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Investigating the Presence of Sarcopenia in Hospitalized Elderly People and Its Relationship with Anthropometry and Body Composition

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Abstract

Sarcopenia is a progressive and widespread disorder of skeletal muscle and may be accompanied by increased morbidity and mortality. The study's objective was to identify, upon hospital admission, elderly people at risk of sarcopenia or with sarcopenia and the relationship with anthropometric variables and body composition data. Forty elderly men and women were included. Initially, the patients answered the sample characterization questionnaire, and for the screening and diagnosis of sarcopenia, the algorithm and criteria proposed by the European Working Group on Sarcopenia in Older People were adopted. Ten percent of the sample were diagnosed with sarcopenia, and 45% were at risk of sarcopenia. When the elderly were classified with the absence or presence of sarcopenia, there were significant differences in the quantitative variables of current weight, recent weight change, BMI, Calf Circumference (CC), Hand Grip Strength (HGS), Arm Muscle Circumference (AMC) and Arm Muscle Area (AMA). Significant positive correlations were found between HGS and thickness of the Adductor Pollicis Muscle (APMS), HGS, and lean mass, and a significant negative correlation between HGS and age. Thus, the prevalence of sarcopenia and the risk of developing it occurred in 55% of the elderly admitted to the hospital, being confirmed in 10% of cases. BMI, CC, AMC, AMA, and lean mass were the anthropometric and body composition variables that showed differences between sarcopenic and non-sarcopenic elderly. Muscle strength was positively correlated with adductor pollicis muscle thickness and lean body mass.

Keywords: Sarcopenia; Elderly; Anthropometry; Muscle mass; Muscle strength

Abbreviations: AC: Arm Circumference; AMA: Arm Muscle Area; AMC: Arm Muscle Circumference; APMT: Adductor Pollicis Muscle Thickness; BMI: Body Mass Index; CC: Calf Circumference; EWGSOP2: European Working Group on Sarcopenia in Older People; HGS: Hand Grip Strength; Kg/f: Kilogram-Force; TS: Triceps Skinfold

Introduction

Sarcopenia is a progressive and widespread disorder of skeletal muscle Cruz-Jentoft et al. [1]. Loss of muscle mass and strength are common during aging and may be accompanied by mobility disorders, which reduce patients' quality of life and autonomy and increase morbidity and mortality Petermann-Rocha et al. [2], Wiedmer et al. [3]. The prevalence of sarcopenia in the world ranges from 10 to 40%. However, the percentage is due to the study site, the sample's characteristics, and the sarcopenia evaluation criteria Mayhew et al. [4], where it occurs more frequently in hospitalized older people or those living in long-term institutions Cruz-Jentoft et al. [5]. Data from a Brazilian study showed that one-third of hospitalized individuals were at risk of sarcopenia Cristaldo et al. [6] however, there are reports that this disease affects about 49% of hospitalized individuals Ozer et al. [7]. It is known that older people with sarcopenia generate high costs for the health system due to a greater dependence on care and hospitalization time Cawthon et al. [8]. Some reports hospitalized older adults with sarcopenia are five times more likely to have higher hospital costs than those without sarcopenia Antunes et al. [9], Nunes et al. [10]. Given the above, this study aimed to identify, upon hospital admission, older people at risk of sarcopenia or with sarcopenia and the relationship between anthropometric variables and body composition.

Materials and Methods

Patients aged ≥ 60 years of both sexes, admitted from July to October 2022 in a hospital in Marília, São Paulo, were included. The data was collected in the first 24 to 48 hours of hospitalization. The exclusion criteria were patients under dietary restriction for weight loss during the study period, with chronic renal failure on dialysis, with paresis or hemiparesis due to stroke, with changes in body fluids (ascites, edema, and dehydration), with a pacemaker and patients on chronic use of oral corticosteroids. This study was approved by the Research Ethics Committee of the University of Marília under protocol number 5,489,649.

Initially, a sample characterization questionnaire was performed (gender, age, race, and number of days of hospitalization). The anthropometric data collected were body weight and height for later calculation of the Body Mass Index (BMI), plus the measurement of the Calf Circumference (CC) and the Thickness of the Adductor Pollicis Muscle (APMT). When it was impossible to measure weight and height, an estimate was made using the Chumlea formulas Chumlea et al. [11-12]. To calculate Arm Muscle Circumference (AMC) and Arm Muscle Area (AMA), Arm Circumference (AC) and Triceps Skinfold (TS) values were required for use in specific formulas Acuña & Cruz [13]. The AMC and AMA were calculated according to Oyhenart et al. [14], Wu et al. [15] respectively. For anthropometric data collection, recommended techniques were used Gibson [16].

For the screening and diagnosis of sarcopenia, the algorithm and criteria proposed by the European Working Group on Sarcopenia in Older People - EWGSOP2 Cruz-Jentoft & Sayer [17]. The volunteers were screened for risk of sarcopenia using the SARC-F questionnaire (simple questionnaire to diagnose sarcopenia rapidly), which consists of 5 items self-reported by patients or caregivers.

Muscle strength was measured using a manual dynamometer, Jamar®, with maximum Hand Grip Strength (HGS) applied to both hands for about three seconds, in triplicate, with a 60-second rest period between measurements in the same hand. The results were expressed in Kilogram-Force (Kg/f), considering each hand's mean of the three measurements. The cut-off point for low muscle strength was HGS < 27 kg for men and women < 16 kg Cruz-Jentoft & Sayer [17]. To estimate the amount of muscle mass, the tetrapolar bioimpedance Biodynamics 310® (Biodynamics Corporation, Washington, USA) was used, with measurements following the instructions for the device. Appendicular muscle mass was obtained through the equation of Lee et al. [18]. The cut-off point used for low appendicular muscle was < 20 kg for men and < 15 kg for women Cruz-Jentoft & Sayer [17].

Descriptive statistics were used to characterize the population and data. Analysis of frequency distribution and measures of central tendency and dispersion were performed. Student's t-test and Mann-Whitney test were used to assess the significance, and Pearson's correlation index was used to analyze the correlation between variables. The significance of 5% ($p \leq 0.05$) was considered.

Results

A total of 40 elderly people participated in the study. Among these, four (10%) were diagnosed with sarcopenia, and 18 (45%) were at risk of sarcopenia (due to the reduction of muscle strength through dynamometry). Only 18 (45%) patients were not diagnosed with risk or sarcopenia, as shown in (Table 1).

Table 1: Descriptive statistics of the qualitative variables of the study participants.

Variables	Categories	Absolute frequency (n)	Relative frequency (%)
Sex	Feminine	29	72.5
	Masculine	11	27.5
Sarc-F	Sarcopenia risk	13	32.5
	No risk of sarcopenia	27	67.5
Reduced muscle strength	Yes	18	45
	No	22	55
Confirmed Sarcopenia	Yes	4	10
	No	36	90

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Table 2: Association between sarcopenia and quantitative study variables.

Presence of sarcopenia Variables	Yes (n= 4)	No n=36	
	Mean ± standard deviation (median)		p-value
Current weight (kg)	43.45±12.11 (44.5)	72.69±15.12 (69.99)	0.0003*
Recent weight change (kg)	-6.06±3.07 (-6.41)	-2.05±6.41 (1)	0.0375**
Body mass index (kg/m^2)	19.59±5.48 (21.31)	28.47±5.52 (28.51)	0.002*
Calf circumference (cm)	27.2±3.31 (27.4)	35.34±4.44 (34.5)	0.0005*
Handgrip strength (kg)	7.21±6.04 (7.64)	22.11±11.06 (19.14)	0.0061*
Lean mass (kg)	27±6.98 (27.5)	44.83±8.86 (44)	0.0002*
Adductor pollicis muscle thickness (mm)	14.75±6.8 (13.5)	18.2±5.99 (18)	0.1431*
Arm muscle circumference (cm)	17.09±3.84 (17.82)	20.69±3.27 (20.06)	0.0233*
Arm muscle area (cm^2)	302.33±123.88 (317)	437.5±137.01 (401,77)	0.0335*

*Student's t-test for independence **Mann Whitney: independent samples.

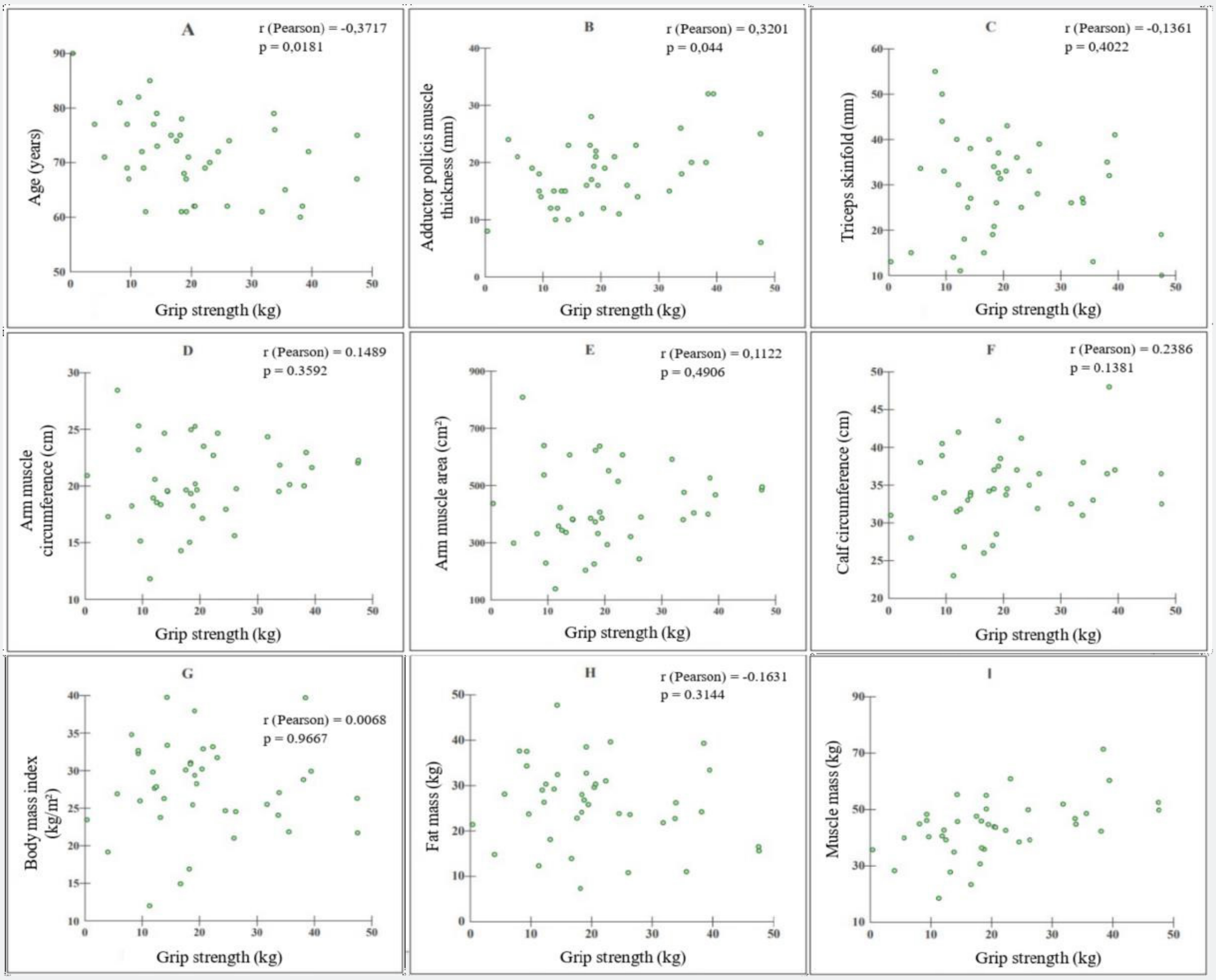

Figure 1: Pearson correlation between handgrip strength x age (A), adductor pollicis muscle thickness (B), triceps skinfold (C), arm muscle circumference (D), arm muscle area (E), calf circumference (F), body mass index (G), fat mass (H) and lean mass (I).

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Based on body mass index, 7 (17.5%) elderly were underweight, 11 (27.5%) were eutrophic, and 22 (55%) were overweight. CC indicated a risk of deficiency or depletion of skeletal muscle mass in only 6 (15%) older people. However, bioimpedance and dynamometry detected the risk of sarcopenia and sarcopenia in more than half (55%) of the participants.

The mean age of participants was 71.2 ± 7.36 years, with no significant difference between both sexes in this variable (p= 0.055), as well as the length of stay, recent weight change, Arm Circumference (AC), Calf Circumference (CC), Arm Muscle Circumference (AMC), Arm Muscle Area (AMA), Triceps Skinfold (TS) and Body Mass Index (BMI). Significant differences existed between the sexes and the variables of usual weight, current weight, height, lean mass, Adductor Pollicis Muscle Thickness (APMT), and Hand Grip Strength (HGS).

When the elderly were classified as having no or no sarcopenia, there were significant differences in the quantitative variables of current weight, recent weight change, BMI, CC, HGS, lean mass, AMC, and AMA, as shown in (Table 2). There was no significant difference, only in the APMT variable.

By correlating handgrip strength with the study variables, significant weak positive correlations were found between HGS and APMT and moderate positive correlations between HGS and lean body mass. A significant weak negative correlation was found between HGS and age. The other correlations were not significant, as shown in (Figure 1).

Discussion

This study indicates a 10% prevalence of sarcopenia among hospitalized elderly during the research period, a fact that corroborates the systematic review and meta-analysis carried out by Shafiee et al. [19], with data from 35 articles and 58,404 individuals worldwide, which estimated the overall prevalence of sarcopenia to be 10% in both men and women over 60 years of age.

As for the distribution of cases related to sex, Papadopoulou et al. [20] indicated a prevalence of 23% in men and 24% in women. These results are inconsistent with our results since all patients with sarcopenia were female.

The high percentage of overweight individuals (55%) in our sample aligns with existing literature suggesting a link between sarcopenia and increased fat deposition as a consequence of changes in body composition due to advancing age, causing muscle and bone mass to progressively decrease from the third decade of life onwards, while fat mass increases up to the age of 70 and then decreases Fantin et al. [21], Santanasto et al. [22], Sun et al. [23].

Our findings also underscore the utility of the Sarc-F questionnaire, which identified a sarcopenia risk in 32.5% of individuals. This aligns with Cristaldo et al. [6], who reported a similar prevalence. The importance of early detection of sarcopenia cannot be overstated, as highlighted by studies from Wiedmer et al. [3] and Petermann-Rocha et al. [2], which associate sarcopenia with increased functional dependence and healthcare costs.

Among the anthropometric measurements performed in these patients to assess the presence or absence of sarcopenia, APMT alone was the only one that did not show a significant difference. Still, there was a positive correlation when correlated with muscle strength (dynamometry). This reinforces the need for its measurement as a fundamental marker in the clinical evaluation of the elderly Sousa- Santos & Amaral [24], in addition to being a validated method that is simple to perform, low cost, and quick to apply in routine Confortin et al. [25] & de Oliveira et al. [26] & Santana Gomes et al. [27].

Interestingly, our study found that muscle strength, as measured by HGS, had significant correlations with APMT and lean body mass but a negative correlation with age. This is consistent with existing knowledge that muscle strength declines with age, but it also suggests that maintaining muscle mass can mitigate some aging effects Wiedmer et al. [3].

Given the strong correlations between CC, muscle strength, and sarcopenia risk, our results support using these measurements in clinical practice to identify at-risk individuals. Landi et al. suggested that larger calf circumference and greater muscle strength are protective against sarcopenia, which our findings corroborate Landi et al. [28].

Healthcare providers should consider incorporating routine sarcopenia screening for elderly patients, particularly those admitted to hospitals. Interventions should focus on maintaining or increasing muscle mass and strength through tailored exercise programs and nutritional support. Additionally, simple and cost-effective measures like the Sarc-F questionnaire and anthropometric assessments can facilitate early identification and management of sarcopenia, potentially reducing healthcare costs and improving patient outcomes.

Further research is needed to explore the underlying mechanisms of sarcopenia and its relationship with other comorbidities. Longitudinal studies could provide more detailed information on the progression of sarcopenia and the effectiveness of various interventions over time.

Conclusion

The prevalence of sarcopenia and the risk of developing it occurred in 55% of this sample. Current body weight, BMI, CC, arm muscle circumference, and AMA showed differences between sarcopenic and non-sarcopenic elderly. On the other hand, muscle strength was negatively correlated with age and positively correlated with adductor pollicis muscle thickness and lean body mass. From this, the importance of raising awareness

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and understanding of this disease is emphasized so that there is the continuous development of diagnostic options, which will lead to adequate therapeutic planning to guarantee the quality of life of the geriatric population.

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