

Trabajo Original

Frequency of sarcopenia according to different criteria among community-dwelling women from Buenos Aires

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RESUMEN

Se denomina sarcopenia a la reducción de la masa muscular esquelética asociada a menor fuerza y rendimiento físico. Su prevalencia no es bien establecida y difiere en la literatura de acuerdo a diversos criterios diagnóstico. En nuestro estudio se consideraron las cuatro definiciones más utilizadas: EWGSOP 1 y 2, IWGS y FNIH. Se desarrolló un estudio de diseño transversal cuyo objetivo fue evaluar la frecuencia de sarcopenia en Buenos Aires de acuerdo a diferentes criterios. Ingresaron al estudio un total de 250 mujeres ambulatorias mayores de 60 años residentes de la comunidad. La masa y fuerza muscular fueron evaluadas mediante absorciometría de rayos x de doble energía (DXA) y dinamometría de mano respectivamente. Por otro lado, para la evaluación del rendimiento físico se utilizaron la velocidad de la marcha y la prueba de levantarse-sentarse de una silla. La edad media de la población fue de 70.37 ± 7.73 años. La frecuencia de sarcopenia varió de acuerdo a las diferentes definiciones propuestas entre 4 a 14 %, siendo IWGS la más frecuente. Solamente 5 mujeres (2%) reunían los 4 criterios internacionales de sarcopenia. Se observaron diferencias entre las mujeres pertenecientes a las diferentes definiciones en: altura, porcentaje de grasa y fuerza de puño $p \leq 0.05$. La prevalencia de sarcopenia presenta un amplio rango de variabilidad principalmente como consecuencia de la diversidad de definiciones en la literatura. Este trabajo, permite direccionar futuras investigaciones para la unificación de criterios además de la obtención de valores de referencias locales.

ABSTRACT

Keywords:

Sarcopenia
Criteria
Frequency
Muscle mass

Sarcopenia is defined as a reduction of skeletal muscle mass associated with low strength and physical performance. Its prevalence is not well established and differs in literature according to several diagnostic criteria. For our study four international definitions were taken into consideration: EWGSOP 1 y 2, IWGS and FNIH. A cross-sectional study was performed with the main purpose of comparing the frequency of sarcopenia according to multiple diagnostic criteria. A total of 250 ambulatory women over 60 years of age were included. Muscle mass and strength were measured using X-ray absorptiometry and handheld dynamometer respectively, physical performance was assessed with the 4-meter-gait-speed (4MGS) test and the 5-repetitions-sit-to-stand (5STS). Mean age was 70.37 ± 7.73 years old. Sarcopenia frequency ranged from 4 to 14% depending on the different criteria, IWGS being the highest. A total of 5 individuals (2%) met all 4 definitions. Differences in height, fat percentage and hand-grip among women according to each consensus were observed $p \leq 0.05$. Sarcopenia prevalence presents a wide range of variability mainly due to the lack of a unique worldwide definition. This study allows addressing future research to find adequate screening strategies and reference values in Argentina, encouraging a unanimous global consensus for diagnosis.

INTRODUCTION

The term sarcopenia is derived from Greek (sarx or flesh and penia or loss), to describe the loss of the muscle mass and strength that frequently occurs with aging^(1,2). Some authors add to the last sentence loss of quality and low physical performance⁽³⁾. Interestingly the concept of sarcopenia has been changing through the years. In 1998, Baumgartner et al. started assessing body composition by Dual X-ray Absorptiometry (DXA) to measure muscle mass, they proposed to define sarcopenia as appendicular skeletal muscle mass (kg)/height², being less than two standard deviations below the mean of a young reference group (ASM/height²). The cut-off values for women and men were <5.45 and <7.26 kg/m², respectively⁽⁴⁾. Later on, subsequent investigations observed that the muscle loss phenomenon was accompanied also by lower muscle strength (handgrip and sit stand test) and physical performance; hence, different criteria and reference values appeared to define sarcopenia.

Currently strength and physical performance are included as criteria for diagnosis of sarcopenia in addition to muscle mass⁽⁵⁻⁷⁾. Thus, the most used definitions of sarcopenia reported in the literature involve these parameters (lean mass, strength and physical performance⁽⁸⁻¹¹⁾). It is well recognized that the loss of lean mass strength and poor physical performance that occur in the elderly predispose them to higher risk of hospitalization, falls, fractures and mortality⁽¹²⁻¹⁵⁾. The association between sarcopenia and falls was evaluated in a meta-analysis: observing that sarcopenic individuals had higher risk of falls

OR 1.60; (95% CI 1.37–1.86, $p < 0.001$, I²= 34%), and fractures OR 1.84 (95% CI 1.30–2.62, $p < 0.01$, I²= 91%)(16). These results lead to serious health events and greater social and economic burden. It is interesting to remark that despite its relevance, there is a lack of a unified definition or consensus criteria for sarcopenia, having a lot of concern for appropriate diagnosis. In addition, it became so dynamic that every certain years in concordance to the growing enthusiasm about this topic, new information summates concepts and dissents, thereupon, highlighting the importance of unanimity among authors in order to establish real prevalence and treatments approach⁽¹⁷⁻²¹⁾.

The causes of sarcopenia are multifaceted and often related with aging; however, there are not entirely elucidated⁽²²⁾. A decline of type II muscle fiber is seen in sarcopenic patients that could be linked to a fall of anabolic hormones such as: testosterone, HGH, IGF-1. Besides a progressive neurodegeneration by a decreasing of alpha motor neurons in the spinal cord, loss of peripheral nerve fibers, and reduced number of neuromuscular junctions play roles in its development^(23,24). It has also been described insulin resistance as a cause of sarcopenic in obese and diabetic patients⁽²⁵⁾. Inflammatory markers such as IL-6, CRP, TNF, other cytokines and diseases could likewise evolve to sarcopenia as a part of an age-related process⁽²⁶⁾.

The prevalence of sarcopenia varies according to the population (ethnicity, sex, age) and reference values used to define the condition, hence a discrepancy in prevalence among researchers is observed. The worldwide prevalence of

sarcopenia in patients over the age of 60 is estimated to be 10%^(3,15,17,27,28). In Argentina limited data on sarcopenia prevalence is available. Thereupon, the aims of our study were first to evaluate the frequency of sarcopenia in women over 60 years old, classifying through the 4 most used international definitions, and subsequently characterize the population evaluating the relationship between sarcopenia criteria.

MATERIALS AND METHODS

Study design

A cross-sectional study was performed to examine the frequency of sarcopenia in postmenopausal Caucasian women aged 60 years or older, who visited our Metabolic Bone Disease Clinic from March 2014 to June 2017. After the ethic committee approval and the sign of a written consent, all women were invited to have their muscle health assessed. Patients were recruited to participate through different publishing media, such as institutional websites, mails and brochures. A consecutive sample of 250 women met the inclusion criteria, consequently entering into the study. Exclusion criteria were: use of a walking cane, neurological diseases and sarcopenia secondary to: pulmonary obstructive disease, oncology diseases, chronic renal disease or insulin-requiring diabetes-conditions that prevented their physical performance assessment. A total of 63 women were retired off from the study. We registered relevant clinical characteristics such as current medication, recent measurement of serum levels of Vitamin D, past history of fractures and falls in the last year, most data were obtained from clinical records, and lacking data was recovered by the principal investigator.

Skeletal muscle mass

Anthropometry measurements, height, weight and body mass index (weight/height²) were performed. Skeletal muscle mass was calculated by DXA (Lunar Prodigy GE Lunar, Madison, WI, USA). Adipose tissue was informed as a percentage and total adipose tissue, in kilograms (kg). Appendicular skeletal mass, (ASM), was calculated following software protocols, adding together muscle mass of arms and legs in kg. The result could be adjusted to body size by dividing to the height squared, similarly to the body mass index calculation (BMI), except that in the upper part of the quotient the appendicular muscle mass is used (arms muscle mass kg + legs muscle mass kg/ height²).

Muscle Strength

Hydraulic dynamometer was used to measure grip strength (Jamar-USA validated equipment). Three determinations were performed in each hand considering the best value. The Jamar dynamometer was calibrated according to manufacturer⁽²⁷⁾. A workbench, positioning block and standardized test weights were used to measure the accuracy and reliability. Correlation coefficient between the mean of the dynamometer and weight

applied was 0.99. Dynamometer was checked a minimum of once a year. All measurements were made by the same evaluator.

Physical Performance

Gait speed, considering time in seconds and meters/seconds to do a four-meter usual walking speed test barefoot or with comfortable shoes, was registered. Rehearsal was performed before the final measure. Sit-Stand test was considered as time applied to repeat 5 times sitting and standing from a chair without arms help. The chair had a back seat and its height was adapted to participants' height.

Sarcopenia diagnosis

Four consensuses with different normal values for the different variables were used to evaluate each participant. The most widely known and used definitions were applied. All measurements were made by the same evaluator:

1. IWGS (International Working Group on Sarcopenia) defines sarcopenia as Appendicular muscle adjusted by body size less than 5.67 (ASM kg/height²) and low physical performance as less than 1 meter/second in gait speed⁽⁹⁾.
2. FNIH (Foundation for the National Institute of Health) defines sarcopenia as appendicular muscle mass adjusted for BMI (ASM/BMI) less than 0.512 or appendicular muscle mass less than 15 kg and handgrip less than 16 kg⁽¹⁰⁾.
3. EWGSOP1 (European Working Group of Sarcopenia in Older People) defines sarcopenia as Appendicular muscle mass adjusted for body size (ASM kg/height²) less than 5,5 kg/height² associated to handgrip less than 20 kg or gait speed less than 0.8 meters/second⁽⁸⁾.
4. EWGSOP2 (European Working Group of Sarcopenia in Older People) defines sarcopenia as handgrip less than 16 kg or sit-stand test more than 15 seconds associated to ASM adjusted for body size less than 5.5 (ASM kg/height²) or ASM less than 15 kg⁽¹¹⁾.

Statistics

Variables were described according to their distribution, and the Shapiro-Wilk test was used for that term. Parametric variables are expressed as mean and standard deviation (X, SD). Taking into consideration the different consensus a frequency table for sarcopenia diagnosis was built informing absolute frequency (n), relative frequency (%) and similarities between the four consensuses. To evaluate participants in each consensus and in view of its distribution; Friedman's Test or Kruskal Wallis analysis was performed, expressing data as median and interquartile range [IQR]. Pearson or Spearman correlation was made for quantitative variables as appropriate. In order to measure the agreement between the four diagnostic definitions of sarcopenia, we applied the Cohen's kappa coefficients (concordance rate, two by two) and the Fleiss' kappa coefficient

(overall concordance rate). As literature reports; coefficient less than 0 indicates disagreement, a coefficient between 0 and 0.20 reflects a slight agreement, and along this line agreement is fair for a value between 0.21 and 0.40, moderate between 0.41 and 0.60 and substantial between 0.61 and 0.80. Finally, an almost perfect agreement exists when the value is higher than 0.81. The software STATISTIX 7.0 Copyright ©1995, 2000 was implemented and a p value <0.05 was designed as significant.

RESULTS

A total of 250 women were included in the analysis. The mean age was 70.37 ± 7.73 years old. Baseline characteristics are shown in Table 1.

Table 1. Population Characteristics (n=250)

Variables	Mean SD
Age (years)	70.37 ±7.73
Weight(kg)	61.81 ± 11.02
Height(m)	1.57 ± 0.06
BMI (kg/m ²)	25.08 ± 4.39
Arms MM (kg)	3.36 ± 0.59
Legs MM (kg)	11.10 ± 1.73
Appendicular MM (kg)	14.50 ± 1.98
ASM/height ² (kg/m ²)	5.85 ± 0.67
Grip-Strength (kg)	22.35 ± 4.49
Gait Speed (m/s)	1.02 ± 0.31
Sit-Stand test (s)	11.96 ±4.50

BMI: Body Mass Index, MM (Muscle Mass), ASM (Appendicular Skeletal Mass)

The frequency of sarcopenia varied from 4-14% according to the different criteria (Table 2), being higher for those with less rigorous reference values (IWGS and EWGSOP1).

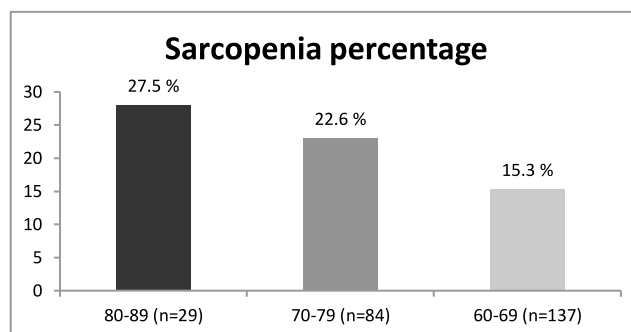
Table 2. Sarcopenia Prevalence according to different consensus (n 250).

Criteria	N participants	Frequency (%)
IWGS (2011)	36	14
FNIH (2014)	11	4
EWGSOP1 (2010)	30	12
EWGSOP2 (2019)	10	4

IWGS (International Working Group on Sarcopenia), FNIH (Foundation for the National Institute of Health), EWGSOP (European Working Group of Sarcopenia in Older People).

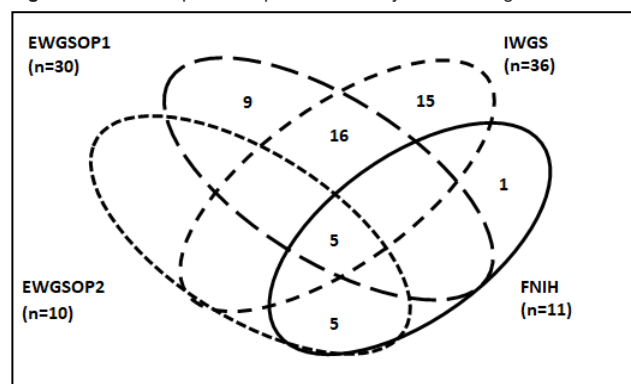
In women older than 80 years old (n = 29), the prevalence of sarcopenia under any of the 4 definitions was 27.5% (p<0.05) (figure 1). A total of 5 individuals (2%) met all 4 definitions of sarcopenia. Concordance and relation between women with sarcopenia are shown in figure 2.

Figure 1. Sarcopenia frequency according to age and any definition.



*chi-squared trend test

Figure 2. The overlap of sarcopenia defined by different diagnostic criteria.



Number of women identified as sarcopenic patient according to four diagnostic criteria (IWGS, FNIH and EWGSOP1 and 2).

After performing two by two Cohen test between definitions in order to assess concordance all Kappa Cohen coefficients are presented in Table 3. Meanwhile, characteristics of the 4 groups (consensuses) with their respective comparisons are described in Table 4.

Table 3. Concordance between different methods for diagnosis of sarcopenia

	IWG	FNIH	EWGSOP1	EWGSOP2
IWG	1	0.16 (0.05-0.26)	0.58 (0.46-0.70)	0.17 (0.07-0.26)
FNIH		1	0.19 (0.08-0.30)	0.95 (0.83-1.07)
EWGSOP1			1	0.20 (0.10-0.31)
EWGSOP2				1

Kappa Cohen test

Table 4.
Characteristics of sarcopenic participants according different consensus.

	IWG (36)	FNIH (11)	EWGSOP1 (30)	EWGSOP2 (10)	p
Age	71	79	76	79	0.15
(years)	(65-78)	(69-87)	(64-79)	(74-87)	
Weight	55.75	55.30	52.75	54.65	0.70
(kg)	(50.00- 63.00)	(44.00- 62.50)	(49.50-62.10)	(44.00-59.50)	
Height	1.60	1.45*	1.56	1.45*	0.01
(m)	(1.54-1.63)	(1.44-1.57)	(1.54-1.60)	(1.44-1.57)	
BMI	21.85	26.30	22.18	25.61	0.25
(kg/m²)	(20.11- 24.59)	(20.93- 28.30)	(20.03-24.59)	(20.93-27.55)	
Fat	38.1*	41.20	38.05*	40.60	0.05
(%)	(33.7- 41.6)	(38.70-43.10)	(33.80-42.00)	(38.70-42.80)	
Vit D (ng/ml)	28,9	27,0	27,65	26,00	0.70
	(25,6-39,6)	(22,8-32,6)	(24,10-33,40)	(21,60-32,60)	
MM Arms	2.94	2.82	2.88	2.69	0.32
(kg)	(2.67-3.15)	(2.32-3.09)	(2.67-3.09)	(2.32-3.09)	
MM Legs	9.89	10.07	9.52	10.08	0.59
(kg)	(9.17-10.76)	(8.85-10.17)	(8.85-10.21)	(8.85-10.17)	
Append MM	12.89	12.68	12.40	12.78	0.54
(kg)	(12.10-14.11)	(11.39-13.19)	(11.85-13.06)	(11.39-13.19)	
ASM/height²	5.17	5.83	5.09	5.61	0.10
(kg/m²)	(4.75-5.43)	(5.07-6.28)	(4.75-5.28)	(5.07-6.28)	
Grip- Strength	21	14*	18	14*	0.0002
(kg)	(18-22)	(12-14)	(16-19)	(12-14)	
GaitSpeed	0.8	0.8	0.8	0.78	0.54
(m/s)	(0.7-0.9)	(0.5-0.9)	(0.76-1.00)	(0.54-0.83)	
Sit-Stand	12.97	10.71	13.15	12.32	0.94
(s)	(10.50 -15.17)	(9.41-17.00)	(9.83-15.18)	(9.41-17.00)	

*Nonparametric test for multiple variables (median IQR). BMI: Body Mass Index, MM (Muscle Mass), ASM (Appendicular Skeletal Mass).

DISCUSSION

Sarcopenia is an important risk factor for morbimortality in the older people. The loss of muscle mass throughout life increases during the 4th-5th decade of life and affects mostly muscles involved in locomotion⁽²⁹⁾. It is very important to identify this phenomenon, because muscles play an important role on falls prevention^(30,31). On the other hand, muscle strength and potency in lower limbs decline faster than muscle mass. Therefore, a closer interaction between these parameters as predictors of mobility limitations is thought. Laurentani et al. described a higher than 50% losses of these components, being women most affected. Likewise, those individuals located in the first power and strength quintile presented a higher prevalence of slowness at walking⁽³²⁾. In the same manner, some investigators highlighted the importance of proper muscle function evaluation in order to assign those individuals who are vulnerable, leaving behind muscle mass as a minor risk factor. Both; low grip strength and low usual gait speed independently predicted falls, self-reported mobility limitation, hip fractures, and mortality in community-dwelling older adults⁽³³⁾. Nonetheless, most definitions are taking muscle mass as an important criterion to sarcopenia diagnosis^(13,34).

Identifying subjects with sarcopenia is often confusing, especially when measurement instruments and limits or reference values are selected. Currently, there are a variety of validated consensuses, with different proposed criteria. These definitions do not necessarily coincide with the reference values and with the measurement tools^(8,11,13,19). For some experts, it is convenient to adjust the muscle mass by the body mass index, while for others the adjustment must be made by height. Other authors propose not to adjust muscle mass^(1,9,17). Regardless of the different criteria, the importance of this condition on health risk is undeniable. These differences between definitions are reflected in the prevalence or incidence of sarcopenia in the different populations. Higher prevalence is associated with those definitions with less rigid reference values, reaching up to 50% of adults older than 80 years of age⁽⁴⁾. In our study, the prevalence of sarcopenia is evaluated using different international criteria. We have used whole body DXA scans for the determination of muscle mass. Its correlation with nuclear magnetic resonance is 0.90 and its radiation dose is low⁽³²⁾. Among 250 women older than 60 years of age, the frequency of sarcopenia ranged from 4 to 14%. A higher frequency was observed when the cut-off values suggested by the EWGSOP1 and IWG were used. We have found significant differences between: strength, fat (%) and height (m) values according to different definitions. Regardless of the applied consensus criteria a higher prevalence was found among people older than 80 years (27,5% p<0.05). These results suggest that variability of sarcopenia diagnosis published in literature is mainly influenced by a lack of consensus in diagnostic criteria. Currently Argentina paradoxically doesn't count with self-reference data values for diagnosis of sarcopenia, depending mostly on published data available from other countries and population, which, certainly shouldn't be extrapolated in light of our obvious differences. It becomes essential to achieve an unanimous consensus for sarcopenia, allowing us to look further and walk together, pursuing strategies for better identification, treatment and prevention.

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Conflict of interests:

None to declare.

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