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ORIGINAL RESEARCH

Anthropometric indicators and their adequacy in older adults from two towns in distinct Brazilian regions

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OBJECTIVE: To compare anthropometric indicators and their adequacy among older adults from two towns of distinct Brazilian regions.
METHODS: A cross-sectional, population, and household-based epidemiological study. A total of 793 persons (age ≥ 60) from the Southern and Northeastern regions of Brazil were evaluated, according to age groups (60-69, 70-79, and ≥ 80 years) and sex. Data for body mass, height, body mass index, triceps skinfold thickness, arm muscle circumference, arm, waist and calf circumferences are presented. The prevalence of adequate anthropometric indicators was also compared for body mass index, arm circumference arm muscle circumference, triceps skinfold thickness, calf circumference and waist circumference.
RESULTS: Subjects from the Southern region (n = 477) showed significantly greater mean values for all anthropometric variables vs. subjects from the Northeastern region (n = 316). Underweight (BMI < 22.0 kg/m^2) was prevalent in the Northeast, overweight (BMI > 27.0 kg/m^2) in the South. Older adults from the Northeast presented a higher proportion of adequate weight circumference. Other measured anthropometric indicators revealed a greater proportion of older adults with nutritional adequacy in the Southern region.
CONCLUSION: This study provides information that can be used for anthropometric assessment of older adults in towns within the same context. Older adults of the two regions show vulnerable nutritional status, deficiency in the northeastern and excess in the southern region.

KEYWORDS: Ageing; Nutritional evaluation; Cross-sectional studies.

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INTRODUCTION

Human aging is marked by morphological and physiological changes such as reduction in muscular mass, body fat increase redistribution (fat tissue in the arms and legs decreases, with a larger deposition of fat in the trunk).[1-6] These changes can be assessed by anthropometry, a non-invasive method included in nutritional assessment and screening scales.[7-8] and widely used in studies involving older adults.[1-4] Although these morphological and physiological changes appear universal, they do not occur at the same rate in all populations.[4-6] Data from different countries[3,6-8] indicate that the patterns of alterations in anthropometric characteristics with increasing age are similar; however, the intensity of the alterations varies between the populations, even in the same country.[9,10] The determinants of body shape changes and body mass index of older adults are based on differences in the endogenous, environmental, and socio-economic characteristics, such as life style, health, and functional state.[10,11]

Brazil is a multiracial, continental country, with intense socio-economic and environmental diversity. The greatest social and economic disparities exist between the Northeastern and Southern regions of the country. The Southern region enjoys much better social, economic, and health indicators than the Northeast, resulting in better quality of life and longer life expectancy.[12]

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Data from the Brazilian National Household Sample Survey (Portuguese acronym PNAD) 2004-2009[13] showed that 18.7% of the housing units of the Southern region had some type of nutritional insecurity, compared to 46.1% in the Northeast. For dwellings with inhabitants aged 65 years and more, the percentage of housing units suffering moderate or severe food insecurity was 6.8 and 22.9% for the Southern and Northeastern regions respectively.[13] It is believed that these environmental and socio-economic differences may influence the anthropometric characteristics and body mass index of the older adults. Data from Brazilian National Survey on Health and Nutrition[14] (Portuguese acronym PNSN), suggest that regional differences in body mass index reflect the conditions of life, occupational history and lifestyle. Anthropometric data from studies recently conducted in some Brazilian large cities[1,2,4,5] also seem to reflect national diversity.

Most information available on this topic in Brazil is limited to large urban centers where the social, cultural and lifestyle conditions differ from those prevailing in small towns. A comparison of the anthropometric characteristics and body mass index of older adults in different contexts may reflect regional characteristics, distinguishing populations. In addition, such data would be useful for both health surveillance and clinical practice. This study aimed to compare the anthropometric indicators and their adequacy among older adults from two towns of distinct Brazilian regions

METHODS

This is a cross-sectional study that used data from the following epidemiological surveys: "Effectiveness of health interventions, physical activity, and nutrition of older adults from Antônio Carlos, Santa Catarina" and "Nutritional status, risk behaviors, and health status of elderly in Lafaiete Coutinho, Bahia".[15] **Antonio Carlos**, in the state of Santa Catarina (AC-SC) is located in Southern Brazil; and **Lafaiete Coutinho**, in the state of Bahia (LC-BA) in the Northeast.

Data from the 2010 Brazilian census[15,16] showed that the AC-SC population was 7,458 inhabitants, with 955 (12.8%) aged ≥ 60 years; the LC-BA population was 3,901 inhabitants, with 598 (15.4%) aged ≥ 60 years. In AC-SC, the average nominal monthly per capita income was ~2.9 times higher than that in LC-BA.[16] AC-SC and LC-BA had three and two Family Health Strategy teams (Portuguese acronym, ESF), respectively, which covered 100% of each municipality. ESF is a national program focused on basic attention to health.

Population and sample

The population and sample details were previously presented[16] and shall be briefly described. The AC-SC sample (n = 477) was composed of older adults of the rural and urban zones enrolled in the ESF program. All subjects (n = 134) aged ≥ 80 years plus 343 individuals (probability sampling) of 60 to 79 years of age were interviewed during 2010-2011. The study population of LC-BA included all individuals aged ≥ 60 (n = 355) that were residents of the town's urban zone; a total of 316 subjects (89.0% of the senior population) were included in the research, performed during 2011.

Study exclusion criteria: absence of an appropriate informant; absence of the elderly after three unsuccessful attempts in alternating days; lack of access due to the conditions of rural roads (AC-SC).

The interviewers were previously trained for testing of the instruments, and for precision and accuracy of the anthropometric measurements.[17]

The measurements anthropometric parameters were: body mass (BM), height, body mass index (BMI), triceps skinfold thickness (TSF), arm muscle circumference (AMC), arm circumference (AC), waist circumference (WC), calf circumference (CC).

Nutritional status evaluation

The parameters used for nutritional status evaluation adhered to the boundaries displayed in Table 1.

Body mass was measured using a digital scale, with the subject dressed in minimal clothing and barefoot.[20] Height was measured in accordance with Chumlea et al.[21]. Circumferences were measured with a non-elastic tape measure and the TSF with a Lange skinfold caliper[22]. Body Mass Index (BMI) was calculated as the ratio between the body mass (kg) and squared height (m) (BMI = kg/m^2), and the AMC according to the Gurney and Jelliffe[23] equation: AMC = AC - (π *TSF).

All measures were made in triplicate (except BM), and the mean values were used for the analyses. In the case of nine persons in AC-SC and seven in LC-BA, it was impossible to obtain measurements of body mass and height. The following equations were used to estimate the missing parameters:

Body mass [women: (AC x 1.63) + (CC x 1.43) - 37.46; men: (AC x 2.31) + (CC x 1.50) - 50.10], according Chumlea et al.[20].

Height [women: (1.83 **x** knee height) - (0.24 x age) + 84.88; men: (2.02 x knee height) - (0.04 x age) + 64.19], according Chumlea et al.[21].

The following variables were used to characterize the population: sex, age groups (60-69, 70-79 and ≥ 80 years), literacy (yes/no), marital status (with/without partner), living arrangement (alone/with someone); work (yes/no), hunger during the first 15 years of life (yes/no); any disease in the first 15 years of life (yes/no).

Statistical analysis

The means and standard deviation or the medians of the anthropometric variables were calculated according

Table 1 - Parametric basis of nutritional status evaluation used in this project

Parameter	underweight	adequate	overweight	Observation	Reference
BMI	< 22 kg/m²	≥ 22 - ≤ 27 kg/m²	> 27 kg/m²	SISVAN	7
Parameter	inadequate	adequate	Observation		Reference
TSF (men)	< 9 mm	≥ 9 mm	As per Percentile-25 for Brazilian elderly		18
TSF (women)	< 20 mm	≥ 20 mm	As per Percentile-25 for Brazilian elderly		18
AMC (men)	< 22.98	≥ 22.98 cm	As per Percentile-25 for Brazilian elderly		18
AMC (women)	< 20.92 cm	≥ 20.92 cm	As per Percentile-25 for Brazilian elderly		18
AC	< 22 cm	≥ 22 cm			8
CC	< 31 cm	≥ 31 cm			8
Parameter	Low risk	High risk	Observation		Reference
WC (men)	< 102 cm	≥ 102 cm	Risk of metabolic diseases		19
WC (women)	< 88 cm	≥ 88 cm	Risk of metabolic diseases		19

BMI: Body mass index; TSF: Triceps skinfold thickness; AMC: Arm muscle circumference; AC: Arm circumference; CC: Calf circumference; WC: Waist circumference.

to sex and age groups (60-69, 70-79 and ≥ 80 years). The Kruskal-Wallis test compared age groups, as the data did not present normality. Differences between means (all older adults) were determined by Student's t test or Mann-Whitney (independent samples) for comparison of sexes. The significance level was defined as 5% ($p < 0.05$). The chi-squared or Fisher exact tests were used to compare prevalence.

The statistical program SPSS (version 16.0) was used to analyze the data. The analysis of the data referring to AC-SC was weighted by the post-stratification weights resulting from the method of sampling.

The study was approved by the ethics committees of Universidade Federal de Santa Catarina (case number 189/09) and Universidade Estadual do Sudoeste da Bahia (case number 064/10).

RESULTS

Women in AC-SC (age: 71.0 ± 7.7 years), were younger ($p<0.001$) than in LC-BA (age: 74.9 ± 10.0); men in AC-SC (age: 71.2 ± 7.9) were also younger ($p = 0.019$) than in LC-BA (age: 73.4 ± 9.4).

Except for sex and living arrangement, the prevalence of other demographic and clinical variables presented significant differences between the two regions. As regards the variables 'living with someone', 'working' and 'literacy', the higher prevalence were observed for the older adults of AC-SC (Table 2).

The men and women from AC-SC showed significantly greater mean values for all other anthropometric variables, compared to the subjects of LC-BA. Compared to younger age groups, the subjects over 80 years (AC-SC and LC-BA) presented lower mean values in most anthropometric variables, with statistical differences. There were exceptions for Triceps Skinfold thickness of the men from LC-BA, and Waist Circumference of men and women of the two towns. Comparing age groups, there were significant differences in the mean values of all anthropometric variables, except for Triceps Skinfold thickness among men over 80 years. The mean values were higher for older AC-SC (Tables 3 and 4).

Subjects over 80 years presented higher prevalence of underweight and lower of overweight, without significant difference for the men from LC-BA. The women and men from AC-SC presented higher prevalence of overweight, while the elderly from LC-BA presented greatest proportion of underweight, with significant difference ($p < 0.05$), as shown in Table 5.

The women from AC-SC presented higher proportion of individuals with risk of metabolic diseases, according to their Waist Circumference. As regards the remaining anthropometric variables analyzed, there was a greatest proportion of older adults from AC-SC with adequate nutritional status. In AC-SC and LC-BA, the prevalence of men with adequate nutritional status was lower in the subjects over 80 years, according to Arm Muscle and Calf Circumferences. Between the women of the two towns this same result was observed for the variables Arm, Arm Muscle and Calf Circumferences, with a reduction of the Triceps Skinfold thickness among the women from LC-BA, as displayed in Table 6.

DISCUSSION

To the best of our knowledge, and after a search through SciELO, Medline and Scholar Google conducted by us in 2015, this is the first study to verify the differences in the anthropometric profile and nutritional status adequacy between the older adults of two different regions of Brazil. The results showed significant differences in the values of the anthropometric variables and the nutritional status between the subjects of the two towns. The older adults

Table 2 - Distribution (%) of the older adults, according to the demographic and clinical variables

	Antônio Carlos - SC	Lafaiete Coutinho - BA	p*
	%	%	
Sex			
Female	56.8	54.9	0.540
Male	43.2	45.1	
Age group (years)			
60 - 69	49.5	36.5	
70 - 79	35.8	33.7	< 0.001
≥ 80	14.7	29.8	
Marital Status			
With partner	75.3	56.6	< 0.001
Without partner	24.7	43.4	
Current Occupation			
Yes	40.7	11.4	< 0.001
No	59.3	88.6	
Literacy			
Yes	81.8	33.2	< 0.001
No	18.2	66.8	
Living arrangements			
Alone	13.1	16.5	0.140
With someone	86.9	83.5	
Hunger in the first 15 years			
Yes	10.5	25.0	<0.001
No	89.5	75.0	
Some disease in the first 15 years			
Yes	22.9	57.7	<0.001
No	77.1	42.3	

* Chi-squared test (χ^2)

of AC-SC presented higher values in all anthropometric variables compared to the subjects of LC-BA. Consistent with the anthropometric variables, the older subjects (≥ 80 years) presented lower values in almost all anthropometric variables, as well as higher prevalence of inadequate nutritional status.

The reduction in anthropometric values with advance of age agree with previous studies,[1-5] and can be explained by the loss of muscular mass and subcutaneous fat. An increase in intra-abdominal fat with advance of age might explain the lack of reduction in Waist Circumference values in the older age groups. The amount of subcutaneous fat reduces with aging, even in the occurrence of increased relative and absolute total body fat. This may be partly explained by the infiltration of fat in muscle and the increase of visceral fat.[6]

Anthropometric values of the AC-SC subjects were higher than those in Brazilian older adults dwelling in the larger cities of Joinville (South),[4] São Paulo (southeast),[1] and Fortaleza (northeast).[2] But anthropometric values for the older adults in LC-BA were lower than those reported in previous studies[1,2,4]. However, in comparison with Cuban older adults,[3] the women in LC-BA presented higher Triceps Skinfold thickness and Waist Circumference values, while the values for the LC-BA men were similar. Among the older adults of LC-BA, the anthropometric values were lower than values found in older adults of others Brazilian cities.

The prevalence of underweight was more frequent in LC-BA than A**C**-SC, whereas excess weight was more frequent in AC-SC. The underweight rate was higher among the men of the two towns, compared to the women, and in agreement with data from cities of various regions of Brazil.[1,2,4,5,24,25] The increase in the proportion of underweight, concomitant with the reduction of the prevalence of overweight with advancing aging, agrees with other Brazilian[5, 20-23] and international studies.[10,26]

We found a high prevalence of underweight in older adults in LC-BA (35.7%), which was similar to values

Table 3 - Anthropometric values for women from Antônio Carlos-SC and Lafaiete Coutinho-BA, according to age groups

Anthropometric Variables	Antônio Carlos, SC					Lafaiete Coutinho, BA				
	n	Mean	SD	Median	p***	n	Mean	SD	Median	p***
Body Mass (Kg)			< 0.001							0.003
60-69	116	73.8	13.9	72.2		58	58.6	13.4	56.5	
70-79	73	68.7	11.9	67.6		57	57.2	9.9	56.0	
80 e +	78	61.9	12.0	61.5		53	50.8	11.2	51.0	
Total*	267	70.4	13.6	68.9		168	55.7	12.2	55.2	
Height (cm)					< 0.001					0.019
60-69	116	156.1	6.0	155.0		58	150.1	6.7	150.8	
70-79	74	154.9	5.0	155.0		57	148.6	5.7	148.2	
80 e +	78	151.7	6.3	152.0		53	146.9	6.7	146.8	
Total*	268	155.1	6.0	154.5		168	148.6	6.5	148.8	
Body Mass Index (kg/m²)					< 0.001					0.017
60-69	116	30.1	5.1	29.2		58	26.0	5.4	24.9	
70-79	73	28.6	4.6	28.5		57	25.9	4.1	25.4	
80 e +	78	26.7	5.0	27.1		53	23.5	5.2	22.9	
Total*	267	29.1	5.1	28.5		168	25.2	5.0	24.6	
Triceps Skinfold Thickness (mm)					< 0.001					< 0.001
60-69	116	27.3	10.1	27.3		58	23.5	9.2	22.7	
70-79	69	24.9	8.1	24.3		57	20.9	6.5	19.8	
80 e +	78	22.7	8.6	22.0		52	16.9	8.1	16.2	
Total*	263	25.8	9.8	25.3		167	20.6	8.4	19.7	
Arm Circumference (cm)					< 0.001					< 0.001
60-69	116	33.3	4.2	33.0		58	29.5	4.5	28.8	
70-79	71	31.8	13.9	31.6		57	27.9	3.1	28.0	
80 e +	78	28.9	4.0	29.0		53	26.1	4.3	26.0	
Total*	265	32.2	4.4	31.7		168	27.9	4.2	27.7	
Arm Muscle Circumference (cm)					< 0.001					< 0.015
60-69	116	24.7	2.6	24.5		58	22.1	2.3	22.0	
70-79	68	24.3	2.4	24.1		57	21.4	2.1	21.5	
80 e +	78	21.8	2.5	21.9		52	20.9	2.4	20.9	
Total**	262	24.1	2.8	24.0		167	21.5	2.3	21.5	
Waist Circumference (cm)					0.182					0.187
60-69	116	101.9	13.2	102.8		57	93.6	12.7	93.2	
70-79	68	101.0	11.7	101.2		55	96.6	12.0	98.6	
80 e +	72	99.1	12.8	99.0		50	93.5	12.9	93.8	
Total**	256	101.2	12.9	101.6		162	94.8	12.5	94.3	
Calf Circumference (cm)					< 0.001					< 0.001
60-69	116	38.9	4.1	38.5		58	33.7	3.2	33.2	
70-79	70	37.5	3.4	37.3		57	33.2	2.8	33.1	
80 e +	78	35.1	3.9	35.5		53	30.9	3.7	30.9	
Total*	264	37.9	4.1	37.5		168	32.6	3.5	32.7	

* Significant difference ($p < 0.05$) among the values of the anthropometric variables of the older adults of the two regions (Mann-Whitney test). ** Significant difference ($p < 0.05$) among the values of the anthropometric variables of the older adults of the two regions (Student *t* test). *** Difference between age groups (Kruskal-Wallis test).

Table 4 - Anthropometric values for men from Antônio Carlos-SC and Lafaiete Coutinho-BA, according to age groups

Anthropometric Variables	Antônio Carlos, SC					Lafaiete Coutinho, BA				
	n	Mean	SD	Median	p***	n	Mean	SD	Median	p***
Body Mass (kg²)					<0.001					0.013
60-69	79	79.7	14.8	38.0		54	63.4	12.7	60.7	
70-79	66	72.5	12.4	71.2		49	64.5	14.3	63.1	
80 e +	55	68.9	12.9	66.1		37	56.4	12.4	56.8	
Total*	200	75.5	14.7	74.3		140	62.0	13.5	60.0	
Height (cm)					0.001					0.064
60-69	79	169.9	5.8	170.0		54	163.5	7.4	161.9	
70-79	69	167.5	7.4	168.0		49	161.5	7.9	161.0	
80 e +	55	166.5	7.1	166.0		37	159.6	1.8	159.5	
Total*	203	168.3	6.8	168.4		140	161.8	7.8	160.7	
Body Mass Index (kg/m²)					<0.001					0.030
60-69	78	27.3	3.3	27.5		54	23.7	4.3	23.5	
70-79	66	25.8	3.9	25.8		49	24.5	4.1	23.7	
80 e +	55	24.5	3.9	24.3		37	22.1	4.1	22.4	
Total**	199	26.5	4.6	26.1		140	23.6	4.3	23.4	
Triceps Skinfold Thickness (mm)					0.022					0.344
60-69	79	14.6	8.2	14.0		54	11.1	9.8	9.8	
70-79	66	15.2	12	12.6		49	12.1	5.0	11.1	
80 e +	55	11.6	4.4	11.0		37	10.5	4.3	10.3	
Total*	200	14.6	9.9	13.0		140	11.3	5.0	10.4	
Arm Circumference (cm)					<0.001					0.002
60-69	78	31.8	3.3	31.6		54	28.1	3.2	27.8	
70-79	65	29.9	3.1	30.0		49	28.0	3.4	27.6	
80 e +	55	27.5	3.8	27.0		37	25.6	3.5	25.3	
Total**	198	30.5	3.7	30.2		140	27.4	3.5	27.2	
Arm Muscle Circumference (cm)					<0.001					<0.001
60-69	78	27.3	3.3	27.5		54	24.6	2.4	24.3	
70-79	65	25.1	4.4	26.1		49	24.2	2.5	24.3	
80 e +	55	23.8	2.9	23.2		37	22.3	2.5	22.1	
Total*	198	26.0	3.9	26.4		140	23.8	2.6	24.1	
Waist Circumference (cm)					0.058					0.081
60-69	77	100.4	12.9	99.0		54	88.3	12.8	88.4	
70-79	64	98.6	11.9	97.8		48	92.7	11.7	91.4	
80 e +	54	95.8	11.3	95.3		36	89.1	21.2	86.9	
Total*	195	99.3	12.6	98.8		138	89.9	15.1	89.4	
Calf Circumference (cm)					<0.001					0.043
60-69	79	38.1	3.4	38.0		54	34.7	9.8	34.3	
70-79	65	36.7	4.1	36.5		49	34.2	3.4	34.2	
80 e +	55	34.8	3.2	34.8		37	32.5	4.1	32.0	
Total**	199	37.0	3.9	36.9		140	33.9	3.7	34.1	

* Significant difference ($p < 0.05$) among the values of the anthropometric variables of the older adults of the two regions, according to the Mann-Whitney test. ** Significant difference ($p < 0.05$) among the values of the anthropometric variables of the older adults of the two regions, according to the Student *t* test. *** Difference between age groups, according to the Kruskal-Wallis test.

Table 5 - Adequacy of body mass index, according to sex, age groups and towns

	Antônio Carlos, SC					Lafaiete Coutinho, BA				
	n	Underweight	Adequate	Overweight	p	n	Underweight	Adequate	Overweight	p
Men					**<0.001****					**0,070**
60-69	78	5.6	44.1	50.3		54	38.9	38.9	22.2	
70-79	66	12.5	56.9	30.6		49	22.4	46.9	30.6	
80 e +	55	27.3	49.1	23.6		37	48.6	40.5	10.8	
Total*	199	11.4	49.7	38.8		140	35.7	42.1	22.1	
Women					**<0.001****					**0.042****
60-69	116	1.9	29.4	68.8		58	24.1	36.2	39.7	
70-79	73	8.5	29.9	61.6		57	14.0	47.4	38.6	
80 e +	78	12.8	41.0	46.2		53	32.1	47.2	20.8	
Total*	267	5.7	31.3	63.0		168	23.2	43.5	33.3	

* Significant difference ($p < 0.05$) among the proportion of the elderly of the two regions, according to the nutritional status (BMI); chi-squared test. ** Difference between age groups and body mass index.

registered in the city of Fortaleza, northeast of Brazil (33.5%),[5] as well to those observed among the older adults of Havana, Cuba[26] (33.0%), a communist country that faces problems of economic productivity and food production.[27] For women, the prevalence of overweight in AC-SC was higher than in the larger cities of Viçosa (54.4%)[25] and Pelotas (53.4%),[24] in the southeast and south of Brazil, respectively. Among the men, the proportions of overweight older adults was similar for AC-SC (38.8), Viçosa (35.4%)[25] and Pelotas, (40.1%).[24]

However, comparisons between the estimates of prevalence must be observed with care. Although the cut-off points used to detect underweight were the same for Cuba,[26] Viçosa[25] and Pelotas,[24] there are differences in the sampling process, and in the periods of collection.

The higher prevalence of muscular mass inadequacy (Arm, Arm Muscle and Calf Circumferences and subcutaneous fat - Triceps Skinfold thickness) variables found among the LC-BA group, agree with Body Mass Index findings. The high prevalence of women with Waist Circumference increase is of concern, as well as the high percentage of overweight in women of AC-SC. It should be noted that although Waist Circumference is a marker of the accumulation of abdominal fat, this is not considered adequate to diagnose visceral fat; however, this indicator has been shown to be clinically and epidemiologically useful.[28] Increased Waist Circumference combined with short stature, often a reflection of socioeconomic deprivation in childhood, can increase the risk of cardiovascular diseases, stroke, and diabetes.[29] In the older adults the effects of being overweight are generally associated to morbidities and on the onset of functional impairment. At the other end of the scale, undernutrition/underweight is a major risk factor for mortality.[30] Finally the effects of overweight seem less important in the elderly when compared with the same in younger individuals.[31]

The differences observed in the anthropometric variables of the subjects from the two towns seem related to the differences in the socio-economic development, conditions of life, occupational history and life style,[12] rather than differences in the migration patterns among the regions.[32] Although there might be a genetic component associated to these differences,[33] our results showed that the *self-report* of *unfavorable* health and nutrition problems in the first 15 years of life were more prevalent among the older adults of LC-BA. Unsatisfactory food intake and health problem during childhood are closely linked to the general standard of living, and can be a reflected in short stature,[29] as observed in the present study.

Socio-economic conditions affect access to health services and characteristics, affects the acquisition of foods and, consequently, impinge upon the nutritional status of individuals.[11] Social differences in Brazil have been reduced over recent decades, but some indicators still evidence regional differences. The incidence of poverty was distinctly lesser in AC-SC (11.88%) than in LC-BA (47.77%); in 2010, the per capita Gross Domestic Product (GDP) in AC-SC was 7-times higher than that in LC-BA.[16] Moreover, it is important to note that the population of oldest older adults (≥ 80 years) is larger in LC-BA, compared to AC-SC. This age group is the most heterogeneous, a condition that is reflected in the anthropometric variables.

Due to the cross-sectional nature of the study, we were able to make comparisons between age groups, showing only differences related to advancing age, and not arising from the process of aging. The study presents representative sample data (60-79 years, in AC-SC) and whole population data (LC-BA, and ≥ 80 years in AC-SC) of the older adults of small towns of Brazil, highlighting the differences in the anthropometric characteristics and body mass index of the subjects from the two different regions as

Table 6 - Adequacy of anthropometric indicators, according to sex, age groups and towns

	Antônio Carlos - SC				Lafaiete Coutinho - BA			
	n	Adequate	Inadequate	p**	n	Adequate	Inadequate	p**
MEN								
Arm circunference (cm)								
60-69	78	100	-	0.021	54	96.3	3.7	0.216
70-79	65	100	-		49	93.9	6.1	
80 e +	55	96.4	3.6		37	86.5	13.5	
Total*	198	99.5	0.5		140	92.9	7.1	
Triceps Skinfold Thickness (mm)								
60-69	79	82.1	17.9	0.065	54	59.3	40.7	0.608
70-79	66	70.8	29.2		49	77.6	22.4	
80 e +	55	74.5	25.5		37	62.2	37.8	
Total*	200	76.7	23.3		140	66.4	33.6	
Arm muscle circunference (cm)								
60-69	78	94.4	5.6	<0.001	54	77.8	22.2	<0.001
70-79	65	85.9	14.1		49	79.6	20.4	
80 e +	55	60.0	40.0		37	40.5	59.5	
Total*	198	86.1	13.9		140	68.6	31.4	
Waist Circumference (cm)								
60-69	77	54.6	45.4	0.124	87.0	13.0	87.0	0.751
70-79	64	60.0	40.0		75.0	25.0	75.0	
80 e +	54	64.8	35.2		86.1	13.9	86.1	
Total*	195	41.8	58.2		82.6	17.4	82.6	
Calf Circumference (cm)								
60-69	79	98.9	1.1	0.004	54	88.9	11.1	<0.001
70-79	65	95.0	5.0		49	85.7	14.3	
80 e +	55	89.1	10.9		37	56.8	43.2	
Total*	199	96.0	4.0		140	79.3	20.7	
WOMEN								
Arm circunference (cm)								
60-69	116	100	-	0.036	58	96.6	3.4	0.005
70-79	71	98.8	1.3		57	98.2	1.8	
80 e +	78	97.4	2.6		53	83.0	17.0	
Total*	265	99.2	0.8		168	92.9	7.1	
Triceps Skinfold Thickness (mm)								
60-69	116	77,7	22,3	0,070	58	63,8	36,2	0,001
70-79	69	73,4	36,6		57	49,1	50,9	
80 e +	78	67,9	32,1		52	30,8	69,2	
Total*	263	74,9	25,1		167	48,5	51,5	
Arm muscle circunference (cm)								
60-69	116	94,8	5,2	<0,001	58	74,1	25,9	0,009
70-79	68	94,1	5,9		57	66,7	33,3	
80 e +	78	64,1	35,9		52	50,0	50,0	
Total*	262	89,8	10,2		167	64,1	35,9	

Continued Table 6

Waist Circumference (cm)								
60-69	116	11.9	88.1	0,989	57	31.6	68.4	0,845
70-79	68	9.8	90.2		55	23.6	76.4	
80 e +	72	16.7	83.3		50	32.0	68.0	
Total*	256	11.9	88.1		162	29.0	71.0	
Calf Circumference (cm)								
60-69	116	100	-	<0,001	58	82,8	17,2	<0,001
70-79	70	98,7	1,3		57	78,9	21,1	
80 e +	78	83,3	16,7		53	49,1	50,9	
Total*	264	97,0	3,0		168	70,8	29,2	

* Significant difference (p<0.05) among the proportion of older adults of the two regions; chi-square test. ** Difference between age groups and anthropometric indicators.

well as in comparison to conditions prevailing in large cities. Our results indicate that the public policies must be tailored with respect to each region, and the health departments of both towns received the original results of the survey. They became the subject matter of courses and training lectures for health agents, nurses, doctors, and older adults.

CONCLUSION

The anthropometric variables and nutritional status (body mass index) of the subjects of the two towns are divergent and identify vulnerability of the nutritional status, either in terms of excess (AC-SC) or of deficiency (LC-BA). Although the anthropometric characteristics and nutritional adequacy change with the advance of age, these regional differences (or the factors that they represent) appear to be determinant factors in the characteristics of older adults. These findings highlight the importance of the use of anthropometric indicators in clinical practice and health monitoring, and stress the importance of differentiating actions and public policies in Brazil.

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AUTHOR CONTRIBUTIONS

Barbosa AR, Coqueiro RS, Fernandes MH contributed for the conception and planning of the study; Marucci MFN, Barbosa AR, Coqueiro RS contributed significantly to the draft and critical review of the content; Marchesan M, Guimarães AV and França VF contributed to the draft and data analysis/interpretation. All authors approved the final version of the manuscript.

CONFLICT OF INTEREST

Authors declare that they have no conflict of interest concerning this study.

INDICADORES ANTROPOMÉTRICOS EM IDOSOS DE DUAS CIDADES DE REGIÕES BRASILEIRAS DISTINTAS

OBJETIVO: Comparar os indicadores antropométricos e sua adequação em idosos de residentes de duas cidades de regiões distintas do Brasil.

MÉTODOS: Estudo transversal, epidemiológico de base domiciliar. Foram examinados 793 indivíduos (≥ 60 anos) das regiões sul e nordeste, de acordo com grupos etários (60-69, 70-79 e ≥ 80 anos) e sexo.

Os dados foram apresentados como médias (± DP) ou medianas para massa corporal estatura, dobra cutânea triciptal (DCT), índice de massa corporal (IMC), circunferência muscular do braço (CMB) e circunferências do braço (CB), cintura (CC) e panturrilha (CP). A adequação dos indicadores antropométricos (prevalência) também foi comparada: CB (≥ 22 cm) CMB (≥ 22,98 cm, homen; ≥ 20,92 cm, mulher), TSF (≥ 9,0 mm, homem; ≥ 20 mm, mulher), CP (≤ 31 cm), CC (< 102 cm, homem; < 88 cm, mulher) and IMC (≥ 22,0 and ≤ 27,0 kg/m^2).

RESULTADOS: Os valores médios, de todas as variáveis antropométricas foram significativamente maiores entre os homens e mulheres da região sul (n = 477), comparados aos dos idosos da região nordeste (n = 316). A prevalência de baixo peso (IMC <22,0 kg/m^2) foi maior na região nordeste e de excesso de peso (BMI >27,0 kg/m^2) na região sul. A região nordeste apresentou maior proporção de idosos com circunferência de cintura adequada. Em relação aos demais

indicadores analisados, houve maior proporção de idosos da região sul com adequação nutricional.

CONCLUSÃO: Os resultados fornecem informações que podem ser usadas na avaliação de idosos de cidades com o mesmo contexto. A vulnerabilidade nutricional está presente nas duas regiões, por deficiência (nordeste) e por excesso (sul).

PALAVRAS-CHAVE: Envelhecimento; Avaliação Nutricional; Estudos transversais.

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