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UNDERNUTRITION IN VERY ELDERLY PEOPLE: ASSESSMENT USING DIFFERENT ANTHROPOMETRIC INDICATORS

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Abstract: *Objective:* To verify the prevalence of undernutrition among very elderly persons in the municipal area of Antônio Carlos, Santa Catarina, using different anthropometric indicators. *Methods:* Cross-sectional study carried out with 133 elderly persons (78 women) ≥ 80 years of age. The anthropometric indicators assessed were TSF (≤ 15 mm, women and ≤ 8 mm, men), AC (≤ 26 cm, women and ≤ 25 cm, men) AMA (≤ 32.76 cm^2, women and ≤ 37.16 cm^2, men), CC (≤ 31 cm, women and men) and BMI (≤ 22.4 kg/m^2, women and ≤ 21.1 kg/m^2, men), according to gender and age group. *Results:* BMI, AC, TSF were higher ($p < 0.05$) in the youngest as compared to eldest elderly women. Mean BMI, AC and TSF was higher ($p < 0.05$) in women compared to men (80-89 age group and total elderly). Mean AMA was lower in the oldest than in the youngest individuals ($p < 0.05$) and was greater ($p < 0.05$) in men than in women. The prevalence of undernutrition varied according to the indicator used. AMA was the anthropometric indictor that identified the highest prevalence (63.8%) of men and women (55%) suffering with undernutrition. *Conclusion:* The very elderly people of Antônio Carlos have a vulnerable nutritional status, both in relation to muscle reserve and fat reserve, with differences according to gender and age group.

Key words: Aged, 80 and over; nutritional status, nutrition assessment.

Introduction

Undernutrition is a grave health problem for very old individuals and it can be identified using different instruments (1, 2). In population-based studies, anthropometry is the most used indicator of malnutrition because it is easy to apply, reliable, non-invasive, and inexpensive. Different anthropometric measurements allow the verification of fat and muscle mass reserves / depletion, as well as their location in the body (3-6).

The arm muscle area, the arm muscle circumference and calf circumference provide estimates of protein reserves, and can also indicate muscular use or disuse (4, 6). Fat reserves can be verified through measurements of the tricipital skinfold and arm circumference (4-7). The body mass index assesses the individual's nutritional status and estimates the risk of disease and mortality in elderly people, while being an indicator highly correlated with body adiposity measurements (8, 9).

A few Brazilian studies have used anthropometric indicators in their assessments (4, 10, 11), however, the data is still scarce, especially with reference to very elderly people living in rural areas. It is important to carry out studies with this segment of the population to establish suitable monitoring and intervention procedures in order to improve their health and quality of life.

The objective of this study was to verify, by using different anthropometric indicators, the magnitude of undernutrition among very elderly people in the municipal area of Antônio Carlos, Santa Catarina, a city located in the south of Brazil, whose life expectancy is 5 years above the national average (12).

Methods

Area of study

The city of Antônio Carlos (229 km^2) is located 30 km from the capital of the state of Santa Catarina, south of Brazil. It is the state's greatest vegetable producer, and its population is distributed mostly (68.6%) in small rural proprieties. The city has good health and quality of life

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indicators, presenting high (0,827) Human Development Index (HDI) (12). The electricity is available for the entire city, and the literacy index is at 91.2% (13). Antônio Carlos has one unity of Health Service, located downtown, which serves individuals of all ages. Three teams (one doctor, one nurse, auxiliary nurses and community health), of the Family Health Strategy program (FHS), founded in year 2000, cover the whole town. This program aims to increase population access to primary care (14). Data from the Brazilian census 2010 show that the town's population is composed of 7.458 inhabitants and subjects ageing ≥ 60 years represent 12.8% (n = 936) of the population in general (15). Information from the FHS have identified 135 elderly aged 80 and older.

Study setting

This epidemiologic cross-sectional, household-based study analyzes part of baseline data of the research entitled, "Effectiveness of health actions, physical activity and nutrition in the elderly of Antonio Carlos – SC".

The study population comprises all elderly aged 80 years or older (n=135), registered in the town's FHS program. However, one individual was absent during the whole gathering period of data (from November 2009 to April 2010) and there was one refusal for the anthropometry's realization, resulting in 133 attendees.

Data collection was conducted by two interviewers (Master's degrees students) who were trained by the research coordinator. The precision and accuracy of the anthropometric measures were confirmed before the collection of data, with the coordinator's measures considered the gold standard for comparison. The reproducibility of the measures was done in 15 individuals, with a one-week difference between the first and the second measures. The interviewers went to campus accompanied by the FHS health agents and authorized by the Board of Health and the town's Social Assistance. To guarantee reliability of data, the research coordinator was responsible for the conference of the received questionnaire.

The study was approved by an ethics committee. Participants were informed of the study purposes, procedures and signed an informed consent.

Anthropometric measurements

The measures of body mass (BM) and height were realized by patterned procedures (16). In case it is impossible or difficult to obtain these measurements, equations were used to estimate BM (17) and height (16): women, BM = (AC x 1.63) + (CC x 1.43) - 37.46; men, BM = (AC x 2.31) + (CC x 1.50) - 50.10; women, height = (1.83 x knee height) - (0.24 x age) + 84.88; men, height = (2.02 x knee height) - (0.04 x age) + 64.19.

Arm (AC) and calf circumferences (CC) were measured with an inelastic measuring tape, according Callaway et al. (18). The triceps skinfold (TSF) was measured with a LANGE caliper (19). All measurements (BM, height, AC, CC, and TSF) were taken in triplicate (same visit), and the mean values were used in the analyses.

Body mass index (BMI = kg/m2) was calculated, as was arm muscle area (AMA): men, AMA = [(AC - π x TSF)2 / 4 x π] – 10 and; women, AMA = [(AC - π x TSF)2 / 4 x π] - 6,5 (20).

In order to diagnose undernutrition, we adopted percentile figures ≤ 25 for elderly persons aged 80 or more, divided by gender, according to Barbosa et al. (4) (AC, CC, TSF, and BMI) and Barbosa et al. (21) (AMA): AC (women ≤ 26 cm and men ≤ 25 cm), CC (women and men ≤ 31 cm), AMA (women ≤ 32.12 cm^2 and men ≤ 37.16 cm2), TSF (women ≤ 15 mm and men ≤ 8 mm) and BMI (women ≤ 22.37 kg/m^2, men ≤ 21.14 kg/m^2).

Statistical analysis

We used means, standard deviations, medians, minimum and maximum values, and proportion of individuals, according to each variable, gender and age groups (80-89 and ≥ 90 years of age). We determined the significance of the difference between averages using Student's t-test for comparison between genders and age groups. The level of significance adopted was 5% (CI 95%). Statistical program SPSS version 17.0 was used to assess the data.

Results

The age of the elderly subjects varied from 80 to 100 years of age (84.7± 4.6). The mean age among men was 85 years of age (± 4.4), whereas for women it was 84.5 years of age (± 4.8).

Table 1 shows mean anthropometric variables figures according to gender and age group. BMI, AC, TSF were higher ($p < 0.05$) in the youngest as compared to eldest elderly women. Mean BMI, AC and TSF was higher ($p < 0.05$) in women compared to men in the 80-89 age group and total elderly. Mean AMA was lower in the oldest than in the youngest individuals ($p < 0.05$) and was greater ($p < 0.05$) in men than in women.

The prevalence of undernutrition varied according to the indicator used (table 2). AMA was the anthropometric indictor that identified the highest prevalence (63.8%) of men and women (55%) suffering from undernutrition. The prevalence of undernutrition has been higher among men aged 90 over, when compared to those aged 80-89, however, these differences were not significant.

Table 1

Mean, standard deviation, median, minimum and maximum values of anthropometric indicators, according to gender and age groups, of the elderly people of the municipal area of Antônio Carlos, Santa Catarina, 2010

	Men			Women		
	Min-Max	Mean ± SD	Median	Min-Max	Mean ± SD	Median
Body mass index						
80-89	19.00-33.00	24.92 ± 3.80†	24.39	14.00-39.00	27.40 ± 4.84†‡	27.62
90 y +	19.00-29.00	23.20 ± 3.66	23.13	18.00-29.00	23.85 ± 3.65‡	23.56
Total	18.51-33.20	24.63 ± 3.80†	24.31	14.26-38.52	26.89 ± 4.83†	27.22
Arm circumference						
80-89	17.50-36.50	27.71 ± 3.89†	27.05	18.00-38.50	29.37 ± 4.05†‡	29.00
90 y +	22.00-30.80	26.33 ± 2.92	26.60	20.50-30.70	26.38 ±3.03‡	27.00
Total	17.50-36.50	24.48 ± 3.76†	27.00	18.00-38.50	28.9 ± 4.04†	29.00
Arm muscle área						
80-89	10.20-69.74	36.86 ± 12.04†‡	35.21	7.12-53.75	32.27 ± 8.98†	31.89
90 y +	23.23-42.90	31.07 ± 5.51‡	30.77	18.37-37.39	29.32 ± 6.41	30.86
Total	10.20-69.74	35.91 ± 11.40†	32.92	7.12-53.75	31.86 ± 8.69†	31.88
Triceps skinfold						
80-89	4.00-22.00	11.60 ± 4.17†	11.00	3.00-44.00	23.74 ± 8.62†‡	23.00
90 y +	5.00-20.00	11.67 ± 5.78	11.00	8.00-25.00	16.73 ± 5.85‡	17.00
Total	4.00-2.00	11.61 ± 4.41†	11.00	3.00-44.00	22.75 ± 8.61†	22.00
Calf circumference						
80-89	28.20-42.00	35.02 ± 3.00	35.15	26.00-45.50	35.62 ± 3.84‡	35.60
90 y +	27.00-40.00	33.33 ± 4.14	33.50	27.30-36.20	32.25 ± 3.40‡	33.30
Total	27.00-42.00	34.75 ± 3.23	34.80	26.00-45.50	35.15 ± 3.94	35.50

† $p < 0.05$ = statistically significant difference of mean values between the genders (Student's t-test); ‡ $p < 0.05$ = statistically significant difference of mean values between age groups (Student's t-test)

Table 2

Distribution of elderly according to nutritional status, anthropometric indicators, gender and age groups. Antônio Carlos-SC, Brazil, 2010

	Men				Women			
	Adequate		Undernutrition		Adequate		Undernutrition	
	n	%	n	%	n	%	n	%
Body mass index								
80-89	35	76.1	11	23.9	59	88.1	8	11.9
90 y +	5	55.6	4	44.4	8	72.7	3	27.3
Total	40	72.7	15	27.3	67	85.9	11	14.1
Arm circumference								
80-89	35	76.1	11	23.9	55	82.1	12	17.9
90 y +	6	66.7	3	33.3	6	54.5	5	45.5
Total	41	74.5	14	25.5	61	78.2	17	21.8
Arm muscle area								
80-89	19	41.3	27	58.7	33	49.3	34	50.7
90 y +	1	11.1	8	88.9	5	45.5	6	54.5
Total	20	36.4	35	63.6	38	48.7	40	51.3
Triceps skinfold								
80-89	35	76.1	11	23.9	57	85.1	10	14.9
90 y +	6	66.7	3	33.3	7	63.6	4	36.4
Total	41	74.5	14	25.5	64	82.1	14	17.9
Calf circumference								
80-89	38	82.6	8	17.4	58	86.6	9	13.4
90 y +	6	66.7	3	33.3	6	54.5	5	45.5
Total	44	80.0	11	20.0	64	82.1	14	17.9

Discussion

This is the first Brazilian population and household-based study that verified the prevalence of undernutrition in eldest old living in a rural area. The study was capable of assessing all the elderly persons aged 80 and over from Antônio Carlos, Santa Catarina, making it possible to know the nutritional conditions of this population segment, which has grown fast in recent years.

The prevalence of undernutrition varied according to the anthropometric measurement or indicator used. However, this outcome was higher among the elderly of the ≥ 90 age group, of both genders, independent from the indicator considered. Other studies demonstrated that the prevalence of undernutrition tends to increase with age (3, 22, 23), and suggest that undernutrition can

be more damaging than obesity in this age group. It is known that with age, physiological changes associated with environmental factors influence the loss of body weight, muscle mass and fat, and it is more pronounced in long-lived elderly people (24).

With regard to BMI, results have shown that women have higher average values and the least prevalence of undernutrition when compared to men. These results were similar to those evidenced for elderly persons aged 80 and over from São Paulo, Havana and Joinvile (a city in the south of Brazil) (4, 5, 11) and different from those observed for elderly persons from Sardinia, Italy (25). However, if we compare the prevalence of undernutrition, we can observe that it was lower among the elderly of Antônio Carlos than verified in elderly people aged 80 and over from São Paulo (4), Havana (5) and Joinvile (11). These results can be considered favorable to the elderly participating in the present study, since for eldest old, undernutrition is a factor associated with negative health events, and higher mortality (3, 26).

Calf circumference is another indicator that provides estimates of muscle mass (6), and it is considered important in nutritional assessments. It also predicts the risk of mortality, especially regarding long-lived elderly people (28). In this study, CC values were higher among women and showed reductions with age. The eldest women had increased chances of having undernutrition than the younger ones.

Results evidenced larger reserves of subcutaneous fat (TSF and AC) among women, compared to men, as identified in other national (4, 10, 11) and international (5, 27) studies. It is worth highlighting that the average TSF and AC values of the women in Antônio Carlos were higher than those identified in elderly women from Fortaleza, northeast Brazil (10), and Havana, Cuba (5), and identical to those identified in the women of Joinville, south Brazil. This could be explained by the cultural and socio-economic differences among the country's regions, and between Brazil and Cuba, and the similarity between the two southern cities in the country (Antônio Carlos and Joinville).

In this study, CC values were higher among women, and showed reduction with age. The elder women had more chances of presenting undernutrition than the younger ones. CC is another indicator that provides estimates of muscle mass quantity (6), and it is important in nutritional assessments. It also predicts the risk of mortality, especially among very old elderly people (28).

With relation to muscle reserve indicator AMA, results showed that men had higher average values than women, as well as a higher prevalence of undernutrition. As age increased, men showed a significant reduction in the values of this measurement, suggesting, just as observed in other studies, that reduced muscle mass is higher among individuals of this gender (4, 5, 27). Comparing with other national studies that used percentile values (4, 10), we can verify that the prevalence of undernutrition identified by AMA is higher among the men and women of Antônio Carlos.

Although the study does not identify the magnitude of changes in anthropometric measurements related with old age, the data allows us to identify the nutritional condition of very old elderly persons from rural regions in Brazil, in a city that has the second highest longevity indicator in the country (12). This cross-sectional data can be used for comparison, evaluation, and surveillance of the nutritional status in the very elderly people, in clinical practice and epidemiologic research.

In general, results evidenced that the elderly people of Antônio Carlos have a vulnerable nutritional status, both in relation to muscle mass reserve (AMA and CC) and fat reserve (BMI, AC and TSF), with differences between genders and age groups. The prevalence of undernutrition measured by muscle reserve and fat reserve indicators is higher among men and women, respectively, and among those aged 90 years and over. The results found are consistent with those involving elderly people from large urban centers (4, 10-11), and rural regions (25). Many social (Inability to feed and shop, poverty, isolation), physiologic and physical factors related to chewing, digestion, and absorption of food intake as well as reduction of smell, taste, and of appetite may contribute to the increased risk of inadequate nutrition observed with the passing of age (29-30).

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