LIPID PROFILE OF ADULT WOMEN AND ITS RELATION WITH CENTRAL ADIPOSITY

Perfil lipídico de mulheres adultas e sua relação com adiposidade central

Perfil lipídico de mujeres adultas y su relación com La adiposidad central

Original Article

Paulo Augusto Ribeiro Neves[1]
Aline Elizabeth da Silva[2]
Elizabethe Adriana Esteves[3]

ABSTRACT

Objective: To access the lipid profile of adult women and to evaluate its relationship with anthropometric measures concerning the central adiposity. **Methods:** Cross-sectional study, conducted in a clinical school of nutrition at a public university in Minas Gerais, comprising 47 adult women who were on the waiting list for the service. The concentrations of total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL), very low-density lipoprotein (VLDL), triglycerides (TG), and weight, height, waist circumference (WC) and hip circumference (HC) were evaluated. The body mass index (BMI) and waist-hip ratio (WHR) were calculated. Analysis of the association of serum lipids to adiposity variables occurred through the Pearson correlation coefficient. **Results:** Of the volunteers, 22 (51.2%) had TC levels above the borderline values and 18 (41.9%) had high LDL. The proportion of subjects with elevated VLDL and TG levels was relatively low (n=4; 9.3% and n=10; 23.3%, respectively). The WC and WHR were positively correlated with the VLDL and TG levels ($p < 0.05$). Among volunteers with BMI ≥ 25 kg/m², the prevalence of dyslipidemia was 39.5% (n=17) and WC was positively correlated with TC levels ($p = 0.04$). **Conclusion:** Results pointed out an association of serum lipids to the measures of central adiposity, with important frequencies of dyslipidemia in the women under investigation, especially high levels of TC and LDL.

Descriptors: Waist Circumference; Waist-Hip Ratio; Body Mass Index; Dyslipidemia.

RESUMO

Objetivo: *Determinar o perfil lipídico de mulheres adultas e avaliar a sua relação com os índices antropométricos relacionados à adiposidade central.* **Métodos:** *Estudo transversal, conduzido em uma clínica-escola de nutrição de uma universidade pública de Minas Gerais, com 47 mulheres adultas em lista de espera para atendimento. Avaliaram-se as concentrações de colesterol total (CT), lipoproteína de alta densidade (HDL), lipoproteína de baixa densidade (LDL), lipoproteína de muito baixa densidade (VLDL), triglicerídeos (TG), peso, estatura, circunferência da cintura (CC) e circunferência do quadril (CQ). Calculou-se o índice de massa corporal (IMC) e a relação cintura-quadril (RCQ). A análise da associação entre concentrações séricas de lipídeos e variáveis de adiposidade ocorreu através do coeficiente de correlação de Pearson.* **Resultados:** *Do total de voluntárias, 22 (51,2%) apresentaram níveis de CT acima dos valores limítrofes e 18 (41,9%) apresentaram LDL elevada. A proporção de indivíduos com VLDL e TG elevados foi relativamente inferior (n=4; 9,3% e n=10; 23,3%, respectivamente). A CC e a RCQ se correlacionaram positivamente com os níveis de VLDL e TG ($p<0,05$). Nas voluntárias com IMC ≥ 25 kg/m², a prevalência de dislipidemias foi de 39,5% (n=17) e a CC se correlacionou positivamente com os níveis de CT ($p = 0,04$).* **Conclusão:** *Os resultados apontaram relação entre os lipídeos séricos e as medidas de adiposidade central, com frequências importantes de dislipidemias nas mulheres investigadas, especialmente níveis elevados de CT e LDL.*

Descritores: *Circunferência da Cintura; Relação Cintura-Quadril; Índice de Massa Corporal; Dislipidemia.*

1) Federal University of Rio de Janeiro (*Universidade Federal do Rio de Janeiro - UFRJ*) - Rio de Janeiro-RJ - Brazil

2) Federal University of Viçosa (*Universidade Federal de Viçosa – UFV*) - Viçosa-MG - Brazil

3) Federal University of Vales Jequitinhonha e Mucuri (*Universidade Federal dos Vales do Jequitinhonha e Mucuri – UFVJM*) - Diamantina-MG - Brazil

Received on: *05/07/2012*
Revised on: *10/15/2012*
Accepted on: *10/21/2012*

RESUMEN

Objetivo: *Determinar el perfil lipídico de mujeres adultas y evaluar su relación con los índices antropométricos relacionados con la adiposidad central.* **Métodos:** *Estudio trasversal realizado en una clínica-escuela de nutrición de una universidad pública de Minas Gerais, con 47 mujeres adultas del listado de espera de consulta. Se evaluó las concentraciones de colesterol total (CT), lipoproteína de alta densidad (HDL), lipoproteína de baja densidad (LDL), lipoproteína de muy baja densidad (VLDL), triglicéridos (TG), peso, altura, circunferencia de la cintura (CC) y circunferencia de la cadera (CC). Se calculó el índice de masa corporal (IMC) y la relación cintura-cadera (RCC). El análisis de la asociación entre las concentraciones séricas de lípidos y variables de adiposidad se dio a través del coeficiente de correlación de Pearson.* **Resultados:** *Del total de voluntarias, 22 (51,2%) presentaron niveles de CT por encima de los valores limítrofes y 18 (41,9%) presentaron LDL elevado. La proporción de individuos con VLDL y TG elevados fue relativamente bajo (n=4; 9,3% y n=10; 23,3%, respectivamente). La CC y la RCC se correlacionaron positivamente con los niveles de VLDL y TG ($p<0,05$). En las voluntarias con el IMC ≥ 25 kg/m², la prevalencia de dislipidemias fue del 39,5% (n=17) y la CC se correlacionó positivamente con los niveles de CT ($p = 0,04$).* **Conclusión:** *Los resultados señalaron relación de los lípidos séricos y las medidas de adiposidad central con frecuencias importantes de dislipidemias en las mujeres investigadas, especialmente niveles elevados de CT y LDL.*

Descriptores: *Circunferencia de la Cintura; Relación Cintura-Cadera; Índice de Masa Corporal.*

INTRODUCTION

Dyslipidemia has been emerging as one of the most important risk factors for cardiovascular diseases (CVDs). An increase of its prevalence in the general population has been noticed in recent years through the high levels of low-density lipoprotein (LDL) and the low levels of high-density lipoprotein (HDL)[1]. Changes in lifestyle, increased physical inactivity and excessive intake of carbohydrates and fats, with consequent overweight and obesity, can contribute to the increase in this prevalence[2].

It is known that obesity, especially abdominal obesity, is largely acknowledged as a risk factor for CVDs and that it is associated with the occurrence of several morbidities[3]. Studies show an association between visceral abdominal fat, but not the subcutaneous one, and the various metabolic disorders, such as dyslipidemias, insulin resistance, hyperglycemia, endothelial dysfunction, among others[4,5].

The 2008-2009 Household Budget Survey (POF in Brazilian Portuguese)[6] shows that overweight rates nearly doubled among women (from 28.7% to 48%) while obesity rates have more than doubled (from 8% to 16.9%) during the period assessed.

There aren't any national researches on CVDs in the Brazilian population. However, a study conducted in 1998 with 8045 Brazilian adults revealed that they had average concentrations of total cholesterol (TC) of 183±39.8 mg/dL with women and elderly people the most affected subgroups[7]. It seems that, regardless of the overweight, abdominal fat is an important risk factor for the occurrence of serum lipids abnormalities[8].

In 1997, the World Health Organization (WHO) recognized the importance of abdominal fat, whereas it can vary widely in relation to total body fat and body mass index (BMI) of an individual[9]. Studies have been conducted to verify the association between anthropometric indicators of obesity and CVDs risk. Simple anthropometric measures are used to gauge the central adipose tissue distribution in individual and collective assessments[10]. The waist circumference (WC) and the waist-to-hip ratio (WHR) have become important indicators to complement the assessments made by the BMI[9]. These indicators are more associated with CVDs risk than total obesity measures[11-13].

Thus, it is clear that the relations between composition, body fat distribution and CVDs risk factors need to be better defined. Therefore, the aim of this study is to determine the lipid profile of adult women and evaluate its relation with anthropometric indexes of adiposity.

METHODS

This is a cross-sectional study conducted with women who were on the waiting list for clinical nutrition care in a clinic school of nutrition at a public university in the countryside of the State of Minas Gerais, Southeastern Brazil. The selection criteria were: age ≥ 18, absence of pregnancy and dietary and/or pharmacological treatment for weight loss or dyslipidemia control.

There were 56 adult women on the healthcare waiting list; however, 2 of them were pregnant, and 7 (who initially met the inclusion criteria) refused to participate or could not be contacted. Therefore, 47 women agreed to participate and signed the Informed Consent Form.

Researchers visited households and used proper registration forms to collect data on sociodemographics (marital status, education, number of residents in the household, profession, income), health and lifestyle (smoking, alcohol abuse, personal and family history of diseases, use of medicines and practice of physical activity); anthropometry (weight, height, waist circumference, WHR). Biochemistry data (total cholesterol, LDL, HDL, very low-density lipoprotein{VLDL} and Triglyceride {TG}) was also collected for the research.

The analysis of the lipid profile was performed at an accredited clinical laboratory. All the volunteers were referred to the lab at specific time and date upon examination requested by a nutritionist.

All the anthropometric measures were performed by the researchers. The BMI was obtained by measuring weight and height and applying the Quetelet's equation (BMI = weight/height^2). Weight was measured using a portable body composition monitor (Tanita BC-534 Inner Scan™) with a weight capacity of 150 Kg with the increments of 0.1 Kg. The Sanny™ ES2020 stadiometer with accuracy of 0.1cm was used for measuring Heights. Volunteers under 20 years old had the BMI classified according to age (BMI-for-age) with estimation of Z-score and the WHO guidelines[14]. For the volunteers aged over 20 years, the classification was performed according to WHO guidelines[15].

Waist circumference was measured using an inelastic measuring tape at the midpoint between the last rib and the iliac crest; the value was interpreted according to the WHO guidelines[9]. Hip circumference was measured by wrapping the measuring taped around the hips at their widest point. The WHR measurement followed the WHO guidelines[9].

The analysis of lipid profile was performed using blood samples collected after a 12-hour fast to check TC, HDL, LDL, VLDL and TG. Dyslipidemias were classified according to the values established by the Fourth Brazilian Guidelines for Dyslipidemia and Atherosclerosis Prevention[16]. The TC/HDL ratio was calculated to check for coronary risk[17].

The anthropometric and biochemical variables were expressed as means, medians, standard deviations, minimum and maximum. Kolmogorov-Smirnov test and Lilliefors test were used for testing of normality. Correlations between anthropometric and biochemical indices were checked by Pearson's correlation coefficient. For statistical analysis, it was established a significance level of $p < 0.05$, and it was used the software Statistica version 6.0[18].

The research protocol was approved by the Research Ethics Committee (Registration No. 179/07) of the Federal University of Vales do Jequitinhonha e Mucuriand followed the guidelines of Resolution 196/96 of the National Health Council.

RESULTS

The study population consisted of 47 women with a mean age of 40.19±12.64 years. The minimum age was 19, maximum 52 and median 38 years. Most participants were married (n=22; 46.8%) and had completed higher education (n=18; 38.3%) or were actively enrolled in a course of higher education (n=9; 19.1%).

The number of people residing in the same household ranged from 3 to 6 for most of the volunteers. Regarding profession, there was a prevalence of teachers (n=11; 23.4%) and personal income of 1 to 4 minimum wages (n=24; 51.1%) (Table I).

Additionally, there were rates of 95.7% (n=45) of non-smokers and 53.2% (n=25) of non-drinkers. The most prevalent diseases among the relatives were hypertension (n=24; 55.8%) and diabetes *mellitus* (n=11; 25.6%). CVDs (n=7; 16.3%), hypothyroidism (n=6; 13.9%) and obesity (n=5; 11.6%) were less reported by the volunteers. The most prevalent diseases among women were: hypertension (n=9; 20.9%) and hypothyroidism (n=7; 16.3%); CVDs (n=3; 6.9%) were less reported by them.

Table I – Sociodemographic characteristics of adult women on healthcare waiting list of a clinic school of nutrition (n=47). Diamantina-MG, 2008.

Variables	Categories	Frequency	
		n	%
Number of people residing in the same household	<3	11	23.4
	3 a 6	35	74.5
	>6	01	2.1
Profession	Teacher	11	23.4
	Student	10	21.3
	Housewife	05	10.6
	Civil Servant	05	10.6
	Other	16	34.1
	None	07	14.9
Wage	< 1 SM	05	10.6
	1 - < 4 SM	24	51.1
	4 - < 7 SM	04	8.5
	≥ 7 SM	07	14.9

Table II – Mean and median values for anthropometric variables of adult women on healthcare waiting list of a clinic school of nutrition (n=47). Diamantina-MG, 2008.

Variables	Mean	Median	SD	Minimum–Maximum
Weight (kg)	67.2	67.2	10.8	41.2 – 88.9
Height (m)	1.6	1.6	0	1.46 – 1.73
Waist Circumference (cm)	83.7	81	9.1	66 – 101
Hip Circumference (cm)	103.1	103	7.2	87 – 121
BMI (kg/m²)	26.2	26.3	3.9	18.5 – 33.8
WHR	0.8	0.8	0	0.7 – 0.9

SD: Standard Deviation; BMI: Body Mass Index; WHR: Waist-to-hip Ratio.

Regarding the use of medicines, 44.7% (n-21) of the women reported using some type of drug, with a higher prevalence of antihypertensives, antidepressants and drugs to treat hypothyroidism. Of all the volunteers, 40.4% (n=19) practiced some kind of physical activity at least twice a week.

The mean BMI of the group was classified as overweight (26.2±3.9 kg/m^2). The mean waist circumference (83.7±9.1 cm) and the mean HCR (0.81±0.06) suggested metabolic risk (Table II). According to the BMI, 36.2% (n=17) of the volunteers were eutrophic; 44.5% (n=21) were overweight and 19.1% (n=9) were classified with obesity class I. With regard to fat distribution, the waist circumference measure showed that 55.3% (n=26) of the volunteers presented risk for metabolic diseases related to obesity (WC > 80 cm), while 17% (n=8) presented high risk and 38.3% (n=18) very high risk (WC > 88 cm). The WHR revealed 23.5% (n=11) volunteers with risk for metabolic diseases related to obesity.

There was a data loss of 8.5% for the exams because four volunteers did not show up at the lab for blood collection. The mean TC (203.6±38.7 mg/dL) was slightly above the cut-off point for classifying borderline. Such behavior – close to borderline values of normality – has also been observed in the biochemical variables - – HDL: 52.6±2.9 mg/dL; LDL: 129.4±32.1 mg/dL; VLDL: 23.2±8.9 mg/dL; TG: 116.5±44.7 mg/dL (Table III).

The study draws attention to the number of women with TC and LDL above borderline values of normality (Table IV). Regarding only the overweight women (BMI ≥ 25.0 kg/m^2), it could be noticed that a significant number of volunteers presented high serum levels of TC and LDL, and 6.3% (n=3) presented a TC/HDL ratio above 5 (Table V).

The waist circumference correlated positevely with serum concentrations of VLDL (r = 0.3384 and p = 0,026) and TG (r = 0.3426 and p = 0.025). A similar result was found for WHR, since it also correlated with VLDL (r = 0.3550 and p = 0.021) and TG (r = 0.3567 and p = 0.019). When assessing the women with IMC ≥ 25 kg/m², the WC only correlated positively with the levels of TC (r = 0.3884 and p = 0.041).

Table III – Mean and median values of serum lipids of adult women on healthcare waiting list of a clinic school of nutrition (mg/dL) and total cholesterol/HDL ratio (n=43). Diamantina-MG, 2008.

Variables	Mean	Median	SD	Minimum- Maximum
TC	203.6	200	38.7	110 - 290
HDL	52.6	53	2.9	47 - 58
LDL	129.4	124	32.1	80 - 203
VLDL	23.2	20	8.9	11 - 50
TG	116. 5	102	44.7	57 - 252
TC/HDL	3.9	3.8	0.8	2 - 6

TC: Total Cholesterol; HDL: High-density Lipoprotein; LDL: Low-density Lipoprotein; VLDL: Very Low-density Lipoprotein; TG: Triglycerides; TC/HDL: Total Cholesterol/HDL ratio; SD: Standard Deviation.

Table IV – Classification of the lipid profile of adult women on healthcare waiting list of a clinic school of nutrition (n=43). Diamantina-MG, 2008.

Classification	TC	HDL	LDL	VLDL	TG
	n (%)				
Low	--	0 (0)	--	--	--
Optimal	21 (48,8)	--	8 (18,6)	39 (90,7)	33 (76,7)
Desirable	--	--	17 (39,5)	--	--
Borderline	14 (32,5)	--	9 (20,9)	--	7 (16,3)
High	8 (18,6)	43 (100)	7 (16,2)	4 (9,3)	3 (7)
Very High	--	--	2 (4,6)	--	--

TC: Total Cholesterol; HDL: High-density Lipoprotein; LDL: Low-density Lipoprotein; VLDL: Very Low-density Lipoprotein; TG: Triglycerides.

Table V – Number and proportion of adult overweight/obese women with high concentrations of serum lipids on healthcare waiting list of a clinic school of nutrition. Diamantina-MG, 2008.

Variables	n	%
Overweight/Obesity (BMI > 25 kg/m^2)	28	65,1
High TC (≥ 200 mg/dL)	17	39,5
High LDL (≥130 mg/dL)	14	32,5
High VLDL (≥ 35 mg/dL)	03	7
High TG (≥ 150 mg/dL)	08	18,6
Low HDL (< 40 mg/dL)	--	--
High TC/HDL ratio (≥5)	03	7

TC: Total Cholesterol; HDL: High-density Lipoprotein; LDL: Low-density Lipoprotein; VLDL: Very Low-density Lipoprotein; TG: Triglycerides; TC/HDL: Total Cholesterol/HDL ratio.

DISCUSSION

Obesity and, mainly, abdominal fat have a strong impact on cardiovascular diseases for being often associated with dyslipidemia, hypertension, insulin resistance and diabetes, favoring the occurrence of cardiovascular events, especially the coronary ones. Even if an individual is not overweight, abdominal fat is an important risk factor for such conditions[4,5].

The BMI is the most widely used index for assessing obesity, while the WC and WHR have been suggested to assess body fat distribution. In recent years, the adipose tissue distribution has been taken into account for assessing obesity-related risks because of the metabolic differences between the abdominal adipose tissue and subcutaneous adipose tissue. The visceral adipose tissue is metabolically active and, in addition to the secretion of proinflammatory cytokines, contributes to insulin resistance[19].

According to the BMI assessment, the nutritional profile of the volunteers follows the current trend in Brazil, which is an increase in overweight/obesity[20]. According to the Brazilian Household Budget Survey (POF 2008-2009), circa 50% of adult people in the country are overweight, i.e., BMI ≥ 25 kg/m^2[6].

When comparing with previous studies[20,21], it was found that the prevalence of obesity continues to increase among lower-income adult women, and the most affected age group is between 25 and 44 years old[6]. In this study, most women had a monthly income of 1-4 minimum wages, a higher education degree, and more than half presented BMI above 25 kg/m^2.

There is a growing interest in the use of anthropometric measurements – especially WC and WHR – due to the close relationship they have with intra-abdominal visceral fat that is considered a potential risk factor for chronic diseases,

regardless of total fat. In the current study, the frequency of women who presented metabolic risk associated with obesity was circa two times higher when assessed by WC rather than the WHR.

A study points to WC as the best measure that correlates to components of metabolic syndrome For instance, low HDL and high LDL); and the WHR as the one that has the worst correlation, presenting no significant effects for any of the investigated variables[22]. High BMI – associated with high concentrations of serum lipid – is a risk factor for adverse coronary events and metabolic syndrome[16].

The prevalence of high concentrations of TC in the current research were close to the ones found in another study conducted in a rural community[23], whose frequency was 20.4%. It is important to note that more than half of the volunteers of this current study presented levels of serum TC above the borderline (> 200 mg/dL). The consequences of high cholesterol are a major public health problem. Early detection of hypercholesterolemia-related risk factors is Paramount for the definition and implementation of preventive actions[24], such as health education campaigns with a special focus on lifestyle change[23].

Regarding the importance of risk factors for CVDs, the analyses point to the importance to quantify them and identify them, especially those addressed in this current study (dyslipidemias, body fat accumulation, overweight and obesity)[25], so that they can serve as a basis for healthcare services to implement actions to prevent and control such diseases.

With regard to LDL, a research found a high concentration (44%) of this lipoprotein in asymptomatic women without previous history of cardiopathy[26]. These differences may reflect the lower socioeconomic condition and the access to processed food, as well as the practice of physical activity twice a week reported by almost half of the volunteers, which favored – to some extent – the lower levels of LDL. According to the Brazilian Society of Cardiology[27], weight loss and physical activity are associated mainly to the increase of HDL and reduction of TG.

As to HDL, all the volunteers presented concentrations above or equals 40mg/dL,an interesting result due to the protective factor of this lipoprotein[28]. It is important to note that the volunteers assessed by this research – despite not presenting HDL disorders – had an overweight profile, which is a cardiovascular risk factor[24].

The frequency of hypertriglyceridemia found in this study was close to the one found in another investigation[26], in which 6% of the women presented concentrations of triglycerides above 150mg/dL, the cut-off point from which preventive measures must be imposed.

According to the Framingham Risk Score[29], a TC/HDL ratio above 5 – if compared to a 3.5 ratio – increases by 3 the chances of astheroclerotic coronary artery disease in women. These authors conducted a research with[29] 50 adult and adolescent patients of both sexes with diabetes and showed that 7.4% of the people aged over 19 presented a ratio above 5, a result that is close to that of this current research.

In this research, the WC and WHR were the indices that correlated to CVD risk factors for all the women, specifically with TG and VLDL values. A similar result was found in another research[30], which showed that the WC was the best indicator of hypertriglyceridemia in a population of Brazilian women and men, and that other dyslipidemias do not fit in this relationship.

Among women aged between 30 and 49 years, all the anthropometric indicators of obesity correlated with CVD risk. Among women aged between 50 and 74 years, the associations were less significant[31]. A research conducted with Australian adults showed that the systolic blood pressure, TG, HDL, fasting glucose and postprandial glucose had a higher correlation to WC compared to other anthropometric indices (BMI and WHR)[32].

In this current study, for women with BMI> 25 kg/ m^2, the WC had a higher correlation with TC only. An analysis presented a similar result[33], in which there was a tendency to increased CVD risk in men and women with WC and BMI above the recommended parameters.

The small sample of this study is a limitation that may have influenced on the lack of more correlations. The WC and WHR have been extensively studied in the literature and associated with dyslipidemias for they are indicators of body fat distribution, being acknowledged the metabolic repercussions of visceral fat accumulation.

Another limitation is the non-inclusion of the food intake assessment to verify its possible association with the lipid profile from the description of inadequate eating habits that influence the occurrence of health problems and overweight.

CONCLUSION

The results showed the relationship between serum lipids and central adiposity measures, with important frequencies of dyslipidemias – especially high levels of TC and LDL – among the assessed women, mainly those who are overweight, which reinforces that obesity is a risk factor for these disorders.

The anthropometric measures of central distribution of body fat appeared as important tools for the detection of metabolic risk, which has been proved by the high concentrations of serum lipids.

ACKNOWLEDGEMENTS

To the volunteers in the study and the Oswaldo Cruz Clinical Analysis Laboratory, located in the city of Diamantina-MG.

REFERENCES

1. Rader DJ, Davidson MH, Caplan, RJ, Pears JS. Lipid and apolipoprotein ratios: association with coronary artery disease and effects of rosuvastatin compared with atorvastatin, pravastatin, and simvastatin. Am J Cardiol. 2003;91(5A):20-4.
2. Andrade Jr. CRM, Clemente EL, Gomes MB. Influência da gordura corporal em parâmetros de controle clínico e metabólico de pacientes com diabetes mellitus tipo 1. Arq Bras Endocrinol Metab. 2004;48(6):885-9.
3. Sampaio, L. R.; SImões, E. J.; Assis, A. M. O.; Ramos, L. R. Validity and reliability of the sagittal abdominal diameter as a predictor of visceral abdominal fat. Arq Bras Endocrinol Metab. 2007; 51(6):980-6.
4. Sandeep S, Gokulakrishnan K, Velmurugan K, Deepa M, Mohan V. Visceral & subcutaneous abdominal fat in relation to insulin resistance & metabolic syndrome in non-diabetic south Indians. Indian J Med Res. 2010; 131:629-35.
5. Romero-Corral A, Sert-Kuniyoshi FH, Sierra-Jonhson J, Orban M, Gami A, Davidson D, Prachi S, Pusalavidyasagar S, Huyber C, Votruba S, Lopez-Jimenez F, Jensen MD, Somers VK. Modest visceral fat gain causes endothelial dysfunction in healthy humans. J Am Coll Cardiol. 2010;56(8):662-6.
6. Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos familiares 2008-2009. Antropometria e estado nutricional de crianças, adolescentes e adultos no Brasil [acesso em 2012 Abr 8]. IBGE, 2010. Disponível em: www.ibge.gov.br
7. Guimarães AC, Lima M, Mota E. The cholesterol level of a selected Brazilian salaried population. CVD Prev. 1998;1:3306-17.
8. Sharma AM. Adipose tissue: a mediator of cardiovascular risk. Int J Obes. 2002; 26(IV):S5-S7.
9. World Health Organization. Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation. Geneva 8-11 Dez. 2008.
10. World Health Organization. Monica Project. Geographical variation in the major risk factors of coronary heart disease in men and women aged 35-64. World Health Stat Q. 1988; 41(3-4):115-40.
11. Ghosh A, Fitzgerald MH, Bose K, Chaudhuri AB. Association of food patterns, central obesity measure and metabolic risk factors for coronary heart disease (CHD) in middle age Bengalee Hindu men, Calcutta, India. Asian Pac J Clin Nutr. 2003; 12(2):66-71.
12. Pitanga FJG, Lessa I. Indicadores antropométricos de obesidade como instrumento de triagem para risco coronariano elevado em adultos na cidade de Salvador - Bahia. Arq Bras Cardiol. 2005;85(1):26-31.
13. Ramos DC, Metha R, Castro JLL, Limones RC, Rubí EG, Aguilar-Salinas CA. Awareness of abdominal adiposity as a cardiometabolic risk factor (The 5A Study): Mexico. Diabetes Metab Syndr Obes. 2011;4:107–17.
14. Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmanna J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007;85(9):660-732.
15. World Health Organization. Obesity, Preventing and Managing the Global Epidemic. Report of a WHO Consultation. World Health Organization: Geneva, June 3-5-1997, 2000. 894.
16. Sociedade Brasileira de Cardiologia. IV Diretrizes brasileiras sobre dislipidemias e diretriz de prevenção da aterosclerose do Departamento de Aterosclerose da Sociedade Brasileira de Cardiologia. Arq Bras Cardiol. 2007; 88(Suppl I):2-19.
17. Haq IU, Jackson PR, Yeo WW, Ramsay, LE. A comparison of methods for targeting CHD risk for primary prevention. Heart. 1997:77(Suppl I):36.
18. Statsoft. Statistica for Windows: computer program manual. Tulsa, OK: StatSoft, Inc; 2000.
19. Ikeoka D, Mader JK, PIeber TR. Adipose tissue, inflammation and cardiovascular disease. Rev Assoc Med Bras. 2010;56(1):116-21.
20. Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos familiares 2002-2003. Análise da Disponibilidade Domiciliar de Alimentos e do Estado Nutricional no Brasil. Análise dos resultados [acesso em 2008 Abr 8]. Disponível em: www.ibge.gov.br
21. Batista Filho M, Rissin A. A transição nutricional no Brasil: tendências regionais e temporais. Cad Saud Públ. 2003;19(Supl I):181-91.
22. Alvarez MM, Vieira ACR, Sichieri R, Veiga GV. Associação das medidas antropométricas de localização de gordura central com os componentes da síndrome metabólica em uma amostra probabilística de

adolescentes de escolas públicas. Arq Bras Endrocrinol Metab. 2008;52(4):649-57.

23. Matos AC, Ladeia AM. Avaliação de fatores de risco cardiovascular em uma comunidade rural da Bahia Salvador. Arq Bras Cardiol. 2003;81(3):291-6.

24. Ferreira SRG, Gimeno SG, Hirai AT, Harima H, Matsumura L, Pittito BA. Effects of an intervention in eating habits and physical activity in Japanese-Brazilian women with a high prevalence of metabolic syndrome in Bauru, São Paulo State, Brazil. Cad Saud Publ. 2008;24(Supl. II):294-302.

25. Nascimento JS, Gomes B, Sardinha AHL. Fatores de risco modificáveis para as doenças cardiovasculares em mulheres com hipertensão arterial. Rev Rene. 2011; 12(4):709-15.

26. Araújo F, Yamada AT, Araújo MVM, Latorre MRDO, Mansur AJ. Perfil Lipídico de Indivíduos sem Cardiopatia com Sobrepeso e Obesidade. Arq Bras Cardiol. 2005;84(5):405-9.

27. Sociedade Brasileira de Cardiologia. Revisão das II Diretrizes da Sociedade Brasileira de Cardiologia para o Diagnóstico e Tratamento da Insuficiência Cardíaca. Arq Bras Cardiol. 2002; 79(Supl. IV):1-30.

28. IShikawa K, Navab M, Lusis AJ. Vasculitis, atherosclerosis, and altered HDL composition in heme-oxygenase-1-knockout mice. Int J Hypertens. 2012; 2012.

29. Martinez TLR, Rabelo LM, Barros MAV, Cendoroglo MS, Aldrighi JM. Dislipidemias em mulheres. Manual de Condutas Clínicas nas Dislipidemias. Belo Horizonte: Ed. Saúde. 1997.

30. Ferreira MG, Valente JG, Silva RMVG, Sichieri R. Accuracy of waist circumference and waist-to-hip ratio as predictors of dyslipidemia in a cross-sectional study among blood donors in Cuiabá, Mato Grosso State, Brazil. Cad Saud Publ. 2006 22(2):307-14.

31. Pitanga FJG, Lessa I. Association of anthropometric indicators of obesity with coronary risk in adults in the city of Salvador, Bahia, Brazil. Rev Bras Epidemiol. 2007;10(2):239-48.

32. Dalton M, Cameron AJ, Zimet PZ, Shaw JE, Jolley D, Dunstan DW, Welborn TA, Ausdiab Steering Committe. Waist circumference, waist–hip ratio and body mass index and their correlation with cardiovascular disease risk factors in Australian adults. J Intern Med. 2003;254(6):555-63.

33. Wildman RP, Gu D, Reynolds K, Duan X, Wu X, He J. Are waist circumference and body mass index independently associated with cardiovascular disease risk in Chinese adults? Am J Clin Nutr. 2005;82(6):1195-202.

Mailing address:
Paulo Augusto Ribeiro Neves
Rua Senador Vergueiro, 218/1213
Bairro: Flamengo
CEP:22230-001 - Rio de Janeiro-RJ
E-mail: paugustorn@gmail.com