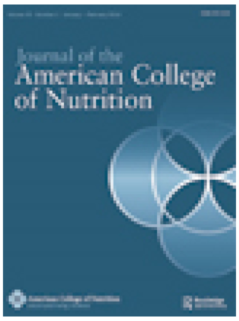

Journal of the American College of Nutrition

ISSN: 0731-5724 (Print) 1541-1087 (Online) Journal homepage: https://www.tandfonline.com/loi/uacn20

General and Central Adiposity in Older Adults in Palmas (TO): Prevalence and Associated Factors

Maria Sortênia Alves Guimarães, Kíllya de Paiva Santos, Joice da Silva Castro, Leidjaira Lopes Juvanhol, Fabiane Aparecida Canaan Rezende & Andréia Queiroz Ribeiro

To cite this article: Maria Sortênia Alves Guimarães, Kíllya de Paiva Santos, Joice da Silva Castro, Leidjaira Lopes Juvanhol, Fabiane Aparecida Canaan Rezende & Andréia Queiroz Ribeiro (2020): General and Central Adiposity in Older Adults in Palmas (TO): Prevalence and Associated Factors, Journal of the American College of Nutrition, DOI: 10.1080/07315724.2020.1734989

To link to this article: https://doi.org/10.1080/07315724.2020.1734989

Published online: 03 Mar 2020.

JOURNAL OF THE AMERICAN COLLEGE OF NUTRITION
https://doi.org/10.1080/07315724.2020.1734989

Taylor & Francis
Taylor & Francis Group

Check for updates

General and Central Adiposity in Older Adults in Palmas (TO): Prevalence and Associated Factors

Maria Sortênia Alves Guimarães[a], Kíllya de Paiva Santos[a], Joice da Silva Castro[a], Leidjaira Lopes Juvanhol[a], Fabiane Aparecida Canaan Rezende[b], and Andréia Queiroz Ribeiro[a]

[a]Department of Nutrition and Health, Federal University of Viçosa (UFV), Viçosa, Minas Gerais, Brazil; [b]Nutrition Science Course, Federal University of Tocantins (UFT), Palmas, TO, Brazil

ABSTRACT

Objectives: To evaluate the prevalence and associated factors with general and central adiposity in older adults in Palmas (TO).

Methods: Cross-sectional study with older adults (≥60 years) of both sexes enrolled in the Family Health Strategy program in Palmas (TO). Sociodemographic aspects, health conditions, and functionality were evaluated as independent variables and Body Mass Index (BMI) for general adiposity and Waist Circumference (WC) for central adiposity as dependent variables. Descriptive analysis and hierarchical multiple Poisson regression with robust variance were performed.

Results: A total of 449 seniors (50.6% women) from 60 to 92 years of age, average of 68.3 years, were evaluated. The prevalence of general adiposity was 46.8% (95% CI: 42.2%–51.4%) and central adiposity was 78.8% (95% CI: 74.7%–82.3%). The prevalence of both outcomes was significantly higher among women and the participants with a history of hypertension, diabetes, dyslipidemia, and rheumatic diseases and those dependent in activities of daily living (ADL) than among men. Lower frequency of adiposity (general and central) was found with increasing age. After adjustment, the prevalence of both outcomes was significantly higher in women aged 70–79 years and hypertensive.

Conclusions: The results of this study confirm the need to establish nutritional status monitoring and direct obesity prevention and control interventions in programs to promote health and quality of life of older adults and those in the stages prior to old age.

ARTICLE HISTORY
Received 7 December 2019
Accepted 28 January 2020

KEYWORDS
Elderly; obesity; prevalence; functionality; nutrition

Introduction

Obesity is defined as excessive body fat accumulation and is considered a worldwide epidemic, with increasing prevalence in the entire population, particularly among the older people. It is considered a modifiable risk factor for the development of several comorbidities (1, 2) which, among the older population, gains great importance because it contributes to increase in cognitive impairment (3), cardiovascular diseases (4), disabilities, reduction in quality of life, and increase of mortality (5).

Data of the National Health and Nutrition Examination Survey (NHANES) shows that one third of older Americans (65 years and over) are obese (6) and highlight that high rates of obesity extend into older adulthood (7). In Brazil, data from the 2017Inquérito da vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico (Vigitel), show that 20.3% of individuals aged 65 years and older present obesity (8). In a study based on data from the 2002/03 and 2008/09 Pesquisas de Orçamentos Familiares (POF), Silva et al. (9) showed a tendency of increasing prevalence of overweight and decreasing prevalence of underweight among older men and women, which reinforces the occurrence of nutritional transition in Brazil.

Despite its limited accuracy, anthropometry is the most accessible method in epidemiological studies with large populations and in clinical practice to assess body composition and predict health outcomes such as chronic diseases (10). Anthropometric indicators include Body Mass Index (BMI) and Waist Circumference, which are used as indirect indicators of general and central adiposity, respectively (11, 12).

Although not allowing the differentiation between lean and fat mass, BMI is widely used because it enables the identification of older adults at high risk of morbidity and mortality (13). In its turn, the waist circumference (WC) indicates a risk factor for cardiovascular disease because it is correlated with the accumulation of adipose tissue in the abdominal region, which may favor insulin resistance, dyslipidemia, and systemic arterial hypertension (SAH) (14). Both methods are noninvasive, inexpensive, easy, and fast-performing and have a good correlation with morbidity and mortality indicators (15, 16).

Despite the increasing prevalence of obesity in the older population, there is still controversy regarding intervention methods for weight loss in this group due to current hypotheses that it may increase mortality or accelerate the process of sarcopenia associated with aging (2). Thus, the identification of factors associated with overweight in older

CONTACT Maria Sortênia Alves Guimarães msortenia@uft.edu.br Department of Nutrition and Health, Federal University of Viçosa (UFV), Viçosa, Minas Gerais, Brazil.

people aiming at its control and prevention is an approach of great relevance for public health.

At the same time, it is known that social, economic, and cultural differences among the various Brazilian subpopulations are important to influence the health-disease process in different ways. Additionally, studies are still scarce on nutritional epidemiology with representative samples of the older population of municipalities in the northern region of Brazil. From the foregoing, the present study aimed to evaluate the prevalence and factors associated with general and central adiposity in older adults in Palmas, Tocantins, Brazil.

Materials and methods

Study design, target population, and sample

Cross-sectional study with older adults 60 years of age and over, of both sexes enrolled in the Family Health Strategy (FHS) program conducted in the city of Palmas (TO) (Brazil), from April to July 2018.

The target population of this study consisted of older people (≥ 60 years) enrolled in the FHS program. The FHS program covers 100% of the population. The sample size was calculated considering the reference population of 9,878 elderly (17). It considered a prevalence of 50%, a tolerable error of 5%, design effect of 1, and 95% confidence level, totaling a sample of 370 participants. The value calculated was added with 10% to cover possible losses and 10% for the multivariate analysis. The sample size was estimated in 449 subjects.

A random sampling was used to select the participants by drawing out the elderly registered by the Community Health Centers (CHC) from a database previously organized in alphabetical order.

Eligibility criteria

The study included subjects 60 years of age and older, of both sexes, resident in the community and enrolled in the Family Health Strategy Program who agreed to participate in the study by signing the Informed Consent Form.

The non-inclusion criteria were subjects with cognitive impairment by the Mini-Mental State Exam (MMSE) (18); subjects who were bedridden or institutionalized; those with upper and lower limb amputations; and those having impaired walking ability.

Data collection

Data were collected at CHCs through pre-scheduled interviews.

Trained interviewers applied a semi-structured, pre-tested questionnaire covering sociodemographic and health information mostly consisting of precoded/closed-ended questions. If there was any difficulty in answering the questions a nearby respondent provided assistance.

Weight and height were measured for the anthropometric evaluation. Weight was measured in a portable scale (JC320 Joycare) of 180 Kg capacity, with participants wearing light clothing and no shoes. Height was measured using a portable stadiometer (20 to 210 cm) (Avanutri, Três Rios - R J, Brazil). The anthropometric variables were measured according to Frisancho's (19) standards.

The waist circumference (WC) was measured in centimeters with a flexible, inelastic measuring tape (Sanny, 200 cm, 1 mm graduation). The subject remained in an orthostatic position and WC was measured at the midpoint between the last rib and the iliac crest (20).

Study variables

The dependent variables general and central adiposity were investigated. General adiposity was assessed by BMI [BMI = body mass (kg)/height (m2)], considering the cutoff points proposed by the Pan American Health Organization: low weight BMI $\leq$ 23 kg/m^2, eutrophy BMI between 23.1 and 27.9 kg/m^2, overweight BMI between 28 and 29.9 kg/m^2, and obesity $\geq$ 30 (21). Regarding the nutritional status, overweight considered BMI values $\geq$ 28.0 kg/m^2.

Central adiposity was assessed by WC using the cutoff point of $\geq$ 94 cm for men and $\geq$ 80 cm for women (22).

The independent variables analyzed were sex (male and female) and age (years and age range). The age range was categorized into three age groups: 60 to 69 years; 70 to 79 years; and 80 years and over. Schooling was categorized into: never studied; 1 to 4 years of study; 5 years or more of study. The income considered was the individual monthly income of the participant, income earned from work or social security (retirement, pension, continued benefit, etc.). The income was categorized into: below 1 minimum wage; 1 minimum wage; and above 1 minimum wage, considering the minimum wage at the time of the study the amount of R$954.00. The history of morbidities was also investigated by self-report of previous diagnosis by a physician or other health professional. Thus, among the 22 defined morbidities, four were considered of interest: diabetes mellitus; hypertension; dyslipidemia; and rheumatic diseases (arthritis/arthrosis).

To assess functional capacity, a self-assessment scale was applied with fifteen types of activities, which include basic activities of daily living (BADL) and instrumental activities of daily living (IADL). The Katz Index was used for the BADL group and the Lawton-Brody scale for the IADL group (23, 24). The capacity to perform BADL was classified as: 1) dependent for ONE activity; 2) dependent for TWO activities; 3) dependent for THREE activities, 4) dependent for FOUR activities; 5) dependent for FIVE activities and; 6) Dependent for ALL activities. In the present study, the classification criterion adopted was independent, dependent for one BADL, and dependent for two or more BADLs. The classification criterion adopted for the IADLs was independence, mild dependence, and moderate and/or severe dependence. The cutoff points adopted were: a) scoring range 25 to 27 - independent; b) scoring range 21 to 25 - mild dependence; c) scoring range 16 to 20 - moderate dependence; d) scoring range 10 to 15 - severe dependence and; e) score 9 - total dependence.

Data analysis

Descriptive analysis was performed using frequency distribution for qualitative variables and estimates of central tendency and dispersion for quantitative variables.

The prevalence of overweight (general adiposity) and central adiposity and their respective 95% confidence intervals were estimated. Proportions of general adiposity and central adiposity between the variables of interest were compared by the Pearson's chi-square test.

Bivariate and multiple analyses were performed using Poisson regression with robust variances to verify the factors associated with the outcomes. The results of the bivariate analysis show that the variables that were associated with outcomes with a $p < 0.25$ were selected for multiple modeling.

In the multivariate analysis, the factors independently associated with the outcomes of interest were determined by hierarchical multiple logistic regression analysis. The model selected was adapted from Victora et al. (25), in which the variables are organized in three hierarchical blocks, based on the logical and theoretical relationships between factors related to adiposity. The first (most distal) block included the demographic and socioeconomic variables age, schooling, and individual income. The second (intermediate) block comprised the health condition variables (history of high blood pressure; diabetes, dyslipidemia, and rheumatic diseases); the third (more proximal) block comprised the capacity to perform BADL and IADL. The most distal variables served as adjustment factors for the hierarchically inferior blocks and were maintained in the other models, even if their statistical significance was not preserved. This design was adopted for the modeling of each one of the outcomes. The multiple regression results were expressed as Adjusted Prevalence Ratio and respective 95% CI.

The statistical significance was $\alpha = 0.05$. All statistical analyses were performed using the STATA software, version 13.0 for Windows (Stata Corp. College Station, United States).

Ethical aspects

This study was approved by the Human Research Ethics Committee of the Federal University of Viçosa (Brazil), number 2.587.419. (CAAE: 84599718.5.0000.5153). All participants signed the Informed Consent Form after verbal and written explanations of the study.

Results

Among the 449 elderly participants in the study, 50.6% ($n = 227$) were female. The median age was 68.28 years, ranging from 60 to 92 years.

More than half of the participants (56.8%) were in the age range between 60 and 69 years old. It was found that 57% of the sample had one to four years of formal schooling and 21.6% had income below one minimum wage. The self-reported morbidities diabetes, hypertension, and dyslipidemia were reported by 35.2%, 67.5%, and 54.3% of participants, respectively. In addition, 36.3% of participants reported rheumatic diseases. Analysis of functional capacity showed 8.0% of the subjects with moderate or severe dependence on IADL and 4.0% dependent for two or more BADL (Table 1).

The prevalence of general adiposity was 46.8% (95% CI: 42.2%–51.4%). Prevalence was significantly higher in women than in men (p-value <0.001), decreased with age (p-value <0.001), and was higher in lower-income participants (p-value = 0.023). Prevalence was also higher in participants with 5 years or more of schooling (p-value = 0.009). Among morbidities, the prevalence of general adiposity was higher in individuals with a history of diabetes (p-value = 0.017), arterial hypertension (p-value = 0.001), dyslipidemias (p-value = 0.003), and rheumatic diseases (p-value = 0.012).

The bivariate analysis found no relationship between general adiposity with IADL (p-value = 0.191) and BADL (p-value = 0.057).

Table 2 shows the results of the hierarchical multiple Poisson regression of factors associated with general adiposity. Among the variables in block 1, statistically significant associations were observed between general adiposity and female sex, aged 70 to 79 years and >80 years (Model 1). In block 2, which included the morbidities and variables of the distal block, hypertension was significantly associated with the outcome, and permanence of gender and age range (Model 2). In the final model (Model 3), after adjustment by the intermediate and distal blocks, the following factors were statistically associated with general adiposity: female sex (RPaj: 1.39; 95% CI: 1.13–1.70); age between 70 and 79 years (RPaj: 0.76; 95% CI: 0.60–0.95) or >80 years (RPaj: 0.53; 95% CI: 0.32–0.90); hypertension (RPaj: 1.41; 95% CI: 1.12–1.76); and dependence for performing one BADL (RPaj: 1.31; 95% CI: 1.04–1.63).

The prevalence of central adiposity was 78.8% (95% CI: 74.7%–82.3%). There was a higher prevalence of central adiposity in women (p-value <0.001), in subjects with a history of diabetes (p-value <0.001), hypertension (p-value <0.001), dyslipidemia (p-value <0.001), and rheumatic diseases (p-value = 0.003). On the other hand, there was a reduction in prevalence with age (p-value = 0.002) (Table 3).

Table 4 summarizes the results from the hierarchical multiple Poisson regression of factors associated with central adiposity in the sample. Among the sociodemographic variables included in block 1 of the model, those that remained statistically significant were female gender and aged 70 to 79 years (Model 1). In block 2, which included morbidities and adjustment at the previous level, it was found that diabetes, hypertension, and dyslipidemia were variables associated with central adiposity, in addition to the significant permanence of gender and age range (Model 2). In the final model (Model 3), after adjusting for the other variables, the following factors were statistically associated with central adiposity: female gender (RPaj: 1.42; 95% CI: 1.28–1.58); age 70 and 79 years (RPaj: 0.89; 95% CI: 0.80–0.99); diabetes (RPaj: 1.10; 95% CI: 1.01–1.20); hypertension (RPaj: 1, 24; 95% CI: 1.11–1.39); and dyslipidemia (RPaj: 1.18; 95% CI: 1.07–1.30).

Table 1. Prevalence and prevalence ratio of general adiposity according to sociodemographic variables, health conditions, and functionality of the older adults. Palmas, Tocantins, Brazil, 2018.

		General adiposity		
Variable	*n* (%)	Prevalence	PR (95% CI)	*p*-Value
Sex				<0.001*
Male	222 (49.4)	36.0	1.00	
Female	227 (50.6)	57.3	1.59 (1.29–1.96)	
Age range (years)				<0.001*
60–69	255 (56.8)	56.5	1.00	
70–79	155 (34.5)	36.8	0.65 (0.52–0.82)	
80 or more	39 (8.7)	23.1	0.41 (0.23–0.73)	
Schooling (years)				0.009*
Never studied	57 (12.7)	47.4	1.00	
1–4 years	256 (57.0)	41.0	0.87 (0.63–1.18)	
5 years or more	136 (30.3)	57.4	1.21 (0.89–1.65)	
Individual monthly income				0.023*
Below 1 MW	96 (21.6)	56.3	1.00	
1 MW	189 (42.4)	39.7	0.70 (0.55–0.90)	
Above 1 MW	160 (36.0)	48.8	0.87 (0.68–1.10)	
History of diabetes				0.017*
No	291 (64.8)	42.6	1.00	
Yes	158 (35.2)	54.4	1.28 (1.05–1.55)	
History of hypertension				0.001*
No	146 (32.5)	35.6	1.00	
Yes	303 (67.5)	52.1	1.46 (1.15–1.87)	
History of dyslipidemia				0.003*
No	205 (45.7)	39.0	1.00	
Yes	244 (54.3)	53.3	1.37 (1.11–1.68)	
History rheumatic diseases				0.012*
No	286 (63.7)	42.3	1.00	
Yes	163 (36.3)	54.6	1.29 (1.06–1.57)	
IADL				0.191
Independent	296 (65.9)	45.6	1.00	
Mild Dependence	117 (26.1)	44.4	0.97 (0.76–1.23)	
Moderate to Severe Dependence	36 (8.0)	61.1	1.33 (1.0–1.78)	
BADL				0.057
Independent	370 (82.4)	44.3	1.00	
Dependent for 1 **BADL**	61 (13.6)	55.7	1.26 (0.98–1.62)	
Dependent for 2 or more **BADLs**	18 (4.0)	66.7	1.50 (1.06–2.13)	

*= *p*-value of Pearson's chi-square test; SM: minimum wage at the time of the study: R$954.00; PR: prevalence ratio; 95% CI: 95% Confidence Interval; BADL: Basic activities of daily living; IADL: Instrumental activities of daily living.

Table 2. Hierarchical multiple regression analysis of factors associated with general adiposity in older adults. Palmas, Tocantins, Brazil, 2018.

	Model 1			Model 2			Model 3		
Variable	PR	CI (95%)	*p*-Value	PR	CI (95%)	*p*-Value	PR	CI (95%)	*p*-Value
Sex female	1.43	1.17–1.75	0.001*	1.39	1.13–1.71	0.002*	1.39	1.13–1.70	0.002*
Age range (years)									
70–79	0.78	0.62–0.97	0.029*	0.76	0.61–0.95	0.016*	0.76	0.60–0.95	0.016*
80 or more	0.55	0.32–0.96	0.035*	0.54	0.31–0.93	0.027*	0.53	0.32–0.90	0.017*
Schooling (years)									
1–4 years	0.82	0.62–1.09	0.171	0.83	0.63–1.10	0.192	0.83	0.63–1.11	0.214
5 years or more	0.96	0.71–1.29	0.775	0.99	0.74–1.33	0.953	0.99	0.73–1.35	0.942
Individual monthly income									
Up to 1 MW	0.84	0.66–1.06	0.144	0.85	0.68–1.07	0.174	0.85	0.67–1.07	0.160
Above 1 MW	0.97	0.77–1.21	0.775	0.99	0.79–1.24	0.946	0.99	0.79–1.25	0.953
History of diabetes				1.01	0.83–1.22	0.941	1.01	0.84–1.23	0.886
History of hypertension				1.43	1.14–1.79	0.002*	1.41	1.12–1.76	0.003*
History rheumatic diseases				1.08	0.90–1.29	0.404	1.04	0.87–1.25	0.659
History of dyslipidemia				1.05	0.86–1.27	0.647	1.03	0.85–1.25	0.761
IADL									
Moderate to Severe Dependence							0.86	0.69–1.07	0.179
Mild Dependence							1.1	0.82–1.47	0.522
BADL									
Dependent for **1 BADL**							1.31	1.04–1.63	0.020*
Dependent for 2 or more **BADLs**							1.31	0.89–1.93	0.165

*= *p*-value of Poisson regression test; MW: minimum wage at the time of the study: R$954.00; PR: prevalence ratio; 95% CI: 95% Confidence Interval; BADL: Basic activities of daily living; IADL: Instrumental activities of daily living.

Discussion

This study identified the prevalence and factors associated with general and central obesity in older adults enrolled in the FHS program in Palmas, TO, Brazil. The findings show a high prevalence of both outcomes and their relationship with sex, age, chronic diseases, and disability. To the authors' knowledge, this is the first study on the theme with a

Table 3. Prevalence and prevalence ratio of central adiposity according to sociodemographic variables, health conditions, and functionality of older adults. Palmas, Tocantins, Brazil, 2018.

		Central adiposity		
Variable	*n* (%)	Prevalence	PR (95% CI)	*p*-Value
Sex				<0.001*
Male	222(49.6)	64.0	1.00	
Female	226(50.4)	93.4	1.46(1.31–1.62)	
Age range (years)				0.002*
60–69	255(56.9)	84.3	1.00	
70–79	154(34.4)	73.4	0.87(0.78–0.97)	
80 or more	39(8.7)	64.1	0.76(0.60–0.97)	
Schooling (years)				0.603
Never studied	57(12.7)	78.9	1.0	
1–4 years	255(56.9)	77.3	0.98(0.84–1.14)	
5 years or more	136(30.4)	81.6	1.03(0.88–1.21)	
Individual monthly income				0.232
Below 1 MW	96(21.6)	84.4	1.00	
1 MW	189(42.6)	75.7	0.90(0.80–1.01)	
Above 1 MW	159(35.8)	79.3	0.94(0.84–1.06)	
History of diabetes				<0.001*
No	290(64.7)	73.1	1.00	
Yes	158(35.3)	89.2	1.22(1.18–1.33)	
History of hypertension				<0.001*
No	145(32.4)	66.2	1.00	
Yes	303(67.6)	84.8	1.28(1.13–1.45)	
History of dyslipidemia				<0.001*
No	204(45.5)	67.2	1.00	
Yes	244(54.5)	88.5	1.32(1.19–1.47)	
History rheumatic diseases				<0.003*
No	286(63.8)	74.5	1.0	
Yes	162(36.2)	86.4	1.16(1.06–1.27)	
IADL				0.528
Independent	295(65.9)	78.0	1.0	
Mild Dependence	117(26.1)	78.6	1.01(0.90–1.13)	
Moderate to Severe Dependence	36(8.0)	86.1	1.10(0.96–1.28)	
BADL				0.251
Independent	369(82.4)	78.1	1.00	
Dependent for 1 **BADL**	61(13.6)	78.7	1.01(0.88–1.16)	
Dependent for 2 or more **BADLs**	18(4.0)	94.4	1.21(1.07–1.37)	

*= *p*-value of Pearson's chi-square test; MW: minimum wage at the time of the study: R$954.00; PR: prevalence ratio; 95% CI: 95% Confidence Interval; BADL: Basic activities of daily living; IADL: Instrumental activities of daily living.

representative sample of older adults in municipalities in the northern region of Brazil. These results confirm the importance of considering both indicators (BMI and WC) to assess adiposity, since BMI alone is limited due to changes in body composition with aging such as the central distribution of body fat. Thus, older adults classified as without general adiposity may have excess body fat, as observed in this study.

Overall, the prevalence of outcomes in the present study was higher than that of studies conducted in other Brazilian regions. In Southern Brazil, a study carried out in Pelotas (RS) showed prevalence of general and abdominal obesity of 29.9% and 50.4% respectively. The prevalence of both outcomes was also higher in hypertensive and diabetic women. Age was inversely associated with general and abdominal obesity (26). In his study, Araújo et al. (27) corroborates the findings of this study, reporting a prevalence of general obesity of 17.3% in men and 34.8% in women. Prevalence of abdominal obesity was higher in women than in men, of 64.5% and 36.7%, respectively. Population studies conducted with older Brazilians (28, 29) also presented similar results, with higher prevalence of obesity in women. In an international study, the prevalence of abdominal obesity in women ranged from 48.5% (Havana) to 72.7% (Mexico City), while among men ranged from 12.5% (Bridgetown) to 32.5% (Santiago) (30).

Although the differences may be partially attributed to the different cutoff points used in the classification of outcomes, as well as to some particularity in measuring waist circumference, the results of this study highlight the need for FHS interventions for the prevention and control of obesity in older adults in Palmas to reduce health damages caused by these conditions and related factors.

The results showed higher prevalence of general and central adiposity among women. These results are in line with the findings of other Brazilian studies conducted with older adults in the states of São Paulo (31), Rio Grande do Sul (26, 28), and Santa Catarina (27), as well as researches conducted in Italy (32) and Mexico (33).

The difference in incidence, distribution, and metabolism of body fat between men and women has been described and explained mainly by changes in the endocrine system during aging (34). The higher prevalence of general and central adiposity in women may have physiological causes, since the accumulation of subcutaneous fat during the aging process is greater in women than in men, and fat loss occurs later in life in older women (19, 35). Therefore, there is both a progressive increase in body fat deposition, as well as its redistribution, with a decrease in the limb region and a greater accumulation in the abdominal region. Generally, this deposition occurs earlier in men, around middle age, and later in women, after menopause (36).

Table 4. Hierarchical multiple regression analysis of factors associated with central adiposity in older adults. Palmas, Tocantins, Brazil, 2018.

Variable	Model 1			Model 2			Model 3		
	PR	CI (95%)	*p*-Value	PR	CI (95%)	*p*-Value	PR	CI (95%)	*p*-Value
Sex Female	1.46	1.31–1.63	<0.001*	1.42	1.28–1.58	<0.001*	1.42	1.28–1.58	<0.001*
Age range (years)									
70–79	0.89	0.80–0.99	0.040*	0.88	0.79–0.98	0.021*	0.89	0.80–0.99	0.032*
80 or more	0.84	0.66–1.07	0.151	0.84	0.67–1.05	0.125	0.84	0.67–1.05	0.116
Individual monthly income									
Up to 1 MW**	0.98	0.87–1.10	0.752	1.01	0.90–1.12	0.897	1.0	0.89–1.12	0.967
Above 1 MW **	1.06	0.95–1.19	0.290	1.08	0.97–1.22	0.153	1.08	0.97–1.20	0.175
History of diabetes				1.10	1.01–1.19	0.033*	1.10	1.01–1.20	0.032*
History of hypertension				1.24	1.11–1.39	<0.001*	1.24	1.11–1.39	<0.001*
History rheumatic diseases				1.01	0.93–1.10	0.844	1.01	0.93–1.10	0.867
History of dyslipidemia				1.18	1.07–1.30	0.001*	1.18	1.07–1.30	0.001*
BADL									
Dependent for **1 BADL**							0.95	0.84–1.07	0.433
Dependent for 2 or more **BADLs**							1.13	0.96–1.34	0.139

*= *p*-value of Poisson regression test; MW: minimum wage at the time of the study: R$954.00; PR: prevalence ratio; 95% CI: 95% Confidence Interval; BADL: Basic activities of daily living.

During menopause, there is an increase in total adiposity levels and the conformation of a centralized fat distribution pattern that contributes to weight gain and adiposity (37). Lauretta et al. (34) discuss that after menopause, the reduction in steroid hormones, e.g. estrogen, favors the maintenance of the characteristic body fat distribution in women, influencing lipolysis and fat uptake. Besides, the hormone would also influence the reduction of fatty acid oxidation, helping to increase body fat. Another contributing factor is the higher life expectancy among women (26), which may underestimate the prevalence in men.

The results of this study show that age is inversely associated with general and central adiposity. The age range of 80 years or older had the lowest prevalence of general and abdominal adiposity, which is in line with the literature (38). In Pelotas-RS, a significant reduction in general and central adiposity was identified with increasing age (26). This relationship can be explained by changes that occur during aging and contribute to weight loss because of the reduction in food intake caused by loss of appetite, difficulty in chewing, digestive problems, etc. In parallel, the loss of muscle mass over the years, as it is converted into intramuscular fat, corroborates weight loss. In agreement with these findings, a study conducted in Florianópolis - SC also identified differences in the prevalence of general and central obesity according to age, with young-old women showing higher frequencies (26, 27).

Furthermore, weight reduction with increasing age can be partly explained by the survival bias, which concerns mortality in individuals with obesity-associated diseases (26).

In the present study, there was no independent association between socioeconomic status (income and education) and adiposity. However, studies point to the association of adiposity with socioeconomic conditions (27, 39).

The results show that general adiposity is positively associated with hypertension and central adiposity is associated with hypertension, diabetes, and dyslipidemia. These results corroborate the findings of a study conducted with older adults from the cohort of Bambuí, MG (40).

A prospective population-based study conducted with an elderly Iranian population found that central adiposity was associated with an increased risk for the development of cardiovascular disease/coronary heart disease. In addition, it showed that arterial hypertension was the most important metabolic risk factor for central adiposity (41).

Obesity is a complex metabolic disorder, often associated with insulin resistance (40, 42, 43) and consequent decompensated circulating glucose levels, as well as adverse lipid profiles. In addition, changes in metabolic profile are more often in individuals with intra-abdominal fat accumulation and represent risk factors for cardiovascular disease (44). Considering the impact of hypertension, diabetes and dyslipidemia on cardiovascular complications, this fact emphasizes the importance of actions to prevent adiposity, thus, preventing the complications that negatively impact the functionality and quality of life of the elderly.

Therefore, the risks for cardiovascular and metabolic diseases can be minimized with the implementation of community nutrition strategies such as nutritional education, which is an invaluable tool in the promotion of healthier dietary behaviors (45). In this context, nutritional interventions aimed at obesity are developed, more frequently, in clinical practice, through nutritional education programs aimed at the formation of healthy lifestyle habits such as a balanced diet and engaging in physical activities (46).

In this context, nutritional guidance is especially important for the elderly to perceive and learn how to deal with the physiological changes and the appearance of diseases related to aging, since a healthy eating pattern contributes to the maintenance of body functions and reduction of risks related to overweight and obesity, thereby increasing life expectancy (47).

This study showed that general adiposity is associated with dependence for performing one BADL. These findings corroborate a study with outpatient elderly in Israel, age range of 65 to 75 years, with general and central obesity. The authors found that central obesity was associated with higher chances of BADL limitations as well as a high correlation between WC and worse functional score (48).

Even though no independent association was found between IADL and general and central adiposity, some observations are relevant for studies on functional capacity among older adults. Studies with data extracted from the English Longitudinal Study of Aging (ELSA) and the Estudo Brasileiro de Saúde, Bem-estar e Envelhecimento (SABE) showed that central adiposity was associated with changes over time in IADL disability among older English and Brazilian subjects (49). The low frequency of the older adults dependent for IADL may have contributed to non-identification of this association.

The main limitations of this study are the use of indirect indicators of adiposity and the lack of validated WC cutoff points for older adults. However, it is important to highlight that anthropometry is considered the most suitable parameter to assess the collective nutritional status, mainly due to the ease of obtaining the measures that can be valid and reliable, as long as there is adequate training and the measurements are properly standardized.

On the other hand, the strengths of this work lie in the methodological quality of the planning process, the training for anthropometric measurements and data collection. Additionally, the high response rate obtained, the use of gauged BMI and WC measures contributed to quality of data, reducing bias inherent in self-reported outcomes. A small number of the older adults in the sample (5.0%) were assisted in some section of the questionnaire.

Final considerations

The high prevalence of general and central adiposity found in the present study, and the associated factors, draw attention to the importance of intersectoral health and food and nutritional security policies for the proper control and/or prevention of adiposity and related morbidities. The focus of these policies should be on maintaining functional capacity, promoting quality of life, and reducing mortality in this population. Differences in sex and age reinforce the importance of individualized prevention and control strategies in an integral approach to health. Therefore, these actions and policies must take into account the cultural and physiological particularities of men and women, as well as younger and older elderly people, aiming to guarantee the effectiveness in promoting health and quality of life.

Acknowledgments

To the researchers who collected the data and support from the Study and Practice Group on Aging, Nutrition and Health (GREENS) of the Department of Nutrition and Health of the Federal University of Viçosa.

Disclosure statement

There is no conflict of interest.

Funding

This work was supported by the Higher Education Personnel Improvement Coordination (CAPES) under Grant number 190815/2014.

ORCID

Maria Sortênia Alves Guimarães https://orcid.org/0000-0001-6648-2530
Kíllya de Paiva Santos https://orcid.org/0000-0002-5169-8408
Joice da Silva Castro https://orcid.org/0000-0001-5640-5937
Leidjaira Lopes Juvanhol https://orcid.org/0000-0001-8012-6006
Fabiane Aparecida Canaan Rezende https://orcid.org/0000-0002-5617-8778
Andréia Queiroz Ribeiro https://orcid.org/0000-0001-6546-1252

References

1. Garvey WT. Clinical definition of overweight and obesity. Bariatr Endocrinol. 2019;121–143. 10.1007/978-3-319-95655-8_7.
2. Haywood C, Sumithran P. Treatment of obesity in older persons - A systematic review. Obes Rev. 2019;20(4):588–598. doi:10.1111/obr.12815.
3. Kanaya AM, Lindquist K, Harris TB, Launer L, Rosano C, Satterfield S, Yaffe K, Health ABC Study. Total and regional adiposity and cognitive change in older adults: the Health, Aging and Body Composition (ABC) study. Arch Neurol. 2009;66(3): 329–335. doi:10.1001/archneurol.2008.570.
4. Konieczna J, Abete I, Galmés AM, Babio N, Colom A, Zulet MA, et al. Body adiposity indicators and cardiometabolic risk: cross-sectional analysis in participants from the PREDIMED-Plus trial. Clin Nutr. 2019; 38(4):1883–1891. doi:10.1016/j.clnu.2018.07.005.
5. de Andrade BM, De Alencar CF, Amaral PC, Nogueira HS, Lima L. Treinamento resistido aplicado ao processo de emagrecimento. Rev Brasil Fisiologia Exercício. 2017;16(2):83–88. http://dx.doi.org/10.33233/rbfe.v16i2.970.
6. Fakhouri TH, Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity among older adults in the United States, 2007-2010. NCHS Data Brief. 2012;(106):1–8.
7. Hales CM, Fryar CD, Carroll MD, Freedman DS, Ogden CL. Trends in obesity and severe obesity prevalence in US youth and adults by sex and age, 2007–2008 to 2015–2016. JAMA. 2018; 319(16):1723. doi:10.1001/jama.2018.3060.
8. Brasil. Ministério da Saúde, Departamento de Vigilância de Doenças e Agravos não Transmissíveis e Promoção da Saúde. Vigitel Brasil 2017: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados brasileiros e no Distrito Federal em 2017. – Brasília: Ministério da Saúde; 2018. Available from: http://bvsms.saude.gov.br/bvs/publicacoes/vigitel_brasil_2017_vigilancia_fatores_riscos.pdf
9. Silva VSD, Souza I, Silva DAS, Barbosa AR, Fonseca M. Evolução e associação do IMC entre variáveis sociodemográficas e de condições de vida em idosos do Brasil: 2002/03-2008/09. Ciênc Saúde Coletiva. 2018;23(3):891–901. doi:10.1590/1413-81232018233.12532016.
10. Frank AA, Soares EA. Nutrição ao Envelhecer. Florianópolis: Atheneu; 2004.
11. Rotella CM, Dicembrini I. Measurement of body composition as a surrogate evaluation of energy balance in obese patients. World J Methodol. 2015;5(1):1–9. doi:10.5662/wjm.v5.i1.1.
12. Batsis JA, Zagaria AB. Addressing obesity in aging patients. Med Clin North Am. 2018;102(1):65–85. doi:10.1016/j.mcna.2017.08.007.
13. Silva MLN, Marucci MFN, Roediger MA. Tratado de Nutrição em Gerontologia. Barueri: Manole; 2016. p. 49–61.
14. Fan H, Li X, Zheng L, Chen X, Lan Q, Wu H, et al. Abdominal obesity is strongly associated with cardiovascular disease and its risk factors in elderly and very elderly community-dwelling Chinese. Sci Rep. 2016;6(1):21521. doi:10.1038/srep21521.
15. Kuzuya M, Kanda S, Koike T, Suzuki Y, Satake S, Iguchi A. Evaluation of mini-nutritional assessment for Japanese frail elderly. Nutrition. 2005;21(4):498–503. doi:10.1016/j.nut.2004.08.023.
16. Rosin BL. The progression of cardiovascular risk to cardiovascular disease. Rev Cardiovasc Med. 2007;8(Suppl 4):S3–S8.
17. IBGE, Instituto Brasileiro de Geografia e Estatística. Resultados Preliminares do Universo do Censo Demográfico 2010 [acesso 15 Maio 2018]. Available from: http://www.ibge.gov.br/home/

estatistica/populacao/censo2010/resultados_preliminares/preliminar_tab_municipio_zip.shtm.

18. Lourenço RA, Veras RP. Mini - Exame do Estado Mental: características psicométricas em idosos ambulatoriais. Rev Saúde Pública. 2006;40(4):712–719. doi:10.1590/S0034-89102006000500023.
19. Frisancho AR. Anthropometric standards for the assessment of growth and nutritional status Ann Harbor: University of Michigan press; 1990.
20. World Health Organization (WHO). Physical status: the use and interpretation of anthropometry. Geneva: WHO; 1995. Report of a WHO expert committee. WHO technical report series. 854. Available from: https://apps.who.int/iris/bitstream/handle/10665/37003/WHO_TRS_854.pdf
21. Organização Pan-Americana De Saúde. XXXVI Reunión del Comitê Asesorde Investigaciones en Salud – Encuesta Multicêntrica – Salud Bienestar y Envejecimiento (SABE) en América Latina e el Caribe – Informe preliminar; 2001.
22. World Health Organization. Physical status: the use and interpretation of anthropometry. Geneva: World Health Organization; 1998.
23. Katz S, Ford AB, Mosckowictz RW, Jackson BA, Jaffe MW. Studies of illness in the aged. JAMA. 1963;185(12):914–919.
24. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. Gerontologist. 1969;9(3 Part 1):179–186. doi:10.1093/geront/9.3_Part_1.179.
25. Victora CG, Huttly SR, Fuchs SC, Olinto MT. The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. Int J Epidemiol. 1997;26(1):224–227. doi:10.1093/ije/26.1.224.
26. Costa CD, Schneider BC, Cesar JA. Obesidade geral e abdominal em idosos do Sul do Brasil: resultados do estudo COMO VAI? Ciênc Saúde Coletiva. 2016;21(11):3585–3596. 10.1590/1413-812320152111.02492016.
27. Araújo C, Giehl MWC, Danielewicz AL, Araújo PGD, D'orsi E, Boing AF. Ambiente construído, renda contextual e obesidade em idosos: evidências de um estudo de base populacional. Cad Saúde Publica. 2018;34:e00060217. 10.1590/0102-311X00060217.
28. Linhares R. d S, Horta BL, Gigante DP, Dias-da-Costa JS, Olinto MTA. Distribuição de obesidade geral e abdominal em adultos de uma cidade no Sul do Brasil. Cad Saúde Pública. 2012;28(3): 438–447. doi:10.1590/S0102-311X2012000300004.
29. Silveira EA, Kac G, Barbosa LS. Prevalência e fatores associados à obesidade em idosos residentes em Pelotas, Rio Grande do Sul, Brasil: classificação da obesidade segundo dois pontos de corte do índice de massa corporal. Cad Saúde Pública. 2009;25(7): 1569–1577. doi:10.1590/S0102-311X2009000700015.
30. Nam S, Kuo YF, Markides KS, Snih SA. Waist circumference (WC), body mass index (BMI), and disability among older adults in Latin American and the Caribbean (LAC). Arch Gerontol Geriatr. 2012;55(2):e40–e47. doi:10.1016/j.archger.2012.04.006.
31. Ferreira P, Papini SJ, Corrente JE. Fatores associados à obesidade em idosos cadastrados na rede básica de saúde do município de Botucatu, São Paulo. Rev Ciênc Méd. 2012; 20(3/4):77–85. doi:10.24220/2318-0897v20n3/4a583.
32. Perissinotto E, Pisent C, Sergi G, Grigoletto F, Enzi G, ILSA Working Group (Italian Longitudinal Study on Ageing). Anthropometric measurements in the elderly: age and gender differences. Br J Nutr. 2002;87(2):177–186. 10.1079/BJN2001487.
33. Velasquez-Alva MC, Irigoyen ME, Zepeda M, Sanchez VM, Garcia Cisneros MP, Castillo LM. Anthropometric measurements of a sixty-year and older Mexican urban group. J Nutr Health Aging. 2004;8(5):350–354.
34. Lauretta R, Sansone M, Romanelli F, Appetecchia M. Gênero nas doenças endocrinológicas: diferenças biológicas e clínicas. Rev Italiana Medicina Específica Gênero. 2017;3(3):109–116. doi:10.1723/2882.29060.
35. Krause MP, Buzzachera CF, Hallage T, Santos ECR, Silva SG. Alterações morfológicas relacionadas à idade em idosos. Rev Bras Cineantropom Desempenho Hum. 2006; 8(2):73–77.
36. Marucci MFN, Barbosa AR. Estado nutricional e capacidade física. In: Lebrão ML, Duarte YAO, organizadores. SABE – Saúde, Bem-estar e Envelhecimento. O projeto SABE no município de São Paulo: uma abordagem inicial. Brasília: Organização Pan-Americana da Saúde; 2003. p. 95–117.
37. Rocha JSB, Ogando BMA, Reis V, Ávila WRM, Carneiro AG, Gabriel R, Moreira M. Impacto de um programa de exercício físico na adiposidade e na condição muscular de mulheres pós-menopáusicas. Rev Bras Ginecol Obstet. 2012;34(9):414–419. doi:10.1590/S0100-72032012000900005.
38. de Menezes TN, Brito MT, de Araújo TBP, Silva CCM, do Nascimento Nolasco RR, Fische M. Perfil antropométrico dos idosos residentes em Campina Grande-PB. Rev Bras Geriatr Gerontol. 2013;16(1):19–27. doi:10.1590/S1809-98232013000100003.
39. Conway BN, Han X, Munro HM, Gross AL, Shu XO, Hargreaves MK, Zheng W, Powers AC, Blot WJ. The obesity epidemic and rising diabetes incidence in a low-income racially diverse southern US cohort. PLoS ONE. 2018;13 (1):e0190993. doi:10.1371/journal.pone.0190993.
40. Barreto SM, Passos VM, Lima-Costa MF. Obesity and underweight among Brazilian elderly: the Bambuí Health and Aging Study. Cad Saúde Pública. 2003;19(2):605–612. doi:10.1590/S0102-311X2003000200027.
41. Kazempour-Ardebili S, Ramezankhani A, Eslami A, Akbarpour S, Azizi F, Hadaegh F. Metabolic mediators of the impact of general and central adiposity measures on cardiovascular disease and mortality risks in older adults: Tehran Lipid and Glucose Study. Geriatr Gerontol Int. 2017;17(11):2017–2024. doi:10.1111/ggi.13015.
42. Hanley AJ, Wagenknecht LE, Norris JM, Bryer-Ash M, Chen YI, Anderson AM, Bergman R, Haffner SM. Insulin resistance, beta cell dysfunction and visceral adiposity as predictors of incident diabetes: the Insulin Resistance Atherosclerosis Study (IRAS) Family Study. Diabetologia. 2009;52(10):2079–2086. doi:10.1007/s00125-009-1464-y.
43. Biggs ML, Mukamal KJ, Luchsinger JA, Ix JH, Carnethon MR, Newman AB, Boer IH, Strotmeyer ES, Mozaffarian D, Siscovick D. Association between adiposity in midlife and older age and risk of diabetes in older adults. JAMA. 2010; 303(24):2504–2512. doi:10.1001/jama.2010.843.
44. Scott D, Cumming R, Naganathan V, Blyth F, Le Couteur DG, Handelsman DJ, Seibel M, Waite LM, Hirani V. Associations of sarcopenic obesity with the metabolic syndrome and insulin resistance over five years in older men: the Concord Health and Ageing in Men Project. Exp Gerontol. 2018;108:99–105. doi:10.1016/j.exger.2018.04.006.
45. Lima-Costa MF, Barreto SM. Tipos de estudos epidemiológicos: conceitos básicos e aplicações na área doenvelhecimento. Epidemiol Serv Saude. 2003;12(4):189–201. doi:10.5123/S1679-49742003000400003.
46. Briggs M, American School Food Service Association, Safaii S, Beall DI. Position of the American Dietetic Association, Society for Nutrition Education, and American School Food Service Association-Nutrition services: an essential component of comprehensive school health programs . J Am Diet Assoc. 2003; 103(4):505–514. doi:10.1053/jada.2003.50100.
47. Cervato AM, Derntl AM, Latorre M, Maruc RC. Educação nutricional para adultos e idosos: uma experiênciapositiva em Universidade Aberta para a Terceira Idade. Rev Nutr. 2005;18(1):41–52.
48. Buch A, Keinan-Boker L, Kis O, Carmeli E, Izkhakov E, Ish-Shalom M, Berner Y, Shefer G, Marcus Y, Stern N. Severe central obesity or diabetes can replace weight loss in the detection of frailty in obese younger elderly–a preliminary study. Clin Interv Aging. 2018;13:1907–1918. doi:10.2147/CIA.S176446.
49. Alexandre TDS, Scholes S, Ferreira Santos JL, Duarte YAO, de Oliveira C. The combination of dynapenia and abdominal obesity as a risk factor for worse trajectories of IADL disability among older adults. Clin Nutr. 2018;37(6):2045–2053. doi:10.1016/j.clnu.2017.09.018.