Influence of obesity on criteria for classification of sarcopenia in old people

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Abstract

Objective: to identify the prevalence of sarcopenic obesity in old residents in the community and to analyze the relation between obesity and the sarcopenia classification criteria. *Method:* This is an analytical cross-sectional study linked to the project "Comprehensive Health Care for the Old People". The assessment of sarcopenia was carried out using the criteria of the European Sarcopenia Consensus. For the classification of the old people as sarcopenic obese, we considered as likely sarcopenic, sarcopenic, or severe sarcopenic associated with a fat percentage >27% for men and >38% for women. The data were analyzed using bivariate statistics and a linear regression model. *Results:* from a sample of 209 community-dwelling old people, a prevalence of 23,9% of sarcopenia, 28,2% of obesity and 4,3% of sarcopenic obesity was found. Still, it can be observed that men had a higher prevalence of sarcopenia (p=0,006) and obesity (p=0,005) than women; the obese had a lower prevalence of muscle mass loss than the non-obese old people (p<0,001); and the obese showed an increase in muscle strength (p=0,003) and muscle mass (p<0,001) in relation to the non-obese, even when adjusted for gender, age group, multicomorbidities, and functional capacity. *Conclusion:* taking into account the prevalence of sarcopenic obesity in the population studied and the positive influence of obesity in the prediction of strength and muscle mass, the importance of multidimensional assessment of the old people is highlighted, in order to ascertain the real need for interventions for weight loss, with the aim of preventing strength and muscle mass loss.

Keywords: Sarcopenia. Obesity. Comprehensive Health Care. Health of the Elderly.

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INTRODUCTION

Sarcopenia was previously considered a physiological alteration due to aging, but today it is classified as a disease characterized by muscle failure occurring before the aging process, with the main investigative reason being the low muscle strength [1]. Measuring muscle strength is the most reliable way of measuring muscle function, and from that, it is possible to classify it as 'probable sarcopenia', when the old person has only low muscle strength; 'sarcopenia', when low muscle strength is associated with low muscle quantity or quality; and 'severe sarcopenia', when the old person declines in physical performance[2].

Age-related changes in the musculoskeletal system and the increased prevalence of obesity currently observed in the old people reveal a new condition called sarcopenic obesity[3], which is the association between sarcopenia and increased body fat[4]. This clinical phenotype implies a close connection between the muscle and adipose tissue and plays a central role in muscle function[5]. These two conditions live together, showing greater risks of mortality and worsening of disabilities such as worse physical performance, higher risk of falls, lower cognitive performance, worsening of cardiovascular diseases, and other unfavorable health conditions such as hospitalizations[3]. It is known that sarcopenic obesity increases the risk of mortality by 1.21 times compared to the robust old people[6].

In aging, sarcopenic obesity is an important cause of frailty, disability, and loss of independence in old people[4]. Causal factors for sarcopenic obesity are inadequate nutrition, insulin resistance, decreased hormone concentration (GH and testosterone), inflammation through the production of pro-inflammatory cytokines by the adipose tissue, physical inactivity, and sedentary lifestyle[7]. It is a consensus that weight loss is responsible for many benefits and reduced risk of complications in young or middle-aged people. In contrast, the effects on old people are still controversial[8]. The literature points out that there is not enough evidence to prove the association between intentional weight reduction and increased life expectancy[8]. Also, there is no association between overweight in old patients and increased overall mortality[9]. Intentional weight loss is only recommended specifically for old people with obesity-related comorbidities such as functional limitations, metabolic syndrome, type 2 diabetes, and cardiovascular diseases[8].

Given this context, the literature shows that there is no consensus on the prevalence of sarcopenic obesity in the old population[10,11]. Studies carried out in different regions of Brazil show the prevalence of sarcopenic obesity in old people ranging from 0.7% to 9.4%[11,12,13]. Also, studies suggest that further research is needed to investigate possible gender differences[11], and to bring a better understanding of the influence of obesity on the health of old people as the mechanisms and clinical implications cannot be compared to those occurring in the young population[8]. Therefore, the objective of the present article was to identify the prevalence of sarcopenic obesity in old residents in the community and to analyze the relation between obesity and the sarcopenia classification criteria.

METHOD

The analytical cross-sectional study linked to the project "Atenção Integral à Saúde do Idoso" (comprehensive care for the health of the old people) approved by the Research Ethics Committee of Universidade Regional do Noroeste do Estado do Rio Grande do Sul under Consubstantiated Opinion No. 2,653,484. The data in the present research refer to the first evaluation carried out in the period from 2018 to 2019.

The study population consisted of individuals aged ≥60 years, both genders, users of primary care services in the urban area of a medium-sized municipality in southern Brazil. The sample calculation method, sampling technique, and selection criteria were previously described in detail[14]. For the sample calculation, data from the Primary Care Information System (SIAB) and the total number of old people registered in Family Health Strategies (FHS) in the urban area was used, which was 5,269 old people. Considering the population aging rate, we chose representativeness greater than 10% of the old population of the FHS. To estimate the sample size, a tolerable sample error of 5% was defined, which defined an initial sample size of 372 old people selected by random sampling technique and stratified proportionally by FHS and by gender.

The study excluded old people who underwent a surgical procedure in less than 30 days, and those who did not have physical and/or psychological conditions to respond to the questionnaire. For this study, the individuals selected had the physical examination protocol complete to assess body composition and sarcopenia, totaling a sample of 209 old people with a minimum age of 62 and a maximum age of 93 years. The reasons for loss included recent hospitalization, deaths, change of address, and non-consent to participate in the research.

The research protocol was applied in the home space, in two stages. In the first stage, the variables of interest were collected from the responses to a structured questionnaire developed by the researchers to obtain sociodemographic data and clinical health conditions, and from tests to assess the functional capacity. Still, at this stage, instructions for carrying out physical examinations were given, and the second stage was scheduled. In the second stage, a physical examination was carried out to assess sarcopenia and measure body composition.

To assess the clinical health condition, the old people were asked to confirm the presence of comorbidities such as diabetes mellitus, hypercholesterolemia, systemic arterial hypertension, brain stroke, Parkinson's disease, dementia, heart disease, kidney disease, osteoarticular diseases, and depression. For statistical purposes, the old people who presented five or more of the aforementioned conditions were classified as multicomorbidities. Also, the functional capacity of the old people was assessed using the Katz scale[15] to measure dependence for basic activities of daily living (BADL), and the Lawton and Brody scale[16] used to evaluate the instrumental activities of daily living (IADL). For statistical purposes, the old people who did not perform or needed help to perform at least one activity of the specific scales were classified as dependent for BADL or IADL.

Sarcopenia was assessed based on the criteria of the European Sarcopenia Consensus[2] which classifies as probable sarcopenic the old people with decreased muscle strength; as sarcopenic those with decreased muscle strength and muscle mass; and as severe sarcopenic those showing decreased muscle strength, muscle mass, and physical performance. The European Sarcopenia Consensus[2] presents a wide variety of tests and techniques that can be used to characterize sarcopenia, in practice, and research. In the present study, the Handgrip Strength technique was chosen to assess the muscle strength; for muscle mass, body composition by Bioelectrical Impedance Analysis; and for physical performance, the gait speed test.

To obtain the Handgrip Strength, the dynamometry technique was used with a dynamometer (E.CLEAR, model EH101) placed on the dominant hand of the old person. The test was performed in a sitting position, with the old person's arm adducted, the forearm flexing at an angle of 90° in relation to the arm, and the wrist in a neutral position. Three attempts were made, with a one-minute interval between them, and the mean of the values was considered. Values <27kg for men and <16kg for women[17]were considered low muscle strength.

The tetra polar Bioelectric Impedance analysis was performed with a portable device (RJL System Inc., model BIA101A, USA) providing resistance and reactance values with a frequency of 50 kHz and 800 μA. The criteria proposed by the equipment manual for the examination were followed, with a previous explanation to the old people regarding not exercising for a period of eight hours and not drinking alcohol for 12 hours before the examination. Also, they were asked to empty their bladder before the exam, to remain silent during the exam, not to be sweaty or urinated, and not to have a fever nor be in shock The resistance and reactance values found were used to calculate the appendicular skeletal muscle mass (ASMM) based on formula[18]: ASMM (kg) = -3.964 + (0.227 * normalized resistance for height) + (0.095 * body weight) + (1.384 * sex) + (0.064 * reactance). With height being expressed in centimeters, and resistance value in ohm; for gender, woman =0 and man =1. The cutoff point adopted was <20kg for men and <15kg for women[19].

The anthropometric body mass and height were measured according to the criteria established by the Food and Nutritional Surveillance System (SISVAN)[20]. For body mass, the individuals were weighed barefoot and wearing light clothing, and oriented to remove heavy objects such as keys, belts, glasses, cell phones, and any other objects that could interfere in the weight. For height, the individual should be barefoot and with nothing in the head, in the center of the equipment, erect, with arms extended along the body, head up looking at a fixed point at eye level, head positioned on the Frankfurt plane (lower margin of the orbital opening, and the upper margin of the external auditory meatus in the same horizontal line), parallel legs, feet forming a right angle with the legs. A portable scale of brand G_Tech with a maximum capacity of 150kg was used to verify the body mass, and a pocket stadiometer brand Cescorf with a measurement range of three meters was used for height.

Gait speed was measured by the four-meter gait speed test demarcated on the ground, in which the old person walks with their usual gait pattern, and the displacement time is measured[21]. The gait speed test is a validated and recommended test by the European Sarcopenia Consensus due to the convenience of use and the ability to predict results related to sarcopenia[2]. The test was carried out in the internal or external area of the home in a place where the old person could walk four meters in a straight line with a flat surface and without obstacles. Gait speed was considered low[2] with values ≤0.8m/s.

For the classification of obesity, the percentage of fat >27% for men and >38% for women was considered[22]. The fat percentage calculation was obtained using the formula[23]: Percentage of fat mass = body mass - {5,741 + {0,4551 * [(height * height) / resistance]} + (0.1405 * body weight) + (0.0573 * reactance) + (6.2467 * Gender)}, and the resistance and reactance values were obtained from the Bioelectric Impedance analysis previously mentioned. For the classification of sarcopenic obesity, the conditions of probable sarcopenic, sarcopenic, or severe sarcopenic associated with the condition of obesity were considered.

The data obtained were analyzed using the software *Statistical Package for the Social Sciences* (SPSS; version 22.0). For the definition of measures of descriptive and analytical statistics, normal behavior was observed by the Kolmogorov-Smirnov test. For the quantitative variables, mean and standard deviation, and the nonparametric mean comparison test for independent samples were used (Mann-Whitney test). For qualitative measures, relative and absolute frequency measures and the association test (Pearson's chi-square test or Fisher's exact test) were used to verify the dependence of the variables. For all cases, a 95% confidence interval (95% CI) was used. The risk probability of one group compared to the other was assessed by calculating the prevalence ratio (PR) considering increased risk values greater than 1.0[24]. The linear regression model was used to analyze the relation between the dependent variables (muscle strength, muscle mass, and gait speed) and the independent variables (obesity, gender, age group, multicomorbidities, and functional capacity). For all tests, $p<0.05$ was considered statistically significant.

RESULTS

The sample consisted of 209 old people with an average age of 73.02±7.38 years. The analysis of age by sex showed that men were older (74.39±7.43 years) than women (72.25±7.27 years; p=0.038). The analysis of body composition showed that obese individuals were younger (71.10±6.83 years) than the non-obese ones (73.77±7.48 years; p=0.017). Table 1 presents the sociodemographic profile and clinical condition of obese and non-obese individuals in which the obese ones had a higher prevalence of men and multicomorbidities when compared to those non-obese.

Regarding the classification of sarcopenia, 75.6% (n=158) of the old people were robust, 13.9% (n=29) were likely to be sarcopenic, 6.2% (n=13) were diagnosed as sarcopenic, and 4.3% (n=9) as severe sarcopenic. For the purposes of statistical analysis, the old people who were probable sarcopenic, sarcopenic, or severe sarcopenic were grouped, as shown in Table 2. But the prevalence of obesity and sarcopenic obesity are presented.

Table 1. Sociodemographic profile and clinical condition of obese and non-obese old residents in the community (n=209). Ijuí-RS, 2019.

Variables	Obese n (%)	Non-Obese n (%)	*p*	PR (IC 95%)
Gender				
Men	30 (50,8)	45 (30,0)	0,005*	2,41 (1,30-4,48)
Women	29 (49,2)	105 (70,0)		
Civil Status				
With companion	45 (76,3)	99 (66,0)	0,149	1,66 (0,83-3,29)
No companion	14 (23,7)	51 (34,0)		
Education				
Did not attend	4 (6,8)	13 (8,7)	0,653	1,31 (0,41-4,18)
Attended	55 (93,2)	137 (91,3)		
Family Income (in minimum wage)				
Up to 3	53 (89,8)	134 (89,3)	0,916	1,06 (0,39-2,84)
More than 3	6 (10,2)	16 (10,7)		
Comorbidities				
5 or more	18 (30,5)	25 (16,7)	0,026*	2,19 (1,09-4,43)
Up to 4	41 (69,5)	125 (83,3)		
Functional capacity - BADL				
Dependent	14 (23,7)	31 (20,7)	0,628	1,19 (0,58-2,45)
Independent	45 (76,3)	119 (79,3)		
Functional capacity - IADL				
Dependent	34 (57,6)	81 (54,0)	0,635	1,16 (0,63-2,13)
Independent	25 (42,4)	69 (46,0)		

* Pearson's chi-square test $p \leq 0,05$; PR (IC95%) = prevalence ratio (95% confidence interval); BADL = basic activities of daily living; IADL = instrumental activities of daily living.

Table 2. Prevalence of sarcopenia, obesity, and sarcopenic obesity in old residents in the community (n=209). Ijuí-RS, 2019.

Variables	n (%)
Sarcopenia	
Yes	50 (23,9%)
No	159 (76,1%)
Obesity	
Yes	59 (28,2%)
No	150 (71,8%)
Sarcopenic Obesity	
Yes	9 (4,3%)
No	200 (95,7%)

Table 3 lists sarcopenia, obesity, and sarcopenic obesity with the gender of old residents in the community. It was found that men have a higher prevalence of these variables when compared to women. However, the difference was significant only for sarcopenia and obesity.

Table 4 shows the bivariate relation between obesity and the sarcopenia variables of old residents in the community. It is observed that the obese had a lower prevalence of muscle mass loss when compared to the non-obese. When comparing the means of the sarcopenia variables, the obese old people compared to the non-obese ones had greater muscle strength (27.59±10.36Kg vs. 22.43±7.18Kg; *p*=0.001), muscle mass (21.46±4.17 kg vs. 17.48±3.88 kg; *p*<0.001), but not gait speed (1.06±0.32m/s vs. 1.04±0,36m/s; *p*=0.719).

Table 5 shows the simple regression model adjusted by gender, age group, multicomorbidities, and functional capacity of obesity to predict muscle strength, muscle mass, and gait speed. After adjusting the model, it was noticed that obesity and male gender were significant in predicting greater muscle strength and muscle mass, whereas gender only influenced the gait speed. The age group of 80 years or more was significant in predicting lower values for the three variables analyzed, whereas multicomorbidities influenced muscle strength and gait speed and dependence for IADL only in muscle strength.

Table 3. Bivariate relation between sarcopenia, obesity, and sarcopenic obesity and sex (n=209). Ijuí-RS, 2019.

Variables	Men n (%)	Women n(%)	*p*	PR (IC 95%)
Sarcopenia				
Yes	26 (34,7%)	24 (17,9%)	0,006*	2,43 (1,27-4,65)
No	49 (65,3%)	110 (82,1%)		
Obesity				
Yes	30 (40,0%)	29 (21,6%)	0,005*	2,41 (1,30-4,48)
No	45 (60,0%)	105 (78,4%)		
Sarcopenic Obesity				
Yes	5 (6,7%)	4 (3,0%)	0,209	2,32 (0,60-8,92)
No	70 (93,3%)	130(97,0%)		

* Pearson's chi-square test *p*≤0,05; PR (IC95%) = prevalence ratio (95% confidence interval)

Table 4. Bivariate relation between obesity and sarcopenia criteria (n=209). Ijuí-RS, 2019.

Sarcopenia Criteria	Obese n (%)	Non-Obese n (%)	*p*	PR (IC 95%)
Low Muscle Mass				
Yes	2(3,4%)	62 (41,3%)	<0,001*	0,05 (0,01-0,21)
No	57(96,2%)	88 (58,7%)		
Low Muscle Strength				
Yes	10 (16,9%)	41 (27,3%)	0,116	0,54 (0,25-1,17)
No	49(83,1%)	109(72,7%)		
Low Gait Speed				
Yes	11(18,6%)	35 (23,3%)	0,461	0,75 (0,35-1,61)
No	48(81,4%)	115(76,7%)		

* Fisher's exact test *p*≤0,05; PR (IC95%) = prevalence ratio (95% confidence interval)

Table 5. Simple and adjusted linear regression model for the criteria of sarcopenia in old residents in the community (n = 209). Ijuí-RS, 2019.

Sarcopenia Criteria	Variables	Simple Regression	*p*	Adjusted Regression	*p*
Muscle Strength (Kg)	Obesity	5,162	<0,001*	3,108	0,003*
	Gender	9,496	<0,001*	9,056	<0,001*
	Age group	-6,207	<0,001*	-5,046	<0,001*
	Multicomorbidities	-2,891	0,047*	-2,581	0,022*
	Functional disability - BADL	-4,046	0,004*	-0,975	0,393
	Functional disability - IADL	-4,769	<0,001*	-2,545	0,010*
Muscle Mass (Kg)	Obesity	3,974	<0,001*	2,607	<0,001*
	Gender	5,607	<0,001*	5,254	<0,001*
	Age group	-1,721	0,019*	-1,918	0,001*
	Multicomorbidities	0,402	0,590	0,163	0,767
	Functional disability - BADL	-0,988	0,177	-0,371	0,507
	Functional disability - IADL	-0,391	0,519	0,418	0,383
Gait Speed (m/s)	Obesity	0,021	0,693	-0,030	0,546
	Gender	0,117	0,021*	0,137	0,003*
	Age group	-0,373	<0,001*	-0,333	<0,001*
	Multicomorbidities	-0,153	0,010*	-0,110	0,043*
	Functional disability - BADL	-0,179	0,002*	-0,045	0,416
	Functional disability - IADL	-0,216	<0,001*	-0,090	0,056

* Linear regression model $p \leq 0{,}05$; Kg= kilograms; m/s= meters per second; BADL = basic activities of daily living; IADL = instrumental activities of daily living.

DISCUSSION

The results of the present study showed a prevalence of 23.9% of sarcopenia, 28.2% of obesity, and 4.3% of sarcopenic obesity in a sample of old residents in the community of southern Brazil. But it can be observed that men had a higher prevalence of sarcopenia and obesity than women, and obese people had a lower prevalence of muscle mass loss than eutrophic old people.

In Brazil and the world, there is evidence that obesity is increasing among the old people[25,26]. In Brazil, a 26% increase in obesity was observed in this population between the years 2007 and 2017[25], but with the associated condition of sarcopenia further epidemiological studies using the same measurement method are needed to establish better prevalence parameters. The 4.4% prevalence of sarcopenic obesity was reported in a study assessing old people from different regions of Brazil[12], a data similar to that found in our study. However, there is a variation in prevalence depending on the methods of assessing sarcopenic obesity. A comparative study presented divergent data for measurements taking into account the Body Mass Index (0.7%), the abdominal circumference (6.5%), and the percentage of fat (9.4%)[11]. The excess of body fat added to the reduction of lean mass due to aging can result in a Body Mass Index within the normal range. Therefore, it is not recommended that the diagnosis of sarcopenic obesity takes this assessment measure into account.

When comparing the genders, another study found a higher ratio among men aged 80 years or older (8.6%) when compared to women in the same age group (1.7%)[13]. In our study, a higher prevalence was found in 143% and 141% of men presenting sarcopenia and obesity, respectively, when compared to women. However, being male was the only variable that positively influenced the prediction of all criteria for sarcopenia, that is, an increase of 9.06 kg in muscle strength, 5.25 kg in muscle mass, and 0.14 m/s in gait speed, even when adjusted for obesity, age group, multicomorbidities, and functional disability. Because of this, we can suggest two hypotheses: the first related to biological differences between genders, which justifies the positive influence of males on strength and muscle mass; and the second related to the cutoff points used to classify sarcopenia and obesity, which may have influenced a higher prevalence of these conditions for men, since the cutoff points used to come from the European population and have different biopsychosocial characteristics from Brazilian old people. It should also be noted that there are no studies establishing specific cutoff points for the classification of sarcopenia in the Brazilian old population.

Our data also suggested that obese old people had a 95% lower prevalence of muscle mass loss when compared to non-obese individuals. However, this data would need to be validated with a larger sample size due to the low absolute and relative number of obese people with low muscle mass. It was also observed that the obese old people had an additional 3.11 kg of muscle strength, and 2.61 kg of muscle mass compared to the non-obese old people, even when adjusted for gender, age group, multicomorbidities, and functional disability. At first, this finding seems to be controversial, given that obesity could be a limiting factor for mobility necessary for the maintenance of the muscle mass capable of generating sufficient muscle strength to carry out the tasks of daily living. Other studies have found similar or greater muscle strength values among obese individuals when compared to their non-obese peers[27,28]. According to the authors, these findings have been attributed to the probable neuromuscular adaptation induced by excess body weight in the musculoskeletal structure[27,28] On the other hand, when muscle strength is expressed per body mass or fat-free mass units, these differences disappeared, thus suggesting that the quality of the muscle tissue is not affected by obesity[27,28].

Excess body mass represents an additional burden to the skeletal muscle structure of obese individuals, leading to possible favorable adaptations in the muscle mass, bone mass, and muscle strength[29-31]. Also, the obese individuals have an altered metabolic profile compared to the non-obese ones, with higher basal insulin values, which can lead to a systemic anabolic state[32]. The combination of this anabolic environment and the additional overload may be responsible for the greater muscle and bone mass, as well as the higher levels of strength observed in obese individuals when compared to the non-obese ones[32].

The aforementioned studies presenting similar or even higher muscle strength values in obese individuals when compared to non-obese individuals were conducted with populations of children and adolescents[29-32]. Therefore, there is still a need for a more detailed investigation of what this data means for the old population since the physiological processes between these two stages of life are different. The combination of reduced muscle mass and strength has been associated with physical dependence, cognitive impairment, and increased risk of comorbidities and death in the old people[33]. Therefore, body weight loss strategies offered to the old population should take into account the prevention of bone and muscle loss[8].

In this sense, it was evidenced that energy restriction from a low-calorie diet, regardless of being associated with physical exercise, resulted in a decrease of one-quarter of lean mass per unit of weight, and consequently worsened the conditions of sarcopenia and osteopenia [34]. Another study found that individuals older than 70 years and with the lowest ratios of adipose tissue had higher mortality rates, regardless of the physical performance[9]. In contrast, our study also confirmed an association between obesity and multicomorbidities, which can bring many harms to the health of old people. It was noticed that obese old people have an increased prevalence of 119% of multicomorbidities when compared to non-obese old people. Also, multicomorbidity predicted 2.58Kg less of muscle strength, and 0.11m/s of gait speed, even when adjusted for gender, age group, obesity, and functional disability.

Therefore, we emphasize that interventions for intentional body weight loss in old people should be based on the basic principles of geriatrics. It is perceived the need to evaluate the benefits and harms that these strategies can bring to the health of the old people. In this sense, it is important to have a multidimensional evaluation of the old people, and treatments with scientific evidence generated in this age group[9].

Limitations of the present study include the design of the cross-sectional study which limits the conclusions and generalizations of the results, the sample number that did not reach the given probabilistic size, and the difference in age between men and women and between obese and non-obese, which may have influenced some results since men and the non-obese old people had higher means.

Also, we emphasize that the European consensus on sarcopenia[2] brings dual energy absorptiometry by X-ray as the gold standard for muscle mass measurement, but this test is not yet accessible to the entire population. The consensus itself indicates the use of Bioelectric Impedance Analysis because it is an accessible and portable device, together with the equation of Sergi[18] to estimate muscle mass. This equation is valid for European populations. Therefore, it is suggested that further studies be carried out to validate it in the Brazilian population. It is also worth mentioning that the data refers to the population of a single city. Therefore, the results cannot be extrapolated to the Brazilian population, since Brazil has different rates of aging, socioeconomic, and cultural conditions among its regions. It is suggested that more research be done to compare data between the regions of Brazil.

CONCLUSION

The results of the present study showed a prevalence of 23.9% of sarcopenia, 28.2% of obesity, and 4.3% of sarcopenic obesity in the old residents in the community of southern Brazil. Also, it was observed that men had a higher prevalence ratio of sarcopenia and obesity than women. However, being male positively influenced the prediction of all variables comprising the classification criteria of sarcopenia. It was also verified that obese individuals had a lower prevalence ratio for loss of muscle mass than non-obese old people. Obesity seems to have positively influenced the prediction of strength and muscle mass.

It is concluded that obesity should be analyzed taking into account the different stages of life since the strategies for bodyweight loss in old people can cause some health harm. The importance of multidimensional evaluation of the old person is emphasized to verify the real need for body weight loss to prevent loss of muscle mass and strength.

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