

# Factors associated with Sarcopenia in the older adults in the Community

*Fatores associados à Sarcopenia em idosos da comunidade*

*Factores asociados con Sarcopenia en ancianos de la comunidad*

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**ABSTRACT** | Our study aimed to identify the factors associated with sarcopenia in older adults in the community. This is a correlational, cross-sectional study with a quantitative approach, conducted with 234 older people. We used the criteria of the European Working Group on Sarcopenia in Older People (EWGSOP2) to assess sarcopenia and collected the following data: sociodemographic and health questionnaire to characterize older adults; geriatric depression scale, Addenbrooke's cognitive exam - revised, international physical activity questionnaire long version and the medical outcomes study 36-item short-form health survey. Most participants were women (n=151; 68.30%), white (n=163; 73.80%), overweight, according to the body mass index - BMI (n=124; 56.10%) and 24.90% (n=55) of them presented sarcopenia, according to the criteria of the European Consensus. The following factors were associated with sarcopenia: age (OR=1.06; p=0.010), BMI<22kg/m<sup>2</sup> (OR=5.82; p=0.003), being insufficiently physically active (OR=3.29; p=0.002) and reports of falls (OR=2.20; p=0.033). Older people, with low weight, according to BMI, insufficiently physically active and that suffered falls are more likely to have sarcopenia.

**Keywords** | Sarcopenia; Aged; Aging.

**RESUMO** | O objetivo deste estudo foi identificar os fatores associados à sarcopenia em idosos da comunidade. Tratou-se de um estudo correlacional, de corte transversal e abordagem quantitativa, realizado com 234 idosos da comunidade. Para avaliar a sarcopenia foram

utilizados os critérios do European working group on sarcopenia in older people (EWGSOP2) e para coleta de dados foram utilizados: questionário sociodemográfico e de saúde para caracterização dos idosos; escala de depressão geriátrica, *Addenbrooke's cognitive examination-revised*, *international physical activity questionnaire*, versão longa e o *medical outcomes study 36-item short-form health survey*. Houve predominância de pessoas do sexo feminino (n=151; 68,30%), de cor branca (n=163; 73,80%), com sobrepeso, segundo o Índice de Massa Corporal (IMC) (n=124; 56,10%) e 24,90% (n=55) dos participantes apresentaram sarcopenia, segundo os critérios do consenso europeu. Se associaram à sarcopenia os seguintes fatores: idade (OR=1,06; p=0,010), IMC<22kg/m<sup>2</sup> (OR=5,82; p=0,003), ser insuficientemente ativo fisicamente (OR=3,29; p=0,002) e presença de quedas (OR=2,20; p=0,033). Os idosos com idade avançada, com baixo peso, insuficientemente ativos fisicamente e que sofreram quedas têm mais chance de apresentar sarcopenia.

**Descritores** | Sarcopenia; Idoso; Envelhecimento.

**RESUMEN** | El objetivo de este estudio fue identificar los factores asociados a la sarcopenia en ancianos de la comunidad. Se trata de un estudio correlacional, transversal, con abordaje cuantitativo, realizado con 234 ancianos de la comunidad. Para evaluar la sarcopenia se utilizaron los criterios del European working group on

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sarcopenia in older people (EWGSOP2), y para la recolección de datos se utilizaron: cuestionario sociodemográfico y de salud para caracterizar a los ancianos; escala de depresión geriátrica, *Addenbrooke's cognitive examination-revised*, *international physical activity questionnaire*, versión larga, y el *medical outcomes study 36-item short-form health survey*. Hubo un predominio de mujeres (n=151; 68,30%), blancas (n=163; el 73,80%), con sobrepeso, de acuerdo con el Índice de Masa Corporal (IMC) (n=124; 56,10%) y 24,90% (n=55) de

los participantes presentaron la sarcopenia, de acuerdo a los criterios del consenso europeo. Los siguientes factores se asociaron a la sarcopenia: edad (OR=1,06; p=0,010), IMC<22kg/m<sup>2</sup> (OR=5,82; p=0,003), estar insuficientemente activo físicamente (OR=3,29; p=0,002) y la presencia de caídas (OR=2,20; p=0,033). Los ancianos con edad avanzada, con bajo peso, insuficientemente activos físicamente y que han sufrido caídas tienen más probabilidades de padecer sarcopenia.

**Palabras clave** | Sarcopenia; Ancianos; Envejecimiento.

## INTRODUCTION

Sarcopenia is a muscle disease that can be defined by an age-related involuntary loss of skeletal muscle mass and strength<sup>1</sup>. In 2010, the European working group on sarcopenia in older people (EWGSOP) published a consensus with the following measurable parameters for the diagnosis of sarcopenia: skeletal appendicular mass, muscle strength and physical performance<sup>1-4</sup>. This consensus was widely used and was updated in 2018. With the new recommendations of EWGSOP2, low muscle strength became the primary parameter and the diagnosis is confirmed by the presence of low muscle quantity or quality. Sarcopenia is classified as severe when combined with low physical performance<sup>2</sup>.

A meta-analysis included 35 studies with older people in the community, aged 60 years or older, in which sarcopenia was evaluated according to EWGSOP criteria<sup>5</sup>. The authors of this meta-analysis found a total prevalence of 10% (95% CI=8-12%) for men and 10% (95% CI=8-13%) for women<sup>5</sup>. These figures evidence the need to treat sarcopenia as a public health problem, since both prevalence and incidence are likely to be significantly higher in hospitals and long-term care institutions<sup>6,7</sup>.

A longitudinal study conducted in Tuscany, Italy, with 538 participants from the community, aimed to verify the predictive values of sarcopenia compared to the development of future disabilities, hospitalization and mortality<sup>8</sup>. Using the sarcopenia criteria established by the EWGSOP, the authors identified that 10.2% of older adults were sarcopenic. This study also showed that 22% of the older sarcopenic adults presented deficiencies in instrumental activities of daily living, and this group presented a significantly higher risk

of developing these deficiencies when compared with the non-sarcopenic older adults. Hospitalization, disabilities and mortality<sup>8</sup> were associated in the prediction of sarcopenia.

Care for people with sarcopenia is essential, since this condition causes high personal, social and economic burdens when untreated<sup>8</sup>. In general, sarcopenia increases the risk of falls and fractures<sup>9,10</sup> and impairs the performance of daily living activities<sup>11</sup>. Moreover, it is associated with heart<sup>12</sup> and respiratory diseases<sup>13</sup>, and cognitive impairment<sup>14</sup>. Sarcopenia also contributes to the decrease in quality of life<sup>15-17</sup>, loss of independence, need for long-term care<sup>18-20</sup> and death<sup>21</sup>.

In financial terms, sarcopenia is expensive for health systems, because it increases the risk of hospitalization and the costs arising from a greater dependence on care<sup>22</sup>. International research has shown that sarcopenic older people have a hospitalization cost two to five times higher when compared with those who do not have sarcopenia<sup>22-25</sup>; thus, the development of preventive actions acting on risk factors that predispose to sarcopenia is essential.

Our study aimed to identify the factors associated with sarcopenia in the community's older people.

## METHODOLOGY

This is a correlational, cross-sectional study of a quantitative approach, conducted with 234 older adults registered in family health units (FHU) in a municipality in the state of São Paulo, Brazil. Older adults that met the inclusion criteria of being registered in a FHU and being 60 or older were interviewed. The exclusion criteria were having severe hearing and/or

vision deficit that made it impossible to understand and respond to the instruments. For data collection, the following instruments were used: sociodemographic and health questionnaires, elaborated by the study team, to characterize the participants; geriatric depression scale-15 (GDS)<sup>26</sup>; Addenbrooke's cognitive examination-revised (ACE-R)<sup>27</sup>; international physical activity questionnaire (IPAQ)<sup>28</sup>; medical outcomes study and 36-item short-form health survey (SF-36)<sup>29</sup>. The interviews for data collection were scheduled and conducted at the participants' households.

To diagnose sarcopenia, the criteria recommended by EWGSOP2 were adopted; muscle strength was evaluated, and sarcopenia was confirmed based on muscle mass and its severity determined based on physical performance. To evaluate the evidence of sarcopenia in the participants, the hand grip strength was measured, according to the criterion established by the study *saúde, bem-estar e envelhecimento* (SABE) that uses cutoff scores of <30Kg for men and <20Kg for women. To confirm sarcopenia by detecting low muscle quantity and quality, dual-energy x-ray absorptiometry (DXA) was performed at the Department of Physiotherapy of the Universidade Federal de São Carlos (UFSCar). All participants that answered the questionnaires were subjected to bone densitometry examination. The cutoff scores were those suggested by the SABE study, 6.37m<sup>2</sup>/kg for women and 8.90m<sup>2</sup>/kg for men<sup>30,31</sup>. To determine the severity of sarcopenia, the gait speed test was performed in a prepared and controlled environment with a cutoff score of less than 0.8 m/s for both sexes<sup>1,2</sup>.

To define the sample size, the scores of the data collection instruments were considered. The existence of a correlation between these instruments was the hypothesis, therefore, the sample size was estimated based on Pearson correlation coefficient, with the coefficient arbitrated from 0.20 to 0.50, with an interval of 0.05, with power of test of 80% ( $\beta=0.20$ ) and confidence of 95%. For a  $r=0.20$  (which represents a low correlation), based on international studies<sup>32</sup>, the sample should be composed of 194 subjects.

The collected data were inserted in a table in Excel 2007 format and the statistical program statistical package for the social sciences (SPSS) version 20.0 was used for the analyses. A descriptive analysis of categorical and continuous variables was performed.

To analyze the effects of independent variables on sarcopenia, multivariate binary logistic regression analysis was performed. The independent variables that

were associated with sarcopenia in the community's older adults, with  $p\text{-value}\leq 0.20$ , entered the model, except for the collinear variables. By using the forward selection method, the independent variables that together obtained  $p\text{-value}\leq 0.05$  were kept in the final model.

The numerical (independent) continuous variables included were age (in years), schooling (in years), monthly per capita income (in reais), number of medications used (in units); number of associated diseases (in units); body mass index (in kg/m<sup>2</sup>); number of falls (in units). The qualitative (independent) variables received values 0 or 1 to identify their categories. The significance level adopted for the statistical tests was 5% ( $p<0.05$ ).

## RESULTS

Of the 234 old people participating in the study, 68.30% (n=151) were female, most participants were white (73.80%) and married (61.10%). Among the participants, 56.10% had BMI>27Kg/m<sup>2</sup>; 24.90% (n=55) presented sarcopenia, according to the criteria of the European consensus; and 33.00% suffered at least one fall in the previous twelve months. The subjects had a mean of 69.37 years of age, 5.44 years of schooling and *per capita* income of 1,200.25 reais. Note that the mean of daily medications was 3.65 and the diseases per participant, 4.44 (Table 1).

Table 1. Distribution of sociodemographic and health characterization of the participants (n=234) - São Carlos (2019)

Variables	n (%)	Mean ( $\pm$ standard deviation)
Gender		
Female	151 (68.30)	
Male	70 (31.70)	
Marital status		
Married	135 (61.10)	
Widow/widower	53 (24.00)	
Divorced	18 (8.10)	
Single	15 (6.80)	
Ethnicity		
White	163 (73.80)	
Black	28 (12.70)	
Mixed race	27 (12.20)	
Asian	3 (1.40)	
BMI (Kg/m <sup>2</sup> )		
<22	17 (7.70)	
22 to 27	80 (36.20)	
>27	124 (56.10)	

(continua)

Tabela 1. Continuação

Variables	n (%)	Mean ( $\pm$ standard deviation)
Age		69.37 (7.03)
Schooling		5.44 (4.37)
Per capita income		1200.25 (1352.20)
Number of medications		3.65 (4.07)
Number of diseases		4.44 (3.35)
Sarcopenia		
No	166 (75.10)	
Yes	55 (24.90)	
Falls		
No	148 (67.00)	
Yes	73 (33.00)	

Table 2 shows the results of the univariate logistic regression analysis. To verify the factors associated with sarcopenia in older adults, the independent variables were included separately as presented in the model (table 2). The variables associated with sarcopenia in the older adults were age, number of medications used, BMI < 22Kg/m<sup>2</sup>, calf circumference, being insufficiently physically active, good cognitive performance, having better GDS scores, functional capacity and good general health status.

Table 2. Univariate logistic regression analysis for sarcopenia (n=234) – São Carlos (2019)

Variable	Category	p-value	OR <sup>*</sup>	95% CI <sup>*</sup>
Age	Continuous variable	<0.001	1.108	1.059-1.158
Sex	Men	Ref.	--	--
	Women	0.127	1.639	0.868-3.094
Falls	Yes	0.055	1.849	0.986-3.466
	No	Ref.	--	--
Number of medications	Continuous variable	0.008	1.104	1.026-1.187
Number of associated diseases	Continuous variable	0.235	1.055	0.966-1.153
Receives emotional social support	Yes	Ref.	--	--
	No	0.055	1.888	0.987-3.610
Receives material social support	Yes	Ref.	--	--
	No	0.226	1.461	0.791-2.698
Body Mass Index	<22kg/m <sup>2</sup>	<0.001	6.625	2.320-18.918
	$\geq$ 22kg/m <sup>2</sup>	Ref.	--	--
Calf circumference	Continuous variable	<0.001	0.791	0.717-0.872
Physical activity level	Active	Ref.	--	--
	Insufficiently active	<0.001	4.69	2.17-8.09
ACE-R total	Continuous variable	<0.001	0.964	0.48-0.80
GDS total	Continuous variable	0.001	1.165	1.063-1.278

(continua)

Tabela 2. Continuação

Variable	Category	p-value	OR <sup>*</sup>	95% CI <sup>*</sup>
Functional capacity**	Continuous variable	<0.001	0.977	0.966-0.987
General state of health**	Continuous variable	<0.001	0.972	0.958-0.987

\*OR: Odds Ratio. 95% CI OR: 95% odds ratio confidence interval. Ref.: reference level. \*\*Health-Related Quality of Life Dimension of the SF-36.

Table 3 shows the model with the variables that were associated with sarcopenia in the evaluated population; age (OR=1.066), BMI < 22kg/m<sup>2</sup> (OR=5.828), being insufficiently physically active (OR=3.298) and having suffered falls the year prior to the study (OR=2.201) were the factors associated with sarcopenia. The model shows that the chance of having sarcopenia increases by 1.066 times each year, and by 5.828 times if malnourished or underweight, according to BMI, by 3.298 times if insufficiently active and by 2.201 times if the person suffered a fall in the year prior to the research.

Table 3. Multivariate logistic regression analysis for sarcopenia (n=234) – São Carlos, SP, (2018)

Selected Variables	p-value	O.R.*	95% CI O.R.*
Age (years)	<b>0.010</b>	1.066	1.015-1.120
Body Mass Index	<b>0.003</b>	5.828	1.810-18.765
Physical activity level	<b>0.002</b>	3.298	1.523-7.143
Falls	<b>0.033</b>	2.201	1.064-4.551
Sex	<b>0.128</b>	1.766	0.848-3.677

\*OR: Odds ratio for sarcopenia; 95% CI: 95% confidence interval. Forward criterion for selecting variables. Categories: age (continuous variable), BMI (<22Kg/m<sup>2</sup>), Physical activity level (Insufficiently active), Falls (yes/occurred), Sex (woman).

## DISCUSSION

In our study, most subjects were female, white, married, with a BMI > 27kg/m<sup>2</sup>, and 24.90% presented sarcopenia, according to the criteria of EWGSOP2, corroborating the findings of the literature. The associated factors of sarcopenia in the population evaluated in this study were: age (OR=1.066), BMI < 22kg/m<sup>2</sup> (OR=5.828), being insufficiently physically active (OR=3.298) and having suffered falls the year prior to the study (OR=2.201)<sup>33-36</sup>.

Petermann-Rocha et al. evaluated the risk factors associated with sarcopenia in 396,283 participants in the UK biobank baseline clinic and found that age over 65 years was associated with sarcopenia. Also, people under the ideal weight were eight times more likely to present this condition (OR: 7.60 [95% CI: 6.08-9.50])<sup>37</sup>.

A study conducted in Malaysia to determine the prevalence of sarcopenia and its associated factors among older people with diabetes mellitus (DM), primary health

care users, found that 28.5% of the 506 participants had sarcopenia. Among the associated factors were: age $\geq$ 70 years ( $\beta=0.73$ ; OR=2.07; 95% CI=1.24, 3.48;  $p=0.006$ ), being male ( $\beta=0.61$ ; OR=1.84; 95% CI=1.12, 3.02;  $p=0.017$ ), with diabetes for  $\geq$ 10 years ( $\beta=0.62$ ; OR=1.85; 95% CI=1.11, 3.09;  $p=0.018$ ), on less than five medications ( $\beta=0.68$ ; OR=1.98; 95% CI=1.17, 3.36;  $p=0.011$ ), with low body mass index (BMI) ( $\beta=-2.43$ ; OR=0.09; 95% CI=0.05, 0.17;  $p<0.001$ ) and engagement in mild ( $\beta=0.77$ ; OR=2.15; 95% CI=1.07, 4.35;  $p=0.032$ ) and moderate physical activities ( $\beta=0.80$ ; OR=2.23; 95% CI=1.07, 4.66;  $p=0.033$ )<sup>35</sup>.

In a study conducted in Salvador – Brazil, with the objective of verifying the prevalence and factors associated with sarcopenia in institutionalized older adults<sup>36</sup>, thinner people (OR=1.28; 95% CI=1.14-1.43) had a higher prevalence of sarcopenia (23%) when compared with the eutrophic older adults.

Tramontano et al. evaluated the prevalence of sarcopenia and its associated factors in 222 individuals over 65 years of age in the Andes and found that advanced age and low physical activity were predictors of sarcopenia<sup>38</sup>.

Regarding the practice of physical activity, several studies in the literature mention that physical inactivity contributes to the development of sarcopenia<sup>39,40</sup>. In a longitudinal survey conducted in England over eight years, which analyzed risk factors for sarcopenia in 1,564 participants, the authors found the inverse association between physical activity and risk of sarcopenia<sup>41</sup>.

Our study also showed that sarcopenia was correlated with falls. Several studies indicate that older sarcopenic individuals have a significantly higher risk of suffering falls compared to non-sarcopenic individuals<sup>42-44</sup>. In an investigation conducted in Spain with 235 older women, Aibar-Almazán et al. found the association between sarcopenia and falls<sup>45</sup>.

Lim et al. also investigated the association between sarcopenia and falls in 147 patients over 65 years of age with hip fracture from several hospitals in South Korea<sup>46</sup>. They found a significant correlation between sarcopenia and falls ( $r=0.222$ ,  $p=0.007$ ). Furthermore, the authors found that sarcopenia was more prevalent in the group of older adults that had suffered falls (53.5%), compared to the group that had reported no falls (32.9%).

The cause of sarcopenia can be considered multifactorial, triggered by decreased physical activity; age-related mitochondrial dysfunction; loss of motor neuron terminal plates; weight loss; loss of anabolic hormones and increased pro-inflammatory cytokines<sup>47</sup>. Sarcopenia can negatively affect the general health of older adults, since it is associated

with poor physical performance and functional decline, which can lead to disability and increased risks for many comorbidities and hospitalization<sup>48</sup>. This meets the findings of our study, since the risk of falls and the worse perception of functional capacity were associated with sarcopenia, and these factors also represent risk for other comorbidities, institutionalization and hospitalization. Sarcopenia was also an independent risk factor for mortality (hazard ratio=1.52, 95% CI=1.06-2.19)<sup>31</sup>.

As limitations of our study, we cite the cross-sectional design, which impedes the attribution of causality between the variables, besides the convenience sample and the small number of people who were classified as sarcopenic. We suggest next studies to adopt a longitudinal approach, with a larger sample size.

## CONCLUSION

Older adults with advanced age, with BMI $<$ 22Kg/m<sup>2</sup>, who were insufficiently active and who suffered falls in the year prior to the study were factors associated with sarcopenia.

Our study emphasizes the importance of identifying risk factors for sarcopenia early in Brazilian older population, enabling early interventions (health education groups, falls prevention workshops and socialization groups), which can prevent the emergence of sarcopenia and avoid sarcopenia's negative outcomes in this population. Also, stimulating the functional capacities of the older population can help protect against sarcopenia.

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