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Prevalence and factors associated with hypertriglyceridemic waist in the elderly: a population-based study

Prevalência e fatores associados à cintura hipertrigliceridêmica em idosos: um estudo de base populacional

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Abstract *To identify the prevalence and factors associated with hypertriglyceridemic waist (HW) in community-dwelling elderly people in northeast Brazil. Population-based cross-sectional study. Some 316 elderly (≥ 60 years) people of both sexes participated in this study. Data were collected using a questionnaire, based on that used in the Health, Welfare and Aging Study (SABE), in addition to blood tests, blood pressure measurements and anthropometric measurements. The hypertriglyceridemic waist condition was diagnosed using high values of triglycerides (≥ 150 mg/dl) and waist circumference increased ≥ 88 and ≥ 102 cm for women and men, respectively. Logistic regression analysis was used to compare the hypertriglyceridemic waist and associated factors, significance level of 5%. The prevalence of hypertriglyceridemic waist (HW) was 27.1%. The logistic regression model (OR) adjusted showed the condition of HW associated to the feminine sex (OR 4.19), to the insufficiently active elderly (OR 2.41) and with overweight (OR 4.06). A high prevalence (27.1%) of hypertriglyceridemic waist was observed, indicating the female sex, physical inactivity and overweight as key factors associated with hypertriglyceridemic waist in community-dwelling elderly people.*

Key words *Elderly, Obesity, Hypertriglyceridemic waist*

Resumo *Identificar a prevalência e os fatores associados à cintura hipertrigliceridêmica em idosos residentes em uma comunidade no nordeste do Brasil. Estudo populacional com delineamento transversal. Participaram do estudo 316 idosos com idade ≥ 60 anos, de ambos os sexos. Os dados foram coletados por meio de um formulário próprio, baseado no questionário usado na Pesquisa Saúde, Bem-Estar e Envelhecimento, além dos exames sanguíneos, aferição da pressão arterial e medidas antropométricas. A cintura hipertrigliceridêmica (CH) foi diagnosticada quando os níveis de triglicerídeos apresentaram valores (≥ 150 mg/dl) e a circunferência da cintura ≥ 88cm para as mulheres e 102 para os homens. Para identificar os fatores associados a CH foi utilizado a análise de regressão logística, com nível de significância 5%. A prevalência de cintura hipertrigliceridêmica foi 27,1%. O modelo de regressão logística (OR) ajustado mostrou a condição de CH associada ao sexo feminino (OR 4.19), aos idosos insuficientemente ativos (OR 2.41) e com sobrepeso (OR 4.06). Foi observada uma alta prevalência de cintura hipertrigliceridêmica em idosos residentes em comunidade, apontando o sexo feminino, a inatividade física e o sobrepeso/obesidade como fatores associados.*

Palavras-chave *Idoso, Obesidade, Cintura hipertrigliceridêmica*

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Introduction

The hypertriglyceridemic waist (HW) condition is a phenotype characterized by the simultaneous association of increased waist circumference (abdominal obesity) and hypertriglyceridemia[1]. The combination of these two factors is associated with higher risks of cardiometabolic disorders[2]. In addition, individuals with 40 years or more with hypertriglyceridemic waist have a higher risk of developing chronic kidney disease[3].

The evaluation of the hypertriglyceridemic waist phenotype can be used in clinical practice as a screening approach to identify individuals with an increased probability of having the atherogenic metabolic triad: fasting hyperinsulinemia, hyperapolipoprotein B and a high concentration of small LDL (Low density lipoprotein cholesterol) particles[4]. Moreover, this phenotype can reliably identify patients with an increased cardiometabolic risk profile[5], as well as being low cost[2].

In a study by Cabral et al.[6] with hypertensive women, an association was observed between hypertriglyceridemic waist and smoking, overweight, hypercholesterolemia, diabetes mellitus and decreased HDL (high-density lipoprotein) cholesterol. Moreover, the hypertriglyceridemic waist is also related with physical inactivity, skin color, family income, intake of fats and high BMI (body mass index)[7].

However, until now, no population-based studies have examined the relationship between hypertriglyceridemic waist and associated factors in the elderly. Accelerated aging of the population is associated with increased prevalence of non-transmissible chronic diseases, such as cardiovascular disease[8]. Cardiovascular mortality in the elderly is associated with reduced HDL and high triglyceride levels. Moreover, dyslipidemia and obesity are also frequent in this age group[9].

Considering the absence of population-based research regarding hypertriglyceridemic waist in the elderly, this study aimed to identify the prevalence and factors associated with hypertriglyceridemic waist in elderly residents in a community in the northeast of Brazil.

Method

This is a study based on data from an epidemiologic cross-sectional, population-based household survey called "Nutritional status, risk behaviors, and health conditions of the older adults of Lafaiete Coutinho-Bahia, Brazil". This study was conducted according to the Helsinki Declaration, and the local Ethics Committee approved the procedures involved. Prior to the data collection, volunteers signed an acknowledged consent form.

The city studied, located in northeastern Brazil, had 4162 inhabitants during the period of data collection, all registered with the Family Health Strategy (FHS). The city has one of the worst human development indexes (HDIs) in Brazil, occupying the 4487th position on the longevity category (longevity-HDIM = 0.635)[10].

A complete census was conducted in Lafaiete Coutinho (January 2011) for the identification of older adults (≥ 60 years). The location of the residences was conducted using information from the Family Health Strategy, a program of primary health care that covers the entire county. All older adults residing in urban areas (n = 355) were contacted. Of the 355 individuals who comprised the study population, 316 (89%) participated in the study: 17 refusals were recorded (4.8%) and 22 (6.2%) individuals were not located after three visits on alternate days, and were considered sample loss.

Data collection occurred in two stages. The first consisted of an interview, conducted by only the individual interviewer, including personal information, health status, medication use and lifestyle. The second stage was conducted in two units of the FHP of the city and included blood pressure measurement and anthropometry; this step was scheduled with an interval of 1-3 days after the home interview.

To collect the data was used a specific form, based on the questionnaire used in the Search Health, Welfare and Aging (SABE) project, realized in seven countries in Latin America and the Caribbean, with the exception of the physical activity questionnaire which, in the present study, used the long version[11]. Details about the data collection, have been previously published[12].

Hypertriglyceridemic waist (Dependent variable)

The waist circumference was measured at the level of the umbilical scar using an inelastic anthropometric tape (ABN™, Brazil). The cutoff points used to define abdominal obesity were > 88 cm for women and > 102 cm for men[13]. To measure 12 hours fasting triglycerides, the Accutrend® Plus system was used (Roche Diagnostics, Germany), as previously validated[14]. Capillary blood samples were collected through transcu-

taneous puncture on the medial side of the tip of the middle finger using a disposable hypodermic lancet. Prior to puncture, 70% alcohol was applied to promote antisepsis. Hypertriglyceridemia (triglycerides ≥ 150 mg / dl) was defined according to the current Brazilian guidelines[15]. The hypertriglyceridemic waist phenotype was defined as the presence of the abdominal obesity plus hypertriglyceridemia.

Independent variables

Sociodemographic: Sex (male and female); Age group (60-69, 70-79, ≥ 80 years); Marital status (single and live with partner) and Literacy (yes/no).

Lifestyle: Alcoholic beverages intake (<1 day/week and ≥ 1 day/week); Smoking (smoker, former-smoker and never smoked); Intake of fruit and vegetables (> 4 times a week and < 4 times a week); Physical activity level was evaluated using the international physical activity questionnaire (IPAQ), long version[11]. The elderly who spent less than 150 minutes per week in moderate or vigorous physical activities were considered insufficiently active; and those who spent more than 150 minutes per week in physical activities were considered active.

Health conditions: High blood pressure (yes/no). The elderly that presented with systolic pressure ≥ 140 mmHg and/or diastolic pressure ≥ 90 mmHg and/or use of medication to control blood pressure were considered as having high blood pressure[16]; Fasting glycemia (< 100 mg/dL e ≥ 100 mg/dL)[17], Total cholesterol (< 200 mg/dL and ≥ 200 mg/dL)[15], Body mass index (BMI = kg / m^2)[18]: BMI < 22 Kg/m^2 = underweight, 22 ≤ BMI ≤ 27 Kg/m^2 = normal and BMI > 27 Kg/m^2 = overweight.

The instruments and procedures used to evaluate the blood pressure, body weight and height have been reported previously[12]. The Accutrend® Plus system was utilized to determine glycemia and total cholesterol, following the same procedures described previously to determine the triglycerides.

Statistical analysis

The association between hypertriglyceridemic waist and the independent variables was verified by means of the logistic regression. In crude analyses, the prevalence of hypertriglyceridemic waist was calculated for each category of the independent variables, and the level of significance was tested by means of the Wald test for heterogeneity. The variables that presented statistical significance of at least 20% ($p \leq 0.20$) in the crude analyses were included in the adjusted analysis, following the order of a hierarchical model for determination of the outcomes (Figure 1). In accordance with the established model, the variables of the higher levels (distal) interact and determine the variables of the lower levels (proximal). The effect of each explanatory variable on the outcome was controlled for the variables of the same level and of higher levels in the model. The significance level adopted in the study was 5%. The data were analyzed using the statistical program SPSS® version 21.0.

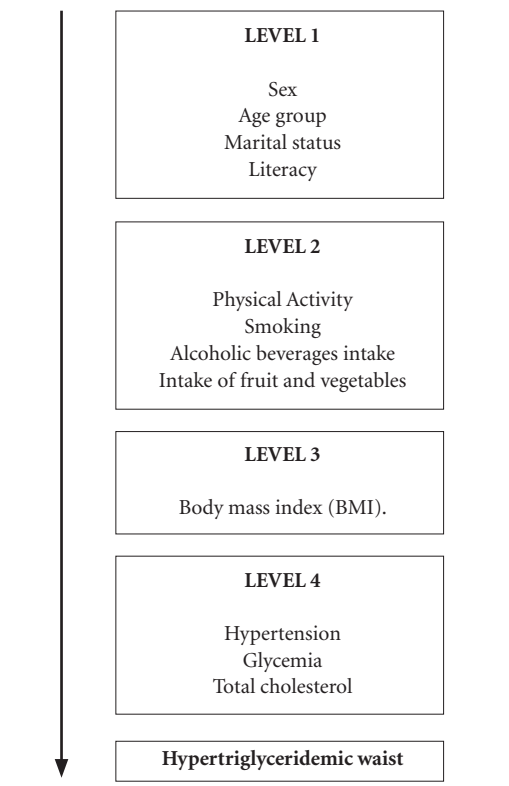

Figure 1. Conceptual model of determination of the outcome used in the multiple analysis. Lafaiete Coutinho, Brazil, 2011.

Results

The participants in the study were 173 women (54.7%) and 143 men (45.3%). Their ages varied between 60 to 105 years (mean 74.2 ± 9.8 years). The mean age of the women was 74.9 ± 10 years (60 – 103 years) and of the men 73.4 ± 9.4 years (60 - 105 years). The prevalence of hypertriglyceridemic waist phenotype was 27.1% (Response rate = 96.4%). The other characteristics of the study population are presented in the Table 1.

The Table 2 shows the prevalence of hypertriglyceridemic waist, in accordance with the explanatory variables of the study. The hypertriglyceridemic waist condition was significantly more frequent in women, and individuals who were insufficiently active, having hypertension, hyperglycemia and those with hypercholesterolemia. However, the hypertriglyceridemic waist was less frequent among the individuals with a lower intake of fruit and vegetables and underweight. The results of the crude analysis showed that, except for the age group and alcoholic in-

Table 1. Characteristics of the study population. Lafaiete Coutinho, Brazil, 2011.

Variables	% response	N	%
Age group (years)	99.7		
60-69		115	36.5
70-79		106	33.7
≥ 80		94	29.8
Body mass index	95.3		
Underweight		87	28.9
Normal		128	42.5
Overweight		86	28.6
Marital status	100.0		
Single		52	16.5
Living with partner		264	83.5
Literacy	100.0		
Yes		105	33.2
No		211	66.8
Physical activity	98.1		
Insufficiently active		148	47.7
Active		162	52.3
Intake of fruit and vegetables	98.7		
≥ 4 times a week		223	71.5
< 4 times a week		89	28.5
Smoking	99.7		
Smoker		35	11.1
Former-smoker		147	46.7
Never smoked		133	42.2
Alcoholic beverages intake	99.7		
< 1 day/week		55	17.5
≥ 1 day/week		260	82.5
Hypertension	96.8		
Yes		256	83.7
No		50	16.3
Glycemia (mg/dL)	97.8		
< 100		251	81.2
≥ 100		58	18.8
Total cholesterol (mg/dL)	97.2		
< 200		146	47.6
≥ 200		161	52.4

Table 2. Prevalence of hypertriglyceridemic waist its relationship with the explanatory variables of the study. Lafaiete Coutinho, Brazil, 2011.

Level	Variables	%	OR crude	IC95%	p-value
1	Sex				< 0.001
	Female	38.3	3.85	2.16-6.87	
	Male	13.9	1		
	Age group (years)				0.218
	60-69	21.6	1		
	70-79	32.0	1.71	0.92-3.15	
	≥ 80	28.2	1.42	0.74-2.74	
	Marital status				0.101
	Single	18.0	0.54	0.24-1.17	
	Living with partner	28.9	1		
	Literacy				0.179
	Yes	32.0	1		
	No	24.6	0.69	0.41-1.18	
	Physical activity				0.024
	Insufficiently active	33.8	1.81	1.08-3.03	
	Active	22.0	1		
2	Smoking				< 0.001
	Smoker	3.0	0.05	0.01-0.41	
	Former-smoker	24.5	0.55	0.32-0.94	
	Never smoked	36.9	1		
	Alcoholic beverages intake				0.313
	< 1 day/week	21.8	1		
	≥ 1 day/week	28.4	1.42	0.71-2.85	
	Intake of fruit and vegetables				0.015
	≥ 4 times a week	30.8	1		
	< 4 times a week	17.4	0.47	0.25-0.90	
3	Body mass index				< 0.001
	Underweight	2.3	0.08	0.02-0.35	
	Normal	22.8	1		
	Overweight	58.1	4.7	2.59-8.52	
4	Hypertension				< 0.001
	Yes	30,4	4.91	1.70-14.13	
	No	8.2	1		
	Glycemia (mg/dL)				0.006
	≥ 100	42.6	2.39	1.29-4.42	
	< 100	23.7	1		
	Total Cholesterol (mg/dL)				0.011
	≥ 200	33.1	1.96	1.60-3.33	
	< 200	20.1	1		

take, the other explanatory variables reached statistical significance ($p \leq 0.20$) sufficient to be included in the multiple model.

After of the inter- and intra-level adjustments in accordance with the hierarchic model, the variables glycemia and hypercholesterolemia were not included in the final model, as they did not meet the significance criterion ($p \leq 0.20$).

The hypertriglyceridemic waist was positively associated with the female sex, and individuals who were insufficiently active and overweight. There was an inverse association between hyper-

triglyceridemic waist and literacy, smoking and being underweight. Although they have been retained in the final model for adjustment purposes, the variables marital status, intake of fruit and vegetables and hypertension were not associated with hypertriglyceridemic waist (Table 3).

Discussion

This study determined the prevalence of hypertriglyceridemic waist (HW) and associated factors in community-dwelling elderly people. The main findings showed a prevalence of 27.1% of hypertriglyceridemic waist in the elderly, and this is strongly associated with the feminine sex, physical inactivity and overweight/obesity. According to our knowledge, this was the first household-based population study to investigate the prevalence of HW and associated factors in older adults of both sexes.

In the present study, the prevalence of HW approached that observed by Cabral et al.[6] (33%) in hypertensive women with a mean age of 60.9 years. International studies with younger age ranges showed a prevalence of HW that ranged from 10.8 to 35.2%[19-22]. This variation may be due to the use of different cutoff points for waist circumference and serum triglyceride levels, in addition to the different age ranges.

In the adjusted analysis of the present study, women were approximately ~ 4 times, the insufficiently active elderly ~ 2.5 times and the elderly with overweight/obesity problems ~ 4.1 times more likely to develop HW.

To our knowledge the association between HW and elderly females has not been reported previously. However, studies with middle-aged individuals, also found an association between females and HW[19,22]. According Bentley-Lewis et al.[23], noted pregnancy, gestational diabetes mellitus, pre-eclampsia, hormonal contraceptives,

Table 3. Model of hierarchical regression of the relationship between hypertriglyceridemic waist and the explanatory variables of the study. Lafaiete Coutinho, Brazil, 2011.

Variables	OR adjusted	IC95%	p-value
Sex			
Female	4.19	2.31-7.59	< 0.001
Male	1		
Marital status			
Single	0.55	0.25-1.23	0.148
Living with partner	1		
Literacy			
Yes	1		
No	0.54	0.30-0.95	0.033
Physical activity			
Insufficiently active	2.41	1.34-4.34	0.003
Active	1		
Smoking			
Smoker	0.10	0.01-0.79	0.029
Former-smoker	0.78	0.43-1.45	0.435
Never smoked	1		
Intake of fruit and vegetables			
≥ 4 times a week	1		
< 4 times a week	0.63	0.2-1.27	0.198
Body mass index.			
Underweight	0.07	0.02-0.32	0.001
Normal	1		
Overweight	4.06	2.08-7.93	< 0.001
Hypertension			
Yes	2.82	0.82-9.71	0.101
No	1		

menopause and polycystic ovary syndrome are several factors unique to women that can have an impact on the prevalence and characteristics of metabolic syndrome in women. In addition, Cornier et al.[24] relate that a higher prevalence of metabolic syndrome among women may be due to different socioeconomic status, work-related activities and cultural perception of body image. Hypertriglyceridemic waist was proposed as an alternative and cost-effective tool to assess cardiometabolic risk that was also associated with metabolic syndrome.

In this study, excess weight in the elderly proved to be a determining factor for development of the HW. The association between HW and excess weight in the elderly has also not been reported previously. Nevertheless, several studies with different age ranges have also observed an association between excess weight and hypertriglyceridemic waist[2,6,7,25]. The elderly with HW presented global obesity as assessed by BMI. According Oliveira et al.[26], the increase of the global obesity is associated with increased visceral fat; this may be explained by the strong correlation between BMI and WC, which is considered a simple measure of abdominal obesity and may better reflect the accumulation of intra-abdominal fat[27]. In the elderly, excess body fat can be intensified due to changes in body composition during aging, where there is often a loss of muscle mass and an increase of fat[28].

According to Fakhouri et al.[29], more than one-third of older adults aged 65 and over were classed as obese in 2007-2010 in the United States. Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance, increased risk for chronic diseases, including type 2 diabetes, cardiovascular disease, hypertension and stroke, and certain forms of cancer[13].

In this study, another important factor that was clearly associated with HW was the low level of physical activity in older adults. To our knowledge the association between HW and physical inactivity specifically in the elderly also has not been reported previously. However, in the study of Irving et al.[30] with adults, the authors reported that the presence of hypertriglyceridemic waist can be associated with physical inactivity. However, studies have shown physical inactivity as a strong risk factor for cardiovascular disease[31] and metabolic syndrome[32] in the elderly.

Therefore, interventions focused on lifestyle such as practice of physical activity associated with healthy eating, can be powerful tools for prevention or reversion of the HW.

In this study, the HW was inversely associated with literacy, smoking and underweight. To our knowledge this has not been reported previously in the elderly. However, underweight is clearly a factor against HW, as studies indicate that underweight elderly people have a lower waist circumference and lower risk for cardiovascular disease[33] and metabolic syndrome[34]. However, the literacy and smoking factors need to be analyzed more cautiously, where studies have noted these variables as risk factors for cardiovascular disease[35,36], and can be best studied with longitudinal follow-up research.

The limitations of this study are inherent to its cross-sectional design, which does not allow a causal relationship between hypertriglyceridemic waist and associated factors in the elderly. Moreover, the absence of studies on HW and associated factors with a specific elderly population has limited discussion. However, the hypertriglyceridemic waist phenotype represents a simple and inexpensive tool to screen elderly people with cardiometabolic risk, which can be used in clinical practice and by health professionals, especially in primary care.

Conclusion

Based on the findings of this study, it is possible conclude that hypertriglyceridemic waist is a disorder with a high prevalence in the elderly, being associated with the female sex, physical inactivity and overweight.

However, becomes important the implementation of public policy geared towards women, as well as actions that promote physical activity and BMI reduction.

Collaborations

LC Fagundes, MH Fernandes and TA Brito participated in the design of the study and helped to draft the manuscript. RS Coqueiro and JAO Carneiro participated in the design of the study, performed the statistical analysis and helped to draft the manuscript. All authors read and approved the final manuscript to be published.

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