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Research paper

Prevalence of sarcopenia in Mexico City

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ABSTRACT

Sarcopenia is an increasingly recognized problem in the elderly. Recently an algorithm to detect this condition was developed. The aim of our study was to determine the prevalence of sarcopenia in a group of elderly in Mexico City, using the European Wording Group on Sarcopenia in Older People (EWGSOP) algorithm. A cross-sectional assessment of community dwelling elderly was performed in a sample of 345 subjects, who were 70 years or older, during the year of 2008. The data was gathered by a group of standardized interviewers. In order to determine sarcopenia, muscle mass, muscle strength and physical performance were obtained from database. Muscle mass was measured by means of calf circumference, muscle strength by grip strength and physical performance by gait speed. Cut-points suggested in the EWGSOP algorithm of sarcopenia detection (ASD) were used. A total number of 116 (33.6%) subjects were detected as sarcopenic, 75 (48.5%) women and 41 (27.4%) men; with a greater prevalence in 80-year or older subjects (50.4%). Sarcopenic obesity was found in five subjects (1.4%), moderate sarcopenia in 21 subjects (6%) and severe sarcopenia in 94 subjects (27.2%). The ASD of the EWGSOP is a useful tool for detecting sarcopenia prevalence; the frequency in our population was similar to other reports using other methodology.

1. Introduction

Since one of its first definitions, sarcopenia has been characterized as a muscle deficiency; evolving to a construct that involves loss of skeletal muscle mass, muscle strength loss, and a lower physical performance [1,2]. Different factors contribute to its development, some of them are: age, nutrition, sedentary life style, immobility, cognition and chronic diseases [3,4]. Nowadays there is not a consensus about how to determine it, specially which instruments to use in order to assess each one of its components [5]. Large population-based studies have reported prevalence between 8 and 50%, in people over 50 years, varying according to ethnicity, place of residence, age and the diagnostic method used [6].

Sarcopenia represents a marked change in health status and is associated with adverse outcomes such as falls, fractures, functional decline, increased mortality, and low quality of life scores [7–9]. In addition, there is a high economic burden for health institutions (18.5 billion of dollars), when it comes to sarcopenia treatment [10].

Regarding the measurement for each of the components of the sarcopenia construct (muscle mass loss, muscle strength loss and low physical performance), there is still not a consensus. For example, muscle mass could be measured with magnetic resonance, computed tomography, dual-energy X-ray absorptiometry (DEXA) and calf circumference; with different accuracy and costs [11].

The aim of our study was to determine the prevalence of sarcopenia using the European Wording Group on Sarcopenia in Older People (EWGSOP) algorithm of sarcopenia detection (ASD).

2. Material and methods

This study is nested in a cohort of Mexico City, which was integrated in 2008, and has been followed since. The inclusion criteria were: subjects over the age of 70 years of age residing in Mexico City (Coyoacan), with the city's maintenance card, which signed informed consent and agreed to join the cohort. The only exclusion criterion was the inability to provide information required. This cohort was sponsored by a group of academic and governmental institutions. Planning of this cohort started in 2007 with a stratified sampling of Coyoacan, one of the most representative counties in Mexico City, due to its sociodemographic composition; which resulted in a total of 1124 70-year or older subjects. Sampling was probabilistic and stratified regarding socioeconomic status in order to assure representativeness. For purposes of this report, a subsample of 345 subjects was selected, that corresponded to those subjects having all the information

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needed to integrate the EWGSOP ASD. To assess the power of the subsample; we used the two proportions formula for power, and based on the review of von Haehling et al. [12], where a range of sarcopenia prevalence was presented (from 11% to 50%) corresponding to a 99.8% power to a 345 subject number [13]. Due to sample bias concerns, we compared between the subsample and the entire cohort variables such as age, gender, marital status, scholarship, body mass index (BMI), number of comorbidities, number of medicines, activities of daily living (ADL) scores, instrumental activities of daily living (IADL) scores, Mini-Mental Status Examination (MMSE) scores, Center of Epidemiologic Studies Depression Scale (CES-D) scores, Mini Nutritional Assessment (MNA) scores.

A group of trained and standardized interviewers visited the home address of the subjects, inviting to participate in the study; those who accepted were visited a second time. The questionnaire included a different set of variables, some of them as individual questions, others included in validated indexes. Additional evaluations included blood samples and dental assessment, which were not included in this report. The interview was done in the presence of the caregiver or a family member, and had an approximate duration of three hours, done in a single visit.

The main variables were grouped in issues: general characteristics, anthropometry, clinical and sarcopenia. Age in years, gender, scholarship (in years) and if the subject had a couple (married or not) were included in the first category. Regarding anthropometry weight, knee height, body mass index, grip strength, gait speed and calf circumference were measured. Clinical variables included: cognition, depression, anxiety, ADL, IADL, balance and gait, nutrition status, abuse, number of comorbidities, number of drugs used, weight loss, smoking, ischemic heart disease, stroke, hypertension, cancer and diabetes. Finally, sarcopenia was defined with the EWGSOP ASD, along with presarcopenia, moderate sarcopenia, severe sarcopenia, and sarcopenic obesity.

The ASD combines an estimate of muscle quantity, muscle function and physical performance. Muscle quantity or muscle mass was determined by calf circumference measured by a millimeter graded tape, registering it in centimeters, with up to two decimals. A cut-point of less than 31 cm was considered lower muscle mass, as described by Rolland et al. [14]. Muscle function was measured by means of grip strength, with cut-points adjusted for gender: 20 kg for women and 30 kg for men, meaning low muscle functioning; grip was tested in the dominant hand, in three repetitions with a hand dynamometer (Takei Ltd., Tokyo, Japan). Finally, physical performance was assessed with gait speed calculated from the 4 m walk included in the Short Physical Performance Battery with a cut-point of less than 0.8 m/s for low physical performance. Presarcopenia was defined as low muscle mass only, moderate sarcopenia as the combination of either low physical performance or low muscle strength in addition to low muscle mass and severe sarcopenia when the three conditions were present, as described in the EWGSOP report [7]. Finally, sarcopenic obesity was determined in those subjects who had a knee-height adjusted BMI higher than 30 kg/m^2 in addition to sarcopenia by means of the ASD.

Anthropometry was performed with standardized and calibrated equipment, and systematic protocols of measurement, with weight in kilograms and height in meters. Adjusted knee height was calculated according to Chumlea et. al. [15] with the following formulas:

- women: $84.88 - (0.24 \times \text{age}) + (1.83 \times \text{knee height})$;
- men: $64.19 - (0.04 \times \text{age}) + (2.02 \times \text{knee height})$.

Table 1
General characteristics.

Characteristics	Gender		
	Men (n = 161)	Women (n = 184)	Total (n = 345)
Age, mean (SD), years	78.5 (7)	78.6 (7)	78.5 (7)
Scholarship, mean (SD), years	6 (5)	5 (5)	5 (5)
With a couple, No. (%)	89 (55.2)	53 (28.8)	142 (41.1)
Weight, mean (SD), kilograms	69.2 (12.9)	60.6 (11)	64.6 (12.7)
Height, mean (SD), meters	1.6 (0.72)	1.47 (0.63)	1.53 (0.93)
Adjusted height, mean (SD), meters	1.62 (0.54)	1.5 (0.56)	1.56 (0.83)
BMI, mean (SD), kg/m^2	26.52 (3.7)	27.8 (4.9)	27.2 (4)
Adjusted BMI, mean (SD), kg/m^2	26.03 (4)	26.8 (4.8)	26.4 (4.5)
Stratified adjusted BMI			
Underweight, no. (%)	6 (3.7)	5 (2.7)	11 (3.2)
Normal, no. (%)	44 (27.3)	41 (22.3)	85 (23.2)
Overweight, no. (%)	83 (51.5)	86 (46.7)	169 (48.1)
Obese, no. (%)	28 (17.4)	52 (28.2)	80 (22)
Calf circumference, mean (SD), centimeters	34.3 (3.6)	33 (4)	33.6 (3.83)
Grip Strength, mean (SD), kg	25.2 (7.7)	15.4 (4.6)	19.9 (7.9)
Gait Speed, mean (SD), m/s	0.74 (0.29)	0.61 (0.25)	0.67 (0.27)
MMSE, mean (SD)	21 (6)	20 (6)	21 (6)
CES D, mean (SD)	9 (7)	15 (10)	12 (9)
Anxiety, mean (SD)	23 (3)	22 (4)	23 (3)
Katz, mean (SD)	5 (1)	5 (1)	5 (1)
Lawton, mean (SD)	5 (1)	6 (1)	5 (1)
TUG, mean (SD), s	13.31 (10.73)	15.39 (10.31)	14.42 (10.54)
MNA, mean (SD)	25.62 (2.95)	24.8 (3.23)	25.18 (3.13)
Number of Comorbidities, mean (SD)	4 (3)	4 (2)	3 (3)
Number of drugs, mean (SD)	3 (3)	3 (3)	4 (2)
Ischemic cardiopathy, no. (%)	15 (9.3)	10 (5.4)	25 (7.2)
Stroke, no. (%)	9 (5.6)	5 (2.7)	14 (4)
Hypertension, no. (%)	82 (50.9)	118 (64.1)	200 (56)
Cancer, no. (%)	6 (3.7)	13 (7)	19 (5.5)
DM, no. (%)	47 (29.2)	37 (20.1)	84 (24.3)
Frail, no. (%)	60 (40.5)	88 (59.4)	148 (42.8)

Table 2
Sarcopenia prevalence by gender, age groups, number of comorbidities and Timed-Up and Go test.

Age/Gender	Men (n = 161)	Women (n = 184)	Total (n = 345)
< 80, no. (%) (n = 234)	20 (8.5)	40 (17)	60 (25.6)
80 or older, no. (%) (n = 111)	21 (18.9)	35 (31.5)	56 (50.4)
Number of comorbidities, mean (SD)	3.41 (2.43)	4.07 (2.36)	3.84 (2.39)
TUG, mean (SD)	13.43 (5.61)	16.71 (10.72)	15.55 (9.35)
Total, no. (%)	41 (27.4)	75 (48.5)	116 (33.6)

TUG: Timed-Up and Go; SD: standard deviation.

BMI was calculated with the resulting height in kg/m^2, and then stratified according to WHO cut-points (less than 18.5 underweight, 18.5 to 25 normal, from 25 to 30 overweight and over 30 obese).

The instruments used to assess the different aspects of geriatric conditions were validated in Spanish [16–21]. Number of comorbidities and drugs used were assessed with an open question, then specific diseases were asked on purpose; diabetes, hypertension, stroke, cancer and ischemic heart disease. Frailty was assessed with the Study of Osteoporotic Fractures (SOF) index, where frailty is considered present if two items out of three (lack of energy self-report, weight loss and inability to rise from a chair five times) [22]. Health self-perception was asked with a Likert scale of four answers. Weight loss in the last 6 months was questioned, irrespective of intentionality. Smoking status was positive only if the subject was a current smoker.

Descriptive statistics were reported; for continuous variables, mean and standard deviations (SD) and for dichotomous or ordinal variables, absolute and relative frequencies; in order to summarize the general characteristics of the sample. Polynomial variables such as marriage status (having a couple or not) or health self-perception (bad or good) were dichotomized. In order to compare the entire cohort to the subsample, hypothesis tests were used, T-test for non-paired variables to those continuous variables and χ^2 test for dichotomous variables. We considered a $P < 0.05$ to be statistically significant. STATA 11 program was used for data analysis.

The ethics committee at our institution approved this study. All subjects in the study signed informed consent.

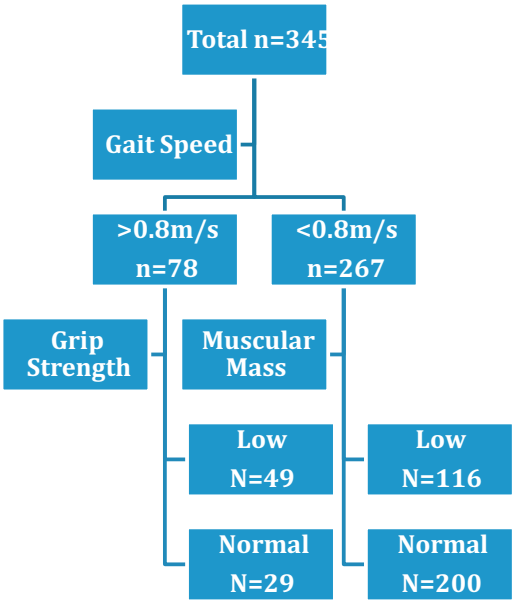

Fig. 1. Frequencies of the diagnostic algorithm.

Table 3
Normal, presarcopenic, moderate sarcopenia, severe sarcopenia and sarcopenic obesity frequencies.

Characteristic/gender	Men (n = 161)	Women (n = 184)	Total (n = 345)
Normal or presarcopenic, no. (%)	121 (75.1)	109 (59.2)	230 (66.6)
Moderate sarcopenia, no. (%)	10 (6.2)	11 (5.9)	21 (6)
Severe sarcopenia, no. (%)	30 (18.6)	64 (34.7)	94 (27.2)
Sarcopenic obesity, no. (%)	0 (0)	5 (2.7)	5 (1.4)

3. Results

Of the 345 subjects, 53.3% were women; and the mean age of the entire sample was of 78.5 (SD 7) years. The average of attending school years was of 5 (SD 5) and the frequency of the subjects with a couple was of 41.1% (n = 142) (Table 1). The analysis to determine if there was a difference in the main variables between the subsample and the entire cohort was not statistically significant in any of them. Regarding anthropometry (Table 1), adjusted for knee height BMI had a mean of 26.4 (SD 4.5) kg/m^2, with 3.2% (n = 11) underweight, 23.2% (n = 85) normal, 48.1% (n = 169) overweight and 22% (n = 80) obese. Mean calf circumference was of 33.6 (SD 3.83) cm, mean grip strength 19.9 (SD 7.9) and mean gait speed 0.67 (SD 0.27) m/s. At least 35% of the subjects had difficulties with one ADL in contrast to the 98% of the subjects who had at least one difficulty with instrumental ADL. Mean scores for MMSE, CES D and anxiety were 21 (SD 6), 12 (SD 9) and 23 (SD 3), respectively. The mean score for the MNA test was 25.18 (SD 3.13). The mean number of drugs ingested was of 4 (2), with a frequency of 82.9 of the subjects with at least one drug. Regarding number of comorbidities, the mean number was of 3 (SD 3), with hypertension as the most frequent. On the other hand, comorbidities like ischemic heart disease were present in 7.2% (n = 25), stroke 4% (n = 14), hypertension 56% (n = 200), cancer 5.5% (n = 19), diabetes 24.3% (n = 84) and frailty 42.8% (n = 148) (Table 1).

With respect to sarcopenia prevalence, a total number of 116 (33.6%) subjects were detected, 75 (48.5%) women and 41 (27.4%) men; with a greater prevalence in 80-year or older subjects (50.4%) (Table 2 and Fig. 1). Sarcopenic obesity was found in five subjects (1.4%), moderate sarcopenia in 21 subjects (6%) and severe sarcopenia in 94 subjects (27.2%) (Table 3).

4. Discussion

To our knowledge, this is the first study to report prevalence of sarcopenia using the EWGSOP ASD. A study by Landi et. al. demonstrated a prevalence of 32.8%, a similar one to that found in our study; but in institutionalized elderly. This may be due to the different instruments used in each study, nevertheless both studies used the EWGSOP ASD [14,23]. Moreover, if sarcopenia is aimed to predict functional decline, using the algorithm in nursing homes could not be appropriate, because those elders have already the adverse outcome (functional decline); it has been suggested that

regarding the value of calf circumference predicting functional decline is "a cheap, simple, noninvasive measurement for a clinician and seems relevant in the screening of sarcopenia" [14]; applying the rest of the algorithm in addition to calf circumference makes the EWGSOP ASD an excellent tool to sarcopenia screening.

It is estimated that 5–13% of elderly people aged 60–70 years are affected by sarcopenia, and the numbers increase to 50% for those aged 80 or above [12]. The prevalence of sarcopenia varies between different populations, ages, gender, and diagnosis method and assessment tools. In this study, using the differential scheme proposed by the EWGSOP ASD, a prevalence of sarcopenia in the middle of the range was found [4,23,24]. If calf circumference was to be discarded due to recommendations of many authors, the prevalence of this condition would still be in range, because the percentage of those subjects with low physical performance or normal physical performance but low muscle strength was of 47.8% [7]. Nevertheless, other conditions could contribute to low physical performance or muscle strength (neuropathies, arthritis) [11].

The sarcopenia construct has been in permanent change, but there is greater consensus that the real definition should be based on muscle mass and strength as well as in physical performance, but how to measure each of the items remains with a lack of consensus. In addition, previous research on sarcopenia has been limited to muscle mass, as measured by DEXA or BIA with the limitation of lack of assessment of intramuscular fat tissue; or CT scan or MRI, with the limitation of the cost and the difficult access [1,5,14,25,26]. All of the above might help to explain why such marked differences in the prevalence rates reported in the different studies.

The majority of the sarcopenic elderly had a normal knee height adjusted BMI to the difference by sex, in contrast to other studies, where obesity or underweight has a predominant role in sarcopenia; this may be due in part to the adjustment of BMI to knee height, which has been reported to change the distribution of stratified raw BMI [15]. Also regarding to BMI, sarcopenic obesity was found in a very low proportion in comparison to other reports, this might be due to the sample and the greater mean age of our study [27].

Regarding the proposed classification of sarcopenia depending in the number of its components, it should be stressed that the definition of presarcopenia, although not well established, could have the potential of intervention early in the problem, and measuring muscle mass with calf circumference could not be appropriate to screen this condition [7]. The severity classification seems adequate, but there is still no clear significance of this classification.

Although it is a useful tool in assessing sarcopenia, there is still the need to validate it with adverse outcomes, such as functional decline, institutionalization, quality of life and preventable deaths. Also future studies should test sensibility to change of this algorithm in order to test interventions for sarcopenia.

5. Conclusions

The EWGSOP ASD used in Mexican population gave a global estimate of sarcopenia prevalence of 33.8% in community dwelling individuals older than 70 years, and showed that the EWGSOP is a useful tool to assess sarcopenia. It should be stressed that this report opens the door to other population studies with simple assessment techniques such as calf circumference measurement.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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