ORIGINAL ARTICLE

Factors associated of dynapenia in elderly women from the population-based study: Study of Health in Pomerode - SHIP-Brazil

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ABSTRACT

Dynapenia refers to the loss of muscle strength that occurs as part of the aging process. It predominantly affects women and has been associated with reduced mobility and the presence of multiple chronic diseases. Objective: To analyze the prevalence and factors associated with dynapenia in elderly women from a population-based study in southern Brazil. Methodology: Cross-sectional population-based study with 393 elderly women from Pomerode, SC, Brazil. Dynapenia was defined as handgrip strength below 20.1 kg. Sociodemographic and economic factors, lifestyle, health conditions, and chronic diseases were investigated, through logistic regression, with odds ratios and their 95% confidence intervals (CI). Results: The mean handgrip strength among participants was 23.4 kg (SD = 5.15), with a dynapenia prevalence of 24.2% (95% CI: 20.0-29.0). Multimorbidity (OR = 2.00; 95% CI: 1.07-3.75) and mobility restriction (OR = 2.06; 95% CI: 1.15-3.68) were independently associated with dynapenia. Conclusion: Dynapenia is independently associated with mobility restriction and the presence of multiple chronic diseases among older women.

Keywords: Aging, Women, Lifestyle, Hand strength.

INTRODUCTION

Women account for approximately 56% of the elderly population in Brazil, a phenomenon referred to as the "feminization of old age"[1,2]. Social and economic factors impact the aging process, and analyzing the female profile enables the assessment and development of social interventions[3,4].

Dynapenia refers to the loss of muscle strength, typically associated with ag ing[5]. Factors related to dynapenia include educational attainment, muscle quality, physical inactivity, comorbidities, and reduced mobility[5,6]. Neurological mechanisms within the cortex and spinal cord influence the voluntary activation of muscle fibers. Reduced muscle strength among older adults increases the prevalence of physical performance impairments[7,8].

The assessment of dynapenia enables the detection of the risk of mobility decline and the onset of disabilities such as walking, standing up, sitting down, reaching, and performing personal hygiene tasks[3,8]. In population-based studies, simple and low-cost tests are required. The Handgrip Strength (HGS) test has proven to be an important assessment tool for predicting fractures, falls, comorbidities, depression, sleep disturbances, nutritional status, and

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https://doi.org/10.11606/issn.2176-7262.rmrp.2025.215065

mortality[9,10].

A previous study analyzing five geographical regions of Brazil demonstrated that the prevalence of dynapenia among older women was 27.5% (cut-off point <16 kg)[6]. Other Brazilian studies reported dynapenia prevalences of 34.4%[7] and 52.4%[11] (cut-off point <20 kg). These figures differ from prevalences identified in the United States, namely 25.1%[12] (lowest quartile <14 kg) and 37.5%[13] (lowest tertile <18 kg). The comparison of dynapenia prevalence across different locations is hindered by the varying cut-off points, sampling procedures, and the diverse methodologies employed in the analyses[6,7].

Socioeconomically disadvantaged women[10] should be more closely monitored, as they are more likely to present with dynapenia[3,6,7,14]. Socioeconomic conditions, gender, age, and other factors may be associated with dynapenia[3], in addition to chronic diseases, multimorbidity, and lifestyle factors[6]. The most common chronic conditions among older women are depression, osteoarthritis, and osteoporosis, probably related to hormonal factors, leading to physical disabilities and reduced muscle strength[6,7,15,16]. The aim of this study was to analyz e dynapenia and associated factors among older women in the city of Pomerode, in the state of Santa Catarina.

METHODS

Population and Sample

SHIP-Brazil

Data from the population-based Study of Health in Pomerode (SHIP-Brazil), conducted between 2014 and 2018 in the city of Pomerode, Santa Catarina, Brazil[17], were utilized. Data collection was performed by a trained team of examiners and interviewers, and standard operating procedures were developed using instruments and materials derived from the Study of Health in Pomerania (SHIP) in Germany[18].

Participants were identified through simple random sampling across 12 strata, including both sexes, aged 20 to 79 years, with 10-year intervals. The total sample of SHIP-Brazil experienced approximately 30% losses and refusals, resulting in 2,488 participants. The sample size calculation considered an event prevalence of 50%, a precision of 5%, and a 95% confidence interval.

Inclusion criteria for SHIP-Brazil comprised individuals of both sexes residing in Pomerode for at least six months and aged between 20 and 79 years. Exclusion criteria included any physical or mental limitation preventing participation in interviews or examinations or refusal to sign the informed consent form.

The SHIP-Brazil was approved by the Research Ethics Committee of the University of Blumenau (FURB) under protocol number 33/2012 and opinion number 2,969,842/2018. This study was approved under opinion number 2,558,368/2018.

Study on Dynapenia in Elderly Women

Our sample included all 393 elderly women aged between 60 and 79 years.

Interviews, Examinations, and Variables

The following independent variables were analyzed: age group (60-69, 70-79 years), educational level (0, 1-8, 9-11, ≥12 years), German cultural background (yes if the language is spoken at home and/or if they participate in German cultural associations), marital status (married or cohabiting, single, separated, or widowed), economic consumption class (A, B, C, or D/E), moderate and vigorous physical activity (insufficiently active <150 min/week or sufficiently active ≥150 min/week as assessed by the short form of the IPAQ), alcohol consumption (abusive or non-abusive). Abusive alcohol consumption was defined using a cut-off point for women of ≥3 points on a scale from zero to 12 points, estimated by three questions on frequency and quantity of alcohol intake from the AUDIT-C. Smoking status was categorized as never smoker, former smoker, or current smoker. Self-reported presence of chronic diseases included systemic arterial hypertension, cerebrovascular accident (stroke), diabetes mellitus, degenerative joint disease/osteoarthritis, osteoporosis, depression, and Parkinson's disease. Multimorbidity was defined as the presence of two or more of the aforementioned diseases[17].

Body weight was measured using a W300 electronic scale (WELMY®) with a total capacity of 300 kg and divisions of 50 g. Participants stood barefoot in the center of the platform wearing minimal clothing and without accessories. Height was measured using a stadiometer with a vertical rod. Participants were in an upright (orthostatic) position, barefoot with feet together, in contact with the measuring device, and with the head positioned according to the Frankfurt plane. The cursor was positioned at a 90º angle relative to the scale, touching the highest point of the head and parallel to the chest at the end of a deep inspiration. Body mass index (BMI) was calculated by dividing weight (kg) by height squared (meters), and classified as underweight (<22), normal weight (22 to 27), or overweight (≥27 kg/m²)[17].

Circumferences were measured using a non-elastic tape measure (Cescorf®), recorded in centimeters. Participants stood erect with feet parallel and arms crossed over the chest in front of the body. Waist circumference was measured at the midpoint between the last rib and the right superior iliac crest, with readings taken at the end of expiration. Hip circumference was measured with the tape maintained horizontally over the trochanters. The waist-to-hip ratio (WHR), expressed in cm, was categorized as low/moderate cardiovascular risk (<0.85) or high cardiovascular risk (≥0.85)[17].

Mobility was assessed using the Timed Up and Go (TUG) test, defined as the time taken for the participant to rise from a chair, walk a distance of 3 meters, turn, and return to sit on the chair, measured with an electronic stopwatch. The test was performed three times per participant, with the shortest time (in seconds) recorded. Mobility restriction was defined as a completion time of ≥13 seconds[17].

Handgrip Strength (HGS) Test

HGS was measured in each hand using a digital dynamometer (Jamar Plus Digital) with the participant seated in a chair, feet flat on the floor, shoulders and forearms in a neutral position, and elbows flexed at 90 degrees. Three measurements were taken at 15-second intervals. The target value was the highest of the three measurements, and the cut-off point for dynapenia was defined as the lowest quartile, with a value of <20.1 kg[19].

Statistical Analysis

Frequency distribution was analyzed using histograms, with mean, standard deviation (SD), and quartiles calculated for HGS values. The Kolmogorov-Smirnov test was applied to assess the normality of distribution. Spearman's correlation was used to examine the association between HGS and the TUG test. Prevalence and their respective 95% confidence intervals (CI) were estimated. Associations between independent variables and the outcome were evaluated using Odds Ratios (OR) and 95% CIs estimated via univariate and multivariate logistic regression. Multivariate logistic regression models were constructed using a stepwise forward procedure to assess confounding, starting with variables most significantly associated with the outcome and those with p-values ≤0.20 in univariate analysis. Variables with p-values

≤0.05, adjusted for other covariates, remained in the final model.

RESULTS

Of the 393 eligible elderly women, there were 48 losses and refusals (12.2%) for the handgrip strength (HGS) test. Losses and refusals were more prevalent ($p < 0.05$) among illiterate participants, those with a history of stroke, and those with none or only one chronic disease. Losses and refusals did not differ according to the level of moderate and vigorous physical activity ($p = 0.947$). There was no difference in mean age between participants (68.4 years; SD = 5.47) and non-participants (69.8 years; SD = 5.92) due to losses ($p = 0.100$). The final sample, considering the dependent variable dynapenia, consisted of 345 elderly women aged between 60 and 79 years (Figure 1).

The histogram of the frequency distribution for HGS among the elderly women showed a minimum value of 9.50 kg, 25th percentile = 20.1 kg, median = 23 kg, 75th percentile = 26.4 kg, maximum value = 40.8 kg, mean = 23.4 kg, and a standard deviation of 5.15. The distribution was normal ($p = 0.200$) (Figure 2). The distribution of TUG presented a mean of 11.6 seconds (SD = 3.18), a median of 11 seconds (minimum = 6 seconds, 25th percentile = 10 seconds, 75th percentile = 13 seconds, maximum = 29 seconds), without adherence to the normal curve ($p < 0.001$). There was a weak negative correlation ($r = -0.34$) between HGS and TUG (Figure 3), but this was statistically significant ($p < 0.001$).

Table 1. Characteristics of elderly women stratified by dynapenia (n=345).

Variables	Total	Dynapenia Yes	Dynapenia No	p-value*
	% (95%CI)	% (95%CI)	% (95%CI)	
Sociodemographic and Economic Factors				
Age group (years)				
60-69	62.2 (60.4-63.9)	55.2 (45.8-64.2)	64.4 (61.0-67.8)	0.125
70-79	37.8 (36.1-39.6)	44.8 (35.8-54.2)	35.6 (32.2-39.0)	
Educational level (years of schooling)				
0	3.6 (2.1-6.1)	1.1 (0.2-7.6)	4.4 (2.5-7.6)	0.343
1-8	86.9 (82.9-90.1)	91.7 (83.6-96.0)	85.4 (80.6-89.1)	
9-11	3.5 (2.0-6.1)	3.6 (1.1-10.6)	3.5 (1.8-6.6)	
≥12	6.0 (3.9-9.0)	3.6 (1.1-10.6)	6.8 (4.3-10.5)	
German cultural				
No	13.9 (10.6-18.1)	13.6 (7.7-23.0)	14.0 (10.3-18.9)	0.932
Yes	86.1 (81.9-89.4)	86.4 (77.0-92.3)	86.0 (81.1-89.7)	
Marital status				
Married or cohabiting	64.2 (59.1-69.1)	68.0 (57.4-77.0)	63.0 (57.0-68.7)	0.265
Single	3.3 (1.8-5.8)	2.4 (0.6-9.3)	3.5 (1.9-6.7)	
Separated	5.5 (3.5-8.5)	1.3 (0.2-8.5)	6.8 (4.3-10.6)	
Widowed	27.0 (22.8-31.7)	28.3 (19.8-38.6)	26.6 (21.7-32.1)	
Economic class				
A	14.0 (10.7-18.1)	12.9 (7.2-21.8)	14.4 (10.6-19.2)	0.915
B	45.2 (40.0-50.5)	43.7 (33.5-54.4)	45.7 (39.7-51.8)	
C	39.2 (34.1-44.4)	41.2 (31.2-52.0)	38.5 (32.8-44.6)	
D/E	1.7 (0.7-3.6)	2.2 (0.6-8.6)	1.5 (0.6-3.9)	
Lifestyle Factors				
Moderate and vigorous physical activity (min/week)				
Insufficiently active (<150)	41.0 (35.5-46.8)	43.1 (31.6-55.4)	40.5 (34.2-47.1)	0.705
Sufficiently active (≥150)	59.0 (53.2-64.5)	56.9 (44.6-68.4)	59.5 (52.9-65.8)	
Alcohol consumption				
Non-abusive	95.2 (92.3-97.0)	96.1 (88.6-98.7)	94.9 (91.4-97.0)	0.667
Abusive	4.8 (3.0-7.7)	3.9 (1.3-11.4)	5.1 (3.0-8.6)	
Smoking				
Never smoked	71.4 (66.3-76.1)	80.0 (69.8-87.4)	68.7 (62.7-74.2)	0.066
Former smoker	18.9 (15.1-23.4)	10.1 (5.1-18.9)	21.7 (17.0-27.2)	
Current smoker	9.7 (7.0-13.3)	9.9 (5.0-18.7)	9.6 (6.6-13.7)	
Health Conditions and Chronic Diseases				
Body mass index (Kg/m²)				
Underweight (<22)	2.4 (1.2-4.8)	3.7 (1.2-11.1)	2.0 (0.8-4.7)	0.378
Normal weight (22–27)	25.7 (21.3-30.6)	20.8 (13.3-31.0)	27.2 (22.1-33.0)	
Overweight (>27)	71.9 (66.9-76.5)	75.5 (64.9-83.7)	70.8 (64.9-76.1)	
Waist-to-hip ratio (cm)				
<0.85 (low/moderate cardiovascular risk)	32.5 (27.7-37.8)	30.5 (21.5-41.3)	33.2 (27.6-39.3)	0.653

≥0.85 (high cardiovascular risk)	67.5 (62.2-72.3)	69.5 (58.7-78.5)	66.8 (60.7-72.4)	
Systemic arterial hypertension				
No	40.4 (35.0-45.9)	42.1 (31.2-53.8)	39.8 (33.8-46.2)	0.731
Yes	59.6 (54.1-65.0)	57.9 (46.2-68.8)	60.2 (53.8-66.2)	
Stroke				
No	96.8 (94.1-98.3)	94.6 (86.4-98.0)	97.5 (94.4-98.9)	0.226
Yes	3.2 (1.7-5.9)	5.4 (2.0-13.6)	2.5 (1.1-5.6)	
Diabetes				
No	81.3 (76.7-85.2)	76.1 (65.5-84.3)	82.9 (77.7-87.1)	0.177
Yes	18.7 (14.8-23.3)	23.9 (15.7-34.5)	17.1 (12.9-22.3)	
Degenerative joint disease/osteoarthritis				
No	49.7 (44.4-55.1)	36.8 (27.0-47.8)	53.9 (47.7-59.9)	0.008
Yes	50.3 (44.9-55.6)	63.2 (52.2-73.0)	46.1 (40.1-52.3)	
Osteoporosis				
No	69.0 (63.8-73.7)	59.7 (48.7-69.8)	71.9 (66.1-77.1)	0.039
Yes	31.0 (26.3-36.2)	40.3 (30.2-51.3)	28.1 (22.9-33.9)	
Depression				
No	63.2 (57.9-68.2)	57.1 (46.1-67.5)	65.1 (59.0-70.7)	0.199
Yes	36.8 (31.8-42.1)	42.9 (32.5-53.9)	34.9 (29.3-41.0)	
Parkinson's disease				
No	98.5 (96.4-99.4)	96.4 (89.4-98.8)	99.2 (96.8-99.8)	0.074
Yes	1.5 (0.6-3.6)	3.6 (1.2-10.6)	0.8 (0.2-3.2)	
Multimorbidity				
No (one or none)	38.9 (33.9-44.2)	25.7 (17.5-36.1)	43.1 (37.3-49.2)	0.004
Yesm (two or more)	61.1 (55.8-66.1)	74.3 (63.9-82.5)	56.9 (50.8-62.7)	
Mobility restriction				
No (<13 sec.)	73.5 (68.7-77.8)	60.9 (50.2-70.7)	77.5 (72.1-82.1)	0.003
Yes (≥13 sec.)	26.5 (22.2-31.3)	39.1 (29.3-49.8)	22.5 (17.9-27.9)	

*Chi-squared test

The characteristics of the elderly women, including the prevalence of dynapenia, are presented in Table 1. The majority of the women were aged 60-69 years (62.2%), had between one and eight years of education (86.9%), preserved German cultural background (86.1%), and belonged to economic classes B (45.2%) and C (39.2%). They were sufficiently active (59%), reported non-abusive alcohol consumption (95.2%), had never smoked (71.4%), were overweight (71.9%), at high cardiovascular risk (67.5%), with systemic arterial hypertension (59.6%), diabetes mellitus (18.7%), degenerative joint disease/osteoarthritis (50.3%), osteoporosis (31%), depression (36.8%), and multimorbidity (two or more chronic diseases) (61.1%).

The prevalence of dynapenia was 24.2% (95% CI: 20.0-29.0). In the unadjusted analysis, dynapenia was associated with being a former smoker compared to never having smoked ($p = 0.028$), presence of degenerative joint disease/osteoarthritis ($p = 0.007$), osteoporosis ($p = 0.036$), multimorbidity ($p = 0.006$), and mobility restriction ($p = 0.004$) (Table 2).

Table 2. Unadjusted analysis of factors associated with dynapenia in elderly women (n=345).

Variables	Dynapenia				p-value
	%	95%CI	OR	95%CI	
Age group (years)					
60-69	21.7	16.6-27.9	1		
70-79	28.3	21.3-36.4	1.41	0.87-2.33	0.168
Educational level (years of schooling)					
0	7.5	1.0-38.8	1		
1-8	25.5	20.9-30.7	4.14	0.53-32.39	0.175
9-11	24.8	8.1-55.1	4.00	0.36-45.10	0.262
≥12	15.2	5.0-38.2	2.12	0.20-22.90	0.537
German cultural					
No	23.5	13.5-37.8	1		
Yes	24.0	19.5-29.3	1.02	0.50-2.13	0.903
Marital status					
Married or cohabiting	25.6	20.2-31.9	1		
Single	17.8	4.4-50.3	0.64	0.14-3.1	0.584
Separated	5.6	0.8-31.0	0.18	0.02-1.32	0.090
Widowed	24.7	16.9-34.5	0.98	0.55-1.70	0.915
Economic class					
A	22.8	13.0-36.7	1		
B	23.6	17.6-30.9	1.04	0.49-2.26	0.909
C	25.5	18.9-33.6	1.17	0.54-2.53	0.698
D/E	19.6	2.6-68.9	0.84	0.09-8.32	0.882
Moderate and vigorous physical activity (min/week)					
Insufficiently active (<150)	23.6	16.8-32.1	1		
Sufficiently active (≥150)	21.6	16.0-28.6	0.90	0.51-1.58	0.637
Alcohol consumption					
Non-abusive	24.0	19.6-29.0	1		
Abusive	19.4	6.4-45.8	0.77	0.21-2.80	0.624
Smoking					
Never smoked	26.7	21.5-32.7	1		
Former smoker	13.1	6.6-24.1	0.41	0.19-0.91	0.028
Current smoker	24.8	12.9-42.3	0.88	0.38-2.02	0.747
Body mass index (Kg/m²)					
Underweight (<22)	37.2	12.3-71.5	1		
Normal weight (22–27)	19.6	12.5-29.4	0.41	0.09-1.90	0.253
Overweight (>27)	24.9	19.9-30.8	0.56	0.13-2.40	0.435
Waist-to-hip ratio (cm)					
<0.85 (low/moderate cardiovascular risk)	22.8	15.9-31.6	1		
≥0.85 (high cardiovascular risk)	25.0	19.7-31.1	1.12	0.66-1.94	0.714

Systemic arterial hypertension					
No	24.6	17.7-33.1	1		
Yes	22.1	16.7-28.7	0.88	0.50-1.50	0.640
Stroke					
No	22.8	18.4-28.0	1		
Yes	32.7	10.7-66.2	1.64	0.34-6.80	0.470
Diabetes					
No	22.1	17.5-27.5	1		
Yes	30.3	20.2-42.8	1.53	0.83-2.83	0.161
Degenerative joint disease/osteoarthritis					
No	17.9	12.8-24.5	1		
Yes	30.2	23.7-37.6	1.99	1.19-3.33	0.007
Osteoporosis					
No	20.6	15.9-26.4	1		
Yes	31.3	23.2-40.9	1.76	1.03-2.97	0.036
Depression					
No	21.0	16.1-27	1		
Yes	27.8	20.5-36.4	1.45	0.86-2.43	0.170
Parkinson's disease					
No	23.7	19.4-28.6	1		
Yes	58.6	19-89.5	4.57	0.74-28.04	0.089
Multimorbidity					
No (one or none)	16.2	10.9-23.4	1		
Yesm (two or more)	29.3	23.6-35.9	2.16	1.25-3.73	0.006
Mobility restriction					
No (<13 sec.)	20.1	15.6-25.6	1		
Yes (≥13 sec.)	35.4	26.2-45.8	2.17	1.27-3.72	0.004

In the multivariate analysis, the factors independently associated with dynapenia were the presence of mobility restriction (OR = 2.06; 95% CI: 1.15-3.68) and multimorbidity (OR = 2.00; 95% CI: 1.07-3.75). The model was adjusted for age group, presence of osteoporosis, and Parkinson's disease (Table 3).

Table 3. Multiple analysis of factors associated with dynapenia in elderly women (n=345).

Variables*	OR	95%CI	p-value
Mobility restriction			
No (<13 sec.)	1		
Yes (≥13 sec.)	2.06	1.15-3.68	0.015
Multimorbidity			
No (one or none)	1		
Yes (two or more)	2.00	1.07-3.75	0.031

*Adjusted for: age group, osteoporosis and Parkinson's disease.

DISCUSSION

This study found that the mean HGS among the elderly women was 23.4 kg. After adjustment for age group, osteoporosis, and Parkinson’s disease, the factors independently associated with dynapenia were mobility restriction and multimorbidity.

No previous studies investigating the prevalence and factors associated with dynapenia among elderly women from the Pomeranian community in Brazil were found. Moreover, different cut-off points and methodologies hinder comparison with other studies[6,7]. One reason for this lack of data may be the absence of consensus regarding reference values, the definition of the term, and measurement procedures when assessing elderly individuals[7]. For the present study, we opted to use the lower quartile (below 20.1 kg) to identify dynapenia in elderly women, in accordance with recommendations from the European Working Group[20].

The Health, Well-Being, and Aging Study (SABE)7 found a dynapenia prevalence of 34.4%. Among the age groups 60-69, 70-79, and 80 years and over, the prevalence rates observed were 26.6%, 41.4%, and 46.1%, respectively. The cut-off point adopted for dynapenia in elderly women was <20 kg of HGS, the same as in the present study. Here, the prevalence was 21.7% among women aged 60-69 years and 28.3% among those aged 70-79 years. These prevalence rates do not differ statistically when considering the respective confidence intervals. In a large national study[6] with older adults from 70 municipalities across five geographical regions of the country, the prevalence of dynapenia among elderly women (aged 60 years and over) was 23.9%, and among those aged 65 years and over it was 27.5%. The cut-off point adopted to define dynapenia was HGS <16 kg[6].

Healthy older adults usually do not present with severe tactile deficits that impair manual dexterity. However, sensory loss related to pre-existing diseases, such as neuropathy in older adults, can more drastically affect hand function[20]. Over the years, cognitive and motor functions deteriorate, and non-functional muscle mass seems to be one of the main determinants of strength differences related to age and sex[6,8].

In a study[21] that analyzed factors associated with dynapenia using cut-off points of <26 kg for men and <16 kg for women, dynapenia was present in 36% of participants. In the univariate analysis, women were three times more likely to have dynapenia than men. After adjustment, the likelihood of dynapenia was three times higher among older adults with lower life satisfaction compared to those with higher satisfaction, and almost four times higher among those with dependency versus those with independence in performing daily life activities. It was also observed that elderly people with lower calf circumference were two and a half times more likely to have dynapenia. A possible explanation is that, during the aging process, there is a progressive decrease in muscle mass in both upper and lower limbs, which may lead to reduced muscle strength and mobility[21].

Dynapenia is prevalent among women aged 50 years or older and is associated with reduced gait speed, limitations in basic activities of daily living, and chronic diseases. On the other hand, physical activity and body mass index are protective factors[7]. During the aging process, there may be a progressive increase in total body mass, leading to greater fat mass and a loss of fat-free mass, which may serve as a protective factor against muscle strength decline[21].

Self-reported presence of two or more chronic diseases was independently associated with dynapenia[6]. In the present study, elderly women with multimorbidity were twice as likely to have dynapenia compared to those without multimorbidity. In a cross-sectional population-based study[22] with 477 older adults (56.6% women) aged

60 years and over, an association between chronic multimorbidity and HGS was found. The authors concluded that HGS is a valid measure for monitoring, considering prevention or intervention in chronic diseases and multimorbidity.

The chronic diseases statistically significant in the univariate model of our study were osteoporosis and degenerative joint disease/osteoarthritis. Osteoarthritis is a very common condition in older adults, generating high healthcare costs, as well as disability and reduced quality of life[23]. In the aforementioned SABE study7, the relative risk ratio for dynapenia was 1.7 times higher among older adults with osteoarthritis compared to those without. Osteoarthritis is a chronic disease that limits mobility due to pain and muscle stiffness. Affected individuals may experience reduced muscle strength and increased activity limitations[24], providing an explanation for the association between osteoarthritis and dynapenia[7].

Muscle strength decline occurs due to concurrent changes between chronic diseases and muscular conditions; however, this relationship still requires further study to elucidate the mechanisms and associated diseases that could compromise muscle strength25. Additionally, in women, sex hormones may play an important role[26].

As in previous studies[6,14,27], mobility restriction, assessed through TUG, was also associated with dynapenia. Elderly women with reduced gait speed were twice as likely to present dynapenia[6]. A mean reduction of 2.16 kg in HGS was estimated in older adults with reduced mobility as measured by TUG. For each additional second, HGS decreased by a mean of 0.08 kg[14].

Among elderly women, muscle strength has a greater impact on functional physical performance. When such performance is compromised, muscle strength plays a smaller role, requiring greater reliance on other capabilities such as balance and aerobic capacity[28]. A systematic review[29] of 28 longitudinal studies analyzed predictive values of physical frailty indicators on disabilities in activities of daily living among community-dwelling older adults. The most significant predictors of these disabilities were reduced gait speed, low physical activity level, loss of body mass, and decreased muscle strength[29].

Dynapenia is associated with the aforementioned factors, and this loss of muscle strength may also be directly related to age[30]. Increasing age and aging must therefore be considered in promoting active ageing with both individualized and collective planning for elderly women.

The present study did not find an association between dynapenia and levels of moderate or vigorous physical activity. One hypothesis for this lack of association is the high prevalence of active elderly women in our sample (59%). Moreover, the nature of the reported activities in this population may be more related to commuting and domestic tasks, and less to leisure-time activities, physical exercise, and resistance training, which could directly impact muscle strength[31]. However, the literature reports that insufficient physical activity levels in the population are negatively associated with muscle strength and dynapenia in older individuals[6,29,32].

Identifying determinants of strength loss, such as assessing muscle quality and movement, may help to minimiz e the sequelae of longevity[3,33]. Physical activity levels have been associated with a lower prevalence of chronic diseases, and even low weekly frequencies appear to reduce the risk of such conditions[34]. Engaging in physical and sporting activities from youth has consistent evidence supporting positive health outcomes[35]. The more time spent being active, the better the outcomes for minimiz ing muscle loss in elderly people, demonstrating a dose-response relationship[34].

In this context, a more active lifestyle may bring benefits to minimize the consequences of muscle strength loss and mobility restrictions associated with longevity[8,32,35]. As a suggestion, elderly women may benefit from actions and programs developed early by health authorities. Hence, the importance of implementing community physical and leisure activities, lifestyle modification interventions, and resistance exercise programs, especially for adult and elderly women with chronic diseases[8,35,36]. Resistance exercises, such as muscle strength training and functional training, have the capacity to preserve strength and muscle mass[31,36].

This study has some limitations. First, the analysis is cross-sectional, making it impossible to establish a causal mechanism between the associations. Second, SHIP-Brazil is conducted among the community-dwelling population and does not include older adults living in long-term care institutions. Thus, the higher prevalence of dynapenia and differences in lifestyle and health conditions in that population could alter the estimates found here. Third, losses and refusals were higher among illiterate individuals and those without multimorbidity. Illiteracy could further increase the prevalence and negative impact of dynapenia. However, it is estimated that a greater number of elderly women in the sample with one or no chronic diseases would decrease the prevalence of dynapenia and perhaps adjust its association with the number of chronic diseases. Moreover, losses and refusals regarding physical activity levels were similar between participants and non-participants, reinforcing the relationship between dynapenia and mobility restriction. Fourth, the study was conducted with a specific sample of elderly women, many of whom have German cultural heritage, in a medium-sized municipality in southern Brazil. However, this potential limitation could also be considered a strength due to the innovation of being the first study to estimate the prevalence of dynapenia and associated factors in this community. Another strength of the study was the representative home-based sample for the city of Pomerode, SC.

CONCLUSION

The findings of this study associated dynapenia with mobility restriction and chronic multimorbidity. Chronic diseases and mobility restrictions can be prevented through an active and healthy lifestyle, which, in turn, may contribute to the prevention and management of muscle strength loss.

FIGURE

Figure 1. Sample flowchart.

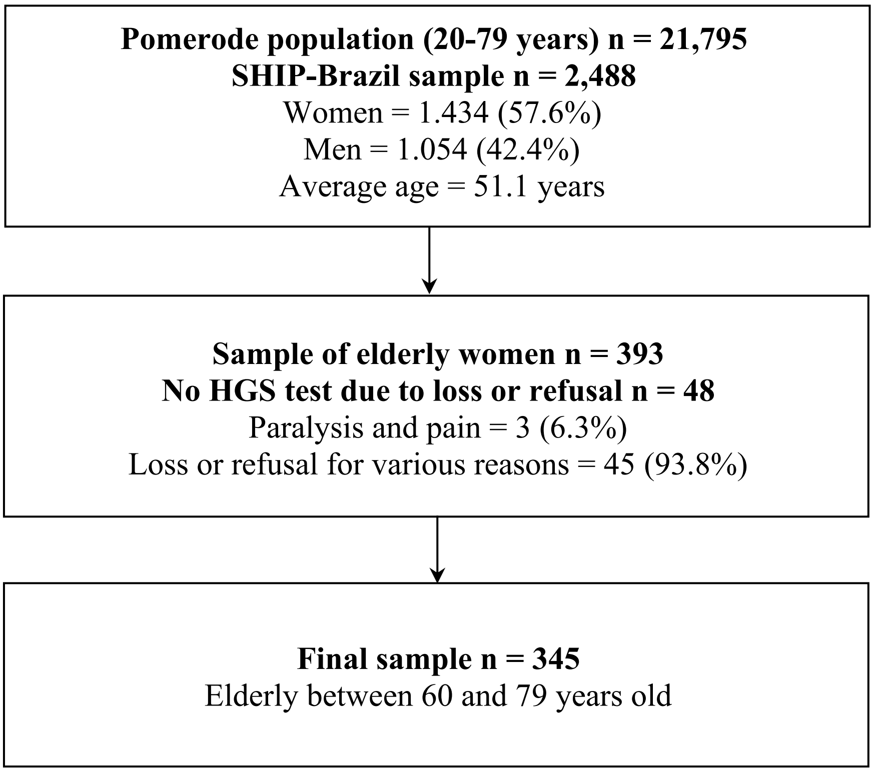


Figure 2. Histogram of the frequency of the elderly women's handgrip strength (n=345, mean=23.4 kg, SD=5.15).

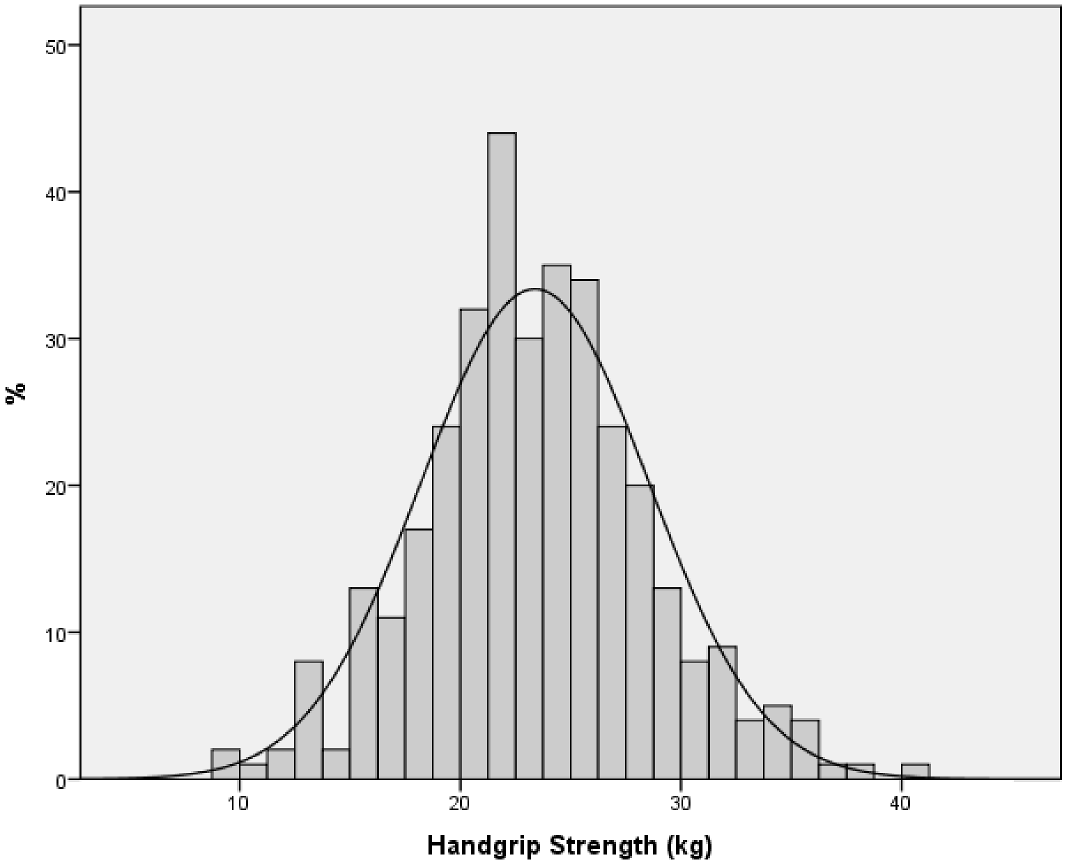
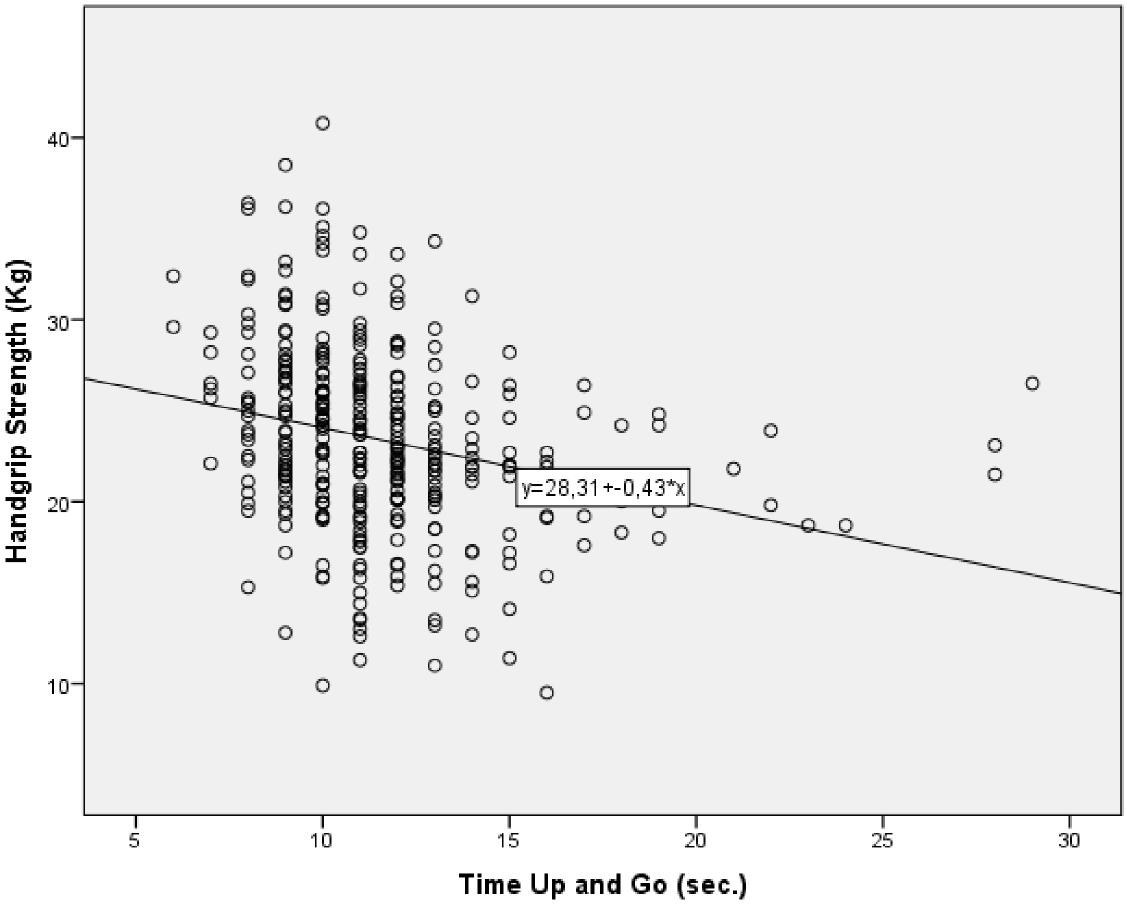


Figure 3. Correlation between Handgrip Strength and Timed Up and Go among elderly women (n=345).



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Author contributions:

K.D.A: Participated in the revision and approval of the final version; agreed to be responsible for the accuracy or integrity of any part of the study.
A.P.F: Made substantial contributions to the study design or data interpretation; participated in drafting the preliminary version; agreed to be responsible for the accuracy or integrity of any part of the study.
M.R.P.M: Participated in the revision and approval of the final version; agreed to be responsible for the accuracy or integrity of any part of the study.
E.T.S.H: Participated in the revision and approval of the final version; agreed to be responsible for the accuracy or integrity of any part of the study.
C.A.S: Participated in drafting the preliminary version; participated in the revision and approval of the final version; agreed to be responsible for the accuracy or integrity of any part of the study.

Conflict of Interest:

The authors declare no conflict of interest.

Acknowledgements:

The SHIP-Brazil study has been made possible thanks to the efforts of numerous professionals and healthcare institutions. Firstly, we thank FAPESC, the University of Blumenau, and the Municipality of Pomerode for their financial support. Secondly, we acknowledge the Institute for Community Medicine at the University of Greifswald, especially Professor Henry Völzke and Professor Carsten Oliver Schmidt, heads of the "Study of Health in Pomerania" (SHIP), who support SHIP-Brazil as part of the international SHIP project, providing expertise in data collection, quality assurance, and data analysis. Thirdly, we extend our gratitude to all health professionals involved in data collection (interviewers, examiners, supervisors, and laboratory staff). Lastly, we thank all study participants and their families for making this project possible.

Ethics Committee:

The SHIP-Brazil study was approved by the Research Ethics Committee of the Regional University of Blumenau under protocol number 2.969.842/2018. This subproject was approved under protocol number 2.558.368/2018.

Funding:

The Study of Health in Pomerode - SHIP-Brazil received financial support from the Research Programme for the SUS (PPSUS) of FAPESC/MS-DECIT/CNPq/SES-SC.

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Received: oct 3, 2023
Approved: aug 12, 2024

Editor: Profa. Dra. Ada Clarice Gastaldi