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Sarcopenia, obesity and sarcopenic obesity among community-dwelling and institutionalized older women in Caxias do Sul, Brazil

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ABSTRACT

Introduction: Sarcopenia, obesity, and sarcopenic obesity are considered risk factors for the health of the elderly, which may cause or worsen the reduction in functional capacity. **Objective:** To determine the prevalence of sarcopenia, obesity, and sarcopenic obesity among community-dwelling and institutionalized female elderly in Caxias do Sul, Brazil. **Methods:** Observational epidemiological study, with cross-sectional design. 423 elderly women (≥60 years old) institutionalized and community-dwellers, participated in the study. Sarcopenia was identified according to the criteria established by the European Working Group on Sarcopenia in Older People (EWGSOP). The gait speed test estimated low skeletal muscle mass (SMM) by bioimpedance, low handgrip strength using a hand dynamometer, and low physical performance. Obesity was defined as Body Mass Index ≥27.0kg/m² and sarcopenic obesity by the simultaneous occurrence of obesity and sarcopenia. The Chi-Square test was performed, with a 5% significance level. **Results:** The overall prevalence of obesity was 53.9%. Sarcopenia was observed in 16.3% of the total sample, affecting 7.5% of the elderly in the community and 25.1% in institutions (p≤0.0001). Regarding sarcopenic obesity, 0.9% of the community and 3.8% of institutionalized elderly presented the dysfunction. Non-sarcopenic elderly women had a high prevalence of obesity. In the elderly of both groups, sarcopenia was more frequent in those with advanced age. **Conclusion:** Institutionalized elderly women had a higher prevalence of sarcopenia, emphasizing the importance of paying attention to the health of this population and highlighting the need for preventive measures.

Keywords: aging; Sarcopenia; obesity; epidemiology; risk factors.

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INTRODUCTION

According to the Brazilian Institute of Geography and Statistics, the longevity of the Brazilian population reached 76 years in 2018, an increase of 22 years compared to the 1960 decade[1]. This life expectation increase has been associated with a decrease in elderly physical and mental health, together with the outbreak and prevalence rise of chronic diseases, loss of independence and autonomy, as well as socio-economic and

environmental limitations, which directly interfere in the functional capacity of the elderly[2].

The reduction in functional capacity, in addition to the loss of independence and autonomy, aggravates the dependence on care. This dependence implicates difficulties to the families in finding someone to take care of the elderly at home, thus, contributing to the institutionalization. All those associated factors contribute to an increasing demand for Long-Term Care (LTC) homes for the elderly, which intend to provide the functional care needed for this population[2,3].

However, the aging process brings alterations to the metabolism and these alterations are associated with changes in body composition. Thus, there is an increase in body fat mass, mainly because of the accumulation of visceral fat deposits, along with a decrease in lean mass, causing the loss of Skeletal Muscle Mass (SMM). This low muscle quantity and quality, nowadays recognized as a muscle disease associated with aging and older people, but also recognized to begin earlier in life, is known as Sarcopenia[3].

Obesity is currently considered a preventable public health problem[4]. This condition is characterized by excess body fat in an unhealthy manner[4,5], which, according to the World Health Organization, can be identified through the Body Mass Index (BMI)[4]. In addition, it is emphasized that the prevalence of obesity has been growing, causing concern worldwide[4], considering that it may impact the increased risk for other diseases and mortality[4,5].

Due to the aging process and its health consequences[3], in addition to the potential risks of obesity[4,5], a condition has been studied, which involves the encounter of two epidemics, sarcopenia together with the presence of obesity, called sarcopenic obesity[6]. Sarcopenia and sarcopenic obesity are considered health risk factors, especially among the elderly, since they increase the risk of falls, impairs the overall ability to perform activities of daily living, and are also related to heart diseases, independence reduction, and necessity of functional and health care, as well as death[7-9]. Furthermore, sarcopenia and obesity increase the risks and the costs of hospitalization[8]. Moreover, sarcopenia, obesity, and sarcopenic obesity may cause or aggravate the reduction of the elderly functional capacity[8].

Based on the context presented and due to the few studies identified at the regional level, the objective was to determine the prevalence of sarcopenia, obesity and sarcopenic obesity among elderly community-dwellers and institutionalized women of Caxias do Sul, Brazil.

METHODS

Design and Study Population

An observational epidemiological study was carried out, with a cross-sectional design, among elderly community-dwellers and institutionalized women (residents of Long-Term Care (LTC) homes) in the city of Caxias do Sul, Brazil.

Sample Characteristics

The sample was obtained by convenience. Elderly women, matching the inclusion criteria, were invited to participate in the study, community-dwellers and institutionalized (residents of Long-Term Care (LTC) homes) in the city of Caxias do Sul, Brazil. The data were collected in groups of elderly community-dwellers and from 36 LTC homes, publics, and privates.

Illiterate elderly women were not included from the study, as well as the ones with mobility impairment, pacemaker carriers, and chronic catabolic patients with cancer, chronic obstructive pulmonary disease, heart, kidney, or liver failure. Also, those unable to perform the handgrip strength and gait speed tests (GST) were not included, as well as the unable to participate in the body composition measurement (weight and height).

The study was composed of 212 individuals community-dwellers and 211 individuals from LTC homes, totalizing 423 female volunteers, aged over 60 years.

Data collection

From October/2016 until March/2018, the data collection took place by trained interviewers. Were collected socio-demographic and nutritional status data: age (categorized in <70 years; 70 to 79 years; ≥80 years), marital status (with or without a spouse), schooling in years of study (categorized in: ≤8 years; >8 years) and monthly income (classified in 3 categories: up to two minimum wages, two up to 5 minimum wages or above 5 minimum wages), weight and height for later Body Mass Index (BMI) definition.

Body Composition

Bioimpedance was applied for measuring the body muscle mass, with the usage of MALTRON – BF 960®. The Skeletal Muscle Mass (SMM) value was obtained through the Janssen equation et al.[10]: SMM (kg) = {(Ht^2/R x 0.401) + (gender x 3.825) + (age x -0.071)} + 5.102 considering: HT: Height in cm; R: resistance values in terms of resistance in ohms; Gender: Male 1 and Female 0; Age: in years. The sarcopenia level ranking was calculated through the SMM value, represented by the muscle mass value in kilograms (kg), divided by the patient's stature squared (m^2). The SMM value was classified[11] as adequate for muscle mass ≥6.76 kg/m^2; severe loss ≤5.75 kg/m^2; mild loss 5.76–6.75 kg/m^2.

Handgrip Strength

For measuring Muscle Strength, the manual dynamometer SAEHAN® was used. In this hydraulic device, the strength is registered in kilograms, with the patient comfortably seated, elbow flexed 90°, forearm in a neutral position, and, at last, wrist position varying from 0° to 30° of extension. Three measures were made, alternating the arms, with 15 seconds breaks between each one. The higher value was considered for analysis. A maximum contraction time of 3 seconds was tolerated for registering the

handgrip strength[12]. According to consensual parameters for women, the Ranking was handgrip strength under 20 kg indicating low muscle strength[13,14].

Physical Performance

For the GST, the elderly women were asked to walk, at their usual pace, a 4-meter distance. On the ground, on a flat surface, the distance of 4 meters was marked and from the starting point to the end, the walk was timed[12]. Gait speeds <0.8 m/s used to define low physical performance[13,14].

Identifying Sarcopenia

The sarcopenia was given to the patients with SMM reduction associated with handgrip strength reduction or low physical performance. The diagnosis of severe sarcopenia was given to the patients with a reduction in SMM and handgrip strength as well as low physical performance. Women just with low SMM were considered as presarcopenia[14]. Subsequently, to assess possible associations with the presence of sarcopenia in the elderly, considering the proportion of individuals in each group, the variable was categorized into "non-sarcopenic" and "presence of sarcopenia". The presence of sarcopenia included elderly women with sarcopenia and severe sarcopenia[15].

Identifying obesity and sarcopenic obesity

The Body Mass Index (BMI) was calculated through the division of body mass by the squared stature (kg/m²), considered as obesity[16] the results over 27.0 kg/m². In this study, the variable was categorized into no obesity and obesity.

For diagnosing sarcopenic obesity, the results of elderly women with sarcopenia were combined with the results of overweight/obesity, that is, elderly women whose both results had alterations were diagnosed with the pathology.

Data analysis

The categorical variables description was given by gross and relative frequency, and the continuous variables by mean and Standard Deviation (SD). For data analysis, the Chi-squared test was used for heterogeneity, aiming to verify the association between exposure variables and outcomes. Subsequently, to control the effects of confusion, Poisson regression was performed, using the background method and including in the regression model the variables that presented a level of significance of up to 20% ($p \leq 0.20$) in the binary analyzes of association. In addition, the adjusted model of sarcopenia included BMI as a control variable. The effects of the adjusted analysis were presented by prevalence ratios (PR) and respective 95% confidence intervals (95% CI). The Statistical Package for the Social Sciences (SPSS), version 18.0, was used for carrying out the analysis. A significance level of 5% (≤ 0.05) was considered in all the statistical analyses.

Ethical Aspects

The study was approved by the Research and Ethics Committee under the number 1.628.941. All the participants signed the Informed Consent Form, containing information about the procedure, as well as risks and benefits related to the research.

RESULTS

A total of 423 elderly women from Caxias do Sul, Brazil participated in the study, being 212 (50.1%) community-dwellers and 211 (49.9%) residents from LTC homes. In the total sample, there was an average age of 75.5 years (SD±9.24). Among the ones community-dwellers, 47.2% had ages under 70 years, while 56.9% of the institutionalized were aged 80 or over ($p \leq 0.0001$). About schooling, 66.5% of the elderly women community-dwellers declared their schooling to be less than or equal to 8 years, compared to 79.1% of those institutionalized ($p=0.003$) (Table 1).

In the comparison between groups, institutionalized elderly women presented a higher frequency of severe loss of SMM (5.2% vs. 0.5%; $p \leq 0.0001$), low muscle strength (94.8% vs. 52.8%; $p \leq 0.0001$), and low gait speed (≤0.8 m/s) (96.7% vs. 55.7%; $p \leq 0.0001$) when compared to community-dwellers (Table 1).

The BMI data revealed an average of 27.84kg/m² (SD±5.21), indicating obesity in both groups. Still referring to obesity, there was a general prevalence of 53.9%, present in 59.4% (n=126) of the community-dwellers and 48.3% (n=102) of the institutionalized. In relation to sarcopenia, the general prevalence identified was 16.3% (n=69), being 7.5% in community-dwellers and 25.1% in institutionalized ones ($p \leq 0.0001$). However, the identified prevalence of sarcopenic obesity was only 2.4% (n=10) of the total sample, being 0.9% community-dwellers and 3.8% from institutions ($p=0.108$) (Table 1).

Table 2 shows socio-demographic and nutritional status related to obesity in both groups separately. Thus, it was observed that 66.0% of community-dwellers elderly women, aged under 70, were obese, while, in the same age group, 73.3% of the institutionalized ones were obese. Considering the age group from 70 to 79, 54.3% of the community-dwellers elderly women and 52.5% of the ones from LTC homes were obese. Moreover, in the group aged 80 or over, 51.6% and 40.0% of participants from the community and LTC homes, respectively, had the condition. Highlights on the fact that there was statistical significance on the association between obesity and age only in the group of institutionalized elderly women ($p=0.004$).

Concerning the presence of sarcopenia and obesity, 12.5% of elderly women in the community who were with sarcopenia were diagnosed with obesity ($p \leq 0.001$). Among the ones from

Table 1: Description of demographic, socioeconomic and sarcopenia variables related to the place of residence of elderly women in Caxias do Sul, Brazil, 2019 (n=423).

Variáveis	Total n (n%)	Community (n=212) n (n%)	Institutionalized (n=211) n (n%)	p*
Age in years (75.5±9.24)				≤0.0001
<70	130 (30.7)	100 (47.2)	30 (14.2)	
70–79	142 (33.6)	81 (38.2)	61 (28.9)	
≥80	151 (35.7)	31 (14.6)	120 (56.9)	
Schooling				0.005
≤8 years	115 (27.2)	141 (66.5)	167 (79.1)	
>8 years	308 (72.8)	71 (33.5)	44 (20.9)	
Results SMM				≤0.0001
Adequate	353 (83.5)	195 (92.0)	158 (74.9)	
Mild Loss	58 (13.7)	16 (7.5)	42 (19.9)	
Severe Loss	12 (2.8)	1 (0.5)	11 (5.2)	
Handgrip Strenght				≤0.0001
Adequate MS	111 (26.2)	100 (47.2)	11 (5.2)	
Low MS	312 (73.8)	112 (52.8)	200 (94.8)	
Gait Speed				≤0.0001
≤0.8 m/s	322 (76.1)	118 (55.7)	204 (96.7)	
>0.8 m/s	101 (23.9)	94 (44.3)	7 (3.3)	
Sarcopenia				≤0.0001
Non-sarcopenic	354 (83.7)	196 (92.5)	158 (74.9)	
Sarcopenia	69 (16.3)	16 (7.5)	53 (25.1)	
Obesity				0.028
No	195 (46.1)	86 (40.6)	109 (51.7)	
Yes	228 (53.9)	126 (59.4)	102 (48.3)	
Sarcopenic Obesity				0.108
No	413 (97.6)	210 (99.1)	203 (96.2)	
Yes	10 (2.4)	2 (0.9)	8 (3.8)	

MS: Muscle Strength, SMM: Skeletal Muscle Mass, n: Absolute Frequency, n%: Relative Frequency.
*Chi-Square Test for heterogeneity. Values in bold are statistically significant (p≤0.05).

Table 2: Description of demographic, socioeconomic and sarcopenia variables related to the presence of obesity in elderly women from the community and LTC homes from Caxias do Sul, Brazil, 2019 (n=423).

Variables	Community (n=212)				Institutionalized (n=211)			
	Total n (n%)	NO n (n%)	OBE n (n%)	p*	Total n (n%)	NO n (n%)	OBE n (n%)	p*
Age in years				0.178				0.004
<70	100 (47.2)	34 (34.0)	66 (66.0)		30 (14.2)	8 (26.7)	22 (73.3)	
70–79	81 (38.2)	37 (45.7)	44 (54.3)		61 (28.9)	29 (47.5)	32 (52.5)	
≥80	31 (14.6)	15 (48.4)	16 (51.6)		120 (56.9)	72 (60.0)	48 (40.0)	
Schooling				0.091				0.927
≤8 years	141 (66.5)	51 (36.2)	90 (63.8)		167 (79.1)	86 (51.5)	81 (48.5)	
>8 years	71 (33.5)	35 (49.3)	36 (50.7)		44 (20.9)	23 (52.3)	21 (47.7)	
Results SMM				≤0.0001				≤0.0001
Adequate	195 (92.0)	71 (36.4)	124 (63.6)		158 (74.9)	64 (40.5)	94 (59.5)	
Mild Loss	16 (7.5)	14 (87.5)	2 (12.5)		42 (19.9)	35 (83.3)	7 (16.7)	
Severe Loss	1 (0.5)	1 (100.0)	0 (0.0)		11 (5.2)	10 (90.9)	1 (9.1)	
Handgrip Strenght				0.661				0.844
Adequate MS	100 (47.2)	39 (39.0)	61 (61.0)		11 (5.2)	6 (54.5)	5 (45.5)	
Low MS	112 (52.8)	47 (42.0)	65 (58.0)		200 (94.8)	103 (51.5)	97 (48.5)	
Gait Speed				0.599				0.636
≤0.8 m/s	118 (55.7)	46 (39.0)	72 (61.0)		204 (96.7)	106 (52.0)	98 (48.0)	
>0.8 m/s	94 (44.3)	40 (42.6)	54 (57.4)		7 (3.3)	3 (42.9)	4 (57.1)	
Sarcopenia				≤0.0001				≤0.0001
NS	196 (92.5)	72 (36.7)	124 (63.6)		158 (74.9)	64 (40.5)	94 (59.5)	
Sarcopenia	16 (7.5)	14 (87.5)	2 (12.5)		53 (25.1)	45 (84.9)	8 (15.1)	

NO: No Obesity, OBE: Obesity. MS: Muscle Strength, SMM: Skeletal Muscle Mass, NS: Non-sarcopenic, n: Absolute Frequency, n%: Relative Frequency.
*Chi-Square Test for heterogeneity. Values in bold are statistically significant (p≤0.05).

LTC homes, 25.1% had sarcopenia, of these, 15.1% were obese (p≤0.0001) (Table 2).

In Table 3 demographic, socioeconomics, and nutritional state variables were investigated and related to the sarcopenia diagnosis on both groups, assessed separately. There was an association between age and sarcopenia in both groups. Thus, the highest prevalence of sarcopenia was found in older women, being 16.1% in those in the community-dwellers (p=0.010) and 35.0% in institutionalized ones (p≤0.0001).

Regarding sarcopenia, after the adjusted analysis, age remained associated with the outcome, regardless of BMI. Thus, elderly women with advanced age – both community (PR: 6.83; 95% CI 1.55–30.21; p=0.040) and institutionalized women (PR: 7.62; 95% CI 1.05–55.17; p=0.016) – were more probability to have sarcopenia compared to younger women (Table 4). As for the presence of obesity, only sarcopenia remained associated after multivariate analysis, in which less probability of obesity was observed in elderly women with sarcopenia, in both investigated groups (community (PR: 0.19; 95% CI 0.05–0.72; p=0.015) and institutionalized (PR: 0.25; 95% CI 0.13–0.49; p≤0.0001)) (Table 4).

DISCUSSION

This study aimed to determine the prevalence of sarcopenia, obesity and sarcopenic obesity prevalence among community-dwellers and institutionalized elderly women of Caxias do Sul, Brazil. That way, the prevalence of sarcopenia observed was 16.3%, being 2.4% and 13.9% for sarcopenia and severe sarcopenia, respectively. Regarding obesity and sarcopenic obesity, the prevalence of 53.9% e 2.4% was observed in the total sample. The prevalence identified in this study may serve as an alert to the health of the investigated population.

Internationally, the sarcopenia prevalence is about 10.0% among elderly women, being relatively higher among non-Asian women[17,18]. Nationally, the sarcopenia prevalence ranges from 2.4% to 20.0% among women over 60 years[19,20]. According to a systematic review, the sarcopenia prevalence varies according to the criteria of the identification method or diagnostic[19]. Thus, stands out that the prevalence found in the literature confirms the findings of the present study. However, the need for monitoring the sarcopenia prevalence in the elderly population increases, being necessary to spread this monitoring to all the regions, aiming

Table 3: Description of demographic, socioeconomic variables related to the presence of sarcopenia in elderly women from the community and LTC homes from Caxias do Sul, Brazil, 2019 (n=423).

Variables	Community (n=212)				Institutionalized (n=211)			
	Total n (n%)	NS n (n%)	SARC n (n%)	p*	Total n (n%)	NS n (n%)	SARC n (n%)	p*
Age in years				0.010				≤0.0001
<70	100 (47.2)	98 (98.0)	2 (2.0)		30 (14.2)	29 (96.7)	1 (3.3)	
70–79	81 (38.2)	72 (88.9)	9 (11.1)		61 (28.9)	51 (83.6)	10 (16.4)	
≥80	31 (14.6)	26 (83.9)	5 (16.1)		120 (56.9)	78 (65.0)	42 (35.0)	
Schooling				0.938				0.861
≤8 years	141 (66.5)	131 (92.9)	10 (7.1)		167 (79.1)	126 (75.4)	41 (24.6)	
>8 years	71 (33.5)	65 (91.5)	6 (8.5)		44 (20.9)	32 (72.7)	12 (27.3)	

NS: Non-sarcopenic, SARC: Sarcopenia, n: Absolute Frequency, n%: Relative Frequency.
*Chi-Square Test for heterogeneity. Values in bold are statistically significant (p≤0.05).

Table 4: Description of the model adjusted about the presence of sarcopenia in elderly women from the community and LTC homes from Caxias do Sul, Brazil, 2019 (n=423).

Variables	Community (n=212)		Institutionalized (n=211)	
	Adjusted PR (95% CI)	p*	Adjusted PR (95% CI)	p*
Adjusted model: Sarcopenia				
Age		0.040		0.016
< 70	1		1	
70–79	4.96 (1.20–20.49)		4.24 (0.54–33.11)	
≥ 80	6.83 (1.55–30.21)		7.62 (1.05–55.17)	
Adjusted model: Obesity				
Sarcopenia		0.015		≤0.0001
NS	1		1	
Sarcopenia	0.19 (0.05–0.72)		0.25 (0.13–0.49)	

PR: Prevalence ratio, CI: Confidence interval, NS: Non-sarcopenic.
*Adjusted analysis performed by the Poisson regression technique, presenting the adjusted prevalence ratio and respective 95% confidence intervals as a measure of effect. Values in bold are statistically significant (p≤0.05).

to track the prevalence changes due to the increase of the elderly population and life expectancy[19].

Still, on sarcopenia, a major prevalence among institutionalized elderly was observed in the present study (25.1% in the LTC homes group vs. 7.5% in the community group). The same group had worse results in the GST too, with low physical performance (96.7% vs. 55.7% community-dwellers). Also, the majority of elderly from LTC homes have shown low muscle strength (94.8% vs. 52.8%) and severe loss of SMM (5.2% vs. 0.5%). Confirming the findings of the present study, according to Tagliapietra *et al.*[21], a similar study comparing elderly community-dwellers with institutionalized women ones has identified the residents of LTC homes with low handgrip strength and low physical performance in the GST. The same study has concluded that institutionalized elderly women were more likely to have sarcopenia, due to predisposing factors[21]. Even so, it was evident that most of the institutionalized elderly had more advanced age, being the opposite among the ones community-dwellers, and this fact is strongly related to the presence of sarcopenia. Nevertheless, stands out the higher risk of developing sarcopenia for institutionalized elderly.

Related to obesity, the prevalence found in Vitória/ES ranges from 22.0% to 28.0%, being relatively higher among elderly with less age[22]. Still, according to international studies[23,24], the obesity prevalence ranges from 37.8% to 40.0%. Thereby, stands out a higher prevalence is identified in this study (53.9%) when compared to studies from Brazil. However, confirming the literature findings[22], in the present study, the obesity prevalence also decreases with the age advance of elderly women. Besides that, it is well known that the prevalence of overweight and obesity has increased with the years due to changes in the population's eating habits[23], highlighting the need to monitor obesity in the elderly population. In addition, although the BMI has some limitations for verifying the nutritional status of elderly women, due to the characteristic changes in the aging process and for not considering body composition[25,26], it can still be used to assess nutritional status in research[25].

Sarcopenic obesity is a big challenge for health professionals, for increasing body fat levels, also increases the risks for comorbidities. Due to this fact, this pathology is considered to be one of the main causes of injuries, augmenting the walking speed decay and mobility dysfunction of these elderly[27]. According to literature studies, the sarcopenic obesity prevalence among elderly women ranges from 0.1% to 9.4%, varying according to the applied diagnostic criteria[18,23,28]. Thus, we observe that the data found in the literature resemble the findings of the present study (2.4%), reinforcing the need for detection and intervention when there is sarcopenic obesity diagnosis in elderly women. Aiming to treat sarcopenic obesity, weight control, and muscle strengthening programs are advisable[9].

It is known that BMI does not allow the assessment of body composition[26]. Other ways of evaluating anthropometric measures that verify obesity, such as waist circumference, which is indicative of visceral fat, are methods recommended for investigation with BMI, to verify the risk of mortality and investigate diseases related to overweight and adiposity[29]. Some studies have investigated sarcopenic obesity using waist circumference as a method for checking obesity (not evaluating by BMI, the method applied in this research)[30,31]. According to a cohort study conducted in the state of São Paulo/Brazil, the prevalence of sarcopenic obesity in elderly women, assessed by waist circumference, was 6.5% in 2000, increasing to 7.2% in 2010[30]. Corroborating with these data, in a survey of elderly women in the Northeast of Brazil, 5.0% of the participants were identified with sarcopenic obesity[31]. Thus, when comparing with the literature data, values were found to approximate those identified in this study. Still, when obesity was assessed by the association of high waist circumference and BMI ≥27.0 kg/m², the prevalence in elderly women in the community was 8.0%[32]. Therefore, when comparing with other methods of assessment of sarcopenic obesity mentioned, a slightly lower prevalence was observed than in this study.

The present study also identified factors associated with obesity and sarcopenia in elderly women. In the bivariate analysis, an association was observed between obesity and MME, in which it was identified that both for the elderly in the community and for the institutionalized ($p \leq 0.0001$), there was a greater loss of SMM among non-obese women. However, this association was not maintained in the multivariate analysis. According to the findings of the literature, it is known that the elderly with overweight and obesity are more likely to have low SMM[33]. Therefore, it is believed that the results of this study may reflect the non-assessment of body composition by BMI for the assessment of obesity, not representing obesity specifically due to high body fat.

As for sarcopenia and obesity, after adjusted analysis, there was an inverse association, that is, less probability of having obesity among sarcopenic elders, with statistical significance. Reinforcing these findings, according to the study, there was higher sarcopenia prevalence among elderly with malnutrition or at risk of malnutrition[20]. Thus, it is believed that there is a higher probability of sarcopenia diagnosis among non-obese elderly women.

Related to sarcopenia and age, there was a statistically significant association, in which elderly women with advanced age were more probability to have sarcopenia compared to younger ones, regardless of nutritional status. Similar findings may be seen in other studies[20], which have identified advanced age as a factor associated with sarcopenia among the elderly. This information is consistent with data in the literature, which present sarcopenia as a condition associated with aging[34,35]. Thus, advanced age was considered to be a risk factor for sarcopenia outbreak and aggravation.

Related to sarcopenia, it is known that low muscle strength according to handgrip strength is a predictor of sarcopenia in elderly women[36]. In addition, the low handgrip strength is associated with greater multimorbidity in the elderly population[2]. Thus, adequate

handgrip strength was associated with a decrease of 18.0% in overall mortality[37]. Therefore, muscle strength is strongly related to the elderly functional capacity[38], in other words, the higher the handgrip strength, the greater the functional capacity and life quality[39].

The lean mass reduction is an increasing issue among this population group[2]. Sarcopenia is related to loss of mobility and dysfunction in individuals over 80, but, the weight and fat level in the body also influence a decrease in mobility, speed, and performance in daily tasks[8,40]. According to the study, representative obesity values were responsible for 19.0% and 8.0% of productivity loss and retirement by disability, respectively[8].

This study has some limitations, as the analysis is cross-sectional, and therefore it is not possible to establish a mechanism of cause and effect between the associations. Also, stands out the selection bias, dealing with a sample obtained by convenience. Furthermore, it is important to note that a possible underestimation of the prevalence of sarcopenia and sarcopenic obesity has occurred due to the exclusion criteria adopted, such as the inability to correctly assess elderly women with physical limitations, thus participating only lucid and walking elderly women. In addition, the measurement of muscle strength did not occur at 1-minute intervals, which may lead to a reduction in strength in subsequent contractions. Finally, it is important to highlight that for the evaluation of sarcopenia, an older consensus was used in 2010, due to the data collection period and the format of the collected data, making it impossible to use the current consensus. However, it is important to emphasize the limited number of studies that investigate this subject, making it possible to compare elderly women in the community with those institutionalized.

Nevertheless, the present study had, as potentials, the high sample number and the comparison between groups and collected data, bringing a large amount of relevant information. Also, stands out the control in data collection and treatment, minimizing possible mistakes with understanding and typing. Besides, it is important to reinforce that all the participants who performed data collection and anthropometric measurements, had received previous training to perform these tasks, thus, increasing the veracity of the data and the results presented in the study.

Lastly, it was concluded that institutionalized elderly had a higher prevalence of sarcopenia, accentuating the public health concerns about this population. In the total sample, the prevalence of sarcopenia, obesity, and sarcopenic obesity, resemble the ones found in the literature. Still, the results sarcopenia was associated with obesity in community and institutionalized elderly women. In both groups, age was identified as a factor associated with sarcopenia. The present study results evidence the importance of interdisciplinary actions and preventive measures, such as professional service, physical activities practice, and the use of dietary supplements that may avoid or retard the sarcopenia occurrence and increase the life quality among elderly women.

REFERENCES

1. Instituto Brasileiro de Geografia e Estatística (IBGE). Brasil: projeção da população 2018. Available from: https://agenciadenoticias.ibge.gov.br/
2. World Health Organization (WHO). World report on aging and health. Geneva: WHO, 2015.
3. Cruz-Jentoft AJ, Bahat G, Bauer J, Boirie Y, Bruyère O, Cederholm T, et al. Sarcopenia: revised European consensus on definition and diagnosis. Age Ageing. 2019;48(1):16-31. https://doi.org/10.1093/ageing/afy169
4. World Health Organization (WHO). Obesity and overweight. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
5. Villareal DT, Apovian CM, Kushner RF, Klein S. Obesity in older adults: technical review and position statement of the American Society for Nutrition and NAASO, the Obesity Society. Am J Clin Nutr. 2005;82(5):923-34. https://doi.org/10.1093/ajcn/82.5.923
6. Batsis JA, Villareal DT. Sarcopenic obesity in older adults: etiology, epidemiology and treatment strategies. Nat Rev Endocrinol. 2018;14(9):513-37. https://doi.org/10.1038/s41574-018-0062-9
7. Antunes AC, Araujo DA, Verissimo MT, Amaral TF. Sarcopenia and hospitalization costs in older adults: a cross-sectional study. Nutr Dietetics. 2017;74(1):46-50. https://doi.org/10.1111/1747-0080.12287
8. Araujo MYC, Norberto MCCS, Mantovani AM, Turi-Lynch BC, Santos LL, Ricardo SJ, et al. Obesity increases costs with productivity loss due to disability retirements, independent of physical activity: a cohort study. J Occup Environ Med. 2020;62(5):325-30. https://doi.org/10.1097/JOM.0000000000001808
9. Woo J, Leung J. Sarcopenic obesity revisited: insights from the Mr and Ms os cohort. J Am Med Dir Assoc. 2018;19(8):679-84.e2. https://doi.org/10.1016/j.jamda.2018.03.003
10. Janssen I, Heymsfield SB, Baumgartner RN, Ross R. Estimation of skeletal muscle mass by bioelectrical impedance analysis. J Appl Physiol. 2000;89(2):465-71. https://doi.org/10.1152/jappl.2000.89.2.465
11. Batsis JA, Mackenzie TA, Barre LK, Lopez-Jimenez F, Bartels SJ. Sarcopenia, sarcopenic obesity and mortality in older adults: results from the National Health and Nutrition Examination Survey III. Eur J Clin Nutr. 2014;68(9):1001-7. https://doi.org/10.1038/ejcn.2014.117
12. Lauretani F, Russo CR, Bandinelli S, Bartali B, Cavazzini C, Di Iorio A, et al. Age-associated changes in skeletal muscles and their effect on mobility: an operational diagnosis of sarcopenia. J Appl Physiol. 2003;95(5):1851-60. https://doi.org/10.1152/japplphysiol.00246.2003
13. Barbosa-Silva TG, Bielemann RM, Gonzalez MC, Menezes AM. Prevalence of sarcopenia among community-dwelling elderly of a medium-sized South American city: results of the COMO VAI? study. J Cachexia Sarcopenia Muscle. 2016;7(2):136-43. https://doi.org/10.1002/jcsm.12049
14. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, Boirie Y, Cederholm T, Landi F, et al. Sarcopenia: European consensus on definition and

diagnosis Report of the European Working Group on Sarcopenia in Older People. Age Ageing. 2010;39(4):412-23. https://doi.org/10.1093/ageing/afq034

15. Kurose S, Nishikawa S, Nagaoka T, Kusaka M, Kawamura J, Nishioka Y, et al. Prevalence and risk factors of sarcopenia in community-dwelling older adults visiting regional medical institutions from the Kadoma Sarcopenia Study. Sci Rep. 2020;10:19129. https://doi.org/10.1038/s41598-020-76185-0

16. Lipschitz DA. Screening for nutritional status in the elderly. Prim Care. 1994;21(1):55-67.

17. Yang L, Yao X, Shen J, Sun G, Sun Q, Tian X, et al. Comparison of revised EWGSOP criteria and four other diagnostic criteria of sarcopenia in Chinese community-dwelling elderly residents. Exp Gerontol. 2020;130:110798. https://doi.org/10.1016/j.exger.2019.110798

18. Chang CS, Chang YF, Liu PY, Wu SJ, Chiu CJ, Chen YC, et al. Interaction of Central Obesity and Sarcopenia on Nutritional Status in the Community-Dwelling Older People. Arch Gerontol Geriatr. 2019;87:104003. https://doi.org/10.1016/j.archger.2019.104003

19. Diz JBM, Leopoldino AAO, Moreira BS, Henschke N, Dias RC, Pereira LSM, et al. Prevalence of sarcopenia in older Brazilians: A systematic review and meta-analysis. Geriatr Gerontol Int. 2017;17(1):5-16. https://doi.org/10.1111/ggi.12720

20. Alexandre TS, Duarte YAO, Santos JLF, Wong R, Lebrão ML. Prevalence and associated factors of sarcopenia among elderly in Brazil: findings from the SABE study. J Nutr Health Aging. 2014;18(3):284-90. https://doi.org/10.1007/s12603-013-0413-0

21. Tagliapietra BL, Vaz TL, Schuch NJ, Margutti KMM. Preditores para diagnóstico de sarcopenia, estado nutricional e atividade física de idosas institucionalizadas e não institucionalizadas. Disciplinarum Sci. 2016;17(1):53-62.

22. Lima LM, Souza RJS, Cunha MRH, Leopoldo AS, Leopoldo APL. Prevalência de sobrepeso e obesidade em idosas do Centro de Convivência para a Terceira Idade de Vitória/ES. Rev Bras Cienc Saude. 2017;21(2):119-26. https://doi.org/10.4034/RBCS.2017.21.02.03

23. Bahat G, Kilic C, Topcu Y, Aydin K, Karan MA. Fat percentage cutoff values to define obesity and prevalence of sarcopenic obesity in community-dwelling older adults in Turkey. Aging Male. 2018;1-7. https://doi.org/10.1080/13685538.2018.1530208

24. Teixeira VBD, Machado CJ, Faria MG, Gonçalves RV. Transição nutricional no Estado de Minas Gerais em 1974 e 2009: um estudo com enfoque na população idosa. Rev Bras Edu Cult. 2018;(17):1-24.

25. Bedogni G, Pietrobelli A, Heymsfield SB, Borghi A, Manzieri AM, Morini P, et al. Is body mass index a measure of adiposity in elderly women? Obes Res. 2001;9(1):17-20. https://doi.org/10.1038/oby.2001.3

26. Zong G, Zhang Z, Yang Q, Wu H, Hu FB, Sun Q. Total and regional adiposity measured by dual-energy X-ray absorptiometry and mortality in NHANES 1999-2006. Obesity (Silver Spring). 2016;24(11):2414-21. https://doi.org/10.1002/oby.21659

27. Benton MJ, Whyte MD, Dval BW. Sarcopenic obesity: strategies for management. Am J Nurs. 2011;111(12):38-46. https://doi.org/10.1097/01.NAJ.0000408184.21770.98

28. Oliveira TM, Roriz AKC, Barreto-Medeiros JM, Ferreira AJF, Ramos L. Sarcopenic obesity in community-dwelling older women, determined by different diagnostic methods. Nutr Hosp. 2019;36(6):1267-72. http://dx.doi.org/10.20960/nh.02593

29. Carmienke S, Freitag MH, Pischon T, Schlattmann P, Fankhaenel T, Goebel H, et al. General and abdominal obesity parameters and their combination in relation to mortality: a systematic review and meta-regression analysis. Eur J Clin Nutr. 2013;67(6):573-85. http://dx.doi.org/10.1038/ejcn.2013.61

30. Crisostomo LAHK. Prevalência e incidência de obesidade sarcopênica em coorte de idosos domiciliados no município de São Paulo [dissertation]. [São Paulo]: Universidade de São Paulo; 2016.

31. Oliveira Neta RS, Souza IFS, Câmara SMA, Souza MC. Sarcopenia, nutritional status, and functionality in elderly women living in the community. Rev Bras Geriatr Gerontol. 2018;21(3):342-51. https://doi.org/10.1590/1981-22562018021.170181

32. Ianiski VB, Schwanke CHA. Obesidade sarcopênica e fatores de risco cardiometabólico em idosos da comunidade [dissertation]. [Porto Alegre]: Pontifícia Universidade Católica do Rio Grande do Sul; 2020.

33. Machado KLLL. Fatores de risco para baixa massa muscular em coorte prospectiva de idosas brasileiras residentes na comunidade: São Paulo Ageing & Health Study (SPAH) [dissertation]. [São Paulo]: Universidade de São Paulo; 2019.

34. Matsushita T, Nishioka S, Taguchi S, Yamanouchi A. Sarcopenia as a predictor of activities of daily living capability in stroke patients undergoing rehabilitation. Geriatr Gerontol Int. 2019;19(11):1124-8. https://doi.org/10.1111/ggi.13780

35. Zhang N, Zhu WL, Liu XH, Chen W, Zhu ML, Kang L, et al. Prevalence and prognostic implications of sarcopenia in older patients with coronary heart disease. J Geriatr Cardiol. 2019;16(10):756-63. https://doi.org/10.11909/j.issn.1671-5411.2019.10.002

36. Cunha BS, Souza CRG, Prudente LOB, Osório NB, Silva Neto LS. Sarcopenia em idosas quilombolas: análise das variáveis antropométricas e de força de preensão manual. Rev Pat Tocantins. 2017;4(3):9-15. https://doi.org/10.20873/uft.2446-6492.2017v4n3p9

37. Lee J. Associations between handgrip strength and disease-specific mortality including cancer, cardiovascular, and respiratory diseases in older adults: a meta-analysis. J Aging Phys Act. 2019;5(1):1-12. https://doi.org/10.1123/japa.2018-0348

38. Gadelha AB, Dutra MT, Oliveira RJ, Safons MP, Lima RM. Associação entre força, sarcopenia e obesidade sarcopénica com o desempenho funcional de idosas. Motri. 2014;10(3):31-9. http://dx.doi.org/10.6063/motricidade.10(3).2775

39. Amigues I, Schott AM, Amine M, Gelas-Dore B, Veerabudun K, Paillaud E, et al. Low skeletal muscle mass and risk of functional decline in elderly community-dwelling women: the prospective EPIDOS study. J Am Med Dir Assoc. 2013;14(5):352-7. https://doi.org/10.1016/j.jamda.2012.12.002

40. Dufour AB, Hannan MT, Murabito JM, Kiel DP, McLean RR. Sarcopenia definitions considering body size and fat mass are associated with mobility limitations: the Framingham Study. J Gerontol A Biol Sci Med Sci. 2013;68(2):168-74. https://doi.org/10.1093/gerona/gls109