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Original

Prevalence of sarcopenia in the elderly adult population in Costa Rica

Isabel Barrientos-Calvo[1], Ernesto Picado-Ovares[2]

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Abstract

Aim: Sarcopenia is the progressive loss of mass and skeletal muscle strength. Its prevalence varies in the different reviews carried out, this by the different measurement methods. Costa Rica does not have data on its prevalence. The aim of the study was to determine the prevalence of sarcopenia and associated factors in the elderly population included in the Costa Rican Study of Longevity and Healthy Ageing.

Methods: A subgroup of 2516 people were analyzed, using the European Working Group on Sarcopenia in Elderly People diagnostic criteria that include low muscle mass and low muscle strength. Muscle mass was assessed using calf circumference < 31 cm and grip strength using a dynamometer, was low strength if < 27 kg in men or < 16 kg in women.

Results: The prevalence of sarcopenia was 10.26%. There was an increasing trend of sarcopenia by age group, it was more prevalent in women. Some characteristics of Costa Ricans with sarcopenia were that most of them had less income, lived accompanied, were perceived as unhealthy, and had incomplete primary education. The weight, brachial, abdominal, and calf circumference were lower in people with sarcopenia. Sarcopenia was positively associated with age (OR 3.164; CI 1.962-5.101), education (OR 4.264; CI 1.547-11.753), perceived as unhealthy (OR 1.691; CI 1.133-2.525), the antecedent of an ischemic vascular event (OR 3.221; CI 1.566-6.628), arthritis (OR 1.648; CI 1.044-2.601), and falls (OR 1.676; CI 1.143-2.458). **Conclusions:** The prevalence of sarcopenia was 10.26%, similar to other countries in Latin America. It increases with age.

Keywords: Prevalence, Sarcopenia, Aged, Costa Rica

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Authors' affiliation:
[1]Departamento de Geriatría, Soporte Nutricional y Unidad de Investigación Hospital Nacional de Geriatría y Gerontología. San José, Costa Rica. [2]Departamento de Atención Comunitaria, Unidad de Investigación. Hospital Nacional de Geriatría y Gerontología. San José, Costa Rica

Abbreviations: CP, calf circumference; CRELES, Costa Rica longevity and healthy aging study; EWGSOP, European Working Group on Sarcopenia in Elderly People; CVD, cerebrovascular disease; FNIH, Foundation for the National Institutes of Health Sarcopenia Project; OR, odds ratio.

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Envejecimientocr@gmail.com

In 1989, Irwin Rosenberg used the term "sarcopenia" (from the Greek sarx: flesh and penia or loss), to describe the decline in muscle mass related to aging. [1] His definition has been expanded in the last 20 years, referring to sarcopenia as the decrease in muscle mass and strength, with repercussions on functional performance, resulting in adverse consequences such as functional impairment, falls, hospitalizations, and poor quality of life and increased mortality.[2-5]

Its prevalence varies in the different reviews carried out, due to the different measurement methods.[6-10] The European Working Group for the Study of Sarcopenia (EWGSOP)[11] established the diagnostic criteria for defining sarcopenia, which has made it possible to homogenize the findings of its prevalence.

Cooker and Wolf (2012)[3] noted the presence of sarcopenia among people aged 60-70 years in the community at 5-13% and up to 68% in the institutionalized population. In the Health Aging and Body Composition Study, the prevalence of sarcopenia in the community was 14% to 18%,[10] while other authors in the same setting have documented it in up to 29% of the population.[11]

In Mexico, with the EWGSOP criteria, elderly adults with sarcopenia were identified in 33.6%, being more prevalent in those over 80 years of age (50.4%),[12] this prevalence has been reported to be lower when standardized measures are used for the Mexican population, being 11.07%.[13]

Sarcopenia is a multifactorial process, among its main etiologies are the chronic low-grade inflammatory state that characterizes aging, low dietary protein intake, sedentary lifestyle, hormonal changes such as testosterone depletion, vitamin D deficiency, and insulin resistance, and chronic decompensated diseases. [7,14]

Due to the adverse effects of sarcopenia and the variability of data regarding its prevalence, information from Costa Rica: Study of Longevity and Healthy Aging (CRELES) was used to determine the prevalence of sarcopenia using the EWGSOP2 criteria, as well as the associated factors in the Costa Rican elderly adult population.

Methods

Design

Based on the CRELES study (Costa Rica: Study of Longevity and Healthy Aging), and using the public databases available on the web page of the Central American Population Center of the University of Costa Rica, the analysis were carried out using the cohort of elderly adults aged 60 years or more.

The development objective of CRELES is explained in other publications. [15,16] CRELES is a longitudinal study with three rounds of study, the first in 2005, then in 2007, and finally in 2009. For this study, we used data from the first round of interviews, conducted from November 2004 to September 2006, based on a representative sample of about 3000 adults born in 1945 or earlier and residing in Costa Rica in the year 2000.

Population

For this analysis, and after eliminating subjects with missing data on the variables to be studied, the final sample was 2516 people aged 60 and over.

Variables

Sociodemographic variables such as age, sex, economic income, level of education, cohabitation, self-perception of health, reported physical activity, reported comorbidities, anthropometric variables, muscle strength and physical performance tests such as the 5 times timed stand-up and sit-down test and walking speed were included, this was measured over a distance of 3 meters.

To define sarcopenia, the criteria of the European Working Group for the Study of Sarcopenia 2 (EWGSOP) were used together with the cut-off points of the Sarcopenia Project of the Foundation for the National Institutes of Health (FNIH):

- *Low muscle mass*. In the absence of body composition methods, calf circumference (WC) was used. A value of less than 31 cm was considered as low muscle mass for both sexes.
- *Low Muscle strength*. Muscle strength was obtained through grip strength, with a Jamar hydraulic dynamometer ©. The maximum measurement in kg obtained with the dominant limb was used. For this study, the cut-off points were adjusted according to gender.

Therefore, sarcopenic were defined as persons with a PC below 31 cm with muscle strength of <27 kg in men and <16 kg in women; those who did not meet this condition were classified as non-sarcopenic.

Statistical analysis

After the sarcopenia variable was constructed, descriptive statistics were performed. For these descriptive analyses, two-dimensional tables were elaborated in which the percentage of sarcopenic and non-sarcopenic were calculated. The different

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sociodemographics and other health variables were determined according to the category, as judged by the expert. Then, logistic regression was conducted, considering in this case sarcopenia as the dependent variable, which has two possible categories, sarcopenic and non-sarcopenic. As independent variables of the model, a large number of previously described variables were used, because the objective, in this case, the nature of the analysis was exploratory. For this case, only variables that provide problems to the model were excluded, for example, the case of multicollinearity, missing data and others that caused the estimated odds ratios not to converge adequately. Once all the problems presented by the model were fixed and given adequate revision, odds ratios for the sarcopenic category were obtained as results, because the non-sarcopenic category was taken as a reference since it is considered to be the healthy one. Now, to contrast, the relevance and possible error in the estimation of the odds ratio, a 95% confidence interval was estimated. All the analysis was carried out using the SPSS v16 program.

Results

A total of 2516 persons aged 60 years and elderly were included. When the sarcopenia criterion was applied, a prevalence of sarcopenia was identified in 10.26% of the persons studied. As age increased, the cases of sarcopenia were higher, being 33.2% in the age range 70-79 years and 43.5% in those over 80 years of age. In the sex variable, women had more sarcopenia than men with 63.4% and 36.6% respectively.

People with sarcopenia had lower economic income (57.4% with an income of fewer than 50 thousand colones per month), and 90% had a level of schooling lower than the sixth year of primary school. Only 16% lived alone. The self-perception of health was evaluated, documenting that 60.4% of the people with sarcopenia perceived themselves as unhealthy. Of those studied, 83.2% denied doing any type of physical activity, as can be seen in Table 1.

Table 1. Sociodemographic variables of the CRELES study subjects, cohort 2005

	Non-sarcopenic %	Sarcopenic %
Age (years)		
60-69	58,8	23,2
70-79	30,9	33,2
80+	10,3	43,5
Sex		
Woman	50,3	63,4
Man	49,7	36,6
Education		
⩽ 6th	77,4	89,4
7mo-9no	7,9	5,9
⩾ 10mo	14,7	4,7
Income		
⩽ 50 thousand	39,3	57,4
51-248 thousand	39,0	32,1
⩾ 249 thousand	21,7	10,5
Physical activity		
Yes	34,2	16,8
No	65,8	83,2
Lives alone		
Yes	9,1	15,9
No	90,9	84,1
Self-perception of health		
Healthy	54,8	39,7
Unhealthy	45,2	60,4

Among the antecedents reported by people with sarcopenia, history of falls (59%), pulmonary diseases (23%), arthritis (20.7%), osteoporosis (11.8%), cerebrovascular disease (CVD) (8.3%), cancer (7.6%) and myocardial infarction (5.6%) were frequently found. Smoking was similar between sarcopenic and non-sarcopenic 40.8% and 44.1% respectively.

Anthropometric and functional variables were analyzed by sex and sarcopenic status (Table 2). Non-sarcopenic men had a higher average weight than sarcopenic men (71.7 kg vs 52.91 kg), the same was true for women (64.68 kg vs 48.66 kg respectively). This phenomenon was also observed with brachial circumference and abdominal circumference. On average, body mass index was lower in both men and women with sarcopenia (20.98 kg/m^2 and 23.60 kg/m^2 respectively), while the average CP was 28.4 cm for people with sarcopenia and 34.9 cm in the group without sarcopenia.

Grip strength was greater in people without sarcopenia than in sarcopenic people; in the latter, men had an average dynamometry of 21.95 kg and women of 13.65 kg. In the gait speed and the stand-up and sit-down test, people with sarcopenia took longer for their execution (Table 2).

Table 2. Average anthropometric and functional variables of the individuals in the CRELES study, cohort 2005

	Sarcopenic		Non-sarcopenic	
	Men	**Women**	**Men**	**Women**
Weight (Kg)	52,91	48,66	71,74	64,68
Brachial circumference (cm)	24,84	25,60	30,27	31,09
Height (cm)	158,85	144,35	164,47	150,95
Body mass index (kg/m^2)	20,98	23,60	26,50	28,44
Abdominal circumference (cm)	82,79	84,92	94,81	95,31
Dynamometry (kg)	21,95	13,65	33,55	21,77
Stand-up and sit-down(s)	18,80	19,75	16,68	17,89
Gait speed (s)	10,57	11,48	9,58	10,03

In the risk ratio (OR), taking sarcopenia as the dependent variable, the variables that showed the greatest association were age, with the risk increasing after 70 years of age (OR 3.164; CI 1.962-5.101), being even greater after 80 years of age (OR 8.846; CI 5.352-14.620), level of education (OR 4.264; CI 1.547-11.753), and perceiving oneself as unhealthy (OR 1.691; CI 1.133-2.525). Of the comorbidities, having a history of CVD (OR 3.221; CI 1.566-6.628), arthritis (OR 1.648; CI 1.044-2.601), falls (OR 1.676; CI 1.143-2.458) and being physically active (OR 0.473; CI 0.283-0.790). Among the anthropometric variables, waist circumference was the only one with an association (OR 0.908; CI 0.819-0.926) (Table 3).

Table 3. Risk factors associated with sarcopenia, CRELES 2005

Variable	Sarcopenic	
	OR	**IC**
Age		
80+	8,846	5,352; 14,620 *
70 -79	3,164	1,962; 5,101 *
60 -69 1/	-	-
Education		
⩽ 6th	1,993	0,843; 4,712
7th-9th	4,264	1,547; 11,753 *
⩾ 10mo 1/	-	-
Sex		
Woman	1,273	0,844; 1,919
Male 1/	-	-
Lives alone		
Yes	1,497	0,889; 2,519
No 1/	-	-

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Discussion

To our knowledge, this is the first study to show national data on the prevalence of sarcopenia in people in the community. The EWGSOP developed a clinical definition and diagnostic criteria with cut-off points that make it easy to apply[6] and to analyze the prevalence of this geriatric syndrome in our country.

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Self-perception of health		
Unhealthy	1,691	1,133; 2,525 *
Healthy 1/	-	-
Income		
⩽ 50 thousand	1,772	0,973; 3,226
51-248 thousand	1,172	0,635; 2,161
⩾ 249 thousand 1/	-	-
Waist circumference		
	0,908	0,819; 0,926 *
Weight loss		
Yes	1,322	0,781; 2,238
No 1/	-	-
Polypharmacy		
Yes	1,142	0,748; 1,744
No 1/	-	-
Physical activity		
Yes	0,473	0,283; 0,790 *
No 1/	-	-
Hypertension		
Yes	1,045	0,669; 1,562
No 1/	-	-
Diabetes		
Yes	1,200	0,747; 1,929
No 1/	-	-
Cancer		
Yes	1,462	0,742; 2,884
No 1/	-	-
Pulmonary diseases		
Yes	1,479	0,949; 2,304
No 1/	-	-
Infarction		
Yes	1,279	0,598; 2,737
No 1/	-	-
Cerebrovascular disease		
Yes	3,221	1,566; 6,628 *
No 1/	-	-
Arthritis		
Yes	1,648	1,044; 2,601 *
No 1/	-	-
Osteoporosis		
Yes	0,837	0,479; 1,463
No 1/	-	-
Falls		
Yes	1,676	1,143; 2,458 *
No 1/	-	-

*p<0,05
CI= 95% Confidence Interval; OR= Odds Ratio
1/ Reference category

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In CRELES, calf circumference was used as an indirect measure of muscle mass, which has studies correlating it with skeletal muscle mass index, disability, and self-reported physical perception.[20,21] Calf circumference is currently considered a sensitive, inexpensive, non-invasive, and easy-to-measure anthropometric measure.[22,23] The cut-off point of 31 cm has been suggested as an indicator of decreased muscle mass. [20,22]

In Mexico, applying the EWGSOP criteria (with PC as a measure of muscle mass), the prevalence of sarcopenia was higher (33.6%)[12] than in our study (10.26%). In a more recent study in that same country, Perez et al (2016) had a prevalence of sarcopenia at 11.07%, similar to that documented in Colombia with 11.5%,[17] values close to that documented in Costa Rica. As described by Arango et al (2012), in Costa Rica it was more prevalent in women and in those over 80 years, which exposes age as a conditioning factor for the appearance of primary sarcopenia.

On the other hand, in Chile, the prevalence of sarcopenia with EWGSOP was 19.1%,[18] however by age, Costa Ricans in their eighties with sarcopenia have a higher prevalence than Chileans (Costa Ricans 43.5% vs 38.5%). In Brazil[19] the reported prevalence was 16.1% in women and 14.4% in men.

Concerning muscle strength, which reflects muscle quality, it is considered a predictor of adverse outcomes.[20,21] Cut-off points for weakness are useful for identifying populations that may benefit from interventions to improve muscle

strength and function. Costa Rican women were on average weaker (13.65 kg) than Chilean women with sarcopenia (18.7 kg), which raises the question of whether all Latin American countries have the same cut-off point for describing normal muscle strength, as changes in their cut-off point may affect the magnitude of sarcopenia prevalence. [23,24]

Another measure that reflects a decrease in strength is the stand-up and sit-down test five times. In the study population, this test was also longer to execute in the nationals than in other Latin American countries; however, it is noteworthy that even in those classified as non-sarcopenic in the CRELES study, the duration was longer than 15 seconds, a cut-off point that reflects an alteration in muscle strength.[2] This finding motivates further studies of this variable and its behavior in the national population.

Commonly used measures of physical performance in geriatrics include the short performance battery, gait speed, and the 6-minute walk test; these represent quick, inexpensive, and reliable measures of physical function that can be easily implemented in clinical settings. [25] Currently, those defined in the FNIH are used as cut-off points because of their strong longitudinal associations with disability, mortality[25] and because their use has been recommended by other experts.[2,11]

Regarding the analysis, gait speed was longer in Costa Ricans with and without sarcopenia, compared to the Chilean population. [18] A gait speed value < 0.8 m/sec classifies sarcopenia as severe, which generates greater adverse outcomes such as frailty, falls, low quality of life, disability, and mortality.[2]

Similar to what was documented by Lera et al.,[18,23], an association was found between sarcopenia and falls, physical inactivity, and comorbidities such as CVD and arthritis, which may be related to the decrease in mobility associated with these conditions, which could influence the development of secondary sarcopenia in the Costa Rican population.

Limitations

One limitation is that it is a cross-sectional analysis, as only one round of the CRELES study was included, and therefore causality factors were not analyzed. Another limitation is the absence of body composition parameters to establish correlations with calf circumference. As this was a retrospective study, we worked with existing information.

Local cut-off points are required to identify sarcopenia; however, using the EWGSOP criteria and cut-off points allowed us to compare results with other prevalence studies conducted in other Latin American countries.

Conclusion

In conclusion, the prevalence of sarcopenia was similar to that documented in other Latin American countries (10.26% in our country). It is more prevalent in women, and the older the age, the higher the risk of developing it.

Identifying sarcopenia in elderly adults in Costa Rica will allow us to intervene and prevent functional deterioration, falls, hospitalizations, and death, all of which are events related to sarcopenia.

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