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PHYSICAL INACTIVITY AND HIGH SEDENTARY BEHAVIOR ARE ASSOCIATED WITH HYPERTRIGLYCERIDEMIC WAIST IN ELDERLY

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abstract

During aging, an increase in sedentary behaviour and a decrease in physical activity levels are observed. These factors may increase abdominal adiposity and triglyceride levels, which characterizes the hypertriglyceridemic waist (HW) phenotype, providing a high risk for cardiometabolic diseases. This study aimed to analyze the association between hypertriglyceridemic waist, physical activity level and sedentary behaviour in community-dwelling elderly. A population--based cross-sectional study was carried out, involving 316 elderlies (≥ 60 years) of both genders. The hypertriglyceridemic waist was diagnosed using high triglycerides (≥ 150 mg/dl) and increased waist circumference ≥ 88 and ≥ 102 cm values for women and men, respectively. The physical activity level and sedentary behaviour were evaluated using the IPAQ. The study included 173 women (54.7%) and 143 men (45.3%), with a mean age of 74.2 ± 9.8 years. The prevalence of HW was 27.1%, 47.7% insufficiently active and 24.1% high sedentary behaviour. The insufficiently active elderly (OR= 2.48; 95% CI: 1.31 - 4.71; p= 0.005) and with high sedentary behaviour (OR= 2.21; 95% CI: 1.04 - 4.32; p= 0.038) were associated positively with HW, indicating that elderly with insufficient physical activity levels and high sedentary behaviour showed themselves to approximately 2.5 and 2.2 times more likely to develop HW, respectively. Low physical activity level and high sedentary behaviour are associated with hypertriglyceridemic waist in community-dwelling elderly.

keywords

Aging. Hypertriglyceridemia. Physical Activity. Sedentary Lifestyle.

1 Introduction

The hypertriglyceridemic waist phenotype (HW) is characterized by the simultaneous association of increased waist circumference and hypertriglyceridemia (LEMIEUX *et al.*, 2000; BLACKBURN *et al.*, 2012). This phenotype can be used in clinical practice as a screening approach to identify individuals with an increased probability of having the atherogenic metabolic triad: fasting hyperinsulinemia, hyperapolipoprotein B and a high concentration of small LDL (Low density lipoprotein cholesterol) particles; and as an alternative to the diagnosis of metabolic syndrome, standing out as cardiovascular and metabolic risk indicator, associated with visceral obesity (LEMIEUX *et al.*, 2000; BLACKBURN *et al.*, 2012).

The excess body weight, associated with the HW, causes metabolic disorders configuring a risk factor for cardiovascular disease in adults and elderly (CRISTIAN *et al*., 2001; ABDEL-MAKSOUD; 2012 ROCHA *et al*., 2013). Those metabolic disorders may cause reduced capacity to perform the activities of the daily living (FERRUCCI *et al*., 2000; APOVIAN *et al*., 2002; BAMMERMAN *et al*., 2002), reflecting in a low physical activity level and time spent with high sedentary behaviour.

A prospective cohort study with approximately ten years of follow-up, carried out by Knaeps *et al*., (2016), with 425 adults and mean age of 55.8 years, showed that a greater increase in sedentary behaviour (SB) was associated with a more detrimental change in clustered cardiometabolic risk, waist circumference, HDL cholesterol and triglycerides, independently of change in moderate-to-vigorous physical activity (MVPA), as well as a greater decrease in MVPA was associated with a greater decrease in HDL cholesterol and an increase in clustered cardiometabolic risk, waist circumference and fasting glucose, independent of change in SB.

However, knowing that the combination of these two factors, high waist circumference and hypertriglyceridemia, is associated with higher risks of cardiometabolic disorders (ARSENAULT *et al*., 2010) and that sedentary behaviour and physical inactivity are risk factors for these disorders, this study aimed to analyze the association between hypertriglyceridemic waist, physical activity level and sedentary behaviour in community-dwelling elderly.

2 Methodological procedures

2.1 Design, population and setting

As a population-based cross-sectional study, this study is based on data from an epidemiologic cross-sectional, population-based household survey entitled "Nutritional status, risk behaviors, and health conditions of the elderly of Lafaiete Coutinho - Bahia, Brazil". This study was approved by the Human Research Ethics Committee at the State University of Southwest Bahia (protocol 064/2010).

Initially, a census was conducted in Lafaiete Coutinho (January 2011) for the identification of the elderly (≥ 60 years). The location of the residences was conducted using information from *Estratégia Saúde da Família* (ESF), a primary health care program that covers the entire county. All the elderly residing in urban areas (n= 355) were contacted. Of the 355 elderly who comprised

the study population, 316 (89%) participated of the study: 17 refusals were recorded (4.8%) and 22 (6.2%) were not located after three visits on alternate days, and were considered a loss. Before the data was collected, the purpose and procedures of the study were explained and the participants signed an informed consent term.

Before the interview, a cognitive screening was conducted using the modified and validated version of the Mini-Mental State Examination (MMSE) (ICAZA; ALBALA, 1999), the cut-off point adopted was ≥ 13 (non-compromised cognitive function) and ≤ 12 points (compromised) (BERTOLUCCI *et al*., 1994). The elderly who reached a score ≤ 12 continued the interview with the help of an informant. The informant was considered to be someone who resided in the same house and knew how to answer the information about the elderly. To the informant, Pfeffer's Functional Activities Questionnaire (FAQ) was applied, if the sum of the score was ≥ 6 the interview was continued with the informant, if the sum was ≤ 5 the elderly continued to answer the questionnaire (PFEFFER *et al*., 1987). The combination of these two instruments, MMSE and FAQ, allowed a greater specificity in identifying elderly people with a more severe cognitive decline, due to the bias produced by the low level of education.

For data collection, a specific form was used, based on the questionnaire used in the Survey on Health, Welfare and Aging (SABE) project, carried out in seven countries in Latin America and the Caribbean (ALBALA *et al*., 2005). The collection of data occurred in two stages, the first was a household interview, including socio-demographic characteristics and personal information (age, gender, level of physical activity, to be able to read/write and if they have a smoking habit). The second stage was carried out in the FHS and included the dosage of triglycerides and waist circumference.

2.2 Hypertriglyceridemic waist (Dependent variable)

To measure 12 hours fasting triglycerides, the Accutrend® Plus system was used (Roche Diagnostics, Germany), as previously validated (COQUEIRO *et al*., 2014). Capillary blood samples were collected through transcutaneous puncture on the medial side of the tip of the middle finger, using a disposable hypodermic lancet needle. Prior to puncture, 70% alcohol was applied to promote asepsis. Hypertriglyceridemia (triglycerides ≥ 150 mg / dl) was defined according to the current Brazilian guidelines (XAVIER *et al*., 2013) and waist circumference was measured using an inelastic anthropometric tape (ABN™, Brazil) at the level of the umbilical scar (ACSM, 2009). The cutoff points used

to define abdominal obesity were ≥ 88 cm for women and ≥ 102 cm for men (WHO, 1998). The hypertriglyceridemic waist phenotype was defined as the presence of the abdominal obesity plus hypertriglyceridemia.

2.3 Physical activity and sedentary behaviour (Independent variables)

The physical activity level and sedentary behaviour were evaluated using the International physical activity questionnaire (IPAQ), long version (CRAIG *et al*., 2003), adapted to elderly people (BENEDETTI; MAZO; BARROS, 2004; BENEDETTI *et al*., 2007).

Physical activity level: was measured using the sum of the quantity of physical activity performed in the first four domains of the IPAQ. Those who performed less than 150 minutes per week in moderate or vigorous physical activity were considered insufficiently active; and those who performed 150 minutes or more per week considered active (WHO, 2010).

Sedentary behaviour: was measured using the fifth domains of the IPAQ (sitting time), considered to be the time that the elder spends in the sitting position in one habitual day of the week and in one day of weekend. The calculation of the weighted average was used (5 x min weekday) + (2 x min weekend day) / 7) to identify the time of exposure to the sedentary behavior, in a habitual week of the elderly. The cutoff point adopted for the analysis of the exposure to the sedentary behaviour was based on the percentile 75 (≥P75) of the sitting time (min/day) of the weighted average (MENEGUCI *et al*., 2015). The elderly were considered to have high sedentary behaviour when they present values ≥ 488.57 min/day.

2.4 Adjustment variables

Sociodemographic: Gender (female and male); age group (60–69, 70–79 or 80 years) and literacy (yes or no). *Lifestyle:* Smoking habit (smoker, former--smoker and never smoked), BMI (< 22; 22 - 27; > 27 kgm^2) and physical activity (insufficiently active or active), the instrument used to assess the level of habitual physical activity and classification has been mentioned previously. These variables were used because they showed association with the HW in this population (FAGUNDES *et al*., 2018).

2.5 Statistical analysis

A descriptive analysis was conducted (frequencies, means and standard deviations). The association between hypertriglyceridemic waist, physical activity level and sedentary behaviour was verified using binary logistic regression. From the logistic regression parameters, the adjusted odd ratio (OR) was calculated, with respective 95% confidence intervals (95% CI). The significance level adopted in the study was 5% ($p \leq 0.05$). The data was analyzed using the statistical software SPSS® version 21.0 (IBM Corp., Armonk, New York, USA).

3 Results

A total of 173 women (54.7%) and 143 men (45.3%) participated in the study. The mean age of the women was 74.9 ± 10 years (60 - 103 years) and of the men 73.4 ± 9.4 years (60 - 105 years). The prevalence of hypertriglyceridemic waist was 27.1%. The other characteristics of the study population are presented in the Table 1.

Table 1 – Descriptive analysis of the qualitatives variables of study. Lafaiete Coutinho, BA, Brasil, 2011.

Variables	% Response	N	%
Literacy	100.0		
Yes		105	33.2
No		211	66.8
Smoking	99.7		
Smoker		35	11.1
Former-smoker		147	46.7
Never smoked		133	42.2
BMI	95.3		
Underweight		87	28.9
Normal		128	42.5
Overweight		86	28.6

Variables	% Response	N	%
Sedentary behavior	98.4		
Yes		75	24.1
No		236	75.9
Physical activity	98.1		
Insufficiently active		148	47.7
Active		162	52.3
Hypertriglyceridemic waist	94.6		
Yes		81	27.1
No		218	72.9

Source: prepared by the authors.
BMI: Body mass index.

The Table 2 shows the odds ratio (OR) for hypertriglyceridemic waist (HW), physical activity and sedentary behaviour (adjusted for sex, literacy, level of physical activity, smoking and BMI). The insufficiently active elderly and with high sedentary behaviour were positively associated with HW (p=0.005 e p=0.038), with approximately 2.5 and 2.2 times more chances of developing HW, respectively.

Table 2 – Adjusted Odds Ratio (OR) of the hypertriglyceridemyc waist with habitual physical activity and sedentary behaviour in elderly. Lafaiete Coutinho, BA, Brasil, 2011.

Variables	OR	IC 95%	p-value
Physical activity level [#]			
Active	1		
Insufficiently Active	2.48	1.31; 4.71	0.005
Sedentary behaviour [#]			
No	1		
Yes	2.21	1.04; 4.32	0.038

Source: prepared by the authors.
OR: *odds ratio*, IC: Confidence intervals, M: *male*, F: *female,* S: second.
[#] Adjusted for sex, literacy, smoking and BMI.
[*] Adjusted for sex, literacy, level of physical activity, smoking and BMI.

4 Discussion

This study aimed to investigate the association between hypertriglyceridemic waist with physical activity level and sedentary behaviour. The main findings showed that 27.1% of the elderly were diagnosed with hypertriglyceridemic waist, and associations were found between HW and low physical activity and high sedentary behaviour. These findings confirm the hypotheses of researchers that low levels of physical activity and greater time spent in sedentary behaviour contribute to increased levels of triglycerides and waist circumference.

According to a study by Bankoski *et al*. (2011), the authors found an association between high sedentary behaviour with increased waist circumference, low HDL cholesterol, high triglyceride levels and metabolic syndrome in people over 60 years. These results corroborate with this study, where the elderly with HW (increased waist circumference and high triglycerides) spent excessive time in sedentary behaviours. According to Matthews *et al*. (2008), the time spent in sedentary behaviour and low physical activity level increase with age, which together with other risk factors contribute to increased triglyceride levels and increased waist circumference in adults and the elderly (FERNÁNDEZ-GARCÍA *et al*., 2020).

In a study by Xiao *et al*. (2016) with volunteers 17 to 74 years old, the authors observed that volunteer with sitting time > 42 hours per week had a 4% -12% attributable risk of contracting metabolic syndrome, central obesity, and high triglycerides in both genders. Still in this study, the authors found an inverse association between high levels of physical activity and central obesity and triglycerides, showing that people with low physical activity level had higher waist circumference and triglyceride levels, corroborating with the findings of this study in that physical inactivity is a risk factor for development of the hypertriglyceridemic waist.

In the study, Knaeps *et al*. (2016) with, approximately, ten years of follow-up, the authors pointed that the greater increase in Sedentary Behaviour (SB) was associated with increased waist circumference, HDL cholesterol and triglycerides, independently of change in moderate-to-vigorous physical activity (MVPA), as well as a greater decrease in MVPA was associated with a greater decrease in HDL cholesterol and increase in waist circumference and fasting glucose, independent of change in SB. The finding is in agreement with this study, in the sense that sedentary behaviour and physical inactivity are associated with the criterion used to defined Hypertriglyceridemic waist (Hypertriglyceridemia and increased waist circumference).

The aforementioned study pointed out that reduction of sedentary behaviour, as well as the increase of the physical activity level of moderate to vigorous in the elderly, contributed to reduction in waist circumference, triglycerides, diastolic blood pressure, fasting glucose and increasing HDL cholesterol (KNAEPS *et al*., 2018). These findings show the importance of the regular practice of physical activity, and reduction of sedentary behaviour for improving health, reducing the risk for cardiovascular disease. In the literature, there are a limited number of studies relating HW with physical activity and sedentary behaviour in elderly. However, many studies have investigated possible risk factors associated with HW in middle-aged adults (ARSENALT *et al*., 2010; AMINI *et al*., 2011).

A possible limitation of this study is related to the use of IPAQ in elderly, for being a self-reported questionnaire and cannot adequately capture the full amount of activities that they are involved in daily, and also by the fact that the responses of the elderly can be influenced by being cognitively impaired. However, this questionnaire is widely used in population studies because it is low-cost and validated for the elderly in Brazil. A strong point of the study is related to its design, because it is a population-based study that points to high sedentary behaviour and physical inactivity as factors that contribute to the increase in hypertriglyceridemic waist.

5 Conclusion

Based on the findings of this study, it is possible to conclude that low physical activity level and high sedentary behaviour are associated with hypertriglyceridemic waist in community-dwelling elderly.

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INATIVIDADE FÍSICA E ELEVADO COMPORTAMENTO SEDENTÁRIO ESTÃO ASSOCIADOS À CINTURA HIPERTRIGLICERIDÊMICA EM IDOSOS

resumo

Durante o envelhecimento, observa-se aumento do comportamento sedentário e diminuições dos níveis de atividade física. Esses fatores podem aumentar a adiposidade abdominal e os níveis de triglicerídeos, o que caracteriza o fenótipo cintura hipertrigliceridêmica (CH), proporcionando um elevado risco para doenças cardiometabólicas. O objetivo deste estudo foi analisar a associação entre cintura hipertrigliceridêmica, nível de atividade física e comportamento sedentário em idosos. Trata-se de um estudo epidemiológico, com delineamento transversal, de base populacional e domiciliar, realizado com 316 idosos (≥ 60 anos) de ambos os sexos. A cintura hipertrigliceridêmica foi definida a partir dos triglicérideos elevados (≥ 150 mg/dl) e circunferência da cintura alterada (≥ 88 cm para mulheres e ≥ 102 cm para homens). O nível de atividade física e o comportamento sedentário foram avaliados por meio do Questionário Internacional de Atividade Física (IPAQ). Participaram do estudo 173 mulheres (54,7%) e 143 homens (45,3%) com idade média de 74,2 ± 9,8 anos. A prevalência de CH foi 27,1%, 47,7% eram insuficientemente ativos e 24,1% tinham elevado comportamento sedentário. Os idosos insuficientemente ativos (OR= 2,48; IC95%:1,31 - 4,71; p= 0,005) e com elevado comportamento sedentário (OR= 2,21; IC95%:1,04 - 4,32; p= 0,038) foram positivamente associados à CH, indicando que os idosos com níveis de atividade física insuficientes e com elevado comportamento sedentário apresentaram, aproximadamente, 2,5 e 2,2 vezes mais chances de desenvolverem a CH, respectivamente. A inatividade física e o elevado comportamento sedentário estiveram associados à CH em idosos residentes em comunidade.

palavras-chave

Envelhecimento. Hipertrigliceridemia. Atividade Física. Estilo de Vida Sedentário.

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