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Prevalence of hypertriglyceridemic waist phenotype and associated factors: cross-sectional study of bank workers in the metropolitan region of Vitória, ES, Brazil

Prevalência do fenótipo cintura hipertrigliceridêmica e fatores associados: estudo transversal em bancários da região metropolitana de Vitória, ES, Brasil

Abstract

Objective:: This paper investigates the prevalence of hypertriglyceridemic waist in bank workers and its association with socioeconomic, labor, behavioral, anthropometric and health condition factors. ***Method:*** This is a cross-sectional study based on information from 525 bank workers. To investigate the hypertriglyceridemic waist phenotype, it was necessary to consider the association between waist circumference and high levels of serum triglycerides. ***Results:*** The investigation resulted in a phenotype prevalence of 19.4%, being higher in men, elderly, married and working in the bank for more than five years. The phenotype was also associated with overweight, low HDL-c (high-density lipoprotein), mixed hyperlipidemia, high triglyceride/HDL-c ratio and arterial hypertension. Being over 50 years of age and being overweight increased the chances of the bankers presenting the phenotype. Being female and having adequate levels of HDL-c were shown to be protective factors against the phenotype. ***Conclusion:*** The prevalence of hypertriglyceridemic waist is high and is associated mainly with the excess weight and unfavorable lipid profile of this population.

Keywords: Breastfeeding. Social network. Health education. Health promotion. Community-Based Participatory Researc.

Resumo

Objetivo: Este artigo investiga a prevalência de cintura hipertrigliceridêmica em bancários e sua associação com fatores socioeconômicos, laborais, comportamentais, antropométricos e de condições de saúde. ***Método:*** trata-se de um estudo transversal com 525 bancários. Para avaliação do fenótipo cintura hipertrigliceridêmica foi considerada a associação de circunferência da cintura e hipertrigliceridemia. ***Resultados:*** A investigação resultou em uma prevalência de fenótipo de 19,4%, sendo maior em homens, pessoas em idades avançadas, que vivem maritalmente e que trabalham na agência há mais de cinco anos. O fenótipo também se associou ao excesso de peso, HDL-c (*high density lipoprotein*) baixo, hiperlipidemia mista, elevada relação triglicerídeos/HDL-c e hipertensão arterial. Ter mais de 50 anos e estar acima do peso aumentava as chances de os bancários apresentarem o fenótipo. Ser do sexo feminino e ter níveis adequados de HDL-c mostraram-se fatores de proteção contra o fenótipo. ***Conclusão:*** A prevalência de cintura hipertrigliceridêmica entre bancários é

alta e associa-se principalmente ao excesso de peso e perfil lipídico desfavorável desta população.

Palavras-chave: Cintura Hipertrigliceridêmica. Trabalhadores. Perfil Lipídico. Bancários.

INTRODUCTION

Non-communicable chronic diseases are currently the largest cause of death in the world. In 2014, the World Health Organization (WHO) recorded approximately 38 million annual deaths.[1] About half of these deaths occurred during the productive life of individuals,[2] with cardiovascular diseases (CVD) being the main cause, accounting for around 31% of deaths.[1]

Several tools are used to identify individuals at greater risk of developing CVD. Lemieux et al.[3] developed a protocol that evaluates the simultaneous presence of hypertriglyceridemia and high abdominal circumference, with a high predictive capacity for changes in atherogenic markers. Thus, the hypertriglyceridemic waist, also called the hypertriglyceridemic waist phenotype (HTGW),[4] has been employed in the identification of individuals who are susceptible to cardiovascular risks and who present more frequently other altered markers such as body mass index (BMI), C-reactive protein, total cholesterol, high density lipoprotein (HDL) and low density lipoprotein (LDL) fractions.[5]

The process of productive restructuring in the banking sector caused significant changes in the way this category was occupied, causing a strong reduction in the labor market. Thus, the combination of mass layoffs, automation and outsourcing, reduction of hierarchical levels, precariousness of work and overload of tasks,[6] would affect the health of bank workers in addition to working conditions.[7] Due to the exhaustive work routine and the changes in this service sector, these individuals are at high risk of occupational stress[8] and are at a higher risk of CVD.[9,10]

Therefore this study aimed to estimate the prevalence of HTGW and associated factors in bank workers in the metropolitan region of Vitória, Espírito Santo state, Brazil.

METHOD

A cross-sectional observational study was conducted, whose data were derived from a research on metabolic syndrome, insulin resistance and associated factors in bank workers.[10] The study was approved by the Ethics Committee in Research (n. 059/2008) of the Health Sciences Center of the Federal University of Espírito Santo. The participants were invited to join the study having had the objectives of the study explained and signed a Term of Free and Informed Consent.

For the sample calculation, the simple random sample formula was used for a prevalence of 20%, error of 3% and a level of significance of 95% in a population of 1,410 bank workers. Thus, the minimum value of the sample was 461, and due to possible data losses, 525 bank employees were invited to participate, of which 4 did not attend the interview. Therefore, the sample consisted of 521 employees of a bank network in Espírito Santo, of both sexes, aged between 20 and 64 years and who were in full employment activity. Data collection occurred from August 2008 to August 2009.

The HTGW dependent variable was defined by the simultaneous presence of abdominal obesity, characterized by waist circumference (WC) ≥ 90 cm and ≥ 80 cm for men and women, respectively,[11] and elevated serum triglycerides (TG) (≥150mg / dL).[12]

The sociodemographic variables used in this study were: gender, age group, socioeconomic class, schooling, ethnicity and marital status. The socioeconomic class was defined according to the criterion of economic classification of Brazil[13] and categorized in "A1 + A2" as A, "B1 + B2" as B, "C1 + C2 + D" as C/D.

The group of labor variables involved position/function, time working in the bank, daily working hours and interval time. The variable position/function was divided into "general direction" and "agencies." The individuals

classified in "general direction" corresponded to those who held administrative and general management positions, carrying out their activities without direct contact with the external public, with a physical structure unrelated to the agencies. Those classified as "agencies" performed functions in banking agencies, such as cashier and management services.

Behavioral and anthropometric variables included alcohol consumption, smoking, physical activity level, and BMI. Smokers were individuals who used tobacco regardless of the quantity or frequency of consumption, according to the consensus of approach and treatment of the smoker.[14] The level of physical activity was determined by applying the short version of the International Questionnaire on Physical Activity validated for the Brazilian population.[15] Those who reported at least 150 minutes of activities with a frequency ≥ 5 days a week were considered sufficiently active individuals, taking into account the sum of the sessions related to leisure and transportation, according to the current recommendation,[16] in order to avoid overestimation of the level of physical activity.

BMI was categorized according to WHO[17] and regrouped in eutrophic/low weight (BMI ≤ 24.9kg/m^2) or overweight/obese (BMI ≥ 25.0kg/m^2).

The group of variables related to the health condition involved the presence of dyslipidemia and arterial hypertension. Classification of blood pressure levels was performed based on the criteria of the 7th Brazilian Hypertension Directive.[18] In this study, we regrouped: high blood pressure (systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg) and normal blood pressure (below these values). It should be noted that hypertensive individuals who reported the use of antihypertensive drugs were also considered hypertensive.

Dyslipidemias were classified according to the update of the Brazilian Guidelines for Dyslipidemias and Prevention of Atherosclerosis:[12] low HDL-c (men <40 mg/dL and women <50 mg/dL), isolated hypercholesterolemia (LDL-c ≥ 160 mg/dL), isolated hypertriglyceridemia (TG ≥ 150 mg/dL), mixed hyperlipidemia (LDL-c ≥ 160 mg/dL and TG ≥ 150 mg/dL). The TG/HDL-c ratio was also analyzed, a value greater than 3.5 considered as being at risk.[19] Further details about the methodology used in the original study to collect these and other data are published in the study by Salaroli et al.[20]

The associations between variables were verified using the chi-square test. When the expected values in the table cells were less than five or when the sum of the expected value of the column was less than twenty, Fisher's exact test was used. The level of significance for the tests was $\alpha \leq 0.05$.

The binary logistic regression model was used to test associations between the independent variables and the HTGW, inserting in the model the variables that had statistical significance with the HTGW of $\alpha \leq 0.2\%$ in the chi-square test. The variables mixed hyperlipidemia and TG/HDL-c ratio were excluded from the models, since they were considered parameters that were predictors of HTGW.

The analyses were performed using the statistical software SPSS Statistics 22, with a significance level of $\alpha \leq$ 5% being adopted.

RESULTS

The data refer to 521 bank workers, of which 268 (51.4%) were men and 253 (48.6%) were women. Most individuals were aged 41−50 (N = 278, 53.4%), were in the socioeconomic class A/B (N = 287; 55.1%), had a high level of education (undergraduation and graduation) (N = 387, 74.3%), were white (N = 318, 61.0%) and married (N = 335, 64.3%). There was a difference between the sexes in age group (p = 0.001) and marital status (p <0.001) (table 1).

Table 1. Baseline characteristics of the study participants according to sex by age group, socioeconomic class, schooling, ethnicity and marital status in Vitoria-ES, 2009

Variable	Category	Male N (%)	Female N (%)	P value	Total N (%)
Age group	< 30 years	52 (19.5)	43 (17.0)	**0.004**	95 (18.2)
	31 to 50 years	147 (55.3)	173 (68.4)		320 (61.4)
	> 50 years	67 (25.2)	37 (14.6)		104 (19.9)
Socioeconomic class*	A/B	141 (52.6)	146 (57.7)	0.253	287 (55.1)
	C/D	127 (47.4)	107 (42.3)		234 (44.9)
Schooling*	First and second	74 (27.6)	60 (23.7)	0.318	134 (25.7)
	University and post	194 (72.4)	193 (76.3)		387 (74.3)
Ethnicity*	Non white	110 (41.0)	93 (36.8)	0.324	203 (39.0)
	White	158 (59.0)	160 (63.2)		318 (61.0)
Marital status*[2]	Not married	69 (25.7)	116 (46.0)	**<0.001**	185 (35.5)
	Married	199 (74.3)	136 (54.0)		335 (64.3)

Chi-square test. * Fisher's exact test. In bold: statistically significant values (p<0.05).
N = 521. [1]N = 519. [2]N = 520

The total prevalence of HTGW in the studied sample was 19.4% (N = 101, $_{95\%}$CI 16−23). Regarding the prevalence found by gender of individuals with HTGW, 75 (74.3%, $_{95\%}$CI 71−78) were males and 26 (25.7%, $_{95\%}$CI - 22−30) were females. There was an association between the sexes (p <0.001) (table 2).

Table 2. Hypertriglyceridemic waist associated with sociodemographic, labor and lifestyle characteristics of the study population in Vitoria-ES, 2009

Variables	Hypertriglyceridemic Waist Phenotype (HTGW)			
	Yes N (%)	No N (%)	P value	Total N (%)
Sex*[1]				
Male	75 (74.3)	180 (45.3)	**<0.001**	255 (51.0)
Female	26 (25.7)	217 (54.7)		243 (49.0)
Age group[5]				
< 30 years	12 (11.9)	79 (20.0)		91 (18.3)
31 to 50 years	61 (60.4)	248 (62.8)	**0.023**	309 (62.2)
> 50 years	28 (27.7)	68 (17.2)		96 (19.3)
Socioeconomic class*[1]				
A/B	61 (60.4)	212 (53.4)	0.220	273 (54.8)
C/D	40 (39.6)	185 (46.6)		225 (45.2)

Table 2. Hypertriglyceridemic waist associated with sociodemographic, labor and lifestyle characteristics of the study population in Vitoria-ES, 2009. (Continues)

Variables	Hypertriglyceridemic Waist Phenotype (HTGW)			
	Yes N (%)	No N (%)	P value	Total N (%)
Schooling[1]*				
First and second degrees	30 (29.7)	98 (24.7)	0.310	128 (25.7)
Undergraduation and graduation	71 (30.3)	299 (75.3)		370 (74.3)
Ethnicity*[1]				
Non white	35 (34.7)	157 (39.5)	0.423	192 (39.0)
White	66 (65.3)	240 (60.5)		306 (61.0)
Marital status*[2]				
Not married	16 (15.8)	158 (39.9)	**<0.001**	174 (35.0)
Married	85 (84.2)	238 (60.1)		323 (65.0)
Position /Function*[1]				
General direction	54 (53.5)	224 (56.4)	0.654	278 (56.0)
Agencies	47 (46.5)	173 (43.6)		220 (44.0)
Time working at the bank*[3]				
< 5 years	15 (15.0)	115 (29.1)	**0.003**	130 (26.0)
> 5 years	85 (85.0)	280 (70.9)		365 (74.0)
Daily working hours[1]				
< 6 hours	35 (34.7)	166 (41.8)		201 (40.0)
8 hours	58 (57.4)	210 (52.9)	0.319	268 (54.0)
> 8 hours	8 (7.9)	21 (5.3)		29 (6.0)
Interval time*[4]				
< 1 hour	35 (35.0)	163 (41.6)	0.254	198 (40.0)
> 1 hour	65 (65.0)	229 (58.4)		294 (60.0)
Drinking*[1]				
Yes	71 (70.3)	240 (60.5)	0.084	311 (62.0)
No	30 (29.7)	157 (39.5)		187 (38.0)
Smoking[5]				
Yes	9 (8.9)	36 (9.1)	0.999	45 (9.0)
No	92 (91.1)	359 (90,9)		451 (91.0)
Physical activity*[1]				
Active	11 (10.9)	38 (9.6)	0.709	49 (10.0)
Sedentary	90 (89.1)	359 (90.4)		449 (90.0)

Chi-square test. * Fisher's exact test. In bold: statistically significant values ($p<0.05$).
N = 521. [1] N = 498. [2] N = 497. [3] N = 495. [4] N = 492. [5] N = 496.

There was an association between age and HTGW (p = 0.001), with a range of 31-50 years (N = 58; 57.4%) with a higher prevalence, followed by "more than 50 years" (N = 30, 29.7%). Marital status was also associated with the phenotype (p <0.001), with a higher prevalence among the married individuals (N = 85, 84.2%). There was an association between time working at the agency and HTGW (p = 0.003), with a higher prevalence in those working there over five years (N = 85, 85.0%) (table 2).

Table 3 presents variables related to the health condition in individuals with and without HTGW. The percentage of overweight/obesity (N = 91, 90.1%), low HDL-c (N = 54, 53.5%) and high TG/HDL-c ratio (N = 81, 80.2%) was higher in bank orkers with the phenotype. Among the bank workers who did not have HTGW, almost all of them presented neither mixed hyperlipidemia (N = 394, 99.2%) nor hypertension (N = 310, 78.1%), which can be explained by the low percentage of people in the sample who had these conditions (N = 14.3%, N = 131, 26%, respectively).

Table 3. Hypertriglyceridemic waist associated with health conditions in the study population in Vitoria-ES, 2009

Variables	Hypertriglyceridemic Waist Phenotype (HTGW)		P value	Total
	Yes N (%)	No N (%)		N (%)
BMI[1]				
Eutrophic/low weight	10 (9.9)	218 (54.9)	**<0.001**	228 (46.0)
Overweight/obese	91 (90.1)	179 (45.1)		270 (54.0)
Low HDL-c*[1]				
Yes	54 (53.5)	134 (33.8)	**<0.001**	188 (38.0)
No	47 (46.5)	263 (66.2)		310 (62.0)
Isolated hypercholesterolemia *[2]				
Yes	11 (11.6)	37 (9.4)	0.564	48 (10.0)
No	84 (88.4)	358 (90.6)		442 (90.0)
Mixed hyperlipidemia *[1]				
Yes	11 (10.9)	3 (0.8)	**<0.001**	14 (3.0)
No	90 (89.1)	394 (99.2)		484 (97.0)
TG/HDL-c ratio*[1]				
At risk	81 (80.2)	37 (9.3)	**<0.001**	118 (24.0)
Not at risk	20 (19.2)	360 (90.7)		380 (76.0)
Hypertension*[1]				
Yes	44 (43.6)	87 (21.9)	**<0.001**	131 (26.0)
No	57 (56.4)	310 (78.1)		367 (74.0)

Chi-square test. * Fisher's exact test. In bold: statistically significant values (p<0.05).
BMI: body mass index; HDL-c: high density lipoproteins; TG: triglycerides.
N = 521. [1] N = 498. [2] N = 490.

After adjustments in the binary regression analysis (table 4), it was observed that the variables marital status and hypertension lost their effect. Being female (OR: 0.19, 95%CI: 0.10−0.35) and having adequate values of HDL-c (OR: 0.141; 95%CI 0.08−0.24) were protective factors against HTGW. Being over 50 years old (OR:

4.767; 95%CI 1.36−16.59) increased the chances of presenting HTGW by 4.76 times and being overweight (OR: 3.540; 95%CI 1.98−6.30) increased by 3.5-fold when compared to eutrophic and/or low-weight individuals.

Table 4. Logistic regression analysis, including the gross and adjusted OR for HTGW in the study population in Vitoria-ES, 2009

Variables	Category	p value	Gross OR /CI	p value	Adjusted OR/CI
Gender	Male		1		1
	Female	**<0.001**	0.204 (0.126-0.332)	**<0.001**	0.195 (0.108-0.351)
Age group	< 30 years		1		1
	31 to 50 years	0.089	1.817 (0.913-3.618)	0.364	1.679 (0.549-5.137)
	> 50 years	**<0.001**	5.201 (2.468-10.959)	**0.014**	4.767 (1.369-16.598)
Marital status	Not married		1		1
	Married	**0.003**	2.041 (1.267-3.289)	0.110	1.677 (0.889-3.161)
Time working at the bank	< 5 years		1		1
	> 5 years	0.079	1.577 (0.949-2.619)	0.353	0.656 (0.270-1.596)
Drinking	Yes		1		1
	No	0.102	0.691 (0.444-1.076)	0.170	0.675 (0.385-1.183)
BMI	Eutrophic/low weight		1		1
	Overweight/obese	**<0.001**	4.430 (2.709-7.242)	**<0.001**	3.540 (1.988-6.304)
Low HDL-c	Yes		1		1
	No	**<0.001**	0.198 (0.127-0.309)	**<0.001**	0.141 (0.081-0.245)
Hypertension	Yes		1		1
	No	**0.008**	0.544 (0.348-0.852)	0.972	0.990 (0.567-1.730)

The odds ratios were adjusted in a logistic regression analysis for other variables in the table, with 95% confidence intervals for the presence of HTGW. Cases of statistical significance ≤ 0.2% in the chi-square test were included in the analysis. In bold: statistically significant values (p <0.05). OR: odds ratio; CI: confidence interval; BMI: Body mass index; HDL: high density lipoproteins.

DISCUSSION

The study revealed a prevalence of HTGW in the bank workers population of almost 20%, similar to that evidenced in several international studies, whose results show a variation from 9.5 to 35.2%.[21,22] The different cutoffs proposed for waist circumference, given the guidelines of each country, as well as the study population and the age group, may contribute to this variation, and comparisons need to be made with caution.

Still there is no consensus in the literature about which cutoff point for WC would be the most appropriate when analyzing HTGW. Currently, there are two most commonly used classifications, namely: the International Diabetes Federation,[11] which classifies as inappropriate WC ≥ 80 cm for women and ≥ 90 cm for men; and the National Cholesterol Education Program,[23] which determines ≥ 88 cm for women and ≥ 102 cm for men. Surveys performed in Brazil, according to the same cutoff point used in this study, show a prevalence of HTGW ranging from 24.7 to 37.6%.[24–26]

The prevalence of individuals with HTGW in this study was higher among males. Although this result differs from that found in national studies,[27-29] it is important to note that obesity rates in men increased continually according to national surveys, since the National Budget Survey (POF 1974–1975) to more recent data from the Surveillance of Risk and Protection Factors for Chronic Diseases by Telephone Survey (VIGITEL – 2017).[30] In the female population, this evolution was different in the periods marked by the surveys, with increases of around 50% between 1974-1975 and 1989 (National Survey on Health and Nutrition – PNSN) and relative stability between 1989 and 2002-2003 (Household Budget Survey).[27] However, the growing trend returns when the 2002-2003 data is compared with VIGITEL 2017, with an increase of 40.9% and 13.5% to 51.2% and 18.7% for overweight and obesity, respectively. VIGITEL 2019[31] shows a higher frequency of overweight among men (57.1%) when compared to women (53.9%), but with similar prevalence when it comes to obesity.

Increased WC measures, such as in HTGW, increase abdominal and visceral fat, which leads to an increase in lipolytic activity in adipocytes and, therefore, a greater release of free fatty acids accumulating in the cells, especially of the liver, muscles and pancreas. The excess of fatty acids in the liver will serve as a substrate for the production of hepatic triacylglycerols and lipoproteins rich in triacylglycerols in the circulation.[28] Thus, people with abdominal obesity have metabolic changes that can be identified early through the use of HTGW.

This study demonstrated that the increase in age is directly proportional to HTGW. A study of individuals aged 60-105 years showed a prevalence of HTGW of 27.1%.[29] Accelerated aging of the population is associated with an increased prevalence of non-communicable chronic diseases, such as cardiovascular diseases.[32] Cardiovascular mortality in the elderly is associated with reduced levels of HDL-c and high triglycerides. Dyslipidemia and obesity are also frequent in this age group.[33] A study conducted in a city in Spain[34] showed that in women, the prevalence and the chance of presenting with HTGW increased proportionally to age, and in men it was more intense in the age group of 55-64 years. The decline after 64 years old may indicate an increase in the mortality rates of these individuals who have been exposed to decades of excessive lipid burden.[35]

It was found in this analysis that being overweight increased by three and a half times the chance of presenting the phenotype. The association between overweight and HTGW can be confirmed by several other studies.[34,36,37] Studies have shown that the association of elevated waist circumference and hypertriglyceridemia may indicate the presence of visceral obesity and highly dysfunctional lipolytic adipose deposits, which together behave as a cardiovascular risk factor, regardless of other factors, such as age, gender and plasma concentration of LDL-c.[4,38] According to Oliveira,[39] the increase in global obesity is associated with increased visceral fat, and this can be explained by the strong correlation between BMI and WC, which is considered a simple measure of abdominal obesity and may reflect the accumulation of intra-abdominal fat.[40]

WC is an anthropometric indicator associated with some metabolic factors, including abdominal obesity, hyperinsulinemia and increased levels of apolipoprotein. Triglyceride concentrations, another component of HTGW, is primarily associated with low HDL-c and elevated LDL-c. Elevation in LDL-c levels could be predicted by hypertriglyceridemia before its manifestation. The association between hypertriglyceridemia and the presence of small and dense LDL-c particles has been suggested.[41,42] The group of alterations formed by hyperinsulinemia, B hyperapolipoproteinemia and high plasma concentrations of small and dense particles of LDL-c is called the atherogenic metabolic triad, and is possibly identified in individuals with HTGW.[4]

In this study, individuals with the phenotype were also found to have high BMI, low HDL-c concentration and undesirable TG/HDL-c values. Analysis of the relationship between the onset of atherosclerosis and plasma lipids shows that the TG/HDL-c ratio is a potent predictor of the development of coronary artery disease[43,44] and correlates directly with the level of small and dense particles in the plasma[43] and the presence of risk factors for atherosclerosis.[45,46]

In this study it was found that adequate levels of HDL-c act as a protective factor against HTGW. A highly unfavorable lipid profile has been verified among individuals with HTGW. It is characterized by high concentrations of total cholesterol, LDL-c, VLDL-c and low HDL-c and is associated with an increased cardiovascular risk in these patients.[3,47] Zhang et al.[48] found that HTGW was associated with an increased risk from 1.24 to 2 times for developing non-communicable chronic diseases.

CONCLUSION

In this article, HTGW was associated with gender, age and time working at the bank, marital status, BMI, low HDL-c, mixed hyperlipidemia and arterial hypertension. The results suggest that HTGW is a good alternative with which to estimate cardiovascular risk, and its use may be useful as a screening tool for non-communicable chronic diseases in apparently healthy individuals, such as bank workers, because of the low cost, ease and viability of the measure, and because it can be used in clinical practice and in public health services.

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REFERENCES

1. World Health Organization. Global status report on noncommunicable diseases 2014. World Health Organization; 2014. ISBN: 9789241564854.
2. Bloom DE, Cafiero E, Jané-Llopis E, Abrahams-Gessel S, Bloom LR, Fathima S, Feigl AB, Gaziano T, Hamandi A, Mowafi M, O'Farrell D. The global economic burden of noncommunicable diseases. Program on the Global Demography of Aging; 2012 Jan.
3. Lemieux I, Pascot A, Couillard C, Lamarche B, Tchernof A, Alméras N, Bergeron J, Gaudet D, Tremblay G, Prud'homme D, Nadeau A. Hypertriglyceridemic waist: a marker of the atherogenic metabolic triad (hyperinsulinemia; hyperapolipoprotein B; small, dense LDL) in men?. Circulation. 2000 Jul 11;102(2):179-84. DOI: 10.1161/01.CIR.102.2.179.
4. Lemieux I, Poirier P, Bergeron J, Alméras N, Lamarche B, Cantin B, Dagenais GR, Després JP. Hypertriglyceridemic waist: a useful screening phenotype in preventive cardiology?. Canadian Journal of Cardiology. 2007 Oct 1;23:23B-31B. DOI: 10.1016/S0828-282X(07)71007-3.
5. Andrade JR, Velasquez-Melendez G, Barreto SM, Pereira TS, Mill JG, Molina MD. Fenótipo da cintura hipertrigliceridêmica e fatores nutricionais: um estudo com participantes do ELSA-Brasil. Revista Brasileira de Epidemiologia. 2017;20:382-93. DOI: 10.1590/1980-5497201700030003.
6. Silva LS, Pinheiro TM, Sakurai E. Reestruturação produtiva, impactos na saúde e sofrimento mental: o caso de um banco estatal em Minas Gerais, Brasil. Cadernos de Saúde Pública. 2007;23:2949-58. DOI: 10.1590/S0102-311X2007001200016.

7. Silva JL, Navarro VL. Organização do trabalho e saúde de trabalhadores bancários. Revista Latino-Americana de Enfermagem. 2012 Apr 1;20(2):226-34. DOI: 10.1590/S0104-11692012000200003.

8. Petarli GB, Zandonade E, Salaroli LB, Bissoli NS. Estresse ocupacional e fatores associados em trabalhadores bancários, Vitória–ES, Brasil. Ciência & Saúde Coletiva. 2015;20:3925-34. DOI: 10.1590/1413-812320152012.01522015.

9. Vinholes DB, Melo IM, Machado CA, de Castro Chaves H, Fuchs FD, Fuchs SC. The association between socioeconomic characteristics and consumption of food items among Brazilian industry workers. The Scientific World Journal. 2012;2012. DOI: 10.1100/2012/808245.

10. Salaroli LB, Saliba RA, Zandonade E, Molina MD, Bissoli NS. Prevalence of metabolic syndrome and related factors in bank employees according to different defining criteria, Vitória/ES, Brazil. Clinics. 2013 Jan;68(1):69-74. DOI: 10.6061/clinics/2013(01)OA11.

11. Alberti KG, Zimmet P, Shaw J. The metabolic syndrome—a new worldwide definition. The Lancet. 2005 Sep 24;366(9491):1059-62. DOI: doi.org/10.1016/S0140-6736(05)67402-8.

12. Faludi AA, Izar MC, Saraiva JF, Chacra AP, Bianco HT, Afiune Neto A, Bertolami A, Pereira AC, Lottenberg AM, Sposito AC, Chagas AC. Atualização da diretriz brasileira de dislipidemias e prevenção da aterosclerose–2017. Arquivos brasileiros de cardiologia. 2017 Aug;109(2):1-76. DOI: 10.5935/abc.20170121.

13. ASSOCIAÇÃO BRASILEIRA DE EMPRESAS DE PESQUISA (ABEP). Critério de Classificação Econômica Brasil (CCEB). São Paulo: 2003. 3p. Disponível em: <http://www.abep.org/novo/Content.aspx?ContentID=302>. Acesso em: 29 de nov de 2015.

14. Brasil. Ministério da Saúde. Instituto Nacional do Câncer (INCA). Abordagem e Tratamento do fumante - Consenso 2001. Rio de Janeiro, INCA, 2001, 38 p.

15. Matsudo S, Araújo T, Matsudo V, Andrade D, Andrade E, Oliveira LC, Braggion G. Questionário internacional de atividade física (Ipaq): estupo de validade e reprodutibilidade no Brasil. Revista Brasileira de Atividade Física & Saúde. 2001;6(2):5-18. DOI: 10.12820/rbafs.v.6n2p5-18.

16. Hallal PC, Gómez LF, Parra D, Lobelo F, Mosquera J, Florindo A, Reis R, Pratt P, Sarmiento O. Lecciones aprendidas después de 10 Años del uso de IPAQ en Brasil y Colombia. J Phys Act Health. 2010;7(Suppl 2):259-64. DOI: 10.1123/jpah.7.s2.s259.

17. World Health Organization. 1995. Physical status: the use and interpretation of anthropometry indicators of nutritional status. Geneva: World Health Organization; (Technical Report Series, 854). DOI: 10.1002/(SICI)1520-6300(1996)8:6<786::AID-AJHB11>3.0.CO;2-I.

18. Malachias Bolívar MV, Souza Weimar KS, Plavnik FL, Rodrigues CI, Brandão AA, Neves MF. 7a Diretriz Brasileira de Hipertensão Arterial. Braz J. Hipertens. 2017;24:2-91. DOI: 10.5935/abc.20160151.

19. Sharma A, Vallakati A, Einstein AJ, Lavie CJ, Arbab-Zadeh A, Lopez-Jimenez F, Mukherjee D, Lichstein E. Relationship of body mass index with total mortality, cardiovascular mortality, and myocardial infarction after coronary revascularization: evidence from a meta-analysis. InMayo Clinic Proceedings 2014 Aug 1 (Vol. 89, No. 8, pp. 1080-1100). Elsevier. DOI: 10.1016/j.mayocp.2014.04.020.

20. Salaroli LB, Cattafesta M, Molina MD, Zandonade E, Bissoli NS. Insulin resistance and associated factors: a cross-sectional study of bank employees. Clinics. 2017 Apr;72(4):224-30. DOI: 10.6061/clinics/2017(04)06.

21. Zainuddin LR, Isa N, Muda WM, Mohamed HJ. The prevalence of metabolic syndrome according to various definitions and hypertriglyceridemic-waist in malaysian adults. International journal of preventive medicine. 2011 Oct;2(4):229. PMID: 22174962.

22. Amini M, Esmaillzadeh A, Sadeghi M, Mehvarifar N, Amini M, Zare M. The association of hypertriglyceridemic waist phenotype with type 2 diabetes mellitus among individuals with first relative history of diabetes. Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences. 2011 Feb;16(2):156. PMID: 22091225.

23. National CE. Third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III) final report. Circulation. 2002 Dec 17;106(25):3143. PMID: 12485966.

24. Freitas RS, Fonseca MD, Schmidt MI, Molina MD, Almeida MD. Fenótipo cintura hipertrigliceridêmica: fatores associados e comparação com outros indicadores de risco cardiovascular e metabólico no ELSA-Brasil. Cadernos de Saúde Pública. 2018 Mar 29;34:e00067617. DOI: 10.1590/0102-311X00067617.

25. Oliveira JL, Lopes LL, Pelúzio MD, Hermsdorff HH. Fenótipo cintura hipertrigliceridêmica e risco cardiometabólico em indivíduos dislipidêmicos. Rev Bras Cardiol. 2014;27(6):395-402.

26. Mota AP, da Conceição Machado ME, dos Reis Almeida M. Cintura Hipertrigliceridêmica em Pacientes Hipertensos. International Journal of Cardiovascular Sciences. 2016;29(3):175-80. DOI: 10.5935/2359-4802.20160036.

27. Rezende FA, LEFPL R, Ribeiro RD, Vidigal FD, Vasques AC, Bonard IS, Carvalho CR. Índice de massa corporal e circunferência abdominal: associação com fatores de risco cardiovascular. Arq Bras Cardiol. 2006 Dec;87(6):728-34. DOI: 10.1590/S0066-782X2006001900008.

28. Conceição-Machado ME, Silva LR, Santana ML, Pinto EJ, Silva RD, Moraes LT, Couto RD, Assis AM. Hypertriglyceridemic waist phenotype: association with metabolic abnormalities in adolescents. Jornal de pediatria. 2013 Feb;89(1):56-63. DOI: 10.1016/j.jpedp.2012.08.006.

29. Fagundes LC, Fernandes MH, Brito TA, Coqueiro RD, Carneiro JA. Prevalence and factors associated with hypertriglyceridemic waist in the elderly: a population-based study. Ciencia & saude coletiva. 2018;23:607-16. DOI: 10.1590/1413-81232018232.02862016.

30. Ministério da Saúde, SVS. Departamento de Análise de Situação de Saúde. Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico, VIGITEL 2017. Brasília: DF; 2018.

31. Ministério da Saúde, SVS. Departamento de Análise de Situação de Saúde. Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico, VIGITEL 2019. Brasília: DF; 2020.

32. Gottlieb MG, Schwanke CH, Gomes I, da Cruz IB. Envelhecimento e longevidade no Rio Grande do Sul: um perfil histórico, étnico e de morbi-mortalidade dos idosos. Revista Brasileira de Geriatria e Gerontologia. 2011;14(2):365-80. DOI: 10.1590/S1809-98232011000200016.

33. Nagatsuyu DT, Moriguti EK, Pfrimer K, Formighieri PF, da Costa Lima NK, Ferriolli E, Moriguti JC. O impacto da obesidade abdominal sobre os níveis plasmáticos de lípides nos idosos. Medicina (Ribeirao Preto. Online). 2009 Jun 30;42(2):157-63. DOI: 10.11606/issn.2176-7262.v42i2p157-163.

34. Gomez-Huelgas R, Bernal-López MR, Villalobos A, Mancera-Romero J, Baca-Osorio AJ, Jansen S, Guijarro R, Salgado F, Tinahones FJ, Serrano-Rios M. Hypertriglyceridemic waist: an alternative to the metabolic syndrome? Results of the IMAP Study (multidisciplinary intervention in primary care). International journal of obesity. 2011 Feb;35(2):292. DOI: 10.1038/ijo.2010.127.

35. Kahn HS, Valdez R. Metabolic risks identified by the combination of enlarged waist and elevated triacylglycerol concentration. The American journal of clinical nutrition. 2003 Nov 1;78(5):928-34. DOI: 10.1093/ajcn/78.5.928.

36. Gasevic D, Carlsson AC, Lesser IA, Mancini GJ, Lear SA. The association between" hypertriglyceridemic waist" and sub-clinical atherosclerosis in a multiethnic population: a cross-sectional study. Lipids in health and disease. 2014 Dec;13(1):38. DOI: 10.1186/1476-511X-13-38.

37. Haack RL, Horta BL, Gigante DP, Barros FC, Oliveira I, Silveira VM. The hypertriglyceridemic waist phenotype in young adults from the Southern Region of Brazil. Cadernos de saude publica. 2013;29:999-1007. DOI: 10.1590/S0102-311X2013000500017.

38. Després JP, Cartier A, Côté M, Arsenault BJ. The concept of cardiometabolic risk: Bridging the fields of diabetology and cardiology. Annals of medicine. 2008 Jan 1;40(7):514-23. DOI: 10.1080/07853890802004959.

39. de Oliveira MA, Fagundes RL, Moreira EA, de Moraes Trindade EB, de Carvalho T. Relação de indicadores antropométricos com fatores de risco para doença cardiovascular. Arq Bras Cardiol. 2010;94(4):478-85. DOI: 10.1590/S0066-782X2010005000012.

40. Feng RN, Zhao C, Wang C, Niu YC, Li K, Guo FC, Li ST, Sun CH, Li Y. BMI is strongly associated with hypertension, and waist circumference is strongly associated with type 2 diabetes and dyslipidemia, in northern Chinese adults. Journal of epidemiology. 2012 Jul 5;22(4):317-23. DOI:10.2188/jea.JE20110120.

41. Czernichow S, Bruckert E, Bertrais S, Galan P, Hercberg S, Oppert JM. Hypertriglyceridemic waist and 7.5-year prospective risk of cardiovascular disease in asymptomatic middle-aged men. International journal of obesity. 2007 May;31(5):791. DOI: 10.1038/sj.ijo.0803477.

42. Scarsella C, Després JP. Treatment of obesity: the need to target attention on high-risk patients characterized by abdominal obesity. Cadernos de saude publica. 2003;19:S7-19. DOI: 10.1590/S0102-311X2003000700002.

43. Luz PL, Favarato D, Faria-Neto Junior JR, Lemos P, Chagas AC. High ratio of triglycerides to HDL-cholesterol predicts extensive coronary disease. Clinics. 2008;63(4):427-32. DOI: 10.1590/S1807-59322008000400003.

44. da Luz PL, Cesena FH, Favarato D, Cerqueira ES. Comparison of serum lipid values in patients with coronary artery disease at< 50, 50 to 59, 60 to 69, and> 70 years of age. The American journal of cardiology. 2005 Dec 15;96(12):1640-3. DOI: 10.1016/j.amjcard.2005.07.080.

45. Holmes DT, Frohlich J, Buhr KA. The concept of precision extended to the atherogenic index of plasma. Clinical biochemistry. 2008 May 1;41(7-8):631-5. DOI: 10.1016/j.clinbiochem.2008.01.023.

46. Frohlich J, Dobiášová M. Fractional esterification rate of cholesterol and ratio of triglycerides to HDL-cholesterol are powerful predictors of positive findings on coronary angiography. Clinical chemistry. 2003 Nov 1;49(11):1873-80. DOI: 10.1373/clinchem.2003.022558.

47. Stępień A, Stępień M, Wlazeł RN, Paradowski M, Banach M, Rysz J. Assessment of the relationship between lipid parameters and obesity indices in non-diabetic obese patients: a preliminary report. Medical science monitor: international medical journal of experimental and clinical research. 2014;20:2683. DOI: 10.12659/MSM.890845.

48. Zhang M, Gao Y, Chang H, Wang X, Liu D, Zhu Z, Huang G. Hypertriglyceridemic-waist phenotype predicts diabetes: a cohort study in Chinese urban adults. BMC Public Health. 2012 Dec;12(1):1081. DOI: 10.1186/1471-2458-12-1081.

Contributors

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