Prevalence of sarcopenia and associated factors in climacteric women of the Colombian Caribbean

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Abstract

Objective: The aim of the study was to determine the prevalence of sarcopenia and associated factors in climacteric middle-aged women.

Methods: This was a cross-sectional study carried out in Colombian Caribbean women (40-59 y, $n = 403$), who were surveyed with a form that included sociodemographic information and two validated tools (the Menopause Rating Scale and the SF-36 Health questionnaire). Calf circumference, handgrip, and gait speed were measured. Low muscle mass (calf circumference <31 cm), reduced muscle strength (<20 kg in handgrip), and lower physical performance (<0.8 m/s gait speed) were estimated. Criteria of the European Working Group on Sarcopenia in Older People were used to identify sarcopenia. Association between sarcopenia (dependent variable) and menopausal symptoms and health perception (independent variables) was estimated.

Results: Median age of surveyed women was 48 years, with 44.5% being postmenopausal. 9.6% had low muscle mass, 18.1% had reduced muscle strength, and 6.9% had lower physical performance. Presarcopenia was identified in 9.6% and sarcopenia in 7.9% (nonsevere sarcopenia 7.1% and severe sarcopenia 0.8%). Most important factors associated with sarcopenia were feeling full of life only sometimes, feeling a lot of energy only sometimes, having joint/muscular discomfort, history of hysterectomy, hot flashes, mestizo ethnic group, age 50 or more, being postmenopausal, and sleep problems.

Conclusions: Sarcopenia was present in this middle-aged female Colombian Caribbean sample and associated with various factors such as ethnicity, age, and menopausal symptoms and status.

Key Words: Climacteric – Middle-age – Perimenopause – Risk factors – Sarcopenia.

T he word sarcopenia derives from the Greek root ''sarco'' which means meat/muscle and ''penia'' deficiency/decrease.[1-3] The European Working Group on Sarcopenia in Older People (EWGSOP)[1] defined sarcopenia as the syndrome characterized by the gradual and generalized loss of skeletal muscle mass with progressive loss of muscle strength and risk of adverse events such as falls, physical disability, poor quality of life, and increased mortality. As it is a pathological condition that can be prevented, it is important to implement actions that entail its early detection and appropriate health interventions.[4-8]

Etiology of sarcopenia is complex and multifactorial, accelerated by sedentary lifestyle, malnutrition, and various morbidities.[2,3,8] In women, menopause is also a factor that increases muscle deterioration due to different hormonal changes, including estrogenic decrease.[5,9-12]

In recent years, several sarcopenia diagnostic classifications have been established. Although some differ in several aspects, the most widely accepted include the EWGSOP,[1] the Foundation for the National Institutes of Health Biomarkers Consortium Sarcopenia Project (FNHI),[13] the International Working Group on Sarcopenia (IWGS),[4] the Asian Working Group for Sarcopenia (AWGS),[14] and the Society of Sarcopenia, Cachexia and Wasting Disorders.[15]

The EWGSOP[1] proposed an algorithm for the diagnosis or suspicion of sarcopenia based on three criteria: low muscle mass, decreased muscular strength, and lower physical performance. They also set the following classification: (1) presarcopenia; low muscle mass as the only criterion without affecting muscle strength or lower physical performance; (2) sarcopenia; low muscle mass with decreased muscle strength or lower physical performance; and (3) severe sarcopenia; when all three criteria are present.

Sarcopenia has been documented extensively in older populations, but data from middle-aged women are warranted. Identifying sarcopenia at younger age favors prompt multidisciplinary intervention that will decrease possible related complications and modify the socioeconomic burden that this syndrome creates for the healthcare system.[5,8] There are gaps in knowledge regarding sarcopenia in Latin

American women, who have their own ethnical, cultural, behavioral, and nutritional connotations. The objective of this research was to determine the prevalence of sarcopenia and associated factors in climacteric middle-aged women.

METHODS

Participants

This was a cross-sectional study part of Calidad de Vida en la Menopausia y Etnias Colombianas (CAVIMEC) research project, which included healthy women (40-59 y) living in Cartagena in the Colombian Caribbean. Participants were invited to participate in their communities of residency by a registered nurse, previously trained, who completed surveys by conducting door-to-door visits. Women were informed of the anonymous and voluntary nature of the study, the scope of the research, the tools to be used, and they were requested to provide signed consent of participation. Helsinki standards on human studies were used. Pregnant women; those affected by chronic or acute physical disabilities in the lower limbs that affected motion; those affected by an entity in the upper limbs that prevented the measurement of muscle strength; and those with cognitive mental disorders, degenerative neuromuscular disease, collagen disease, or with malignant pathological conditions under treatment were excluded.

Tools used

A survey form was designed that included the evaluation of sociodemographic variables (age, ethnicity, years of study, educational level, occupation or work activity, and number of children). Ethnicity was determined by self-recognition and racial phenotypic characteristics. Medical (hypertension, diabetes mellitus, depression, arthritis/osteoarthritis, and use of hormone therapy) and gynecological surgical history (hysterectomy and oophorectomy) were included.

The form also contained two quality of life scales: the Menopause Rating Scale (MRS) and the SF-36 Health Survey (version 2) in its Spanish version (SF-36v2 Health Survey 1996). The MRS is a specific tool used to assess the presence and severity of menopausal symptoms as well as the impairment of quality of life. The MRS has been widely used and validated in several languages.[16] The SF-36 is a universal instrument that evaluates the general perception of health condition.[17]

The following anthropometric measurements were assessed and recorded. Body weight (kg) was measured on a digital scale (Kex-Germany) by having participants stand barefoot with minimal clothing, no accessories, and nothing held in their hands. Height (m) was measured with a fixed stadiometer, with women standing barefoot and with heels, gluteus, back, and head against the stadiometer surface. Waist circumference (cm) was measured at the level of the umbilicus, obtaining data with a tape measure. Abdominal obesity was defined as an abdominal circumference greater than 88 cm, according to ATP-III criteria. Body mass index was calculated as weight (kg) divided by squared height (m) according to World Health Organization criteria. Menopause status was defined according to Stages of Reproductive Aging Workshop criteria as premenopausal, perimenopausal, and postmenopausal.[18]

EWGSOP criteria were applied to determine clinical findings suggestive of sarcopenia.[1] Muscle mass was estimated by measuring calf circumference in the area of greater thickness of both calves with a metric tape and the average was recorded. Measurement below 31.0 cm was considered low muscle mass. Although the circumference of the calf does not exactly measure muscle mass, it correlates positively with it[19] and may be of interest in ambulatory settings despite limitations and vulnerabilities. Muscle strength was measured with a digital dynamometer (Camry EH101), and expressed in kilograms. The following technique was applied: participant standing or sitting in a comfortable position without armrests, shoulders in adduction without rotation, elbow flexed at $90°$, and forearm and wrist in a neutral position. Grip strength of the skillful hand was measured 3 consecutive times and values recorded. One-minute rest for muscle recovery was given between measurements. Finally, the average was calculated and registered as the muscle strength. Values below the cutoff of 20.0 kg were diagnostic of decreased muscle strength.[1] The speed test was used to determine physical performance. For this, a distance of 4 m was marked on the floor and participants asked to walk this distance at a normal step. Time to walk this distance was measured (s) with a digital chronometer. Three measurements were performed and the average registered. Also, 1-minute rest was given between determinations. Gait speed was defined as the time taken to walk the 4-m distance and expressed in meters per second (m/s). A cutoff value of <0.8 m/s was defined as decreased gait speed which is equivalent to lower physical performance.[1]

Sample size

Sample size calculation was performed taking into account data from the Colombian population census of 2005 that established a projection for 2018 of 25,228,444 women, of whom 534,663 resided in the city of Cartagena.[20] Of these, 125,454 were aged 40 to 59 years. A sample size of 383 women was calculated with a 95% confidence level, 50% heterogeneity, and a 5% margin of error. To compensate for incomplete or inadequately completed forms, 48 participants were added (12.5%); therefore, we searched and identified 431 women who met the inclusion criteria and were eligible to participate in the study.

Statistical analysis

The statistical analysis of the data was performed with EPI-INFO 3.5.3. (Centers for Disease Control and Prevention, Atlanta, GA, 2008). Data are expressed as medians and interquartile ranges (IQRs) for continuous data, and absolute values, percentages, and 95% CIs for categorical data. According to the characteristic of the variable, results obtained with the quality of life scales and the clinical evaluations related to sarcopenia are presented as means with standard deviations or percentages with 95% CIs. Bivariate

analysis was performed to establish an association between sarcopenia (including nonsevere and severe) and sociodemographic characteristics, menopausal symptoms (MRS), and perception of health status (SF-36). A $P < 0.05$ was considered as statistically significant.

RESULTS

Of the 431 women invited to participate, 12 (2.7%) declined participation or did not understand the tools used. Hence, 419 forms were filled out, of which 16 (3.8%) were incomplete, and therefore excluded. Finally, data from 403 women were analyzed. Median (IQR) age of the total sample was 48.0 [IQR: 45.0-54.0] years. 64.2% of surveyed women were Hispanic, 32.2% Afro-descendant, and 0.5% indigenous. Median [IQR] weight and height was 68.0 kg [IQR: 60.0-76.0] and 1.6 m [IQR: 1.5-1.8]. A third of surveyed participants were professional or had technological or technical skills. Forty-nine percent were housewives, 21% performed manual trades, and 28% were professional workers. Arterial hypertension and diabetes mellitus were the most reported medical pathological conditions. 36.4% of women were premenopausal, 19.1% perimenopausal, and 44.5% postmenopausal. Sociodemographic characteristics of surveyed women are presented in Table 1.

Hot flashes and joint/muscular discomfort were the most prevalent menopausal symptoms, reported by 6 out of 10 participants, followed by irritability, and physical and mental exhaustion. The other symptoms evaluated by the MRS were present in half of the studied women. The most frequent severe/very severe symptom was joint/muscular discomfort, reported by a quarter of the surveyed women.

When assessing self-perception of health condition, women reported being limited upon walking 1 km (44.3%); climbing several flights of stairs (40.3%); performing vigorous activities (34.6%); walking several hundred meters (34.7%); climbing one flight of stairs (28.5%); performing moderate activities (22.3%); bending down or kneeling (20.8%); walking 100 m (8.1%); and lifting or carrying groceries (18.6%). Two out of 10 reported that they accomplished less than they would have liked or they cut down on the amount of time spent on work or other activities due to emotional problems. 80.1% of surveyed women said they had some bodily pain in the last month and in 64.1% pain interfered with their normal work. Table 2 describes self-perception of health, obtained by means of the SF-36 scale. None of the domains of the SF-36 scale had an excellent or bad score, the bodily pain domain was regular, mental health domain was very good, and the other six domains were good.

Mean calf circumference, muscle strength, and gait speed were 35.3 ± 4.7 cm, 26.0 ± 6.3 kg, and 1.0 ± 0.09 m/s, respectively. Low muscle mass was observed in 39 women (9.6%, 95% CI, 7.1-12.9), decreased muscle strength in 73 (18.1%, 95% CI, 14.6-22.1), and lower physical performance in 28 (6.9%, 95% CI, 4.8-9.8). The presence of presarcopenia (only low muscle mass) was estimated in 9.6% [95% CI, 7.1-12.9] and sarcopenia in 7.9% [95% CI, 5.6-10.9], being nonsevere (low muscle mass with decreased muscle strength or lower physical performance) in 7.1% [95% CI, 5.2-10.1] and severe (low muscle mass, muscular strength decreased and lower physical performance) in 0.8% [95% CI, 0.2-2.7].

Main menopausal symptoms significantly associated as risk factors for sarcopenia included: joint/muscular discomfort, physical and mental exhaustion, and hot flashes. Being postmenopausal or being over 50 was associated with a higher risk of presenting with sarcopenia (odds ratio [OR] 2.99, 95% CI, 1.38-6.51 and OR 3.06, 95% CI, 1.41-6.65, respectively). Protective factors for sarcopenia were not observed (Table 3).

Figure 1 shows the prevalence of sarcopenia distributed by age range, with a significant increase from 4.1% in the 40 to 44 age group to 16.4% found in the 55 to 59 age group ($P < 0.05$). Taking the 40 to 44 age group as a reference, being 45 to 49, 50 to 54, or 55 to 59 years of age had a higher odds of having sarcopenia (OR 1.13, 95% CI, 0.31-4.13, $P = 0.84$; OR 1.88, 95% CI, 0.51-6.92, $P = 0.33$; and OR 4.59, 95% CI, 1.47-14.29, $P < 0.05$; respectively).

DISCUSSION

The importance of sarcopenia relies not only on its prevalence, but also on its expected increase. Indeed, the prevalence of sarcopenia could increase worldwide to 72.4% in 2045 in women aged 65 or more.[21] The prevalence of sarcopenia in individuals aged 60 to 70 may range from 5% to 13%, and in older than 80 this figure ranges from 11% to 50%.[2] According to the World Health Organization, by 2000, the total population aged above 59 was 600 million. It is estimated that this

TABLE 1. *Sociodemographic characteristics of studied women (n = 403)*

Parameters	n = 403
Age, y, median [IQR]	48.0 [45.0-54.0]
Body mass index, kg/m^2, median [IQR]	25.9 [23.4-28.7]
Abdominal circumference, cm, median [IQR]	85.0 [78.0-92.0]
Percentage of body fat, %, median [IQR]	33.0 [30.0-36.7]
Age at menopause onset (among postmenopausal), median [IQR]	48.0 [46.0-55.0]
Age group 40-44, n (%) [95% CI]	97 (24.0) [20.1-28.4]
Age group 45-49, n (%) [95% CI]	129 (32.0) [27.6-36.7]
Age group 50-54, n (%) [95% CI]	80 (19.8) [16.2-24.0]
Age group 55-59, n (%) [95% CI]	97 (24.0) [20.1-28.4]
Normal weight, n (%) [95% CI]	161 (39.9) [35.2-44.8]
Overweight, n (%) [95% CI]	163 (40.4) [35.7-45.3]
Obesity class-I, n (%) [95% CI]	48 (11.9) [9.1-15.4]
Obesity class-II, n (%) [95% CI]	13 (3.2) [1.8-5.4]
Obesity class-III, n (%) [95% CI]	3 (0.7) [0.2-2.1]
Abdominal obesity, n (%) [95% CI]	167 (41.4) [36.7-46.3]
Arterial hypertension, n (%) [95% CI]	130 (32.2) [27.8-36.9]
Diabetes, n (%) [95% CI]	17 (4.2) [2.6-6.6]
Depression, n (%) [95% CI]	7 (1.7) [0.8-3.5]
Arthritis/osteoarthritis, n (%) [95% CI]	60 (14.8) [11.7-18.6]
Premenopausal, n (%) [95% CI]	147 (36.4) [31.9-41.2]
Perimenopausal, n (%) [95% CI]	77 (19.1) [15.5-23.2]
Postmenopausal, n (%) [95% CI]	179 (44.4) [39.6-49.3]
Hysterectomy, n (%) [95% CI]	41 (10.1) [7.5-13.5]
Oophorectomy, n (%) [95% CI]	10 (2.4) [1.3-4.5]

Data are presented as medians and interquartile ranges (IQR), frequencies n (%) and corresponding CIs.

TABLE 2. *Self-perception of the State of Health SF-36 Scale (n = 403)*

Items	Evaluation	n (%) [95% CI]
In general, would you say your health is	Fair	62 (15.3) [12.1-19.2]
Compared with 1 y ago, how would you rate your health in general now?	Somewhat worse now than 1 y ago	15 (3.7) [2.2-6.0]
The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?		
Vigorous activities (running, lifting heavy objects, participating in strenuous sports)	Yes, limited a lot	51 (12.6) [9.7-16.2]
Moderate activities (moving a table, pushing a vacuum cleaner, walking 1 h)	Yes, limited a lot	27 (6.7) [4.6-9.5]
Lifting or carrying groceries	Yes, limited a lot	25 (6.2) [4.2-9.0]
Climbing several flights of stairs	Yes, limited a lot	46 (11.4) [8.6-14.8]
Climbing one flight of stairs	Yes, limited a lot	37 (9.1) [6.7-12.4]
Bending or kneeling	Yes, limited a lot	23 (5.7) [8.8-8.4]
Walking 1 km or more	Yes, limited a lot	65 (16.1) [12.8-20.0]
Walking several hundred meters	Yes, limited a lot	46 (11.4) [8.6-14.8]
Walking the block (100 m)	Yes, limited a lot	21 (5.2) [3.4-7.8]
Bathing or dressing yourself	Yes, limited a lot	2 (0.50) [0.14-1.79]
During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?		
Cut down on the amount of time you spent on work or other activities	None of the time	260 (64.5) [59.7-69.0]
Accomplished less than you would like	None of the time	276 (68.4) [63.7-72.8]
Were limited in the kind of work or other activities	None of the time	284 (70.4) [65.8-74.7]
Had difficulty performing the work or other activities	None of the time	253 (62.7) [57.9-67.3]
During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems?		
Cut down on the amount of time you spent on work or other activities	None of the time	311 (77.1) [72.8-81.0]
Accomplished less than you would like	None of the time	294 (72.9) [68.4-77.0]
Did work or other activities less carefully than usual	None of the time	229 (56.8) [51.9-61.5]
During the past 4 weeks		
What extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?	Not at all	220 (54.5) [49.7-59.3]
How much bodily pain you had?	None	77 (19.1) [15.5-23.2]
How much did pain interfer with your normal work?	Not at all	145 (35.9) [31.4-40.7]
How much of the time during the past 4 weeks		
Did you feel full of life?	All of the time	272 (67.4) [62.7-71.88]
Have you been very nervous?	None of the time	268 (66.5) [61.7-70.9]
Have you felt so down in the dumps that nothing could cheer you up?	None of the time	364 (90.3) [87.0-92.8]
Have you felt calm and peaceful?	All of the time	201 (49.8) [45.0-54.7]
Did you have a lot of energy?	All of the time	189 (46.9) [42.0-51.7]
Have you felt downhearted and depressed?	None of the time	299 (74.1) [69.7-78.2]
Did you feel worn out?	None of the time	240 (59.5) [54.6-64.2]
Have you been happy?	All of the time	235 (58.3) [53.4-63.0]
Did you feel tired?	None of the time	245 (60.7) [55.9-65.4]
During the past 4 weeks		
How much of the time has your physical health or emotional problems interfered with your social activities?	None of the time	145 (35.9) [31.4-40.7]
How true or false is each of the following statements for you?		
I seem to get sick a little easier than other people	Definitely false	186 (46.1) [41.3-51.0]
I am as healthy as anybody I know	Definitely true	200 (49.6) [44.7-54.4]
I expect my health to get worse	Definitely false	209 (51.8) [46.9-56.7]
My health is excellent	Definitely false	49 (12.1) [9.3-15.7]

figure will increase to 1.2 billion in 2025 and 2 billion in 2050. By 2010, 50 million individuals were affected with sarcopenia. It is estimated that in the next 40 years the number will reach 200 million.[2]

Muscular aging is a multifactorial process that involves intrinsic (ie, endocrinological, neuronal, and muscular) as well as extrinsic events (ie, diet, physical activity, and lifestyle).[5,7,8,22] In sarcopenia there is a decrease in muscle mass due to a reduction of the size and quantity of type II muscle fibers. This process includes fat and connective tissue infiltration and a reduction of the capillary/muscle tissue ratio which

alter the availability of nutrients.[22] The progressive reduction of muscle mass and function predisposes to adverse personal, familiar, and social situations, causing a negative impact on economic costs.[8,23] Janssen et al[24] pointed out that in the United States in 2000, the direct costs of health care in relation to sarcopenia were 18.5 trillion dollars. As the world population is aging, costs are expected to increase in upcoming years.

Screening for sarcopenia should not start in older individuals because the maximal peak of muscular mass is reached in the third and fourth decades of life, which coincides with perimenopause. During this time 3% to 8% of muscle mass is

TABLE 3. *Factors associated with sarcopenia among studied women (n = 403)*

Factors	OR [95% CI]	P
To feel full of life only sometimes or never	11.12 [4.74-26.07]	<0.001
Always or sometimes feeling so down in the dumps that nothing could cheer her up	10.76 [4.79-24.14]	<0.001
To be limited to stoop or kneel	7.99 [3.72-17.17]	<0.001
To be limited to walk one kilometer or more	6.17 [2.48-15.36]	<0.001
To consider true that her health will get worse	5.65 (2.27-14.05]	<0.001
To feel a lot of energy only sometimes or never	5.07 [2.41-10.66]	<0.001
To feel downhearted and depressed sometimes or always	4.92 [2.33-10.37]	<0.001
Physical or emotional health problems interfered with her normal social activities	4.81 [2.03-11.40]	<0.001
To report joint and muscular discomfort	4.38 [1.50-12.73]	<0.001
To present physical and mental exhaustion	4.26 [1.84-10.33]	<0.001
To have difficulty performing the work or other activities	4.17 [1.91-9.08]	<0.001
To accomplish less than she would like	4.11 [1.94-8.70)	<0.001
To be limited to do moderate activities	4.01 [1.91-8.40]	<0.001
To present hot flashes	3.99 [1.37-11.63]	<0.001
History of hysterectomy	3.98 [1.75-9.03]	<0.001
To be limited to climb several flights of stairs	3.71 [1.70-8.07]	<0.001
To feel worn out sometimes or always	3.58 [1.65-7.79]	<0.001
Primary school, high school or none	3.51 [1.20-10.22]	<0.001
To be Hispanic ethnic group compared to Afro-descendant/indigenous	3.23 [1.21-8.59]	0.018
Over 50 y of age	3.06 [1.41-6.65]	0.004
Being postmenopausal	2.99 [1.38-6.51]	0.005
Arthritis/osteoarthritis	2.91 [1.30-6.52]	0.009
To be limited to walk 100 m	2.82 [1.31-6.06]	0.007
To be limited to walk several hundred meters	2.62 [1.26-5.45]	0.009
To accomplish less than she would like as a result of any emotional problems	2.60 [1.24-5.41]	0.017
To report sleep problems	2.25 [1.05-4.81]	0.035
To cut down on the amount of time she spent on work or other activities due to physical problems	2.23 [1.07-4.61]	0.030

lost.[3] After 50, muscle mass decreases 1% to 2% per year, which means a 12% to 15% loss in that decade. Therefore, muscle loss during the climacteric is important in terms of functionality.[19,25]

Using anthropometric measurement of the calf, the present study performed on middle-aged women found that 9.6% had low muscle mass. In another study addressing women with a higher mean age, who had a gynecological consultation, it was
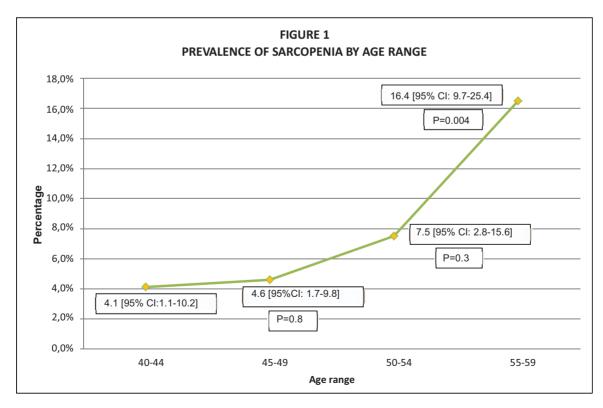

FIGURE 1
PREVALENCE OF SARCOPENIA BY AGE RANGE

16.4 [95% CI: 9.7-25.4]
P=0.004
7.5 [95% CI: 2.8-15.6]
P=0.3
4.1 [95% CI:1.1-10.2]
4.6 [95%CI: 1.7-9.8]
P=0.8

FIG. 1. Prevalence of sarcopenia according to age groups. Percentage values, 95% CI, value of *P* as compared with the 40 to 45 age group.

found that 22.6% had low muscle mass as determined with DEXA,[26] a value more than double ours. DEXA is expensive and may not be available at times, and although anthropometric measurements have greater limitations in terms of sensitivity compared with DEXA, they offer the advantage of low cost, which makes them valuable for community assessments or primary care, even though they provide a very indirect and observer-dependent approach. Other anthropometric measurements have been used including arm skin folds or abdominal, lumbar, or arm circumferences. Results are, however, usually influenced by ethnicity and body mass, among other factors.[5] Despite the low sensitivity of anthropometric measurements, these can be used when more precise methods are not available: DEXA, magnetic resonance imaging, computed tomography, ultrasound, and bioelectrical impedance analysis.[6,21] Several indicators and equations of moderate to significant complexity have been formulated.[21,27]

Evaluation of sarcopenia should include not only muscle mass but also function, that is, muscular strength and physical performance.[1] In our study, it was observed that 18.1% had decreased muscle strength and 6.9% had a gait speed indicating lower physical performance, figures that should be considered high for age and associated with menopausal symptoms and perception of health status. 63.5% of women reported joint/muscular discomfort and of these 24.2% indicated this symptom as being severe or very severe. Monterrosa et al[28] previously pointed out in Afro-descendant women joint/muscular discomfort as the most prevalent symptom, even more than hot flashes. Blümel et al[29] also reported the same fact in Latin American women, pointing out that some neurotransmitters such as serotonin, noradrenaline, substance P, and glutamate may be involved in the genesis of these painful symptoms. It is unknown whether joint/muscular discomfort is a clinical indicator of muscle mass integrity or function. In the present series, joint/muscular discomfort was found to be a factor associated with sarcopenia. Pain has not been considered as a diagnostic feature of sarcopenia, but the high rate found as a menopausal symptom requires exploration during routine medical consultation.

Some studies[1,2,21,23,26] indicate that the prevalence of sarcopenia rises with increasing age; this was also observed in our series. Equally, postmenopause status was associated with sarcopenia. This stage is characterized by reduced ovarian function and low serum circulating estradiol levels. Laakkonen et al[10,11] have identified that estradiol is a potential regulator of muscular energy pathways, and point out aspects that help to understand the complex functional interactions between female reproductive hormones and the healthy state of muscle tissue. Agostini et al[30] have explained the interrelation between estrogen and muscle fiber. They noted that estrogen signaling of muscle satellite cell activation and proliferation is mediated via the estrogen receptor-alpha located on skeletal muscle, which activates several signaling pathways, including insulin-like growth factor-1 (IGF-1) signaling, nitric oxide signaling, or activation of the phosphor-inositide-3 kinase/protein kinase B (Akt) pathway which

then positively influence muscle satellite cells and promote protein synthesis.

In our series, other factors associated with sarcopenia included physical and mental exhaustion, sleep disorders, hot flashes, and older age above 50. One must bear in mind that oxidative stress and accumulation of mutations in muscle mitochondrial DNA (due to the aging process) tend to accelerate myocyte apoptosis with the consequent loss of muscle mass, especially type II fibers.[22]

In addition, hot flashes contribute to the poor quality of life in climacteric women; sarcopenia accelerates frailty and negatively impacts daily life activities and quality of life.[7,31,32] In turn, sarcopenia is associated with increased mortality. Data from the National Health and Nutrition Examination Survey[33] indicate that individuals with reduced muscle mass have an increased risk of cardiovascular mortality. At the same time, the deterioration of muscle structure (quantity and quality) and function are associated with a higher risk of osteoporosis, falls, factures, and a reduction in the quality of life.[7,8,26,32] Women with sarcopenia have a twofold higher risk of falls and bone fractures as compared with those without the disease. Hence, early diagnosis of sarcopenia offers the possibility of implementing preventive measures.[30]

It is recommended that governmental and nongovernmental entities, as well as academic and scientific societies propose actions to increase awareness and information regarding sarcopenia because its insufficient recognition implies that the disease is poorly prevented, diagnosed, and treated. Health professionals who take care of postmenopausal women, in primary or specialized care, should be interested in the early identification in their patients of muscle mass and strength reduction. Diagnosis of sarcopenia must be identified before age of 50, to prevent related adverse outcomes in older individuals. The treatment of sarcopenia includes resistance exercise, leucine-enriched essential amino acids, or hydroxymethylbutyrate and vitamin D supplementation.[5,34]

Healthcare providers can use questionnaires or specific scales of quality of life to fully assess patients with sarcopenia. Recently, the SarQol tool (sarcopenia and quality of life) has been introduced. It has been validated in several languages, is self-applied, and is available online.[35] Beaudart et al[32] evaluated populations of both sexes and point out that the SarQoL was able to discriminate sarcopenic from nonsarcopenic individuals in relation to their quality of life, regardless of the definition used to diagnosis sarcopenia. Therefore, poorer quality of life seems to be related more to muscle function than to muscle mass. Studies using the SarQol in climacteric women are still lacking.

As for the limitations of the present study, one can mention that it is a cross-sectional design which does not allow for determining causality, only associations. Our results are specific for the group of studied women and cannot be extrapolated to any other population. Muscle mass measurement was performed with anthropometric techniques because the most sensitive imaging studies were not available due to economic reasons. This can also be considered a potential

drawback of our study. Although the criteria and flowchart proposed by EWGSOP were used to identify sarcopenia, muscle strength was measured with a dynamometer and physical performance with gait speed. Although suggested cutoff points were used, bias cannot be totally ruled out and the prevalence of sarcopenia be underestimated. The study has the strength of being carried out in women in the fourth and fifth decades of life, in their own communities, apparently healthy and evaluated at the same time with two validated international scales. To the best of our knowledge, our study may in fact be the first to provide data regarding sarcopenia in middle-aged women of Colombia and/or Latin America.

CONCLUSIONS

Sarcopenia was present in this middle-aged female Colombian Caribbean sample and associated with various factors such as ethnicity, age, and menopausal symptoms and status.

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