study. Of these women, 49.7% did not have healthy weight, 47.3% were sedentary and more than 60% were dependent for at least one activity of daily living. The other characteristics of the study population are shown in Table 1.

Table 1. Characteristics of the population. Lafaiete Coutinho, Brazil, 2011.

Variables	% responses	N	%
Age group	99.4		
60-69 years		59	34.3
70-79 years		57	33.1
≥ 80 years		56	32.6
Marital status	100,0		
Has partner		147	85.0
Single		26	15.0
Can read and write	100,0		
Yes		125	72.3
No		48	27.7
Religious activity	99.4		
Participates		164	95.3
Does not participate		8	4.7
Alcohol consumption	100		
0 to 1 time per week		168	97.1
2 or more times per week		5	2.9
Smoking	100		
Never smoked		104	60.1
Ex-smoker		62	35.8
Current smoker		7	4.0
Physical activity	97.7		
Active		89	52.7
Insufficiently active		80	47.3
Number of chronic diseases	96.5		
None		19	11.4
1		55	32.9
2 or more		93	55.7
Hospital admissions	99.4		
None		128	74.4
1 or more		44	25.6
Use of medications	100		
0 or 1		52	30.1
2 or more		121	69.9
Depression	93.1		
No		119	73.9
Yes		42	26.1
Falling episode	100		
No		117	67.6
Yes		56	32.4
Functional capacity	96.5		
Independent		60	35.9
Dependent for I-ADL		80	47.9
Dependent for B-ADL		27	16.2

I-ADL – Instrumental Activities of Daily Living; B-ADL – Basic Activities of Daily Living.

Figure 2 illustrates the prevalence of elderly women with and without sarcopenia. The analyses of sarcopenia prevalence were conducted with the results for 146 elderly women (84.4% of the sample), which is the number of participants for whom all information needed to calculate the variable sarcopenia. It will be observed that there was a 17.8% prevalence of sarcopenia among these elderly women.

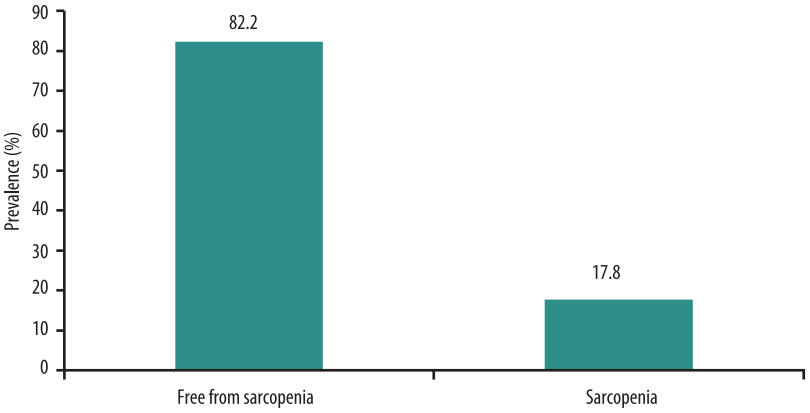

Figure 2. Prevalence of sarcopenia among women elderly. Lafaiete Coutinho, Brazil, 2011.

Table 2 shows the prevalence of sarcopenia according to the explanatory variables investigated. It will be observed that elderly women aged ≥ 80 years, those who were insufficiently active, those who had been admitted to hospital at least once and those who exhibited functional dependence were all more likely to be sarcopenic.

The results of the crude regression analysis show that just four variables (age group, physical activity, hospital admissions and functional capacity) attained sufficient statistical significance ($p \leq 0.20$) to be included in the multiple model.

After intralevel and interlevel adjustments (Table 3) according to the hierarchical model, the variables physical activity and functional capacity were not retained in the final model because they did not meet the criterion for significance ($p \leq 0.05$). There was a positive relationship between sarcopenia and both advanced age and hospital admissions during the previous twelve months. Elderly women aged ≥ 80 years exhibited 4.5 times greater chance of sarcopenia than women in the age group 60 to 69 years ($p = 0.005$), and women who had been admitted to hospital at least once during the previous year exhibited a 3.49 times greater chance of sarcopenia than those who had not been admitted to hospital within 12 months ($p = 0.009$).

Table 2. Prevalence of sarcopenia and its relationship to the explanatory variables investigated. Lafaiete Coutinho, Brazil, 2011.

Level	Variables	%	OR_{crude}	95%CI%	p
1	Age group				0.004
	60-69 years	34.3	1		
	70-79 years	33.1	1.03	0.29-3.64	
	≥ 80 years	32.6	4.55	1.58-13.05	
	Marital status				0.873
	Has partner	85	1		
	Single	15	1.10	0.33-3.59	
	Can read and write				0.213
	Yes	72.3	1		
	No	27.7	0.51	0.18-1.46	
	Religious activity				0.210
	Participates	95.3	1		
	Does not participate	4.7	3.25	0.51-20.51	
2	Alcohol consumption				0.896
	0 to 1 time per week	97.1	1		
	2 or more times per week	2.9	1.16	0.12-10.82	
	Smoking				0.927
	Never smoked	60.1	1		
	Ex-smoker	35.8	1.14	0.47-2.77	
	Current smoker	4.0	0.80	0.09-7.14	
	Physical activity				0.015
	Active	52.7	1		
	Sedentary	47.3	2.96	1.23-7.12	
	Number of chronic diseases				0.817
	None	11.4	1		
	1	32.9	0.82	0.21-3.18	
	2 or more	55.7	0.67	0.19-2.39	
3	Hospital admissions				0.002
	None	74.4	1		
	1 or more	25.6	4.21	1.72-10.30	
	Use of medications				0.771
	0 or 1	30.1	1		
	2 or more	69.9	0.87	0.35-2.14	
	Depression				0.861
	No	73.9	1		
	Yes	26.1	1.09	0.39-3.03	
	Falling episode				0.300
	No	67.6	1		
	Yes	32.4	1.58	0.66-3.76	
	Functional capacity				0.016
	Independent	35.9	1		
	Dependent for I-ADL	47.9	4.58	1.45-14.47	
	Dependent for B-ADL	16.2	3.05	0.60-15.37	

OR – Odds Ratio; CI – Confidence interval; I-ADL – Instrumental Activities of Daily Living; B-ADL – Basic Activities of Daily Living.

Table 3. Hierarchical logistic regression model of the relationship between sarcopenia and the explanatory variables investigated. Lafaiete Coutinho, Brazil, 2011.

Variables	$OR_{adjusted}$	95%CI%	*p*-value
Age group			
60-69 years	1		
70-79 years	1.03	0.29-3.64	0.955
≥ 80 years	4.55	1.58-13.05	0.005
Hospital admissions			
None	1		
1 or more	3.49	1.37-8.89	0.009

OR – Odds Ratio; CI – Confidence interval.

DISCUSSION

The results of this study show that sarcopenia was present in approximately 18% of the elderly women studied, and indicate that it was positively associated with age greater than or equal to 80 years and hospital admission during the previous 12 months.

Other studies that have been conducted to estimate the prevalence of sarcopenia using the EWGSOP[2] criteria (the same criteria used in the present study) have reported prevalence rates that contrast with those observed here. A study conducted by Patel et al.[5] used skin folds to estimate body composition and estimated a prevalence of approximately 8% among elderly women, while Arango-Lopera et al.[10] found a prevalence of 48.5% using calf circumference. The differences in prevalence may be because an MMI was used in the present study to estimate body composition. A similar prevalence of sarcopenia was reported in the results of a study by Alexandre et al.[11] where prevalence was approximately 16%. In that study the same criteria were used, but the sample was larger and the design included intervention.

Prevalence rates vary from 33% among elderly Spanish women[24], through 19.84% in elderly Italian women[4] to 7.9% among women from England[5]. Depending on the technique employed in the different studies and the cutoff values chosen, the proportion of muscle mass can vary considerably. As a result, comparison of prevalence rates is problematic because of the lack of consensus and because of population variations and methodological differences in the criteria used to diagnose sarcopenia[25].

Another very important point is that the study population has a low Human Development Index (which was 0.599 in 2010[26]), high mortality rates and low educational levels, which distinguishes it from the studies mentioned above that investigated populations in developed countries, particularly in terms of the unfavorable conditions of health and quality of life.

Sarcopenia was positively associated with age ≥ 80 years, which is in line with results that can be found in the literature, such as those from a study by Iannuzzi-Sucich et al.[27], who found that sarcopenia prevalence increased from 22.6% to 31.0% among women over 80 years of age. There is also a similarity with a study by Alexandre et al.[11], since age was associated with sarcopenia, but in that study in São Paulo the likelihood of

sarcopenia increased from 70 years of age onwards, whereas in Lafaiete Coutinho it increased from 80 years of age onwards.

The association between sarcopenia and advanced age brings with it discussions related to the process of muscle degeneration as a consequence of senescence. During aging the muscle structure becomes disorganized and there is a substantial loss of lean mass, in terms of both number and size of muscle fibers[15]. This process takes place because skeletal muscle loses a large proportion of its fibers from 65 years of age onwards, reducing its mass, strength and contractile force[28].

Analysis of the relationship between sarcopenia and hospital admissions detected a positive association. Alva et al.[29] conducted a study in which 27.2% of women classified as malnourished had been admitted to hospital more than three times during the previous year, whereas those with normal weight had not been admitted. Although the total length of hospital stays was not analyzed, these results suggest that bedridden people are at greater risk of the syndrome. There are few studies in the literature that show this association. However, a study published by Sayer explains that the link between inactivity and the consequent loss of muscle mass is predictive of sarcopenia[30].

This study is subject to certain limitations that should be mentioned. These include the cross-sectional design, which means that measurement of these people's status in terms of exposure and effects over the long term was not possible. Additionally, while the methodology employing equations to accomplish measurements facilitates diagnosis it does not offer the same degree of accuracy as imaging exams.

CONCLUSIONS

Based on the results of this study, it can be concluded that: (i) the prevalence of sarcopenia among elderly women resident in the community in a town in Northeast Brazil was 17.8%; (ii) age ≥ 80 years and hospital admission during the previous 12 months appear to be the most important determinants of sarcopenia in this population.

As such, the findings of this study provide a guide for identification of subgroups at risk of sarcopenia by means of analysis of the factors associated with it and offer a foundation for planning measures to prevent functional limitations or to help reverse them in elderly women, thereby helping to provide integrated care for these people.

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