Sarcopenia and its association with changes in socioeconomic, behavioral, and health factors: the EpiFloripa Elderly Study

Sarcopenia e sua associação com mudanças nos fatores socioeconômicos, comportamentais e de saúde: Estudo EpiFloripa Idoso

Sarcopenia y su asociación con cambios en factores socioeconómicos, comportamentales y de salud: Estudio EpiFloripa Idoso

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Abstract

This study aimed to verify the prevalence of sarcopenia and its association with changes in socioeconomic, behavioral, and health factors in the elderly. The longitudinal population-based study included 598 elderly (≥ 60 years) in Florianópolis, Santa Catarina State, in the South of Brazil. Sarcopenia was defined on the basis of appendicular skeletal mass index (ASMI) according to gender (ASMI < 7.26kg/m² for men and < 5.5kg/m² for women). We assessed changes that occurred between the two study waves (2009/2010 and 2013/2014) in relation to socioeconomic, behavioral, and health factors. Crude and adjusted logistic regression analyses were performed. Prevalence of sarcopenia was 17% in women (95%CI: 12.4-22.9) and 28.8% in men (95%CI: 21.3-37.7). In the final model, women that continued to consume or that started consuming alcohol (OR = 0.31; 95%CI: 0.11-0.91) showed lower odds of sarcopenia. Women who continued to smoke or that started smoking (OR = 2.55; 95%CI: 1.16-5.58) and/or that remained inactive or became insufficiently active (OR = 2.90; 95%CI: 1.44-5.84) showed higher odds of sarcopenia. For men, no change variable was associated with sarcopenia. The results suggest that continuing or starting to smoke and remaining or becoming physically inactive are preventable and modifiable risk factors for sarcopenia.

Sarcopenia; Health of the Elderly; Aged; Behavior; Socioeconomic Factors

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Introduction

Sarcopenia was originally defined nearly three decades ago as a gradual reduction in skeletal muscle mass with advancing age [1]. The European Working Group on Sarcopenia in Older People [2] recently incorporated into the loss of muscle mass the reduction in physical strength and function that occurs with the aging process. However, there is no universal working definition or diagnostic criterion for sarcopenia [2]. Since loss of muscle mass and strength may not be simultaneous in the same individual [3], some studies disaggregate these characteristics [3,4], with loss of muscle mass verified by the appendicular skeletal mass index [5,6] (ASMI = appendicular skeletal mass (ASM) /height²), used as the diagnostic criterion for sarcopenia in population-based studies [7,8,9]. Regardless of the working definition, sarcopenia should be assessed to determine its natural course and develop effective treatments for this syndrome.

Sarcopenia contributes to adverse health outcomes such as functional incapacity, frailty, declining quality of life, and premature death [10,11]. It can be considered a public health problem [7] due to its social implications including loneliness and need for care and its health policy impact [12], besides generating high costs for the health system [13].

The prevalence of sarcopenia depends on the methodology employed in its identification and the characteristics of the study population, and it is more prevalent in men and in older individuals [14]. In the elderly, prevalence of sarcopenia varies from 13% to 22.6% in women and from 19% to 26.8% in men [6,15], according to the method and cutoff proposed by Baumgartner et al. [7]. In Brazil, data from a systematic review [16] on the topic showed that prevalence of sarcopenia was 20% in women and 12% in men.

The etiology of sarcopenia is known to be multifactorial, that is, dependent on and resulting from multiple causes, probably interconnected, that intervene in its development and progression. These causes feature aging itself, genetic factors, sociodemographic factors, lifestyle, and certain health conditions [6,7]. This complex causal model that combines diverse components dynamically constitutes the syndrome's determinants. Technical and methodological differences in establishing the diagnosis also hinder the syndrome's assessment, the comparison between studies, and the development of policies for the prevention and treatment of sarcopenia.

The effects of changes in the socioeconomic, behavioral, and health-related factors on the syndrome have received relatively little attention in the population over 60 years of age. The analysis of changes in factors over a given time period can allow the identification of their impact on the health of the elderly and determine whether it is still possible to intervene in this stage of life in order to delay or reverse negative effects, allowing these individuals to live longer with independence, autonomy, and quality of life. The study also aims to verify the prevalence of sarcopenia and its association with changes over the course of three years in socioeconomic, behavioral, and health factors in elderly residents of Florianópolis, Santa Catarina State, Brazil.

Methods

Reference area and population

The current study used as the reference population the elderly in the epidemiological survey entitled *Health Conditions of the Elderly in Florianópolis: the EpiFloripa Elderly Study*, using the EpiFloripa Elderly data for 2009/2010 as the baseline and with follow-up in 2013/2014 and the inclusion of complementary clinical exams in the study follow-up in 2014/2015.

Details on the study site, population, and sampling have been published previously and will be presented here briefly [17]. The sample consisted of 1,705 elderly in 2009/2010. Of these, 220 were excluded (217 deaths, 2 duplicates, and 1 with inconsistent age). Of the 1,485 elderly individuals eligible in 2013/2014, 159 were considered losses and there were 129 refusals. A total of 1,197 (80.6%) were interviewed at home, and of these, 604 (50.38%) completed the clinical exams. The analytical sample for this study was 598 elderly (6 excluded because they were bedridden and lacked adequate information from the DXA imaging tests).

Data collection

Data were collected with a structured instrument in face-to-face interviews. A personal digital assistant (PDA) was used in 2009/2010 and a netbook in 2013/2014, in which the data were recorded and stored. Data were collected from September 2009 to June 2010, a total of ten months. The study's second wave was from December 2013 to October 2014. The interviewers received prior training to test the instrument and refine and calibrate the tests (precision and accuracy).

The data's consistency was verified weekly using simple frequencies and comparisons with the expected values. Noncongruent answers were identified, corrected by the supervisor and interviewer, and then returned to the person responsible for the final databank. Quality control used a short version of the questionnaire applied by telephone to 10% of the interviewees, randomly selected.

Dependent variable

Sarcopenia (yes or no) was identified by analysis of skeletal muscle mass using dual-energy X-ray absorptiometry or DXA (Model Lunar Prodigy Advance, General Electric, Diegem, Belgium) and defined by calculating the ASMI as proposed by Baumgartner et al. [7]. The following formula was used: ASMI (kg/m^2) = [lean muscle mass of the arms (kg) + lean muscle mass of the legs (kg)]/height^2 (m). The criterion adopted for identifying sarcopenia was ASMI ≤ 2 standard deviations (SD) from the mean for the reference population (young adults from the *Rosetta Study*), by gender, as in Baumgartner et al. [7], with cutoff points for inadequate ASMI (kg/m^2) (loss of muscle mass) defined as < 7.26kg/m² for men and < 5.5kg/m² for women.

Independent variables (change)

The independent variables were characterized as change variables, and baseline and follow-up data were used to categorize them, verifying how many elders remained in the same baseline category, how many changed, and to which categories they moved.

(a) Socioeconomic: (i) work status (remained or started working, remained not working, or stopped working).

(b) Behavioral: (i) consumption of alcoholic beverages [continued to not drink (never drank) or stopped consuming alcoholic beverages; continued or started consuming alcohol (non-abusive and abusive consumption)]. These data were verified by the first three questions from the Alcohol Use Disorders Identification Test (AUDIT) [18]; (ii) smoking (continued not smoking or stopped smoking; continued or started smoking); (iii) leisure-time physical activity and commuting (yes: ≥ 150 minutes of physical activity per week; no: < 150 minutes of physical activity per week). Physical activity was measured by the long version of the *International Physical Activity Questionnaire* (IPAQ) [19] (remained or became physically active; remained or became physically inactive); and (iv) daily consumption of fruits and vegetables [20] (continued or started to consume < 5 portions per day; continued or started to consume ≥ 5 portions per day).

(c) Health: (i) diseases (maintained the same number of diseases, developed one or more diseases, decreased the number of diseases) verified with the following question: "Has some physician or other health professional told you that you have ...?". There were twelve options for diseases (questionnaire of the *Brazilian National Household Sample Survey* – PNAD); (ii) cognitive decline (no/yes), verified with the *Mini-Mental State Examination* (MMSE), was assessed as a decrease in the MMSE score from 2009 to 2013, where cognitive decline was defined as a reduction of four points or more [21]; (iii) history of falls (no falls or stopped suffering falls versus continued or started to suffer falls), verified with the question, "Did you suffer any falls in the last year?"; (iv) depressive symtoms [22] (absence of depressive symptoms or stopped having depressive system; continued or started having depressive symptoms); and (v) mobility (perceived capacity for locomotion), identified by use of part of the *Brazilian Questionnaire for Multidimensional Functional Assessment*, adapted from the *Old Americans Resources and Services* questionnaire (BOMFAQ/OARS) [23]. The questions asked about difficulty in performing three activities of daily living – walking on a level surface, climbing one flight of stairs, and walking near home – divided into four categories of possible answers: no difficulty, little difficulty, great difficulty, and

does not perform the activity. For the analysis, the options were divided into two categories: some degree of difficulty with mobility (those with some or great difficulty or who cannot perform any of the activities) versus no difficulty with mobility, categorized as a change variable (continued or started not to have any difficulty versus continued or started to have some degree of difficulty).

More details on the change variables prior to grouping (due to the low number in some categories) can be seen in a previous descriptive study [17].

Adjustment variables (2013/2014)

The adjustment variables were: age bracket (60-69; 70-79; or ≥ 80 years), years of schooling (none; 1-4; 5-8; 9-11; or ≥ 12); per capita income (≤ 1 minimum wage [MW]; > 1-3 MW; > 3-5 MW; > 5-10 MW; or > 10 MW [MW 2010: BRL 510.00]); marital status (married, single, divorced, or widow/widower); family arrangement (living alone, living with others of his/her generation, living with others of another generation); self-rated health status (obtained with the question "In general, would you say that your health is very good, good, fair, bad, or very bad?") [24], categorized as negative (fair, bad, or very bad) versus positive (very good or good); social support (no or yes), investigated on the basis of an affirmative answer to one of these questions: "Has some friend or neighbor invited you to walk, cycle, or practice sports in your neighborhood?" and/or "Has someone in your family invited you to walk, cycle, or practice sports in your neighborhood?"; functional dependence in 15 activities of daily living (ADL) (no – difficulty in zero to three activities; yes – difficulty in four or more activities) [23].

Data analysis

Descriptive analyses were performed for all the variables. Prevalence rates and respective 95% confidence intervals (95%CI) were calculated for sarcopenia, based on the nature of exposures and according to gender. Crude and adjusted analyses used logistic regression, estimating the crude and adjusted odds ratios and respective 95%CI. In the adjusted analysis, the association between each independent variable and sarcopenia was controlled by the adjustment variables, considering three analytical models: Model 1 – adjusted by age, income, marital status, family income; Model 2 – adjusted by age, income, marital status, family income, smoking, alcohol intake, physical activity, and social support; Model 3 – adjusted by age, income, marital status, family income, smoking, alcohol intake, physical activity, social support, self-related health, functional dependence, cognitive decline, depressive symptoms, and diseases.

Data analysis used Stata 13.0 (https://www.stata.com). All analyses considered the cluster sampling design effect, incorporating sampling weights with the *svy* command.

Ethical issues

The study project was approved by the Ethics Committee for Research in Human Subjects at Federal University of Santa Catarina, case review 526.123/2013, and participants signed a free and informed consent form. The authors had no conflicts of interest.

Results

The current study's sample consisted of 598 individuals (63 to 93 years), of whom 391 women and 207 men, with mean ages of 72.5 years (± 6.24) and 72 years (± 6.35), respectively. The proportion of sarcopenia was 17% in women (95%CI: 12.4-22.9) and 28.8% in men (95%CI: 21.3-37.7).

There were differences between the interviewees in the follow-up and those who had undergone the clinical tests. Individuals that appeared for the exams were younger (mean of 72.3 years versus 75.5 years; p ≤ 0.001), working at the time of the assessment (17% versus 7.6%; p ≤ 0.001), more physically active (30.4% versus 23.5%; p = 0.028), and less dependent (26% versus 34.6%; p = 0.046) and showed better cognitive function (78.6% versus 71.7%; p = 0.017) and lower prevalence of depressive symptoms (78.2% versus 83.5%; p = 0.035). There were no differences between the groups in the

following variables: gender (p = 0.802), schooling (p = 0.125), income (p = 0.288), marital status (p = 0.188), and number of diseases (p = 0.609).

Table 1 shows the distribution of women and men according to sociodemographic, behavioral, and health characteristics. The women were predominantly 70 to 79 years of age, with one to four years of schooling, with income > 1 to 3 times the minimum wage, widows, living with others of their own generation, with positive self-rated health, without functional dependence, and without social support. The men were predominantly younger (60-69 years), with 12 or more years of schooling, with income greater than ten times the minimum wage, married, living with others from their own generation, with positive self-rated health, without functional dependence, and without social support.

For the change variables, in both women and men, the highest prevalence was of elderly that continued not to work or that stopped working, remained or became physically active, and continued or started to consume fewer than 5 portions a day of fruits and vegetables. Proportionally more elderly had not experienced cognitive decline, either had no falls or no longer suffered falls, and had either shown no depressive symptoms or no longer had them. Proportionally more elders had developed one or more new chronic conditions. There were higher prevalence rates of women who continued not to consume alcohol or who stopped consuming alcohol and who continued not to smoke or who stopped smoking. Men showed the opposite pattern to that of women for both drinking and smoking (Table 1).

Tables 2 and 3 show the results of the associations between sarcopenia and socioeconomic, behavioral, and health characteristics for women and men, respectively. In the crude analysis, continuing or starting to consume alcohol (OR = 0.34; 95%CI: 0.16-0.73) reduced the odds of women having sarcopenia. Continuing to be inactive or becoming insufficiently active (OR = 2.10; 95%CI: 1.07-4.12) and reduction in the number of diseases (OR = 2.10; 95%CI: 1.02-4.34) were associated with higher odds of sarcopenia. In Models 1 and 2, for women, continuing not to consume alcohol or stopping alcohol consumption and remaining inactive or becoming insufficiently active continued to be associated with sarcopenia. The number of diseases was only associated with sarcopenia in Model 1.

In Model 3, women who continued or began to consume alcohol showed 0.69 times lower odds (OR = 0.31; 95%CI: 0.11-0.91) of presenting sarcopenia. Those who remained or became insufficiently active showed 2.90 times higher odds (95%CI: 1.44-5.84) of sarcopenia. Those who continued to smoke or started smoking showed 2.55 higher odds (95%CI: 1.16-5.58) of sarcopenia, only in Model 3.

In the crude analysis, men that remained inactive or that stopped working (OR = 3.63; 95%CI: 1.22-10.79) and those with cognitive decline (OR = 4.65; 95%CI: 1.01-21.57) showed higher odds of sarcopenia. After applying the adjustment variables in Models 1, 2, and 3, these variables did not remain associated (Table 3).

Discussion

In the current study, the prevalence rates for sarcopenia in women and men were 17% (95%CI: 12.40-22.87) and 28.8% (95%CI: 21.35-37.67), respectively. The estimated prevalence of sarcopenia was thus higher in men, corroborating a previous study [6] using the same criteria and cutoff points as our study. Dufour et al. [6] assessed 274 men and 493 women in Framingham, Massachusettsm USA (72-92 years of age), in whom the prevalence of sarcopenia was 19% and 13%, respectively. The higher prevalence of sarcopenia in men can be explained by the fact that the decline in muscle strength and muscle mass is more severe in men than in women [25].

Despite the selective loss of participants, which may have resulted in underestimation of sarcopenia, the prevalence rates were higher than those observed in another Brazilian study of the elderly in São Paulo [26]. This difference may result from the use of different criteria to assess sarcopenia, besides individual characteristics and/or behavioral and social aspects in each location.

In the current study, women that continued or started to consume alcohol showed lower odds of sarcopenia. Some studies [27,28] have shown that alcohol consumption is not a risk factor for sarcopenia, and even that it acts as a protective factor, as in the current study. However, Domiciano et al. [29] found that elderly in São Paulo that consumed alcohol had 4.1 times higher odds of sarcopenia.

Table 1

Description of the sample and prevalence of sarcopenia according to demographic, socioeconomic, behavioral, and health characteristics in the elderly. Florianópolis, Santa Catarina State, Brazil, 2013/2014.

Variables	Women			Men		
	n	%	% Sarcopenia	n	%	% Sarcopenia
Age group (years) [n = 598]						
60-69	160	40.5	15.7 (8.3-27.8)	93	45.5	20.7 (11.4-34.5)
70-79	170	42.3	15.0 (9.4-23.2)	82	40.0	34.7 (24.0-47.3)
≥ 80	61	17.2	24.8 (12.7-42.7)	32	14.5	38.1 (21.0-58.8)
Schooling (years) [n = 597]						
No formal schooling	26	6.2	8.9 (2.5-26.7)	14	5.3	38.3 (15.8-67.4)
1-4	155	39.2	17.1 (11.3-25.1)	60	24.5	31.9 (18.6-49.1)
5-8	72	18.4	14.2 (5.4-32.3)	34	20.2	31.3 (16.2-51.7)
9-11	70	18.5	19.3 (8.3-38.7)	24	16.9	38.2 (17.8-63.7)
≥ 12	67	17.7	20.1 (10.5-35.1)	75	33.1	18.7 (9.8-33.0)
Per capita income in (minimum wages) [n = 579]						
≤ 1	37	8.6	18.3 (6.8-40.6)	8	3.3	70.1 (32.0-92.12)
> 1-3	122	35.3	15.9 (9.5-25.5)	48	22.3	35.4 (19.0-56.3)
> 3-5	87	19.9	20.0 (11.2-33.1)	34	14.9	27.8 (14.8-46.1)
> 5-10	91	24.3	20.4 (11.9-32.7)	49	28.2	30.7 (16.6-49.5)
> 10	39	11.9	8.4 (3.0-21.3)	64	31.2	18.6 (9.4-33.5)
Marital status [n = 598]						
Married	158	39.3	13.7 (7.7-23.3)	177	85.0	29.1 (21.4-38.1)
Single	34	8.3	8.7 (3.1-22.2)	6	3.8	9.1 (21.4-38.1)
Divorced	38	11.2	23.7 (11.9-41.8)	13	6.4	29.1 (8.9-63.2)
Widow/Widower	161	41.2	19.9 (12.4-30.6)	11	4.8	40.2 (14.3-73.1)
Family arrangement [n = 593]						
Living alone	104	28.8	12.1 (5.2-25.5)	21	10.5	31.1 (14.1-55.3)
Living with others from their own generation	164	41.6	15.2 (9.2-24.1)	176	85.0	28.6 (21.2-37.2)
Living with others from a different generation	119	29.6	25.8 (15.1-38.0)	9	4.5	30.4 (8.0-68.5)
Social support [n = 587]						
No	205	52.8	15.1 (9.9-22.6)	115	57.0	27.7 (18.1-39.9)
Yes	178	47.2	18.3 (10.8-29.5)	89	43.0	31.2 (20.4-44.5)
Work status [n = 559]						
Kept working or started working	46	10.9	13.4 (6.1-27.1)	44	22.4	12.3 (4.6-29.2)
Continued not working or stopped working	309	89.1	17.7 (12.4-24.7)	160	77.6	33.8 (25.5-43.2)
Alcohol consumption [n = 597]						
Continued not consuming or stopped consuming alcohol	270	69.0	20.9 (16.7-28.9)	76	34.0	30.9 (10.1-44.3)
Continued consuming or started consuming alcohol	121	31.0	8.3 (4.5-14.6)	130	66.0	26.8 (17.0-39.6)
Smoking [n = 598]						
Continued not smoking or stopped smoking	300	74.7	14.4 (9.5-21.4)	75	31.0	27.9 (17.2-41.9)
Continued smoking or started smoking	91	25.3	24.6 (15.2-37.2)	132	69.0	29.2 (20.7-39.5)
Physical activity in leisure time and commuting [n = 597]						
Remained or became physically active	199	51.5	12.0 (7.3-19.2)	142	72.7	25.4 (17.0-36.1)
Remained or became physically inactive	192	48.5	22.3 (15.4-31.1)	64	27.3	37.6 (22.3-56.0)
Consumption of fruits and vegetables (portions daily) [n = 571]						
Consumed or started to consume < 5	293	79.3	18.3 (12.5-25.9)	168	85.5	27.8 (19.7-37.6)
Consumed or started to consume ≥ 5	82	20.7	10.5 (4.80-21.6)	28	14.5	31.4 (13.8-56.6)
Self-rated health [n = 587]						
Negative	184	46.9	17.0 (11.0-25.4)	58	29.0	31.8 (20.1-46.4)
Positive	199	53.1	16.3 (9.9-25.7)	146	71.0	28.1 (18.6-40.0)

(continues)

Table 1 (continued)

Variables	Women			Men		
	n	%	% Sarcopenia	n	%	% Sarcopenia
Functional dependence [n = 595]						
No	276	70.4	19.7 (13.5-27.7)	167	82.1	27.9 (19.6-38.1)
Yes	115	29.6	10.6 (6.0-18.0)	37	17.9	33.2 (19.2-50.9)
Cognitive decline [n = 594]						
No	342	87.4	17.5 (12.7-23.6)	190	92.4	26.2 (19.1-34.8)
Yes	46	12.6	15.1 (06.4-31.6)	16	7.6	62.3 (27.2-87.9)
Falls in the last year [n = 598]						
No history of falls or stopped having falls	260	66.1	15.7 (10.8-22.2)	160	76.1	28.4 (20.6-37.8)
History of falls or started having falls	131	33.9	19.5 (11.9-30.4)	47	23.9	30.1 (16.3-48.8)
Depressive symptoms [n = 569)						
None or stopped having symptoms	297	81.1	16.4 (11.2-23.3)	179	88.9	27.6 (20.3-36.3)
History or started having symptoms	75	18.9	19.7 (10.7-33.5)	18	11.1	36.1 (12.5-69.0)
Disease history [n = 596]						
Maintained the same number of diseases	146	37.7	11.7 (7.2-18.4)	74	37.7	22.9 (13.6-36.1)
Developed one or more new diseases	145	38.2	19.4 (11.5-30.9)	85	40.4	34.3 (22.4-48.5)
Decreased the number of diseases	98	24.1	21.7 (13.2-33.7)	48	21.9	28.9 (17.2-44.2)
Mobility [n = 598]						
No history or stopped having difficulty	193	48.4	17.8 (11.6-26.3)	147	71.8	29.0 (19.8-40.3)
History of difficulty or started having difficulty	198	51.6	16.2 (11.1-23.2)	60	28.2	28.4 (17.6-42.5)

The beneficial effect of alcohol intake may be due to a pattern of low use (amount and frequency). Among the women in the current study that already consumed or started to consume alcohol (n = 121; 30.95%), only 6.1% reported abusive use, while 24.81% reported non-abusive consumption. In addition, the observed alcohol consumption may be associated with greater social interaction and better living conditions among women that consume, thus representing a small percentage of healthier elderly women who are less prone to sarcopenia.

In relation to smoking, women that continued or started to smoke showed higher odds of sarcopenia. Previous studies [30,31,32] have shown that smoking is a risk factor for sarcopenia and that elderly smokers have less appendicular skeletal mass when compared to those who have never smoked. This may be explained by the fact that smoking causes breakdown of skeletal muscle proteins [33], with a direct effect on muscle or vascular function [34]. Smoking's sarcopenic effect [35] is related to a substantial decline in muscle mass and strength [36,37,38], leading to functional decline and loss of independence.

As for physical activity, women that remained or became insufficiently active showed higher odds of sarcopenia. Physical inactivity induces alterations in systemic and cellular characteristics, resulting in muscle atrophy and declining muscle contractility [39], which can combine with the aging to lead to muscle atrophy [40]. Previously active women that became inactive showed higher odds of sarcopenia, highlighting the importance of physical activity throughout the aging process.

The study has some limitations. First, it used characteristics of change that did not allow determining the exact moment in which a given activity was started or stopped by the individual. Second, the losses pertaining to tests may have led to a selection bias, since only the elderly in better health appeared for testing, which may have underestimated the prevalence of sarcopenia. Another limitation was the use of self-reported measures, potentially entailing an information bias. Finally, the fact that participants were not asked about types of alcoholic beverages prevents a clearer explanation of the observed association.

The study's strengths feature the use of validated and standardized instruments and training of the fieldwork team. The study also used a population database of elderly of the city of Florianópolis, where sarcopenia was assessed with the gold standard established in the literature, rarely used in population studies in Brazil. The change variables studied here were living conditions or habits that

Table 2

Crude and adjusted analysis of factors associated with sarcopenia in women. Florianópolis, Santa Catarina State, Brazil, 2013/2014.

Variables	Crude analysis OR (95%CI)	Model 1 OR (95%CI)	Model 2 OR (95%CI)	Model 3 OR (95%CI)
Work status				
Kept working or started working	1.00	1.00	1.00	1.00
Continued not working or stopped working	1.39 (0.54-3.55)	1.47 (0.50-4.30)	1.40 (0.44-4.50)	1.84 (0.56-6.10)
Alcohol consumption				
Continued not consuming or stopped consuming alcohol	1.00	1.00	1.00	1.00
Continued consuming or started consuming alcohol	0.34 (0.16-0.73)	0.30 (0.11-0.81)	0.32 (0.11-0.86)	0.31 (0.11-0.91)
Smoking				
Continued not smoking or stopped smoking	1.00	1.00	1.00	1.00
Continued smoking or started smoking	1.93 (0.87-4.32)	2.03 (0.89-4.66)	2.31 (0.99-5.39)	2.55 (1.16-5.58)
Physical activity				
Remained or became physically active	1.00	1.00	1.00	1.00
Remained or became physically inactive	2.10 (1.07-4.12)	2.34 (1.22-4.49)	2.32 (1.21-4.43)	2.90 (1.44-5.84)
Consumption of fruits and vegetables (portions daily)				
Consumed or started to consume < 5	1.00	1.00	1.00	1.00
Consumed or started to consume ≥ 5	0.53 (0.20-1.34)	0.46 (0.18-1.1)	0.43 (0.17-1.12)	0.42 (0.15-1.17)
Cognitive decline				
No	1.00	1.00	1.00	1.00
Yes	0.84 (0.32-2.18)	0.82 (0.33-2.09)	0.81 (0.32-2.02)	0.75 (0.27-2.09)
Falls				
No history of falls or stopped having falls	1.00	1.00	1.00	1.00
History of falls or started having falls	1.31 (0.66-2.56)	1.25 (0.63-2.49)	1.14 (0.51-2.54)	1.36 (0.62-2.96)
Depressive symptoms				
None or stopped having symptoms	1.00	1.00	1.00	1.00
History or started having symptoms	1.25 (0.55-2.86)	1.08 (0.47-2.49)	0.90 (0.39-2.07)	1.38 (0.60-3.17)
Disease history				
Maintained the same number of diseases	1.00	1.00	1.00	1.00
Developed one or more new diseases	1.82 (0.76-4.35)	2.02 (0.85-4.80)	1.80 (0.73-4.48)	1.52 (0.65-3.54)
Decreased the number of diseases	2.10 (1.02-4.34)	2.20 (1.01-4.79)	2.29 (0.98-5.34)	2.18 (0.89-5.35)
Mobility				
No difficulty or stopped having difficulty	1.00	1.00	1.00	1.00
History of difficulty or started having difficulty	0.89 (0.50-1.60)	0.91 (0.52-1.59)	0.67 (0.38-1.16)	1.20 (0.53-2.71)

95%CI: 95% confidence interval; OR: odds ratio.

Note: Model 1 – age, schooling, income, marital status, and family arrangement; Model 2 – age, schooling, income, marital status, family arrangement, smoking, alcohol consumption, physical activity, and social support; Model 3 (final) – adjusted for all the variables above plus self-rated health, dependence in activities of daily living, cognitive decline, depressive symptoms, and disease history.

are amenable to interventions and change. Smoking, physical inactivity, and underweight, considered risk factors for sarcopenia, are important targets for the development of health promotion strategies.

Conclusion

For women, continuing or starting to consume alcohol was associated with lower odds of sarcopenia. Meanwhile, continuing or starting to smoke and remaining or becoming insufficiently active were associated with higher odds of sarcopenia. For men, no factor was associated with sarcopenia.

These results indicate that preventive strategies against the observed risk factors may reduce the loss of muscle mass and thus mitigate or control the prevalence of sarcopenia in the elderly.

Table 3

Crude and adjusted analysis of factors associated with sarcopenia in men. Florianópolis, Santa Catarina State, Brazil, 2013/2014.

Variables	Crude analysis OR (95%CI)	Model 1 OR (95%CI)	Model 2 OR (95%CI)	Model 3 OR (95%CI)
Work status				
Kept working or started working	1.00	1.00	1.00	1.00
Continued not working or stopped working	3.63 (1.22-10.79)	2.80 (0.95-8.18)	2.72 (0.93-7.91)	2.78 (0.87-8.92)
Alcohol consumption				
Continued not consuming or stopped consuming alcohol	1.00	1.00	1.00	1.00
Continued consuming or started consuming alcohol	0.82 (0.34-1.94)	1.04 (0.39-2.75)	1.00 (0.37-2.63)	0.95 (0.35-2.56)
Smoking				
Continued not smoking or stopped smoking	1.00	1.00	1.00	1.00
Continued smoking or started smoking	1.07 (0.53-2.14)	1.10(0.52-2.32)	0.95 (0.45-2.01)	1.05 (0.46-2.38)
Physical activity, inverted				
Remained or became physically active	1.00	1.00	1.00	1.00
Remained or became physically inactive	1.77 (0.66-4.70)	1.94 (0.72-5.20)	2.08 (0.77-5.64)	1.75 (0.63-4.84)
Consumption of fruits and vegetables (portions daily)				
Consumed or started to consume < 5	1.00	1.00	1.00	1.00
Consumed or started to consume ≥ 5	1.19 (0.39-3.59)	1.37 (0.41-4.56)	1.29 (0.33-5.07)	1.07 (0.27-4.25)
Cognitive decline				
No	1.00	1.00	1.00	1.00
Yes	4.65 (1.01-21.57)	3.92 (0.88-17.68)	3.92 (0.88-17.52)	3.84 (0.85-17.2)
Falls				
No history of falls or stopped having falls	1.00	1.00	1.00	1.00
History of falls or started having falls	1.09 (0.47-2.52)	0.95 (0.37-2.44)	0.95 (0.41-2.19)	0.91 (0.41-2.03)
Depressive symptoms				
None or stopped having symptoms	1.00	1.00	1.00	1.00
History or started having symptoms	1.48 (0.38-5.77)	1.21 (0.33-4.41)	0.99 (0.29-3.43)	1.01 (0.25-4.05)
Disease history				
Maintained the same number of diseases	1.00	1.00	1.00	1.00
Developed one or more new diseases	1.75 (0.70-4.40)	2.08 (0.77-5.62)	1.78 (0.67-4.76)	1.66 (0.62-4.47)
Decreased the number of diseases	1.36 (0.62-4.40)	1.56 (0.70-3.58)	1.23 (0.46-3.26)	1.29 (0.47-3.58)
Mobility				
No difficulty or stopped having difficulty	1.00	1.00	1.00	1.00
History of difficulty or started having difficulty	0.97 (0.44-2.17)	0.81 (0.39-1.72)	0.79 (0.33-1.90)	0.61 (0.15-2.46)

95%CI: 95% confidence interval; OR: odds ratio.

Note: Model 1 – age, schooling, income, marital status, and family arrangement; Model 2 – age, schooling, income, marital status, family arrangement, smoking, alcohol consumption, physical activity, and social support; Model 3 (final) – adjusted for all the variables above plus self-rated health, dependence in activities of daily living, cognitive decline, depressive symptoms, and disease history.

These preventive approaches should start earlier in adulthood, since aging involves alterations in body composition.

Health policies and intervention programs based on physical activity and the promotion of healthy habits can protect against the harms caused by sarcopenia in the elderly population, who can thus remain more independent and autonomous and enjoy better quality of life longer.

The study's results in terms of public health can back measures to increase physical activity in all age and schooling groups (with specific approaches for various groups). The study found that 48.5% of the women and 27.3% of the men in the sample remained or became insufficiently active (with less than 150 minutes of physical activity per week, which is below the recommended level).

Physical activities or physical exercise aimed at recovering muscle strength and skeletal mass, such as bodybuilding and resistance training, should be publicized and encouraged among the elderly. Meanwhile, aerobic exercises do not present the same significant benefits.

Contributors

S. C. Confortin, L. M. Ono, A. R. Barbosa and E. d'Orsi collaborated in the study design, data analysis and interpretation, and elaboration of the manuscript. All the authors contributed substantially to the critical revision and approval of the final version for publication.

Acknowledgments

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Resumo

O objetivo do presente estudo foi verificar a prevalência de sarcopenia e sua associação com mudanças nos fatores socioeconômicos, comportamentais e de saúde em idosos. O trabalho, longitudinal e de base populacional, incluiu 598 idosos (≥ 60 anos) de Florianópolis, Sul do Brasil. A sarcopenia foi identificada por meio do índice de massa muscular apendicular (IMMA), de acordo com o sexo (IMMA < 7,26kg/m² para homens e < 5,5kg/m² para mulheres). Foram avaliadas as mudanças ocorridas entre os dois momentos do estudo (2009/2010 e 2013/2014), relativas aos fatores socioeconômicos, comportamentais e de saúde. Foram realizadas análises de regressão logística bruta e ajustada. A prevalência de sarcopenia foi de 17% (IC95%: 12,4-22,9) nas mulheres e de 28,8% (IC95%: 21,3-37,7) nos homens. No modelo final, as mulheres que se mantiveram ingerindo ou passaram a ingerir álcool (OR = 0,31; IC95%: 0,11-0,91) apresentaram menor chance de ter sarcopenia. Aquelas que permaneceram fumando ou passaram a fumar (OR = 2,55; IC95%: 1,16-5,58) e se mantiveram ou passaram a ser insuficientemente ativas (OR = 2,90; IC95%: 1,44-5,84) apresentaram mais chance de ter sarcopenia. Para os homens, nenhuma variável de mudança foi associada a sarcopenia. Os resultados sugerem que manter-se fumando ou passar a ter o hábito de fumar, assim como permanecer ou passar a ser inativo fisicamente, são fatores de risco preveníveis e modificáveis para a sarcopenia.

Sarcopenia; Saúde do Idoso; Idoso; Comportamento; Fatores Sicioeconômicos

Resumen

El objetivo del presente estudio fue verificar la prevalencia de sarcopenia y su asociación con cambios en factores socioeconómicos, comportamentales y de salud en ancianos. El trabajo, longitudinal y de base poblacional, incluyó a 598 adultos mayores (≥ 60 años) de Florianópolis, sur de Brasil. La sarcopenia se identificó mediante el índice de masa muscular apendicular (IMMA), de acuerdo con el sexo (IMMA < 7,26kg/m² para hombres y < 5,5kg/m² para mujeres). Se evaluaron los cambios ocurridos entre los dos momentos del estudio (2009/2010 y 2013/2014), referentes a factores socioeconómicos, comportamentales y de salud. Se realizaron análisis de regresión logística bruta y ajustada. La prevalencia de sarcopenia fue de 17% (IC95%: 12,4-22,9) en las mujeres y de 28,8% (IC95%: 21,3-37,7) en los hombres. En el modelo final, las mujeres que se mantuvieron ingiriendo o empezaron a ingerir alcohol (OR = 0,31; IC95%: 0,11-0,91) presentaron una menor oportunidad de sufrir sarcopenia. Aquellas que permanecieron fumando o empezaron a fumar (OR = 2,55; IC95%: 1,16-5,58) y se mantuvieron o empezaron a ser insuficientemente activas (OR = 2,90; IC95%: 1,44-5,84) presentaron más oportunidad de sufrir sarcopenia. Para los hombres, ninguna variable de cambio se asoció a la sarcopenia. Los resultados sugieren que mantenerse fumando o pasar a tener el hábito de fumar, así como permanecer o pasar a estar inactivo físicamente, son factores de riesgo prevenibles y modificables en el caso de la sarcopenia.

Sarcopenia; Salud del Anciano; Anciano; Conducta; Factores Socieconómicos