ORIGINAL ARTICLE

Prevalence of sarcopenia in community-dwelling older people of Mexico City using the EGWSOP (European Working Group on Sarcopenia in Older People) diagnostic criteria

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Abstract

Background The aim of this study is to determine the prevalence of sarcopenia in community-dwelling older people living in Mexico City using the EGWSOP (European Working Group on Sarcopenia in Older People) diagnostic criteria that include muscle mass, muscle strength and physical performance.

Methods The sample population was based on older people (≥60 years) affiliated with the Mexican Institute of Social Security in Mexico City. Data were derived from the database of the "Cohort of Obesity, Sarcopenia and Frailty of Older Mexican Adults" (COSFOMA). Sarcopenia was diagnosed using the EGWSOP criteria: gait speed (4 m) <0.8 m/s; handgrip strength (using a dynamometer) <20 kg in women or <30 kg in men, and muscle mass index (MMI) <6.1 kg/m^2 in women or <8.5 kg/m^2 in men (using bioelectrical impedance analysis, BIA).

Results Thousand hundred seventy-seven subjects were included (median age 68.4 years, 60.2% women). 20.5% had low gait speed (19.1% women and 22.6% men); 62.4% had low handgrip strength (69.9% women and 51.2% men) and 12.3% had low muscle mass (9.9% women and 16.0% men). Only 9.9% of older people with sarcopenia (9.0% women and 11.1% men): 1.9% with severe sarcopenia (1.4% women and 2.6% men) and 8.0% with moderate sarcopenia (7.6% women and 8.5% men).

Conclusions Sarcopenia is present in one of ten community-dwelling older people residing in Mexico City. According to what has been reported in the literature, the prevalence of sarcopenia in older Mexican adults is similar to the community-dwelling population.

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Introduction

Sarcopenia is a concept that has evolved during the last decade and its current definition includes, in addition to loss of muscle mass, the presence of poor muscle function (strength or performance) [1, 2]. Older people with sarcopenia have a higher risk of adverse events such as the presence of physical disability, poor quality of life and death [1–3].

The reported prevalence of sarcopenia in a systematic review, which included 18 studies that used the diagnostic criteria of muscular mass and muscular strength or physical performance according to the proposal by the European Working Group on Sarcopenia in Older People (EWGSOP), between 1% and 29% (up to 30% in women)

was observed in community-dwelling older people; however, this range is related to the diversity of methods, cut-offs and populations studied, which need to take into account ethnicity diversity on the variability of the prevalence [4].

It should be mentioned that none of the studies selected examines an adult Latin American population. On the other hand, there are isolated studies reporting the prevalence of sarcopenia in older people in Mexico City performed from surrogate measures and without reference values from the young adult population [5–7]. The clinical implication of these studies may be under- or overestimate real prevalence of sarcopenia. Therefore, the present study aims to determine the prevalence of sarcopenia in community-dwelling older people living in Mexico City using the EGWSOP diagnostic criteria.

Methods

Study design and subjects

A baseline cross-sectional was carried out using data from the "Cohort of Obesity, Sarcopenia and Frailty of Older Mexican Adults" (COSFOMA), at April–September 2014. The rate of participation of the 1547 older people who were contacted and invited to participate in the COSFOMA was 80.9% (n=1252). The original study sample was 1252 adults >60 years of age selected through simple random selection from the list of older people affiliated with the 48 Family Medicine Units of the Mexican Institute of Social Security from Mexico City. Finally for this study, only 1177 older community-dwelling adults who had no contraindications to having a bioelectrical impedance analysis (BIA) performed were included.

The COSFOMA protocol was approved by the National Commission of Scientific Research and Ethics Commission for Health Research (COMBIOETICA09CE101520130424) of the Mexican Institute of Social Security (Registry No. 2012-785-067). Written informed consent was obtained from all participants.

Setting

The Mexican Institute of Social Security is a Mexican social security institution that provides health coverage to salaried workers and their families for preventive and curative medical services as well as providing economic pension benefits for disability and retirement. The beneficiaries are affiliated with a Family Medicine Unit based on their place of residence. There are 48 Family Medicine (units primary care services) located in Mexico City. The Mexican Institute of Social Security covers 36.5% of the population in Mexico City and ~50.9% of older people [8].

Measurements

Participant evaluations were carried out in eight Family Medicine Units that covered four quadrants of the southern area and four quadrants of the northern area of Mexico City. Participants with scheduled visits came to the Family Medicine Units located closest to their place of residence. Data collection was performed by healthcare professionals from April–September 2014 and was obtained via a questionnaire and evaluation scales to determine the sociodemographic characteristics (gender, age, marital status, education, paid employment, living alone), consumption of tobacco or alcohol, comorbidity (chronic diseases diagnosed by a physician), cognitive impairment (Mini-Mental State Examination, MMSE) [9,10], depression (Center for Epidemiologic Studies Depression Scale-Revised (CESD-R) [11,12], and polypharmacy (≥5 drugs) [13]. Height and weight were taken following standardized procedures [14].

Body composition was evaluated using bioelectrical impedance analysis (BIA). BIA-resistance (ohms, Ω), was obtained using a model BIA 101 (RJL Systems, Inc. Clinton Township, MI) with an operating frequency of 50 kHz at 800 μA. Whole-body BIA measurements were taken between the wrist and ankle whit the subject in a supine position [15]. BIA has emerged as a valid alternative for the assessment of body composition, given that it is relatively quick and inexpensive and a large number of individuals can be examined in a shorter period of time across different settings. This is an alternative to more invasive and expensive methods like dual-energy X-ray absorptiometry, computerized tomography, and magnetic resonance imaging [16].

Sarcopenia was defined based on the criteria proposed by the EWGSOP [2]. An older adult was considered to have sarcopenia if their muscle mass index (MMI = muscle mass/height^2) was <6.1 kg/m^2 for women or 8.5 kg/m^2 for men. The cut-off points were obtained from a sample of 230 young adult volunteers who resided in the same region where the study sample was obtained (Appendix 1: Supplementary data and equation used), taking into consideration 2 SD below the mean of the MMI according the Janssen and coworkers equation [17], and also b) A cut-off point ≤0.8 m/sec was considered as low walking speed for 4 m or low handgrip strength <20 kg in women or <30 kg in men using a dynamometer (TKK 5001, Takei Scientific Instruments Co. Ltd., Tokyo, Japan) [2]. The stages of sarcopenia were established according to the EWGSOP: severe sarcopenia—reduced muscle mass with low speed and low handgrip strength; moderate

sarcopenia—reduced muscle mass with low walking speed or low handgrip strength; pre-sarcopenia—reduced muscle mass with preserved muscle function, and normal—muscle mass preserved with any degree of muscle function [2, 18].

Data Analysis

Data were analyzed using the program IBM-SPSS 23 (SPSS, Inc., Chicago, IL). Descriptive analysis was done by means of frequency for qualitative variables and mean (±SD) for quantitative variables. Comparison of the means was done using Student t-test for independent samples and chi square test or Fisher exact test for qualitative variables with a 95% confidence level.

Results

The sample was comprised of 1177 older people with a mean (±SD) age of 68.4 (7.1) years, 60.2% (n=708) women and 39.8% (n=469) men with a mean age of 68.6 (7.3) years and 68.1 (6.7) years (p=0.231), respectively. Table 1, shows frequency and distribution of the characteristics of the study population according to the gender. Risks behaviors as smoking and alcoholism were higher among men (13.2% vs 7.2%, p = 0.001 and 35.8% vs 18.5%, p <0.001 respectively). While adverse health status was higher among women, presence of any comorbidity (45.2% vs 53.8%, p = 0.009), cognitive impairment (18.6% vs 28.0%, p <0.001) and depression (19.6% Vs 37.0%, p <0.001), however polypharmacy was similar between gender.

Table 2, shows anthropometric measurements and body composition (mean ± SD). For all measurements, there were statistically significant genders differences. It should be highlighted that among women the average handgrip strength was lower than the cut-off point reported by the EWGSOP (<20 kg) [2] and the mean BMI in both genders is classified as overweight.

According to the patterns of the criteria for diagnosis of sarcopenia, 12.3% (n=145) of older people had low muscle mass with or without change in the other patterns of evaluation, 9.9% (n=70) in women and 16.0% (n=75) in men (p=0.002). For low walking speed, there were 20.5% (n=241), 19.1% (n=135) women and 22.6% (n=106) men (p=0.141); 62.4% (n=735) with low handgrip strength, 69.9% (n=495) women and 51.2% (n=240) men (p<0.001). Table 3 shows the frequency and distribution by gender.

The prevalence of sarcopenia was 9.9% (n=116) in all older people, in women 9.0% (64) and 11.1% (40) in men. The presence of sarcopenia in all older people was 6.3% (n=48) in the 60- to 69-year-old age group, 10.3% (n=32) in the 70- to 79-year-old age group, 31.4% (n=32) in the 80- to 89-year-old age group and 57.2% (n=4) in the group 90 years and older. In women, it was 5.4% (n=24) in the group 60- to 69-years of age, 10.4% (n=20) in the group 70- to 79-years of age, 25.7% (n=18) in the group 80- to 89-years of age and 50.0% (n=2) in the group 90 years and older. For men, it was 7.7% (n=24) in the 60- to 69-year-old group, 10.1% (n=12) in the 70- to 79-year-old group, 43.8% (n=14) in the 80- to 89-year-old group and 66.7% (n=2) in the group 90 years and older.

Table 4 shows the frequency and distribution of the stages of sarcopenia according to the EWGSOP; 1.9% (n=22) of older people presented severe sarcopenia, 8.0% (n=94) moderate sarcopenia, 2.5% (n=29) pre-sarcopenia and 87.7% (n=1,032) had normal results.

Table 1 Characteristics of older community-dwelling adults in Mexico City.

	Females % (n)	Males % (n)	Total % (n)	p*
Age (years)				
60-69 years	62.6 (443)	67.2 (315)	64.4 (758)	.233
70-79 years	27.0 (191)	25.4 (119)	26.3 (310)	
80-89 years	9.9 (70)	6.8 (32)	8.7 (102)	
≥90 years	0.6 (4)	0.6 (3)	0.6 (7)	
Marital status				
Widow	27.3 (193)	8.3 (39)	19.7 (232)	<.001
Single	26.0 (184)	12.8 (60)	20.7 (244)	
Married/Free union	46.8 (331)	78.9 (370)	59.6 (701)	
Education				
None	4.1 (29)	3.6 (17)	3.9 (46)	.046
1-6 years	35.2 (249)	28.6 (134)	32.5 (383)	
7 and more years	60.7 (430)	67.8 (318)	63.6 (748)	
Paid employment				
Yes	73.9 (167)	87.8 (202)	80.9 (369)	<.001
Live alone				
Yes	10.7 (76)	9.8 (46)	10.4 (122)	.610
Tobacco use				
Yes	7.2 (51)	13.2 (62)	9.6 (113)	.001
Alcohol consumption				
Yes	18.5 (131)	35.8 (168)	25.4 (299)	<.001
Co-morbidity				
≥3	9.3 (66)	6.4 (30)	8.2 (96)	.009
1-2	44.5 (315)	38.8 (182)	42.2 (497)	
0	46.2 (327)	54.8 (257)	49.6 (584)	
Cognitive decline				
Yes	28.0 (198)	18.6 (87)	24.2 (285)	<.001
Depression				
Yes	37.0 (262)	19.6 (92)	30.1 (354)	<.001
Polypharmacy				
Yes (≥5 drugs)	25.1 (178)	21.5 (101)	23.7 (279)	.154

***χ2 test.**

Table 2 Anthropometric characteristics of older community-dwelling adults in Mexico City.

	Females (n=708)	Males (n=469)	
	Mean (SD)	Mean (SD)	p
Height (cm)	151.6 (6.7)	163.6 (7.0)	<.001
Weight (kg)	66.0 (14.2)	74.4 (17.7)	<.001
Body mass index (kg/m^2)	28.7 (5.8)	27.8 (6.7)	.019
Muscle mass (kg)	16.7 (3.0)	26.1 (3.7)	<.001
MMI (kg/m^2)	7.2 (1.1)	9.8 (1.1)	<.001
Walking speed (m/s)	1.2 (0.7)	1.1 (0.6)	<.001
Handgrip strength (kg)	17.9 (5.1)	30.4 (6.9)	<.001

MMI, muscle mass index.

Table 3 Frequency and distribution of the patterns of the criteria for diagnosis of sarcopenia proposed by the EWGSOP.

Criteria	Females	Males	Total
Low muscle mass/low walking speed/low Handgrip strength Yes (Y)/No (N)	**% (n)**	**% (n)**	**% (n)**
Y/Y/Y	1.4 (10)	2.6 (12)	1.9 (22)
Y/Y/N	0.3 (2)	1.5 (7)	0.8 (9)
Y/N/Y	7.3 (52)	7.0 (33)	7.2 (85)
Y/N/N	0.8 (6)	4.9 (23)	2.5 (29)
N/Y/Y	12.0 (85)	8.3 (39)	10.5 (124)
N/Y/N	5.4 (38)	10.2 (48)	7.3 (86)
N/N/Y	49.2 (348)	33.3 (156)	42.8 (504)
N/N/N	23.6 (167)	32.2 (151)	27.0 (318)

p <.001.
EWGSOP, European Working Group on Sarcopenia in Older People.

Table 4 Frequency and distribution of the stages of sarcopenia in accordance with the EWGSOP in older community-dwelling adults.

	60–69 years	70–79 years	80–89 years	≥90 years	Total
Females	**% (n)**	**% (n)**	**% (n)**	**% (n)**	**% (n)**
Severe sarcopenia	0.7 (3)	1.0 (2)	5.7 (4)	25.0 (1)	1.4 (10)
Moderate sarcopenia	4.7 (21)	9.4 (18)	20.0 (14)	25.0 (1)	7.6 (54)
Pre-sarcopenia	0.7 (3)	1.6 (3)	0.0 (0)	0.0 (0)	0.8 (6)
Normal	93.9 (416)	88.0 (168)	74.3 (52)	50.0 (2)	90.1 (638)
					p <.001
	60–69 years	**70–79 years**	**80–89 years**	**≥90 years**	**Total**
Males	**% (n)**	**% (n)**	**% (n)**	**% (n)**	**% (n)**
Severe sarcopenia	2.9 (9)	0.0 (0)	9.4 (3)	0.0 (0)	2.6 (12)
Moderate sarcopenia	4.8 (15)	10.1 (12)	34.4 (11)	66.7 (2)	8.5 (40)
Pre-sarcopenia	6.0 (19)	3.4 (4)	0.0 (0)	0.0 (0)	4.9 (23)
Normal	86.3 (272)	86.6 (103)	56.3 (18)	33.3 (1)	84.0 (394)
					p<.001
	60-69 years	**70–79 years**	**80–89 years**	**≥90 years**	**Total**
Total	**% (n)**	**% (n)**	**% (n)**	**% (n)**	**% (n)**
Severe sarcopenia	1.6 (12)	0.6 (2)	6.9 (7)	14.3 (1)	1.9 (22)
Moderate sarcopenia	4.7 (36)	9.7 (30)	24.5 (25)	42.9 (3)	8.0 (94)
Pre-sarcopenia	2.9 (22)	2.3 (7)	0.0 (0)	0.0 (0)	2.5 (29)
Normal	90.8 (688)	87.4 (271)	68.6 (70)	42.9 (3)	87.7 (1,032)
					p <.001

Discussion

In our study, we observed a prevalence of sarcopenia of 9.9% (9.0% in women and 11.1% in men), which is within the range (1% to 29%) reported in the literature in community-dwelling older people using the criteria proposed by the EWGSOP [4]. A study conducted in one of the 16 Mexico City delegations [7] reported a prevalence of sarcopenia in 116 persons aged 70 years or older from 33.6% (48.5% in women and 27.4% in men). It should be mentioned that in this study a cut-off point for muscle mass was considered to be <31 cm calf circumference. In our study it was observed that among persons aged 70 years and older the prevalence was 16.2% (15.1% in women and 18.2% in men). The differences in the prevalence reported in the literature with our results appear to be attributed to the age of the population and to the methods used for the evaluation as well as cut-off points used for the diagnosis of sarcopenia [19]. Though, previous studies, remark the special value of comparison of elderly population with the subjects under similar characteristics, to reflect with precision the trend of sarcopenia prevalence [20-23]. Our study could be considered as one of the first studies referent to describe the prevalence of sarcopenia in urban community-dwelling older people in Latin America. However, a recent study about prevalence of sarcopenia in community-dwelling older people living in a mountain region of Peruvian Andes, and evaluated by the International Work Group Sarcopenia (IWGS), could be taken as reference of indigenous Latin American population [24]. As previously mentioned, in our study we used the criteria proposed by the EWGSOP [4], adjusting the cut-off point for muscle mass in our study population as recommended in place of using another cut-off point for a population different from ours [4, 23]. The cut-off point was obtained from a group of young adult volunteers in our study population. Different studies have reported a fluctuation as cut-off point for low muscle mass between MMI <5.5 kg/m^2 and MMI <7.4 in women and MMI <7.3 kg/m^2 to MMI <9.2 kg/m^2 in men [23, 25, 26]. The cut-off point used in our study for low muscle mass is within the range mentioned previously (MMI <6.1 kg/m^2 in women and MMI <8.5 kg/m^2 in men). Additional studies in different populations need to be analyzed [20, 21, 26-28].

In this study, we used the BIA because it is one of the methods used for the evaluation of adequate muscle mass both for functionally independence subjects and bedridden subjects [2], with a standard error of the estimate for the prediction of BIA muscle mass from 9% [17]. BIA has been considered a good alternative to DEXA (dual energy X-ray absorptiometry)

because of its availability, speed, non-invasiveness, low cost, easy reproducibility and practice in its operation, as well as not requiring a skilled, high-level operator [2, 16, 23].

Among the patterns of diagnostic criteria for sarcopenia, it has been observed that 10.5% (12.0% in women and 8.3% in men) of older people have low walking speed and low handgrip strength, preserving muscle mass. These subjects did not present sarcopenia in accordance with the criteria proposed by the EWGSOP. It has been considered that measurement of muscle mass could differentiate persons with frailty from those who may have sarcopenia [18, 27, 28]. A recent study clearly indicates that sarcopenia and frailty are two different entities based on existing definitions. Therefore, it is recommended that the diagnosis for sarcopenia and frailty be made as separate entities as well as their treatment considerations [19].

The prevalence of sarcopenia is higher in men and increases with age [19] as reported in our study. Statistically significant differences were maintained in all measurements relative to sarcopenia by gender. It has been suggested that the decrease in fat free mass among older men is related to the catabolic influence of myostatin as a negative regulator of muscle mass growth, whereas the reduction of type I insulin growth factor (IGF1) could contribute to the chronic anabolic deterioration relative to age in the muscle mass of women [30].

It is noteworthy that in our study there was a decrease in handgrip strength below the cut-off point, higher in women compared with men. Coincidental with prior studies, it has been observed that gender differences in regard to muscle strength could be explained based in the distribution of body lean mass, men tend to have greater amounts of upper body lean mass [31], meanwhile women tend to have a lower production of muscle fibers [32], however, the muscular fiber quality among gender is similar and it doesn´t explain strength differences [33].

One limitation of this study may be the representation of the sample for Mexico City, taking into consideration that only ~50.9% of older people from Mexico City are beneficiaries of the Mexican Institute of Social Security [8]. In addition, the participation of the young adults in the study was voluntary and possibly gave rise to a selection bias for those persons with higher interest in health self-care.

Sarcopenia has become a health condition associated with aging and represents a potential public health problem due to its multiple clinical, more hospitalization days and social consequences, all these aspects have an important economic burden for health care, both for the patient and for society [19, 34]. The detection of sarcopenia could lead to improving health and offers an opportunity for implementing preventive and treatment interventions of sarcopenia in community-dwelling older people.

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The authors certify that they comply with the ethical guidelines for publishing in the Journal of Cachexia, Sarcopenia and Muscle: update 2015 [35].

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Conflicts of interest

The authors declare that they have no conflict of interest.

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Appendix 1: Supplementary data

Conformation and sample size of a healthy young reference group (18–40 years old) for cut-off point of low muscle mass

For definition of reference values for low muscle mass for the study population, anthropomorphic evaluation was done (weight and height) and body composition with a bioelectrical impedance analysis (BIA) using a device from BIA 101 (RJL Systems, Inc. Clinton Township, MI) in a sample of healthy young adult volunteers (18–40 years of age).

The BIA 101 device is suitable for determination of Fat Free Mass (FFM) and total body water (TBW) in subjects without significant pathologies of liquids and body electrolytes [1]. It works well in healthy subjects and with chronic diseases [2], it is advisable to evaluate limb composition because it allows a better evaluation of intra cellular water since it employs a frequency of 50 kHz at 800 µA [3,4].

BIA-resistance, was measured with a model BIA 101 (RJL Systems, Inc. Clinton Township, MI) with an operating frequency of 50 kHz at 800 µA. Whole body measurements were taken with the subject in a supine position on a non-conducting surface, with the arms slightly abducted from the trunk and the legs slightly separated. Surface electrodes were placed on the right side of the body on the dorsal surface of the hands and feet proximal to the metacarpal-phalangeal and metatarsal-phalangeal joints, respectively, and also medially between the distal prominences of the radius and ulna and between the medial and lateral malleoli at the ankle [5, 6]. All resistance measurements were adjusted for stature (height cm^2/ohms) [6], Bioelectrical impedance analysis with BIA 101, have a high correlations coefficients with DXA (gold standard) (r=0.87 at 0.98, p<0.001), evaluated on previous study with until 12 months of follow-up [7].

The presence of low muscle mass was defined as a cut-off point at 2 SD below the mean of the muscle mass of the sample of young adults. Muscle mass was calculated using the formula of Janssen et al. [6]:

Muscle mass (kg) = [(height^2/BIA-resistance * 0.401) + (gender * 3.825) + (age * -0.071)] + 5.102 where height is in cm; BIA-resistance is in ohms (Ω); for gender, females=0 and males=1; and age in years.

Sample calculation was based on prior studies. A sample of 230 young adults was considered as the minimum size [8-10]. Demographic variables were analyzed (gender and age), anthropometry (weight and height), muscle mass and muscle mass index (MMI=muscle mass/height^2).

The sample was comprised of 230 young adults, 60.0% (n=138) women and 40.0% (n=92) men. Low muscle mass was considered as an MMI <6.1 kg/m^2 in women and 8.5 kg/m^2 in men.

Supplementary Table 1. Characteristics of the sample of adult volunteers (18-40 years)

	Females (n=138)	Males (n=92)	p
	Mean (SD)	Mean (SD)	
Age (years)	26.8 (6.9)	28.0 (7.2)	.190
Height (m)	157.2 (5.8)	170.1 (6.9)	<.001
Weight (kg)	62.4 (15.1)	76.9 (14.3)	<.001
Muscle mass (kg)	19.4 (2.5)	31.0 (3.7)	<.001

MMI (kg/m^2)	7.9 (0.9)	10.7 (1.1)	<.001

SD, standard deviation; MMI, muscle mass index.

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