ORIGINAL ARTICLE

Association between Central Obesity and Biochemical Markers of Cardiometabolic Risk in Elderly Attended in Geriatric Ambulatory – Lagarto/SE

Ana Caroline de Souza Almeida,[2] Carolina Cunha de Oliveira,[1] Emanuelle Dias Costa,[2] Adenilda Queiroz S. Deiró[2]

Universidade Federal de Sergipe,[1] Sergipe, SE – Brazil
Universidade Federal da Bahia,[2] Salvador, BA – Brazil

Abstract

Background: Central obesity, especially visceral adipose tissue (VAT), represents a health risk due to its endocrine and metabolic capacity, contributing to the development of the atherogenic profile and strongly associating with cardiovascular morbimortality.

Objective: To identify the association between central obesity and biochemical markers of cardiometabolic risk in elderly patients treated at a geriatric outpatient clinic in Lagarto-SE.

Method: This is a cross-sectional study of 159 elderly people of both sexes. Central adiposity was considered an independent variable, identified by measuring the Waist Circumference (WC). Total Cholesterol (TC), LDL-c, HDL-c, non-HDL-c, triglycerides, glycemia and Castelli I and II indices were considered dependent variables. Pearson's chi-square test was used to evaluate the association between central obesity and biochemical markers of cardiometabolic risk. Those with p < 0.20 were used in the bivariate regression analysis, adopting a 95% confidence interval.

Results: Mean age was 70.9 ± 7.5 years. Central obesity was present in 43.2% of males and 56.8% of females (p = 0.002). There was statistically significant association between HDL-c, HDL-C and Castelli I Index and central obesity. Individuals with central obesity are 2.48 and 3.13 times more likely to develop changes in HDL-C and Castelli I index, respectively.

Conclusion: There is an association between central obesity and biochemical markers of cardiometabolic risk in the elderly. (Int J Cardiovasc Sci. 2020; 33(3):245-251)

Keywords: Cardiovascular Diseases; Obesity; Metabolic Syndrome; Hypertension; Diabetes Mellitus; Risk Factors; Prevention and Control; Dyslipidemias; Life Style; Elderly.

Introduction

Cardiometabolic risk factors (RF) have been widely studied nowadays, with special focus on central obesity, excessive weight, dyslipidemia, Systemic Arterial Hypertension (SAH), insulin resistance and Diabetes Mellitus (DM).[1-4] Central obesity, especially visceral adipose tissue (VAT), represents a health risk due to its metabolic and endocrine capacity, contributing to the development of an atherogenic profile, in addition to being strongly associated with cardiovascular morbidity and mortality.[5,6]

Roriz et al.,[7] highlight that metabolic changes that promote the onset of chronic diseases are more related with visceral adipose tissue than with excessive weight, and that these conditions increase the need for drug treatment and interfere in the quality of life of individuals.

Mailing Address: Carolina Cunha de Oliveira
Fundação Universidade Federal de Sergipe - Departamento de Nutrição - Avenida Governador Marcelo Déda, 13. Postal Code: 49400-000, Centro, Lagarto
Sergipe, SE - Brazil
E-mail: carol_cunh@yahoo.com.br

The individuals with high VAT levels tend to have insulin resistance, hyperglycemia, hypertriglyceridemia, increased low density lipoprotein (LDL) serum levels and reduced high density lipoprotein (HDL-C) concentration.[8] HDL-C reduction in viscerally obese patients represents the main factor responsible for increased total cholesterol/HDL-C ratio, and this relationship is a strong risk predictor for cardiovascular disease.[5,6,9]

According to Piepoli et al.,[10] age is the main cardiovascular risk factor and most individuals aged 65 years are already considered at high risk. Thus, it is of major relevance to determine the associations of metabolic RF with advanced age, especially among the population in the northeast of Brazil, where there are no studies in this context, due to its negative influence on functional capacity, as well as to the costs incurred to the Brazilian Unified Health System (SUS) for its treatment.[11-14]

The objective of this study is to determine the association between central obesity and biochemical markers of cardiometabolic risk in elderly patients treated at a geriatric outpatient clinic in the city of Lagarto-SE.

Materials and Methods

This is a cross-sectional, primary data collection study, composed by a sample selected by convenience of 159 elderly individuals (aged ≥ 60 years), of both sexes, treated at a geriatric outpatient clinic in the city of Lagarto-SE.

The inclusion criteria used in the research were: patients aged ≥ 60 years, registered at the reference outpatient service and who accepted to participate voluntarily. The exclusion criteria were: patients with abdominal injury or tumors, hepatomegaly and/or splenomegaly, ascites and those who had undergone abdominal surgery recently which could compromise the verification of abdominal fat measures.

The data were collected using a standardized questionnaire, applied by duly trained individuals, following standardized procedures for data collection, such as quality control measures and consistency of information.

The selected covariables were: sex (male and female), age in complete years, self-referred skin color (black; non-black), education (uneducated/Incomplete middle school, complete middle school/Incomplete high school, complete high school or more), occupation (receiving assistance/Organic Law of Social Assistance - LOAS), retired, living on income or pension).

Central adiposity (the accumulation of adipose tissue in the abdominal region) was considered an independent variable, determined by waist circumference (WC) measurement, using an inelastic anthropometric tape (Cescorf, Brazil), in accordance with the measurement techniques proposed by Lohman et al.,[15] and classified according to the International Diabetes Federation (IDF) criteria[16] for South American individuals, when WC ≥ 80 cm and ≥ 90 cm for women and men, respectively.

Total cholesterol (TC), LDL-C, HDL-C, Non HDL-C, Triglycerides (TG), Glucose and Castelli's I and II risk indexes were considered dependent variables, obtained upon request and/or through analysis of data contained in the geriatric medical record, over a period of less than one month from data collection. To perform the classification, the criteria established by the V Brazilian Guidelines on Dyslipidemia and Atherosclerosis Prevention[17] and by the Brazilian Diabetes Society Guidelines[18] were used: TC < 200 mg/dL; LDL-C < 160 mg/dL; HDL-C > 40 mg/dl in men and > 50 mg/dl in women; non-HDL-C < 130 mg/dL, TG < 150 mg/dL and Glucose < 100 mg/dL.

Castelli risk index-I (CRI-I) is calculated as TC/HDLc and Castelli risk index-II (CRI-II), as LDLc/HDLc. TC/HDL-C ratio > 4.7 and LDL-C/HDL-C ratio > 3.1 indicate high metabolic risk.

Statistical Analysis

Statistical software SPSS (version 20.0) was used for statistical analysis. The categorical variables were expressed as percentages and the continuous variables, as mean and standard deviation or median and interquartile interval, according to the distribution pattern. The normality of continuous variables distribution was evaluated using the Kolmogorov-Smirnov test. For parametric and nonparametric variables, the unpaired student's t-test and the Mann-Whitney test were used, respectively, for independent samples. All analyses were performed with the statistical significance level of 5% (p < 0.05). Pearson's chi-square test was used to assess the association between central obesity and biochemical markers of cardiometabolic risk. Those with p < 0.20 were included in the bivariate logistic regression analysis, adopting a CI of 95%.

Ethical aspects

This study was approved by the Committee of Ethics in Research of the Federal University of Sergipe, under the protocol number 559.936, complying with the Resolution

466/2012 on researches involving human beings of the National Health Council of the Brazilian Ministry of Health. Participation in the study was voluntary, by previous signature or digital impression of the Term of Free and Clarified Consent, after patients had been informed about the objectives of the study and the procedures to which they would be submitted. The study did not involve high risk procedures for the individuals. The institution was notified of cases of elderly patients classified as severely ill, so that the necessary procedures and referrals would be performed.

Results

The sample was characterized as individuals with or without central obesity. Thus, out of the 159 of the elderly assessed, central obesity was present in 43.2% of men and 56.8% of women (p = 0.002), with a higher prevalence among black patients (56.8%), uneducated/incomplete middle school (90.4%), retired (87.9%) and with excessive weight (51.2%) (p < 0.001) (Table 1).

The individuals' mean age was 70.9 ± 7.5 years. When the mean values of biochemical markers were assessed,

Table 1 - Description of elderly patients treated at a geriatric outpatient clinic in the city of Lagarto-SE, stratified by central obesity

Variables	Sample	Central obesity		p
		No	Yes	
	n (%)	n (%)	n (%)	
Sex				
Male	79 (49.7)	25 (73.5)	54 (43.2)	0.002
Female	80 (50.3)	9 (26.5)	71 (56.8)	
Skin color				
Black	96 (60.4)	25 (73.5)	71 (56.8)	0.077
Non-black	63 (39.6)	9 (26.5)	54 (43.2)	
Education				
Uneducated/Incomplete middle school	144 (90.6)	31 (91.2)	113 (90.4)	
Complete middle school/incomplete high school	6 (3.8)	0 (0.0)	6 (4.8)	0.301
Complete high school or more	9 (5.7)	3 (8.8)	6 (4.8)	
Current occupation				
Receiving assistance/LOAS	4 (2.5)	1 (2.9)	3 (2.4)	
Retired	140 (88.1)	31 (91.2)	109 (87.9)	
Living on income or pension	4 (2.5)	0 (0.0)	4 (3.2)	0.773
Others	8 (5.0)	1 (2.9)	7 (5.6)	
Unknown	3 (1.9)	1 (2.9)	2 (1.6)	
Nutritional state				
Low weight	37 (23.3)	21 (61.8)	16 (12.8)	
Adequate	57 (35.8)	12 (35.3)	45 (36.0)	< 0.001
Overweight	65 (40.9)	1 (2.9)	64 (51.2)	

LOAS: Organic Law of Social Assistance.

no statistical significance was observed for individuals with or without central obesity (Table 2).

A significant statistical association was observed between the HDL-C (p = 0.019), Castelli's index I (p = 0.040) and central obesity among the elderly (Table 3). These and the non-HDL-C were included in the logistic regression model (Table 4), which showed a positive association between central obesity and low HDL-C (OR = 2.48; CI 95%: 1.15-5.37) and increased TC/HDL-C ratio (OR = 3.13; CI 95%: 1.01-9.76).

Discussion

The association between central obesity and biochemical changes has been widely discussed nowadays[19-21], since visceral fat produces adipocytes which, in turn, are directly linked with inflammatory processes and cardiometabolic complications .[22]

In this sense, this study contributes with the scientific literature because it shows a positive correlation between central obesity and the biochemical markers HDL-C and Castelli's index I. A similar association was observed by several authors[22-24] who identified a positive correlation between WC and the lipid variables: TC, LDL-C, Non-HDL-C and TG. Roriz et al.,[7] also observed an association

between the visceral adipose tissue (VAT) area and Glucose, TG and uric acid. However, the biochemicals TC, LDL-C, HDL-C and VLDL-C did not present results with statistical significance.

Castelli's index I was adopted in this study because it is considered a major risk predictor for cardiovascular disease,[5,9] since HDL-C concentrations are inversely proportional to the incidence of atherosclerosis, due to its essential role in protecting the vascular bed, through cholesterol reverse transport.[25] In this process, the HDL-C removes the oxidized lipids of LDL, inhibits the fixation of adhesion molecules and monocytes to the endothelium and stimulates the liberation of nitric oxide.[26] In this context, the data presented are in line with the authors mentioned before, since in the logistic regression analysis we observed that the individuals with central obesity were 2.48 (p = 0.021) and 3.13 (p = 0.049) times more likely to develop changes in HDL-C and Castelli's I index, respectively. Similarly, Cabral et al.,[27] when assessing the association between the phenotype hypertriglyceridemic-waist (HTW) and the cardiometabolic risk in women, also observed a prevalence ratio (PR) of 3.41 (CI 95%: 2.42-4.81) for the HDL-C.

These data corroborate the study conducted by Silva et al.,[14] with older patients with type 2 diabetes,

Table 2 - Descriptive analysis of the variables "age" and "biochemical markers of cardiometabolic risk", stratified by central obesity, in elderly patients treated at a geriatric outpatient clinic in the city of Lagarto-SE

| Variables | Sample | Central obesity | | p |
| | | No | Yes | |
		(n = 34)	(n = 125)	
Age	70.9 (7.5)	70.9 (8.4)	70.9 (7.2)	0.962
TC	192.4 (41.7)	190.7 (51.3)	192.9 (38.9)	0.791
LDL-C[a]	142.0 (119.0-173.0)	141.7 (114.7-174.3)	143.0 (118.0-173.0)	0.993
HDL-C[a]	41.0 (38.0-44.0)	41.0 (37.8-51.0)	40.0 (37.5-43.0)	0.309
Non-HDL-C	150.4 (42.4)	147.3 (51.2)	151.3 (39.8)	0.628
TG[a]	149.0 (137.0-167.0)	141.0 (130.5-162.5)	149.0 (139.0-167.5)	0.114
Glucose[a]	99.0 (91.0-121.0)	98.5 (87.7 -121.0)	101.0 (101.0-125.5)	0.334
Castelli's index I	4.7 (1.3)	4.5 (1.5)	4.8 (1.2)	0.381
Castelli's index II	3.5 (1.1)	3.3 (1.2)	3.5 (1.0)	0.575

Central obesity (WC > 80M; > 90H); High TC (> 200 mg/dL); High LDL-C > 160 mg/dL; Low HDL-C < 40 mg/dL in men and < 50 mg/dL in women, Non-HDL-C < 130 mg/dL, High TG (> 150 mg/dL); High Glucose (> 100 mg/dL); Castelli's index I > 4.7; Castelli's index II >3.1. ªData expressed as median (interquartile interval). Other results expressed as mean (standard deviation).

Table 3 - Association between central obesity and biochemical markers of cardiometabolic risk in elderly patients treated at a geriatric outpatient clinic in the city of Lagarto-SE

Clinical variables	Central obesity		p
	No (n = 34)	Yes (n = 125)	
	n (%)	n (%)	
TC			
Adequate	26 (68.4)	76 (62.8)	0.529
Altered	12 (31.6)	45 (37.2)	
LDL-C			
Adequate	26 (68.4)	77 (63.6)	0.590
Altered	12 (31.6)	44 (36.4)	
HDL-C			
Adequate	18 (47.4)	39 (32.2)	0.019
Altered	20 (52.6)	82 (67.8)	
Non-HDL-C			
Adequate	14 (41.2)	36 (28.8)	0.168
Altered	20 (58.8)	89 (71.2)	
TG			
Adequate	23 (60.5)	68 (56.2)	0.638
Altered	15 (39.5)	53 (43.8)	
Glucose			
Adequate	20 (52.6)	62 (51.2)	0.515
Altered	18 (47.4)	59 (48.8)	
Castelli's index I			
Adequate	6 (17.6)	8 (6.4)	0.040
Altered	28 (82.4)	117 (93.6)	
Castelli's index II			
Adequate	17 (50.0)	52 (41.6)	0.381
Altered	17 (50.0)	73 (58.4)	

Table 4 - Logistic regression of biochemical markers of cardiometabolic risk associated with the presence of Central Obesity in elderly patients treated at a geriatric outpatient clinic in the city of Lagarto-SE

Variables	OR (CI 95%)	p
HDL-C		
Adequate	1.00	0.021
Altered	2.48 (1.15-5.37)	
Non-HDL-C		
Adequate	1.00	0.171
Altered	1.73 (0.79-3.79)	
Castelli's index I (TC/HDL-C)		
Adequate	1.00	0.049
Altered	3.13 (1.01-9.76)	

in which 55.6% of men and 76.6% of women (p = 0.024) presented increased cardiovascular risk according with Castelli's index I. However, few studies have used this relationship for predicting the cardimetabolic risk and/ or its association with central obesity, which makes it difficult to compare the results with this variable.

The high prevalence of central obesity observed in this study was also seen in 51.9% of the individuals

in a study carried out by Pinho et al.,[28] Similar results were presented by Ding et al.,[1] in a multicentric study performed with 12,607 Chinese adults. It is worth mentioning that, although this is applicable to both sexes, these results are more often found in women.[4,24] Corroborating this statement, in a study performed by Soar,[4] the prevalence of abdominal adiposity was statistically higher in older women (76.16%) (p = 0.00). These data agree with those of Cabral,[27] in whose study 67.4% of women also presented high WC. In a study carried out only with elderly patients, Souza[29] observed that the majority of them (91.2%) also had central obesity.

This heterogeneity of abdominal fat distribution between the sexes may be due to the higher body-fat percentage in women as a result of hormonal differences, pregnancy, menopause and the climacteric period.[30]

Therefore, it is worth highlighting the importance of promoting healthy eating habits and lifestyle to reduce cardiometabolic risk factors in the population and, consequently, reduce hospitalization and mortality rates. As evidenced in a study developed in Canada, which assessed the association between adopting healthier lifestyle and decreased cardiovascular RF, for each increase of one healthy lifestyle habit, WC decreased by 4.0 cm and 4.8 cm for men and women, respectively. A decrease in TC of 0.2 mmol/L, in non-HDL-C of 0.2 mmol/L and in TG of 0.1 mmol/L was also observed.[31]

Piepoli et al.,[10] contributing to these data, highlight that, in the last three decades, more than half of the

decline in CVD mortality was attributed to changes in risk factor levels in the population, especially reduction in cholesterol levels, blood pressure and smoking.

The results of this study are added to others, thus aggregating scientific evidence of correlation between central obesity and changes in the biochemical markers of metabolic risk of older patients, which reinforces the adoption of WC measurements in clinical practice and in epidemiologic studies, due to its ease of application, practicality, accuracy and low cost. However, these results should be carefully analyzed, since this study used a cross-sectional design, which does not allow for causal inferences to be made. Besides, the biochemical data may have been affected by medication taken by the patients. Hence, more robust cohort studies are required to further investigate these parameters, including lifestyle, smoking and blood pressure assessments, as recommended by the European Society of Cardiology and other Societies on Cardiovascular Disease Prevention in Clinical Practice.[10]

Conclusion

We conclude that there was an association between central obesity and biochemical markers of cardiometabolic risk in the elderly patients who participated in the study. The findings suggest the need for better monitoring of these markers, as well as of VAT accumulation, even considering the use of more accurate measurement techniques, such as computed tomography and magnetic resonance, so that adequate health strategies can be provided in order to reduce the number of hospitalizations and deaths by these causes.

Author contributions

Conception and design of the research: Oliveira CC, Costa ED. Acquisition of data: Costa ED. Analysis and interpretation of the data: Almeida ACS, Oliveira CC, Deiró AQS. Statistical analysis: Oliveira CC. Obtaining financing: Oliveira CC. Writing of the manuscript: Almeida ACS. Critical revision of the manuscript for intellectual content: Almeida ACS, Oliveira CC, Costa ED, Deiró AQS.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This article is part of the thesis of residence completing work in Clinical Nutrition submitted by Ana Caroline de Souza Almeida, from Universidade Federal da Bahia.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the Hospital Universitário de Aracajú/Universidade Federal de Sergipe under the protocol number 559.936/2014. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

References

1. Ding L, Xu Y, Wang L, Xu M, Jiang Y, Zhang M, et al. The cardiometabolic risk profile of Chinese adults with diabetes: a nationwide cross-sectional survey. J Diabetes Complications. 2017;31(1):43-52.

2. Maddaloni E, Cavallari I, De Pascalis M, Keenan H, Park K, Manfrini S, et al. Relation of body circumferences to cardiometabolic disease in overweight-obese subjects. Am J Cardiol. 2016;118(6):822-7.

3. Gutiérrez-Repiso C, Soriguer F, Rojo-Martínez G, García-Fuentes E, Valdés S, Goday A, et al. Variable patterns of obesity and cardiometabolic phenotypes and their association with lifestyle factors in the Di@bet.es study. Nutr Metab Cardiovasc Dis. 2014;24(9):947-55.

4. Soar C. Prevalence of cardiovascular risk factors in non-institutionalized elderly. Rev Bras Geriatr Gerontol. 2015;18(2):385-95.

5. Scarsella C, Després JP. Treatment of obesity: the need to target attention on high-risk patients characterized by abdominal obesity. Cad Saude Publica. 2003;19(suppl 1):S7-19.

6. Barroso SG, Abreu VG, Francischetti EA. A participação do tecido adiposo visceral na gênese da hipertensão e doença cardiovascular aterogênica. um conceito emergente. Arq Bras Cardiol. 2002;78(6):618-30.

7. Roriz AKC, Mello AL, Guimarães JF, Santos FC, Medeiros JMB, Sampaio LR. Imaging assessment of visceral adipose tissue area and its correlations with metabolic alterations. Arq Bras Cardiol. 2010;95(6):698-704.

8. Hermsdorff HHM, Monteiro. JBR. Gordura visceral, subcutânea ou intramuscular: onde está o problema? Arq Bras Endocrinol Metab. 2004;48(6):803-11.

9. Castelli WP, Abbott RD, McNamara PM. Summary estimates of cholesterol used to predict coronary heart disease. Circulation. 1983;67(4):730-4.

10. Piepoli MF, Hoes AW, Agewall S, Albus C, Brotons C, Catapano AL, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts) Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). Eur Heart J. 2016;37(29):2315-81.

11. Dantas CMDHL, Bello FA, Barreto KL, Lima LS. Functional ability of elderly with chronic diseases living in Long-Stay Institutions. Rev Bras Enferm. 2013;66(6):914-20.

12. Ferreira CCC, Peixoto MRG, Barbosa MA, Silveira ÉA. Prevalence of cardiovascular risk factors in elderly individuals treated in the Brazilian Public Health System in Goiânia. Arq Bras Cardiol. 2010;95(5):621-8.

13. Alves LC, Leimann BCQ, Vasconcelos MEL, Carvalho MS, Vasconcelos AGG, Fonseca TCO et al The effect of chronic diseases on functional status of the elderly living in the city of São Paulo, Brazil. Cad. Saúde Pública. 2007;23(8):1924-30.

14. Silva RCP, Simões MJS, Leite AA. Fatores de risco para doenças cardiovasculares em idosos com diabetes mellitus tipo 2. Rev Ciênc Farm Básica Apl. 2007;28(1):113-21.

15. Lohman TG, Roche AF, Martorell R. Anthropometric standardization reference manual. Champaign, IL: Human Kinetics Books; 1988.

16. Alberti KG1, Zimmet P, Shaw J; IDF Epidemiology Task Force Consensus Group. The metabolic syndrome--a new worldwide definition. Lancet. 2005;366(9491):1059-62.

17. Xavier HT, Izar MCO, Faria Neto JR, Assad MH, Rocha VZ, Sposito AC, et al. V Diretriz Brasileira de Dislipidemias e Prevenção da Aterosclerose. Arq Bras Cardiol. 2013;101(4 supl 1):1–20.

18. Oliveira JEP, Foss-Freitas MC, Montenegro Jr RM, Vencio S. Diretrizes da Sociedade Brasileira de Diabetes 2017-2018; 2017.

19. Bertoni VM, Guattini VLO, Vieira BA, Sauer P, Piovesan CH, Marcadenti A. TG/HDL-c ratio and anthropometric indexes among men and women admitted in a tertiary hospital. Rev Bras Nutr Clin. 2015;30(1):9-14.

20. Oliveira CC De, Roriz AKC, Moreira P de A, Eickemberg M, Amaral MTR, Passos LCS, et al. Anthropometric indicators associated with

21. Silva ARA, Dourado KF, Pereira PB, Lima DSC, Fernandes AO, Andrade AM, et al. TG/HDL-c Ratio and Anthropometric Indicators as Cardiovascular Disease Risk Predictors. Rev Bras Cardiol. 2012;25(1):41-9.

Hypertriglyceridemia in the Prediction of visceral fat. Rev Bras Cineantropom Desempenho Hum. 2014;16(5):485-93.

22. Garcez MR, Pereira JL, Fontanelli MM, Marchioni DML, Fisberg RM. Prevalence of dyslipidemia according to the nutritional status in a Representative Sample of São Paulo. Arq Bras Cardiol. 2014;103(6):476-84.

23. Rocha FL, Menezes TN, Melo RLP, Pedraza DF. Correlation between indicators of abdominal obesity and serum lipids in the elderly. Rev Assoc Med Bras. 2013;59(1):48-55.

24. Montenegro Neto AN, Oliveira SSM, Dantas de Medeiros AC, da Silva Portela A, Moreira da Silva Dantas P, Irany Knackfuss M. Estado nutricional alterado e sua associação com perfil lipídico e hábitos de vida em idosos hipertensos. Arch Latinoam Nutr. 2008;58:350-6.

25. Leança CC, Passarelli M, Nakandakare ER, Quintão ECR. HDL: the yin-yang of cardiovascular disease. Arq Bras Endocrinol Metab. 2010;54(9):777-84.

26. Faludi AA, Izar MCO, Saraiva JFK, Chacra APM, Bianco HT, Afiune Neto A, et al. Atualização da diretriz brasileira de dislipidemias e prevenção da aterosclerose - 2017. Arq Bras Cardiol. 2017;109(2 supl 1):1-76.

27. Cabral NAL, Ribeiro VS, Cunha França AKT, Salgado JVL, Santos AM, Salgado Filho N, et al. Cintura hipertrigliceridêmica e risco cardiometabólico em mulheres hipertensas. Rev Assoc Med Bras. 2012;58(5):568-73.

28. Pinho CPS, Diniz A da S, Arruda IKG, Filho MB, Coelho PC, Sequeira LAS, et al. Prevalence of abdominal obesity and associated factors among individuals 25 to 59 years of age in Pernambuco State, Brazil. Cad Saúde Pública. 2013;29(2):83-9.

29. Souza MCM, Nóbrega SS, Tomiya MTO, de Arruda IKG, Diniz A da S, de Lemos MCC. Central adiposity among elderly women in a gerontology-geriatric unit. Rev Bras Geriatr Gerontol. 2016;19(5):787-96.

30. Ronsoni R.M, Coutinho MSSA, Pereira MR, Silva RH, Becker IC. Prevalence of abdominal obesity and associated factors among individuals 25 to 59 years of age in Pernambuco State, Brazil. Cad Saúde Pública. 2013;29(2):313-24.

31. Leroux C, Gingras V, Desjardins K, Brazeau AS, Ott-Braschi S, Strychar I, et al. In adult patients with type 1 diabetes healthy lifestyle associates with a better cardiometabolic profile. Nutr Metab Cardiovasc Dis. 2015;25(5):444-51.