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Muscle mass analysis in women of different ages

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ABSTRACT

Introduction: During the aging process, significant changes in the pattern of distribution of morphological and structural variables such as body fat and muscle mass can be observed. **Objective**: To analyze the distribution of total and appendicular muscle mass in women in different age groups. **Methods:** The sample consisted of 129 women, aged between 50 and 80 years. The study was divided into two stages, composed of the anthropometric measures, total body mass (kg) and height (m) and body composition evaluation using DEXA. **Results:** There was a significant reduction in muscle mass with the advancement of age, and from age 60 and older, the age group showed a significant increase when compared to subjects of lower age, with a decrease of 1.65 kg in their total muscle mass. It should be noted that in our study, this progression increased in subjects older than 72 years, with a decrease of 2,10 kg in their total muscle mass. **Conclusions**: The reductions of muscle mass in the lower limbs presented greater amplitudes in comparison with the other regions of the analyzed human body, being an area with greater focus of analyzes with the objective of identifying and assisting the diagnosis of sarcopenia in future studies.

Keywords: Elderly; Sarcopenia; Body Composition.

INTRODUCTION

During the aging process, significant changes in the pattern of distribution of morphological and structural variables can be observed, such as body fat and muscle mass. These changes include muscle mass reduction, linked to other factors such as dysfunctions in the endocrine system, changes in growth hormone levels, increased insulin resistance, cellular apoptosis, mitochondrial dysfunction, decreased motor neurons[(1)], and physical inactivity are associated with aging and the sarcopenia syndrome, which causes damage to the health of people in a physiological and psychological way[(2,3)].

According to the *European Working Group on Sarcopenia in Older People* (2010) – EWGSOP - the decrease in skeletal muscle mass compromises levels of muscular strength and performance in the elderly[(4)]. This reduction in muscle mass has direct associations with increased levels of hypokinesia, mobility limitations, decreased quality of life, risk of falls, hospitalizations, and mortality[(5-7)]. For the evaluation of muscle mass, double-indirect and indirect methods are used, such as Dual-Energy X-ray Absorptiometry (DEXA)[(8-10)]. In the indirect methods the information is linked to the chemical, physical and biological domain to develop image estimates of the components of fat, lean mass and bone mineral density[(11)]. Among the techniques of measurement by image, the DEXA has been one of the resources most used in the literature and recommended by the *Asian Working Group for Sarcopenia* (2014) - AWGS - as the gold standard technique for the analysis of skeletal muscle mass[(12)].

Knowing that adiposity, muscle mass and age are variables that negatively influence the functional status of women over 40 years[(13-14)], our hypothesis is that the identification of the total and regional lean mass distribution can help in the training and rehabilitation processes of this population. With the process of muscle aging being a continuous progress, its high speed of decline and pronounced dysfunction around the age of 50[(15)] and with acceleration and progression at age 60[(16)], become markers to be treated with relevance in the health of the elderly[(17)]. Thus, the present study aimed to analyze the distribution of total and appendicular muscle mass in women in different age groups through the DEXA.

METHODS

This is a cross-sectional and descriptive research that was performed at the Human Performance Evaluation Laboratory (LAPH) of the College of Physical Education of Pernambuco (ESEF). The sample consisted of 129 women who were voluntarily invited to participate in the research, through posters attached by the University and advertisements through

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social networks, and after the explanation of all the procedures that would be performed they signed the Free and Informed Consent Form (ICF). The research project was submitted and approved by the Human Research Ethics Committee of the Universidade de Pernambuco (UPE), according to the norms established by the National Health Council (Resolution nº 466/12) with number 35659214.0.0000.5192. The study included women aged 50 to 80 years, physically active, participating in the water aerobics project, who agreed to participate in the project and signed the ICF. The following were excluded from the study, volunteers who did not complete all the evaluations, undergoing any cancer treatment intervention, AIDS, cachexia or had any metallic material in the body. The present investigation was divided into two stages. The first one (I) consisted of the verification of the anthropometric measures, total body mass (kg) and height (cm), identifying possible anthropometric indicators capable of measuring skeletal muscle mass and sample characterization. In the second stage (II) the body composition evaluation was performed by DEXA. For anthropometric evaluation it was performed by a previously trained evaluator and using a digital scale with accuracy of 0.1kg (Filizola Ltda, São Paulo, Brazil), stature by a wooden stadiometer, with scale in millimeters. In order to evaluate body composition, was considered the three compartments model. Its components were divided into lean tissue (muscle, vital organs and other viscera of the body), fat tissue (amount of body fat) and bone tissue (totality skeleton). The procedure used for analysis was by the DEXA equipment, following the manufacturer's calibration guidelines and procedures. The measurement of the percentage measure of body fat and fat free mass was obtained by means of a full body scan using the Hologic DXA System (Hologic, QDR 4500W, Bedford MA, USA). The normality of the data distribution was verified by *Kolmogorov-Smirnov* test. The data were represented by quartiles and the analysis performed at the interquartile intervals. For the interquartile comparison it was verified by an *ANOVA-One Way* with *Post hoc Bonferroni*. For the analysis the SPSS software version 10.0 was used. In all analyzes was considered significant a value of $p < 0.05$.

Table 1. Anthropometric variables of 129 subjects.

Variables	Mean	Standard Deviation
Weight (Kg)	69.61	11.30
Stature (m)	1.53	0.05
Age (Years)	66.34	8.87
BMI (Kg/m²)	29.74	3.52

Note: BMI – Body mass index.

RESULTS

The presentation of the subjects begins with a description of their anthropometric characteristics (Table 1), then presents the information on the distribution of muscle mass in different age groups (Table 2). Finally, we present the multiple comparisons performed between the age groups to verify the differences in the distribution of muscle mass.

DISCUSSION

Aging is a natural process of the human species, which that evolution directly portrays changes in the physiological structure of your body. Changes in muscle structure in humans begin in the fourth decade of life, causing their decrease, functional weaknesses and disabilities[15,18]. Considering the explored data, a significant reduction in muscle mass was observed with the advancement of the age, and from 60 years, the age group in which this progress is accentuated when compared with the individuals of a lower age group, it was showed a decrease of 1.658kg in the total muscle mass, corroborating with the study of Sreekumaran[19] in which found, by means of computed tomography, a decrease in the muscular area of the thigh sharply in women with 50 years (Figure 1). It should be noted that in our study this progression increased in individuals aged over 72 years, with a decrease of 2.109 kg in the total muscular mass, agreeing with Ribeiro et al.[20] which indicated that this decrease in muscle mass increases significantly in women with 75 years of age in relation to men of the same age group in a gradual manner.

In the current investigation, the decrease of the appendicular muscle mass of the lower limbs presented greatest differentiation in relation to the other compartments analyzed (Figure 2). Appendicular muscle mass is defined as the sum of skeletal muscle mass plus soft tissues without consideration of fat and bone mineral density[21]. This decrease

Table 2. Distribution of muscle mass by age group

Variables	G1 (<60) (n=27)	G2 (60–67) (n=35)	G3 (67–72) (n=33)	G4 (>72) (n=34)
MMss (Kg)	3.82±0.75	3.49 ±0.68	3.53 ±0.86	3.30 ±0.47
MMii (Kg)	12.69 ±1.91	11.37 ±1.78	11.94 ±2.16	11.10 ±1.61
MMtotal (Kg)	16.52±2.41	14.86±2.33	15.47±2.87	14.41±1.94
Mean of age (years)	53.55	63.31	69.09	76.97
BMI (Kg/m²)	30.03	28.90	30.46	28.73

Note: G1- Group 1; G2- Group 2; G3- Group 3; G4- Group 4; MMss- Appendicular muscle mass of the upper limbs; MMii- Appendicular muscle mass of the lower limbs; MMtotal- Total appendicular muscle mass; BMI- Body mass index.

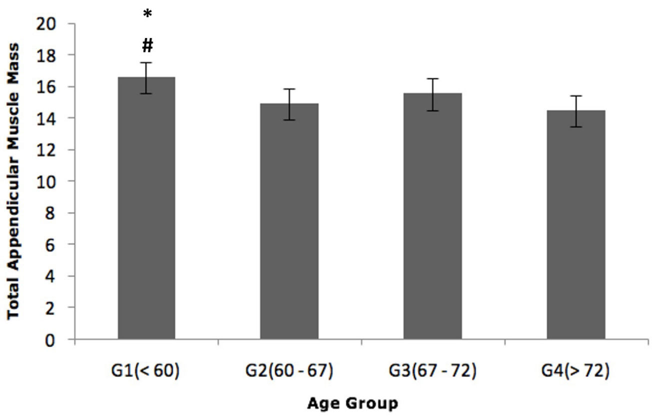

Figure 1. Mean, standard deviation and multiple comparison between the distribution of muscle mass by age groups (*ANOVA One Way - Post hoc Bonferroni*). *: Significant difference between G1 and G2; #: Significant difference between G1 and G4; p< 0.05.

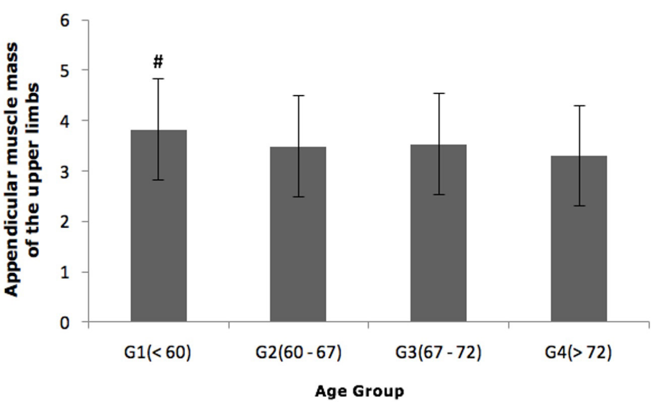

Figure 2. Mean, standard deviation and multiple comparison between the distribution of muscle mass by age groups (*ANOVA One Way - Post hoc Bonferroni*). #: Significant difference between G1 and G4; p< 0.05.

was significantly identified in the younger group, with individuals under 60 years of age when compared to individuals in the next range, between 60 and 67 years, with a variation of 1.325kg and is accentuated in an elevated way with the individuals of greater age group, with more than 72 years, arriving this variation to 1.587kg (Figure 3). This process of decline may be directly related to a high level of falls, loss of independence, reduction of quality of life and mortality presented by the elderly, as investigated by Scoot et al. which associated these characteristics to the effect of sarcopenia[(22)].

In contrast to our results, the similar study carried out by Auyeung et al. which divided the sample into a group of quartis, with individuals aged 60 to 80 years and longitudinally analyzed the process of muscle mass decrease in elderly women over a four-year period, found that the decrease in appendicular muscle mass is only significantly identified in the elderly over 80 years of age with an average decrease of 0.500 kg of appendicular muscle mass, which we identified in our study in a younger age group (72 years of age)[(23)].

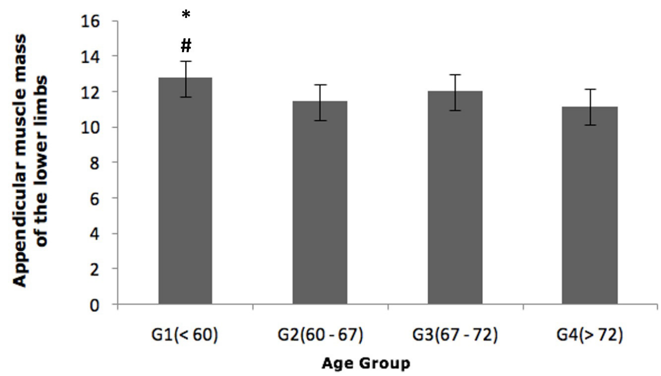

Figure 3. Mean, standard deviation and multiple comparison between the distribution of muscle mass by age groups (*ANOVA One Way - Post hoc Bonferroni*). *****: Significant difference between G1 and G2; **#**: Significant difference between G1 and G4; p< 0.05.

CONCLUSION

In this study, it was identified that the process of muscle decrease occurs in different proportions and intensities, depending on the age group. The reductions in the lower limbs presented greater amplitudes in comparison with the other regions of the analyzed human body, being an area with greater focus of analyzes with the objective of identifying and assisting the diagnosis of sarcopenia in future studies. The understanding of the way that muscular mass is distributed in elderly women becomes increasingly necessary for the diagnosis of sarcopenia in addition to the other aspects that this geriatric syndrome is characterized, necessitating future studies in which they analyze a larger number of subjects, to verify this behavior in the population.

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AUTHOR'S CONTRIBUTIONS

RRB: Research development, data collection and data analysis and text revision; TCAS: Research development, data collection and data analysis and text revision; TAL: Data collection and data analysis and final text revision; APSA: Data collection; FJSPG: Data analysis; MCC: Advisor.

CONFLICTS OF INTEREST

The authors declare that there was no conflict of interests.

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