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Sarcopenia: prevalence and associated factors among elderly from a Brazilian capital

Sarcopenia: prevalência e fatores associados em idosos de uma capital brasileira

Sarcopenia: prevalencia y los factores asociados en ancianos en una capital brasileña

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Abstract

Introduction: Sarcopenia has been currently considered a public health problem, affecting a large portion of the elderly and making them more susceptible to the risk of falls. **Objective**: To estimate the prevalence and factors associated with sarcopenia in the elderly from a Brazilian capital. **Methods**: This is an epidemiological study with cross-sectional design involving data of 439 elderly people from Florianópolis city, Santa Catarina

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state. The factors potentially associated with sarcopenia (sex, age, weight status) were tested using binary logistic regression, estimating the Odds Ratio and the respective confidence intervals. **Results**: The prevalence of sarcopenia was 33.3% (95% CI: 28.9, 36.9). Older women (75 years or more) showed less muscle mass in relation to other age groups ($p < 0.05$). Elderly men, individuals that are 75 years or more, and those with low weight were the subgroups at higher risk for sarcopenia. Obese individuals were less likely to have the outcome. **Conclusion**: More than one-third of elderly people were diagnosed with sarcopenia. Men, individuals who are older, and those with low weight had a higher risk of having sarcopenia.

Keywords*:* Aging. Body Composition. Prevalence. Public Health. Sarcopenia.

Resumo

Introdução: *A sarcopenia tem sido considerada atualmente um problema de saúde pública e afeta uma grande parcela dos idosos, deixando-os mais suscetíveis ao risco de quedas.* ***Objetivo****: Estimar a prevalência e os fatores associados à sarcopenia em idosos de uma capital brasileira.* ***Métodos****: Este é um estudo epidemiológico com delineamento transversal envolvendo dados de 439 idosos da cidade de Florianópolis, Santa Catarina. Os possíveis fatores associados à sarcopenia (sexo, idade, status do peso) foram testados por meio de regressão logística binária, estimando-se a Odds Ratio e os respectivos intervalos de confiança.* ***Resultados****: A prevalência de sarcopenia foi de 33,3%. As mulheres com mais idade (75 anos ou mais) apresentaram menos massa muscular em relação às outras faixas etárias. Homens idosos, aqueles com 75 anos ou mais e os com baixo peso foram os subgrupos em maior risco de apresentar sarcopenia. Os obesos estiveram menos propensos a apresentar o desfecho.* ***Conclusão****: Mais de um terço dos idosos foram diagnosticados com sarcopenia. Os homens, aqueles idosos mais velhos e os com baixo peso tiveram maior risco de terem sarcopenia.*

Palavras-chave: *Envelhecimento. Composição Corporal. Prevalência. Saúde Pública. Sarcopenia.*

Resumen

Introducción*: La sarcopenia se ha considerado actualmente como un problema de salud pública y afecta a una gran parte de los ancianos, lo que los vuelve más vulnerables al riesgo de caídas.* ***Objetivo****: Estimar la prevalencia y los factores asociados a la sarcopenia en ancianos en una capital brasileña.* ***Métodos****: Este es un estudio epidemiológico con diseño transversal que involucra datos de 439 ancianos en la ciudad de Florianópolis, Santa Catarina. Los posibles factores asociados a la sarcopenia (sexo, edad, estado del peso) se probaron por medio de regresión logística binaria, estimándose el Odds Ratio y sus intervalos de confianza.* ***Resultados****: La prevalencia de sarcopenia fue del 33,3%. Las mujeres de más edad (75 años o más) mostraron menor masa muscular en relación a otros grupos de edad. Los hombres, los ancianos con 75 años o más y aquellos con bajo peso fueron los subgrupos de mayor riesgo de sarcopenia. Los obesos eran menos propensos a presentar el desenlace.* ***Conclusión****: Se diagnosticó más de un tercio de los ancianos con sarcopenia. Los hombres, los ancianos mayores y con bajo peso tuvieron un riesgo mayor de tener sarcopenia.*

Palabras clave*: Envejecimiento. Composición Corporal. Prevalencia. Salud Pública. Sarcopenia.*

Introduction

The population aging is a global phenomenon. According to the 2010 census data in Brazil, there was a reduction in the number of children and adolescents aged up to 20 years old and an increase in adult population. The elderly population in 2013 was 23.1 million and the life expectancy at birth, 73.9 years. It is estimated that, in 2060, the number will be approximately 73.0 million of elderly people and that the life expectancy reaches 81.3 years [1]. These estimates have caused concern in public

health authorities by virtue of the decline in physiological systems of people aged over 60 years [2], mainly concerning increased fat mass and reduced lean body mass, which are related to the impairment and/or functional dependence of the elderly [3]. This has been associated with an increased risk of falls, which in turn can result in debilitating lesions, physical disability and early mortality [4].

In this context, sarcopenia is considered as a worrying disease that can affect the public health in Brazil, since a large increase in the number of elderly people is expected in the near future. Sarcopenia is characterized by involuntary loss of lean mass and muscle strength associated with age. It has received growing attention in recent years and it is considered a disease that can be diagnosed and treated [4]. Nevertheless, associated with aging, this is a slow, progressive and apparently inevitable process; even between those individuals who exercise regularly [5] the symptoms appear to be highly prevalent [2, 6]. A previous study showed a reduction in muscle mass after 40 years of approximately 5% per decade of life, and after 65 years of age, the problem became more pronounced, especially in lower limbs [7]. Also, it was observed considerable loss of muscle mass from the fifth decade of life in healthy physically active individuals in many countries [8, 9] and an estimate prevalence of sarcopenia of 17.8% in women with 60 years or older living in the urban area of a city from Brazil [10].

The estimation of muscle mass can be performed using different evaluation methods, chief among which are the dual-energy X-ray absorptiometry (DEXA), magnetic resonance imaging, and computed tomography [8]. Despite the high cost of these instruments, other cheaper and more accessible types of methods have already been recommended to evaluate this problem in elderly people, among which stands out the anthropometry used for the estimation of muscle mass, especially for epidemiological purposes [9, 11-13]. This method allows the use of anthropometric measurements in valid predictive equations for estimating the amount of muscle mass and the prevalence of sarcopenia, and it has also been tested in a study with the Brazilian elderly [12].

Given the above, studies focusing on the prevalence of sarcopenia are relevant because they are useful in developing and guiding public health programs, policies that will guide the population in general beforehand and mainly make the elderly adopt habits that reduce risks of developing sarcopenia. Furthermore, these studies foster the investigation to find which subgroups of elderly people may be more susceptible to the development of this outcome, thus facilitating the implementation of emergency strategies for sarcopenia care. In this sense, this study aims to determine the prevalence of sarcopenia and its association with demographic and nutritional status in the elderly of a capital of southern Brazil.

Methods

This study was conducted in the urban area of the Florianópolis city, capital of Santa Catarina state, Brazil. The municipality had a population of 421,240 inhabitants in 2010, distributed in a land area of 908.02 km2. Florianópolis has, on its natural scenery, beaches, rocky shores, salt marshes, mangroves and dunes. The morphology is discontinuous, formed by crystal mountains coming up to 532 meters of altitude. The municipal human development index (HDI-M) was 0.847 in 2010, considered high, placing the city in the 3rd position among all Brazilian capitals. The life expectancy was 77.4 years, higher than the ones referring to Santa Catarina State (76.6 years) and Brazil (73.9 years). In 2010, it presented a total fecundity rate (children per woman) of 1.2 children, urbanization rate of 96.2%, dependency ratio of 34.1%, and aging rate of 7.5%. The average per capita income of Florianópolis has grown by 95% in the last two decades [14]. The poverty rate was 23.5% and the Gini index was 0.40 [15]. The city had a population of 48,000 elderly: 20,529 men and 27,894 women [15].

This epidemiological study with cross-sectional design was conducted with elderly participants of the following physical activity projects: Third Age Study Group at UDESC, Santa Catarina State University; and Physical and Aquatic Activities for the Third Age of UFSC, Federal University of Santa Catarina. The sample of this research was intentionally selected with the following inclusion criteria: elderly people (> 60 years), individuals who participated in physical activity projects in 2010 and that were present on the day scheduled for data collection.

The data collection took place at the premises of the Center for Health and Sport Sciences at UDESC and at the Sports Center in UFSC. Prior to collection, the elderly were informed about the study and those interested in participating signed an Informed Consent Form. The entire team of data collection, consisting of academics and physical education teachers, has been previously trained.

There were collected anthropometric measurements of body mass and height, according to Brazilian standardization [16]. The measurement of body mass was accomplished by means of a digital scale Plenna Wind MEA 07710, with a resolution of 100 grams and capacity of 150 kg. The height was measured using a portable stadiometer from WCS brand, 217 cm, with Cardiomed brand platform, with a resolution of 1 mm. Subsequently, concerning the collected data, we

calculated the body mass index (BMI = kg/m2). The weight status was classified according to previous recommendations: BMI < 22.0 kg/m2 – underweight, 22.0 ≤ BMI ≤ 27.0 kg/m2 – normal weight and BMI > 27.0 kg/m2 – obesity [17].

The estimation of muscle mass (MM) was performed using the equation of Lee et al. [18] validated for use with elderly Brazilians (13): Muscular Mass (kg) = (0.244 * body mass) + (7.80 * height) + (0.098 * age) + (6.6 * gender) + (ethnicity – 3.3). The variables were represented according to the following values: 1 for men and 0 for women; ethnicity = -1.2 for Asian, 1.4 for African descent and 0 for Caucasians. After the estimation of muscle mass, the muscular mass index (MMI) was calculated: MMI (kg/m^2) = Muscular Mass (kg) / $(Height)^2$ (m) [19].

After the calculation, we found the prevalence of sarcopenia according to Janssen et al. [19]. Sarcopenia can be divided into three categories (normal, moderate and severe). Owing to the low number of elderly people with severe sarcopenia, the categories "moderate" and "severe" were grouped, denominating them as presence of sarcopenia. The variable "age" was categorized into four groups according to age groups (60-64, 65-69, 70-74, and ≥ 75).

A descriptive analysis of the variables studied (mean, standard deviation and frequency distribution) was performed. The normality of the data was tested using the Kolmogorov-Smirnov test, accepting p values > 0.05. An indicative case of non-normal distribution, the U Mann-Whitney test was used for comparison of data. The Chi-square and Fisher's Exact tests were used to assess the association between the presence/absence of sarcopenia and gender (male, female), age (60-64, 65-69, 70-74, and ≥ 75) and BMI (eutrophic, underweight and obesity). The comparison of the MMI between age groups was verified by two-way ANOVA with post hoc of Bonferroni. The logistic regression analysis, gross and adjusted, was used to verify the association of the outcome (sarcopenia) with the independent variables (gender, age group and nutritional status), presenting the values of the Odds Ratio (OR) with the respective confidence intervals of 95% (95% IC). For the adjusted logistic regression analysis, all variables were included in the model, regardless of the value of p in the crude analysis. In all analyses, the adopted significance level was 5% ($p < 0.05$ or 95%).

The project was approved by the Ethics Committee on Research with Human Beings of the Santa Catarina State University, according to ruling n. 02/2010.

Results

Table 1 shows the sample general characteristics of the elderly sample. The average age of participants was 79.9 (standard deviation = 6.0) years, and 369 (84.2%) were women. We verified a significant higher average for male body mass, height, muscle mass, and muscle mass index. On the other hand, statistically higher values were observed among women in the body mass index. The prevalence of sarcopenia among elderly was 33.3% (moderate + severe), with higher rates in males.

Table 1 - General characteristics of the sample of elderly

Variables	Total (n = 438)	Male (n = 69)	Female (n = 369)	p-value
	$\bar{x}$ (sd)	$\bar{x}$ (sd)	$\bar{x}$ (sd)	
Age (years)	79.9 (6.0)	71.5 (6.4)	70.8 (6.0)	0.393
Body Mass (kg)	68.1 (11.3)	74.3 (10.9)	67.0 (11.0)	< 0.001
Height (m)	1.6 (0.1)	1.7 (0.1)	1.5 (0.1)	< 0.001
BMI (kg/m^2)	27.9 (4.3)	26.5 (3.5)	28.1 (4.4)	0.002
MM (kg)	20.2 (4.9)	27.4 (3.2)	18.8 (3.9)	< 0.001
MMI (kg)	8.2 (1.6)	9.8 (0.9)	7.9 (1.5)	< 0.001
Age Group (years)	**n (%)**	**n (%)**	**n (%)**	**0.819**
60-64	72 (16.5)	11 (15.9)	61 (16.5)	
65-69	125 (28.5)	17 (24.6)	108 (29.3)	
70-74	113 (25.8)	18 (26.2)	95 (25.7)	
≥75	128 (29.2)	23 (33.3)	105 (28.5)	
Weight Status				0.001
Eutrophic	236 (53.9)	42 (60.9)	138 (37.4)	
Underweight	22 (5.0)	04 (5.8)	18 (4.9)	
Obesity	180 (41.1)	23 (33.3)	213 (57.7)	
Sarcopenia				< 0.001
Normal	292 (66.7)	10 (14.5)	282 (76.5)	
Moderate	133 (30.3)	55 (79.7)	78 (21.1)	
Severe	13 (3.0)	04 (5.8)	09 (2.4)	

Note: x = mean; sd = standard deviation; BMI = body mass index; MM = skeletal muscle mass; MMI = muscle mass index; p-value = difference between genders in mean values or proportions.

Table 2 shows the characteristics of elderly in accordance with the absence and presence of sarcopenia. The results indicate a higher proportion of sarcopenia among elderly males, individuals aged above 75 years, and those with low weight.

Table 2 - Elderly characteristics according to the absence or presence of sarcopenia

Variables	Sarcopenia		p-value
	Absence	Moderate/ Severe	
	n (%)	n (%)	
Gender			**< 0.001**
Male	10 (14.5)	59 (85.5)	
Female	282 (76.4)	87 (23.6)	
Age Group (years)			**0.001**
60-64	54 (75.0)	18 (25.0)	
65-69	93 (74.4)	32 (25.6)	
70-74	74 (65.5)	39 (34.5)	
≥75	71 (55.5)	57 (44.5)	
Weight Status †			**< 0.001**
Eutrophic	68 (37.8)	112 (62.2)	
Underweight	03 (13.6)	19 (86.4)	
Obesity	221 (93.6)	15 (6.4)	

Note: † Fisher's Exact.

Figure 1 shows the values of the MMI of elderly according to age group, stratified by gender. In men, there was no significant difference in the mean values of MMI between age groups. On the other hand, there was a trend in average MMI in women inversely proportional to age ($p < 0.05$), i.e., elderly females aged ≥ 75 years showed statistically lower values when compared to other age groups (60-64, 65-69 and 70-74 years).

The results of the crude analysis revealed that all independent variables were associated with the outcome. When the analysis was adjusted, it was observed that the male gender (OR: 196.33, 95% CI = 40.05-962.54), the age group "75 years or more" (OR: 3.73, 95% CI = 1.41-9.91) and low-weight individuals (OR: 5.79, 95% CI = 1.52-21.40) were associated with moderate/severe sarcopenia. Obese elderly had less chances of sarcopenia than elderly with normal weight (OR: 0.01, 95% CI = 0.00-0.03) (Table 3).

Table 3 - Association between sarcopenia, demographic variables (gender, group age) and nutritional state in elderly

Variables	OR (95%CI)	p-value	OR** (95%CI)	p-value
Gender				
Female	1		1	
Male	19.12 (9.38-38.98)	< 0.001	196.33 (40.05-962.54)	< 0.001
Age (years)				
60-64	1		1	
65-69	1.03 (0.53-2.01)	0.926	1.36 (0.52-3.57)	0.535
70-74	1.58 (0.82-3.06)	0.173	2.45 (0.90-6.64)	0.078
≥75	2.41 (1.27-4.56)	0.007	3.73 (1.41-9.91)	0.008
Weight Status				
Eutrophic	1		1	
Underweight	3.85 (1.10-13.38)	0.035	5.79 (1.52-21.40)	0.010
Obesity	0.04 (0.02-0.08)	< 0.001	0.01 (0.00-0.03)	< 0.001

Note: OR = Odds Ratio; 95% CI = confidence interval; ** Analysis adjusted for all independent variables.

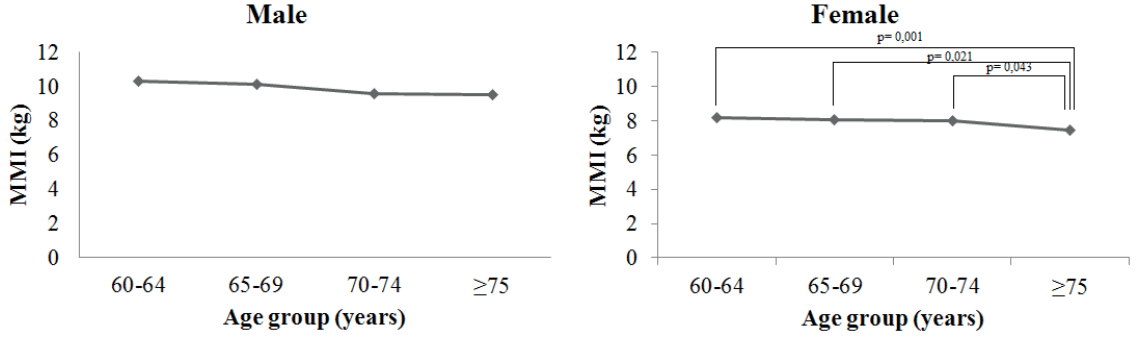

Figure 1 - Muscle mass index of elderly according to age group, stratified by gender.

Discussion

Among the main findings, it is emphasized that approximately one third of the investigated elderly people has moderate/severe sarcopenia, even when participating in physical activity programs. Furthermore, the MMI tended to decrease with increasing age.

The prevalence of sarcopenia was 33.3%. Similar prevalence was reported in other studies conducted in adults and elderly Thai (35.0%) [20] and Mexican individuals (36.6%) [21]. On the other hand, the lower prevalence of sarcopenia was observed in Chinese (11.4%) [22] and Thai elderly people (9.6%) [23]. In Brazil, the prevalence of sarcopenia to date was lower than what we found in this study. For example, in São Paulo, 16.1% of women and 14.4% of men were diagnosed with sarcopenia [24]. Recently, Dutra et al. observed women aged 60 years or older living in the urban zone of the municipality of Lafaiete Coutinho, Bahia, Brazil, and verified that 17.8% had sarcopenia [10]. The differences between these studies should be analyzed with caution, mainly owing to the use of different methods applied for the evaluation and classification of sarcopenia (DEXA, anthropometry, bioelectrical impedance). Thus, it is not impossible that the prevalence found in this study was overestimated, considering that our sample was convenient, which unfortunately undermines our results.

It is possible to observe in this study a tendency of reducing MMI with the increase of age, especially in females. Studies indicate that the loss of muscle mass is associated with age [6, 22, 25], which seems to be natural, since the aging process provides reduction of muscle mass of 3 to 8% per decade, especially if the elderly do not practice regularly physical activities [5]. These findings are disturbing because the reduction of muscle mass has a direct impact on the functional capacity of the elderly and may adversely impact their lives [6, 26]. In this context, the estimation of muscle mass seems to be a good indicator of body composition that can be used in programs of exercise and nutrition, supporting the diagnosis of risks in order to enable appropriate interventions, and improving the quality of life for seniors.

The elderly aged 75 years or more were more likely to have sarcopenia. These results confirm the evidence found by Yamada et al., who found that the prevalence of sarcopenia in elderly Japanese increased from 8.6% in those aged less than 70 years to 39.6% in those aged 80 years or older [27]. Dutra et al. also showed that the strongest associations with sarcopenia were with ages over 80 years [10]. The etiology of sarcopenia is multifactorial and its progression is usually attributed to age-related changes in skeletal muscle and the interaction of numerous factors, which may explain the results of this study. Among these factors related to the increase of age, stand out the decrease in hormone secretion, insulin resistance, decreased insulin growth factor, and increased inflammatory cytokines [28].

Regarding the association between sarcopenia and weight status (BMI), we observed an inverse association, in which the obese elderly were less likely to have sarcopenia than those eutrophic. These results differ from the findings of Baumgartner et al. [29], who investigated the association of sarcopenic obesity with the onset of disability in daily living instrumental activities during a follow-up of eight years. They found that obese sarcopenic are two to three times more likely to develop this inability than individuals only sarcopenic or non-sarcopenic obese. Thus, in general, obese people have a greater chance of developing sarcopenia than non-obese individuals [4].

On the other hand, it was observed that individuals with low weight were more likely to have sarcopenia when compared to their eutrophic pairs. These results corroborate the findings of the elderly of the United Kingdom [30] and Italia [11], which shows that the low weight is associated with increased sarcopenia. Probably, this is owing to the low intake of nutrients and the energy shortage affecting undernourished people, harming the body composition [30].

The present study has limitations concerning the cross-sectional design, which cannot verify reverse causalities between variables, the body composition analysis by doubly indirect method (anthropometry), and intentional sample selection.

Conclusion

The results demonstrate that the prevalence of sarcopenia is greater than 30% and it increases with age. The population subgroups with higher chances of sarcopenia were: males, individuals with age 75 or older, and those with low weight. These findings contribute to a better understanding of sarcopenia, which can help to take policy actions of health promotion as an incentive to practice regular physical activities and concomitantly have healthy eating habits.

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