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PREVALÊNCIA E FATORES ASSOCIADOS À INATIVIDADE FÍSICA EM IDOSOS BRASILEIROS AVALIADOS PELA ACELEROMETRIA: EVIDÊNCIAS DO ESTUDO SABE

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Resumo: Estudos populacionais utilizando acelerômetros para estimar a inatividade física em idosos têm sido realizados em países desenvolvidos. No Brasil, esses estudos se limitam a medidas subjetivas. Objetivo: identificar por meio de um acelerômetro a prevalência e os fatores associados à inatividade física em idosos residentes em São Paulo, Brasil. Métodos: Trata-se de um estudo transversal de base populacional realizado com 543 idosos (média de 73,8 anos) a partir dos dados do estudo SABE (Saúde, Bem-Estar e Envelhecimento). O nível de atividade física foi medido por meio de acelerômetros, e os participantes categorizados em inativos com <30 minutos de atividade moderada e / ou vigorosa diariamente; e ativo com> 30 minutos de atividade moderada e / ou vigorosa diariamente. As variáveis independentes foram sociodemográficas, antropométricas, clínicas e estilo de vida. A associação da variável dependente com as variáveis independentes foi realizada por meio de análise de regressão múltipla. Resultados: Dos idosos avaliados, 85,4% eram inativos fisicamente (homens = 74,3% e mulheres = 91,9%). Idosos com idade> 75 anos (OR = 4,67 [1,87 a 11,66]), mulheres (OR = 2,26 [1,15 a 4,44]), com circunferência da cintura elevada (OR = 2,93 [1,41 a 6,12]), elevado número de comorbidades (OR = 2,27 [1,22 a 4,23]) e dor crônica (OR = 2,54 [1,32 a 4,88]) foram associados de forma independente à inatividade física. Conclusão: A prevalência de inatividade física em idosos com 65 anos ou mais é preocupante e está associada a variáveis sociodemográficas, antropométricas e clínicas.

Palavras-chave: Envelhecimento; Epidemiologia; Saúde pública; Inatividade física

Afiliação

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PREVALENCE AND FACTORS ASSOCIATED TO PHYSICAL INACTIVITY IN OLDER PEOPLE BRAZILIANS EVALUATED BY ACCELEROMETRY: EVIDENCE FROM THE SABE STUDY

Abstract: Background: Population studies using accelerometers to estimate physical inactivity in older people have been carried out in developed countries. In Brazil, these studies are limited to subjective measures. Objective: to identify through an accelerometer the prevalence and factors associated with physical inactivity in older people residents in São Paulo, Brazil. Methods: This is a cross-sectional population-base study conducted with 543 older people individuals (mean 73.8 years) using data from the SABE study (Health, Welfare and Ageing). The level of physical activity was measured using accelerometers, and the participants categorized into inactive with <30 minutes of moderate and/or vigorous activity daily; and active with > 30 minutes moderate and/or vigorous activity daily. The independent variables were sociodemographic, anthropometric, clinical, and lifestyle. The association of the dependent variable with the independent variables was conducted using multiple regression analysis. Results: Of the older people evaluated, 85.4% were physically inactive (men = 74.3% and women = 91.9%). Older people aged >75 years (OR=4.67 [1.87 to 11.66]), women (OR=2.26 [1.15 to 4.44]), with high waist circumference (OR=2.93 [1.41 to 6.12]), high number of comorbidities (OR=2.27 [1.22 to 4.23]), and chronic pain (OR=2.54 [1.32 to 4.88]) were associated independently with physical inactivity. Conclusion: The prevalence of physical inactivity in older people individuals aged 65 or over is appalling and associated with sociodemographic, anthropometric, and clinical variables.

Key words: Aging; Epidemiology; Public health; Physical inactivity

Introduction

Physical inactivity is responsible for the occurrence of 6% of the coronary heart diseases, 7% of type 2 diabetes, 10% of breast and colon cancer, and 9% of deaths worldwide (Lee et al. 2012). In addition, physical inactivity is associated with reduced mobility and frailty in the older people population (Santos et al. 2013; Vaingankar et al. 2017). These data are even more disturbing, since more than half of the adult population (54.4%), and 93.5% of the Brazilian older people are physically inactive (Hallal et al. 2014; Ribeiro et al. 2018). The reasons for the lower prevalence of regular practice of physical activity in older people are the discomfort, such as chest pain, fear of falling and concern for safety, and negative self-perception of health (pain, tiredness and disease) (Tucker et al. 2011).

In epidemiological studies, the level of physical activity is assessed using self-reported questionnaires due to the low cost and feasibility for large populations. However, these subjective methods present some disadvantages, which limit the accuracy of the measurements, especially in the older people population (Mathews et al. 2010).

Given the particular limitations of self-report physical activity in the older people, objective measurement equipment, such as accelerometers, are needed to accurately identify daily levels and physical activity patterns (Skender et al. 2016). The ability to accurately assess intensity and volume may provide more reliable and valid results in relation to factors associated with physical inactivity (Mathews et al. 2010). However, there is a lack of studies with accelerometers available in a representative sample of Brazilian older people (≥ 60 years) that analyzed factors associated with physical inactivity.

In addition, studies with a representative sample and with objective measurements of physical activity, would improve the results of the prevalence of physical inactivity and its associated factors; leading to effective recommendations of physical activity in this population. Therefore, the aim of this population-based study was to analyze the prevalence of physical inactivity using accelerometers, and the associated health factors in Brazilian older people residents in São Paulo.

Methods

This is a cross-sectional population-based study involving Brazilian older people living in São Paulo, Brazil - part of the SABE Study - Health, Welfare and Aging. The SABE Study is a longitudinal study of multiple cohorts that started in 2000 with a random sample of 2143 individuals aged 60 years or more in the city of São Paulo (cohort A). In 2006, 1115 individuals from the first cohort were located and re-interviewed. The difference in numbers was due to deaths (649), refusal to participate (177), change of addresses (51), institutionalization (11) and loss of contact (140). At that time a new random sample of 298 individuals aged 60 to 64 (cohort B) was introduced, because this age group was no longer represented in the original sample. In 2010, 990 individuals were located and interviewed and, like in 2006, a new cohort of older people individuals (n = 355) 60-64 years (cohort C) was introduced. The losses corresponded to deaths (280), refusal to participate (109), change of addresses (49), institutionalization (10) and loss of contact (63).

For the present study, all re-interviewed older people individuals from cohorts A and B (n = 990) were asked to use an accelerometer for three consecutive days. Of those, 599 agreed to participate (65 and older); those who presented less than two days of use of the device (31) or presented incomplete data (25) were excluded. A sample of 543 older people individuals, aged 65 years or older (mean 76.2 $\pm$ 8.05 years), living in the city of São Paulo, took part in this study.

For the analysis of physical activity level, the Actigraph, model GT3X (Actigraph LLC, Pensacola, FL) motion sensor accelerometer was used. A trained technician delivered the accelerometer to the older people volunteers who agreed to use the equipment. The accelerometer was placed around the waist, on the right side, and fixed by and an elastic waistband. The participants used the accelerometer for 24 hours for three consecutive days, removing it only for swimming or other water activities (Sabia et al. 2015).

The accelerometer was prepared the day before, with the name of the participant, and programmed to start working from 9 am of a Tuesday and stop at 9 am of the coming Friday. The elastic band was individually sized, according to the participants' waist circumference.

On completion of the trial period, the accelerometers were collected for downloading the recorded data. This process was conducted using the Actlife software, version 5.0. Only completed data collection days were included in the analyses. Zero count consecutive hours were considered as the period of non-use and days with less than ten hours of use were excluded as they increased the possibility of greater data variability[9].

The Actigraph GT3X measures and records acceleration variations with magnitudes spanning from 0.05 to 2.5 g (g = 9.8m/s2), within a frequency range of 0.25 to 2.5 Hertz. The information recorded by the accelerometer was scanned by a 12-bit analog-to-digital converter at a rate of 30 times per second (30 Hertz). The raw accelerometer data (counts) were translated into minutes of physical activity. The intensity of physical activity practice was analyzed based on the cutoff points established by the equation of Freedson et al. (1998). This classification includes: sedentary (0-99 counts/minute), light activity (100-759 counts/minute), lifestyle (760-1951 counts/minute), moderate (1952-5724 counts/minute), vigorous (5725 - 9498 counts/minute), and very vigorous activity ($\geq$ 9499 counts/minute) (Garatachea et al. 2010).

For the present study the older people participants were divided into two levels of physical activity, according to the classification of Nelson et al.: active (performing 30 or more minutes of moderate and/or vigorous activity per day) and inactive (performing less than 30 minutes of moderate and/or vigorous activity per day) (Nelson et al. 2007).

Nutritional status was verified based on body mass index (BMI). Individuals were classified as normal weight if BMI was $\leq$ 24.9 kg/m^2) or overweight if was > 25 kg/m^2 (King 2007). Body mass was measured using a digital scale (Filizola) with an accuracy of 0.1 kg and maximum capacity of 150 kg and height was measured using a fixed metal stadiometer, with an accuracy of 0.1 cm with a maximum length of 2 meters.

Central obesity was verified through the waist circumference (WC) and waist/hip ratio (WHR), measured using a metal tape (Sanny) with an accuracy of 0.1 cm with a maximum length of 2 m. The following values were ranked as high:

- WC $\geq$ 88 cm for women and $\geq$102 cm for men (Lean et al. 1995).
- WHR $\geq$ 0.84 for women and $\geq$ 1.00 for men (Lean et al. 1995).

All anthropometric variables followed the standard measurements proposed by (Lohman et al. 1988).

The number of chronic diseases reported was obtained from the question "*Have you ever been told by a doctor or nurse that you have or have had* ...?" and included the following diseases: hypertension, diabetes, joint disease, heart disease, chronic lung disease, osteoporosis and stroke. Thus, the variable comorbidities was constructed and analyzed from the presence of two or more chronic diseases (Marengoni et al. 2009).

The number of medications was obtained based on the sum of all medications that the older people reported using daily, and polypharmacy was characterized with five or more medications in use (Secoli 2010). The variable chronic pain was constructed based on two questions. *"Do you feel pain or discomfort when you make some physical effort or movement such as standing up or walking"* and, *"Have you experienced any pain for more than three months, which hurts continuously or comes and goes at least once a month?"* If the participant answered 'yes' to either of the two questions they were classified as having chronic pain. The presence of cognitive decline was identified using a modified version of the Mini-Mental State Examination (MMSE) (Folstein et al. 1975). This instrument contains 13 items (maximum score of 19 points) independent of the level of education, and the cutoff point used for positive screening for cognitive decline was 12 or less (Icaza and Albala 1999).

The variable marital status was categorized as either living with a partner (married or cohabiting) or living alone (single, widowed, divorced). The perception of sufficient income was analyzed from the question "*Do you consider that you have enough money to cover your daily expenses*?". Educational level was analyzed from the number of years of study and categorized as < 3 years and > 4 years. Smoking status was obtained from the question: "*Do you smoke or have you ever smoked*?" For the current study, smoking habit was classified into two categories: i) smoke or has smoked; and, ii) never smoked. All these questions were taken from the SABE questionnaire and were answered by the participant.

For the descriptive analysis, the mean and confidence interval (CI 95%) were calculated for the continuous variables and the proportion was calculated for the categorical variables. The differences between the groups were estimated using the generalized test of equality between Wald averages and the Rao-Scott test that consider the weighted samples for estimates with population weights (Rao and Scott 1987).

The chi-square test was used to analyze the association between the variables and to compare proportions. A binary logistic regression was described using Odds Ratio (OR) and 95% CI. The analyzed variables that presented an association of $p \leq 0.20$ in the univariate model were selected for the multiple regression analysis. The Hosmer-Leme show test was used to determine the quality of the final model. As this was a conglomerate multi-stage sampling, sample weights were used in all analyzes. All analyzes were performed using STATA software, version 11.0 and the significance was set at 0.05.

All participants were informed about the study procedures and only those who signed the informed consent were included in the sample. All protocols were reviewed and approved by the Ethics Committee (Protocol no. 2044/2010).

Results

The descriptive values (mean and 95% CI) and comparison between sexes, anthropometrics, clinical, and individual's physical activity level are shown in Table 1. Older people men demonstrated significantly higher values for weight, height, WHR, WC, and MVPA **(p <0.01)**. Older people women demonstrated significantly higher values for BMI, number of diseases and number of medications **(p <0.01)**.

Table 1 Mean and confidence interval of the anthropometrics, clinical and physical activity characteristics of the participants. SABE study, São Paulo-SP/Brazil.

Risk Factors	Overall	Men	Women	p
	Mean (CI 95%)			
Age (years)	73.8 (72.5 – 75.1)	73.7 (72.1 – 75.2)	73.9 (72.5 – 75.3)	0.72
Weight (kg)	68.5 (67.0 – 70.0)	72.3 (69.8 – 74.8)	66.3 (64.6 – 67.9)	<0.01
Height (cm)	156.1 (155.2 – 157.1)	164.3 (163.0 – 165.7)	151.3 (150.6 – 152.0)	<0.01
BMI (kg/m²)	28.1 (27.6 – 28.6)	26.7 (25.9 – 27.5)	28.9 (28.2 – 29.6)	<0.01
WHR	0.91 (0.90 – 0.91)	0.96 (0.95 – 0.97)	0.88 (0.88 – 0.89)	<0.01
WC (cm)	94.0 (92.7 – 95.2)	96.1 (94.1 – 98.0)	92.7 (91.3 – 94.2)	<0.01
No. of diseases	2.0 (1.8 – 2.1)	1.6 (1.4 – 1.8)	2.2 (2.1 – 2.4)	<0.01
No. of medications	4.8 (4.5 – 5.2)	4.3 (3.6 – 5.0)	5.1 (4.8 – 5.5)	0.02
Physical Activity				
Sedentary (min)	817 (806 – 829)	826 (808 – 846)	812 (798 – 826)	0.19
LPA (min)	276 (264 – 288)	280 (263 – 297)	274 (261 – 287)	0.51
MVPA (min)	12 (10 – 14)	18 (14 – 21)	9 (7 – 11)	<0.01
Counts (day)	386,095 (367,834 – 404,357)	386,480 (359,550 – 413,409)	385,870 (364,066 – 407,673)	0.96

Note: Nº. - number; BMI – body mass index; WC- waist circumference; WHR- waist/hip ratio; LPA – Light physical activity; MVPA – Moderate and vigorous physical activity.

Descriptive values (mean and 95% CI) and comparison between active and inactive individuals, anthropometrics, and clinical characteristics are presented in Table 2. The inactive older people presented significantly higher values for age, BMI, number of diseases, and number of medications **(p <0.01)**.

Table 2 Comparison of the anthropometrics and clinical variables according to daily level of moderate to vigorous physical activity in older people. SABE study, São Paulo - SP/Brazil.

Variables analyzed	**Active (n= 79)**	**Inactive (n= 464)**	**p**
	Mean (CI 95%)		
Age (years)	70.3 (69.1 – 71.5)	74.4 (72.9 – 75.8)	<0.01
Weight (kg)	68.6 (66.2 – 71.1)	68.5 (66.7 – 70.3)	0.92
Height (cm)	161.1 (158.8 – 163.4)	155.2 (154.2 – 156.3)	<0.01
BMI (kg/m²)	26.5 (25.6 – 27.4)	28.3 (27.7 – 29.0)	0.02
WHR	0.91 (0.89 – 0.93)	0.91 (0.90 – 0.92)	0.87
WC (cm)	91.5 (89.1 – 93.9)	94.3 (92.9 – 95.9)	0.07
N°. of diseases	1.2 (0.9 – 1.5)	2.1 (1.9 – 2.3)	<0.01
N°. of medications	3.3 (2.5 – 4.1)	5.1 (4.8 – 5.4)	<0.01

Note: Nº. - number; BMI – body mass index; WC- waist circumference; WHR- waist/hip ratio.

Of the total sample, 85.4% were inactive. The prevalence of physical inactivity was lower in men (i.e., 74.3%) than in women (i.e., 91.9%). The physical activity level was associated with age, sex, BMI, WC, WHR, multimorbidities, chronic pain, polypharmacy, marital status, and educational level (Table 3). No statistically associations was found between physical activity level and cognitive decline, sufficient income, smoke or has smoked.

Table 3 Association between physical activity level and sociodemographic, anthropometrics, clinical and lifestyle variables. SABE study, São Paulo-SP/Brazil.

Variables analyzed		**Active %**	**Inactive %**	χ^2	**p**
Age	≤74 years ≥ 75 years	20.2 5.1	74.8 94.9	23.071	<0.01
Sex	Men Women	25.7 8.1	74.3 91.9	30.906	<0.01
BMI (kg/m²)	≤ 27 kg/m² ≥ 28 kg/m²	22.4 7.22	77.6 92.8	15.632	<0.01
WC (cm)	Adequate Elevated	22.4 7.2	77.6 92.8	24.982	<0.01
WHR	Adequate Elevated	24.6 7.0	75.4 93.0	33.282	<0.01
Multimorbidities	No Yes	24.1 8.8	75.9 91.2	23.891	<0.01
Polypharmacy	No Yes	27.2 10.3	72.8 89.7	23.680	<0.01
Pain	No Yes	23.0 8.9	77.0 91.1	21.112	<0.01
Cognitive decline	No Yes	15.8 6.1	84.2 93.9	4.473	0.05
Marital status	Has a partner No partner	19.5 9.1	80.5 90.9	11.755	0.01
Education level	≥ 4 years ≤ 3 years	9.6 18.5	90.4 81.5	8.586	0.02
Sufficient income	Yes No	13.1 16.9	86.9 83.1	1.477	0.24
Smokes	No Yes	12.9 16.7	87.1 83.3	1.581	0.28

Note: BMI - body mass index; WC- waist circumference; WHR- waist/hip ratio.

In the univariate model, the logistic regression indicated that older people aged 75 or more (OR = 4.71 [2.03 to 10.89]), females (OR = 3.88 [2.11 to 7.14]), overweight (OR = 3.78

[1.70 to 8.39]), with high WC (OR = 3.70 [1.89 to 7.25]) and WHR (OR = 4 35 [2.46 to 7.70]), with two or more chronic diseases (OR = 3.28 [1.75 to 6.17]), using three or more medications (OR = 3.26 [1.65 to 6.46]), with chronic pain (OR = 3.09 [1.70 to 5.58]), and living alone (OR = 2.42 [1.22 to 4. 79]) were more likely to be physically inactive. Individuals with three or less years of education had lower odds (OR = 0.46 [0.23 to 0.91]) to be physically inactivity (Table 4).

Table 4. Univariate analysis of the association between physical inactivity and sociodemographic, anthropometric, clinical and lifestyle variables. SABE study, São Paulo - SP/Brazil.

Variables analyzed		Inactive %	Physically inactive	
			OR (CI95%)	**P**
Age	≤74 years	79.8	1.0	<0.01
	≥ 75 years	94.9	4.71 (2.03 – 10.89)	
Sex	Men	74.4	1.0	<0.01
	Women	91.9	3.88 (2.11 – 7.14)	
BMI (kg/m²)	≤ 27 kg/m²	77.6	1.0	<0.01
	≥ 28 kg/m²	92.8	3.78 (1.70 – 8.39)	
WC (cm)	Adequate	77.6	1.0	<0.01
	Elevated	92.8	3.70 (1.89 – 7.25)	
WHR	Adequate	75.4	1.0	<0.01
	Elevated	93.0	4.35 (2.46 – 7.70)	
Multimorbidities	No	75.9	1.0	<0.01
	Yes	91.2	3.28 (1.75 – 6.17)	
Polypharmacy	No	72.8	1.0	<0.01
	Yes	89.7	3.26 (1.65 – 6.46)	
Pain	No	77.0	1.0	<0.01
	Yes	91.1	3.09 (1.70 – 5.58)	
Cognitive decline	No	84.2	1.0	0.06
	Yes	93.9	2.91 (0.92 – 9.16)	
Marital status	Has a partner	80.5	1.0	0.01
	No partner	90.9	2.42 (1.22 – 4.79)	

Education level	≥ 4 years ≤ 3 years	90.4 81.5	1.0 0.46 (0.23 – 0.91)	0.02
Sufficient income	Yes No	86.9 83.1	1.0 0.74 (0.44 – 1.23)	0.24
Smokes	No Yes	87.1 83.3	1.0 0.73 (0.42 – 1.30)	0.28

Note: BMI - body mass index; WC- waist circumference; WHR- waist/hip ratio.

The final model is presented in Table 5. Older people with advanced age (OR = 4.67 [1.87 to 11.66]), female (OR = 2.26 [1.15 to 4.44]), with high WC (OR = 2, 93 [1.41 to 6.12]), with multimorbidities (OR = 2.27 [1.22 to 4.23]), and chronic pain (OR = 2.54 [1.32 to 4.88]) were independently associated with being physically inactive. This model was adjusted for cognitive decline, marital status, and educational level.

Table 5 Multiple logistic model of the association between physical inactivity and sociodemographic, anthropometric and clinical variables. SABE study, São Paulo - SP/Brazil.

Variables analyzed		**Physically inactive**	
		OR (CI95%)	**p**
Age	≥ 75 years	4.67 (1.87 – 11.66)	<0.01
Sex	Women	2.26 (1.15 – 4.44)	0.01
WC	Elevated	2.93 (1.41 – 6.12)	<0.01
Multimorbidities	Yes	2.27 (1.22 – 4.23)	0.01
Pain	Yes	2.54 (1.32 – 4.88)	<0.01
Cognitive decline	Yes	1.71 (0.58 – 5.11)	0.32
Marital status	No partner	1.15 (0.53 – 2.50)	0.71
Education level	≤ 3 years	0.72 (0.33 – 1.57)	0.40

Note: BMI - body mass index; WC- waist circumference; WHR- waist/hip ratio; Hosmer-Lemeshow (p> 0.05)
Area under ROC curve = 89%

Discussion

The main finding of this study was the alarming prevalence of physical inactivity, determined with the accelerometer, in Brazilian older people living in São Paulo. Of the sample, 74.3% and 91.9% of older people men and women, respectively, were below the physical activity recommendations. Moreover, the multiple logistic model revealed that women, aged 75 years or more, with elevated WC, multimorbidities and pain presented higher odds for physical inactivity.

Our results are similar to those reported by Tucker et al.[5] from the *National Health and Nutrition Examination Survey* (NHANES). The authors found a prevalence of physical inactivity between 74% and 91% in older people individuals aged 60 to 69 years, and between 90% and 94% in those with 70 years or more. Moreover, (Evenson et al. 2012) found a prevalence of physical inactivity in 90.8% of North Americans ≥ 60 years, which was higher in older people at older ages.

Our results are consistent with previous studies on factors associated with physical inactivity. Older people with four years or more of education and living alone had an association with physical inactivity. Older people who reported three years or less of education were more physically active. In general, individuals with lower levels of education and retired tend to continue to work to assist their family income. In most cases, the work is manual labor, which is more a physical work compared to the work performed by individuals with more years of education. The advantage of using education is because its effects are not only observed at the present moment (such as current income, family arrangement, etc.), but throughout life (Zimmer et al. 2012). However, this association was insignificant after adjusting for sex and age ($p = 0.71$). This finding was expected, since education modulates general health and low level of physical activity. On the other hand, might be directly influenced by chronic diseases and nutritional factors (Rocha et al. 2013).

In the present study, older people who reported living alone had greater chance to be physically inactive. Marital status represents an important determinant for physical activity among older adults. The same results were found in a study that compared married individuals with singles, married men reported higher average levels of exercise participation and the married women reported higher levels of total activity (Manfredini et al. 2017).

Davis et al. found in an urban population with a mean age of 78 years, that men spend more time performing moderate/vigorous activities than women; and women spend more time on light activities(Davis et al. 2011)[24]. The same results were found in the study of (Bueno et al. 2016), conducted with 568 older people in the city of Sao Paulo. The authors reported that male older people individuals (< 70 years) had higher levels of physical activity than older older people individuals and female. According to (Monteiro et al. 2003), men prefer to practice sports activities, while women favor lighter activities, such as walking. It is undeniable that these differences must be considered when planning and implementing physical activity programs for this population (Davis et al. 2011; Bueno et al. 2016).

In the present study, older people individuals with high WC were more likely to be physically inactive. These results agrees with findings from recent studies from the National Health and Nutrition Examination Survey (NHANES) that found that older people individuals (> 60 years) who presented elevated WC were less active and had increased risk for disabilities than older people with adequate WC (Batsis et al. 2015).

Older people individuals with high WC and who are physically inactive have more chances to develop hypercholesterolemia (Turi et al. 2016). Abdominal fat is strongly related to elevated LDL-cholesterol and low HDL-cholesterol, responsible for the excessive release of free fatty acids, cytokines, and other inflammatory markers, leading to the formation of atherosclerotic plaques and cardiovascular diseases (Henson et al. 2013).

The prevalence of chronic diseases is higher in older people, and the presence of two or more chronic diseases, or multimorbidity, is associated with a higher mortality rate (Salive 2013) increase in health costs due to prolonged hospitalization and increased number of medications (polypharmacy) (Autenrieth et al. 2013). In older people, the risk of decline in functional capacity increases by 50% with every new disease (Marengoni et al. 2009), leading to decrease in physical activity. In the present study, multimorbidity was associated with physical inactivity, independent of all the other variables investigated. This result corroborates with previous studies, and this association is stronger in older people men (Autenrieth et al. 2013; Jefferis et al. 2014).

In addition to exert a protective effect on the development of diseases, physical activity improves quality of life and well-being of older people due to its analgesic effect on pain intensity in individuals with chronic pain (Reid et al. 2015).

In the presence of pain the sympathetic nervous system predominates, especially in men, with an imbalance of the autonomic nervous system (Tousignant-Laflamme et al. 2005). Evidence suggests that moderate and/or vigorous physical activity can inhibit the sympathetic nervous system (Reid et al. 2015), assisting in the restoration of the autonomic nervous system and thereby controlling pain.

This study has some limitations. First, the cross-sectional analysis prevents any causal relationships. Second, the use of the accelerometer for three days limited the prediction of physically active or inactive subjects during the weekend. For the evaluation of the physical activity profile of adults and older adults the use of the accelerometer is indicated for at least three consecutive days, but one the days should be during the weekend. Although week and weekend days are alike in the older people population, active older adults generally practice more sports activity during the weekdays (Smith et al. 2015). However, recent systematic review demonstrated that it is possible to estimate the level of physical activity in two to three days, from the moderate and high intensity of the older people' physical activity using accelerometers (Dowd et al. 2018). It is important to highlight that for valuation of sedentary behavior, the number of days recommended is higher than that used in the present study. This enables the use of an accelerometer in a representative sample of a large city.

This study also has strength. First, it was conducted with a representative sample of the older people population of São Paulo. Second, to date, this is the first study to analyze the prevalence of physical inactivity in the Brazilian older people using an objective measure. There is a high correlation (r = 0.83) between this type of measure and methods considered gold standard for energy expenditure analysis (Gardner and Poehlman 1998), which considerably increases the reliability of the results.

Conclusion

We showed that prevalence of physical inactivity is alarming in Brazilian older people. Women and older people (> 75 years) with elevated waist circumference and presence of multimorbidities and pain should be considered at a higher risk for physical inactivity. Therefore, older people individuals should be encouraged by healthcare professionals to increase their physical activity level in order to attenuate the age-related physiological changes and its impact on health-related quality of life.

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Maria Lúcia Lebrão - In memory.

References

Autenrieth CS, Kirchberger I, Heier M, Zimmermann AK, Peters A, Döring A, et al. Physical activity is inversely associated with multimorbidity in older people men: Results from the KORA-Age Augsburg Study. Prev Med (Baltim) [Internet]. 2013;57(1):17–9. Available from: http://dx.doi.org/10.1016/j.ypmed.2013.02.014

Batsis JA, Germain CM, Vásquez E, Lopez-Jimenez F, Bartels SJ. Waist circumference, physical activity, and functional impairments in older U.S. Adults: Results from the NHANES 2005-2010. J Aging Phys Act. 2015;23(3):369–76.

Bueno DR, Marucci M de FN, Roediger M de A, Gomes IC, Duarte YA de O, Lebrão ML. Nível de atividade física, por acelerometria, em idosos do municipio de São Paulo: Estudo SABE. Rev Bras Med do Esporte. 2016;22(2):108–12.

Davis MG, Fox KR, Hillsdon M, Sharp DJ, Coulson JC, Thompson JL. Objectively measured physical activity in a diverse sample of older urban UK adults. Med Sci Sports Exerc. 2011;43(4):647–54.

Dowd KP, Szeklicki R, Minetto MA, Murphy MH, Polito A, Ghigo E, et al. A systematic literature review of reviews on techniques for physical activity measurement in adults: A DEDIPAC study. Vol. 15, International Journal of Behavioral Nutrition and Physical Activity. International Journal of Behavioral Nutrition and Physical Activity; 2018.

Evenson KR, Buchner DM, Morland KB. Objective measurement of physical activity and sedentary behavior among US adults aged 60 years or older. Prev Chronic Dis. 2012;9(1):2–11.

Folstein MF, Folstein SE, McHugh PR. A Practical Method For Grading The Cognitive State of Patients For The Clinician. Proc Int Offshore Polar Eng Conf. 1975;12:189–98.

Garatachea N, Luque GT, Gallego JG. Physical activity and energy expenditure measurements using accelerometers in older adults. Nutr Hosp. 2010;25(2):224–30.

Gardner AW, Poehlman ET. Assessment of free-living daily physical activity in older claudicants: Validation against the doubly labeled water technique. Journals Gerontol - Ser A Biol Sci Med Sci. 1998;53(4):275–80.

Hallal PC, Cordeira K, Knuth AG, Mielke GI, Victora CG. Ten-year trends in total physical activity practice in Brazilian adults: 2002-2012. J Phys Act Heal. 2014;11(8):1525–30.

Henson J, Yates T, Edwardson CL, Khunti K, Talbot D, Gray LJ, et al. Sedentary time and markers of chronic low-grade inflammation in a high risk population. PLoS One. 2013;8(10):4–9.

Icaza MC, Albala C. Projeto SABE. Minimental State Examination (MMSE) del estudio de demência en Chile: análisis estatístico. Washingt OPAS; 1999;

Jefferis BJ, Sartini C, Lee IM, Choi M, Amuzu A, Gutierrez C, et al. Adherence to physical activity guidelines in older adults, using objectively measured physical activity in a population-based study. BMC Public Health [Internet]. 2014;14(1):1–9. Available from: BMC Public Health

King TC. Tissue Homeostasis, Damage, and Repair. Elsevier's Integr Pathol. 2007;59–88.

Lean MEJ, Han TS, Morrison CE. Waist circumference as a measure for indicating need for weight management. Bmj. 1995;311(6998):158.

Lee I-M, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Impact of Physical Inactivity on the World's Major Non-Communicable Diseases. Lancet. 2012;380(9838):219–29.

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

Manfredini R, De Giorgi A, Tiseo R, Boari B, Cappadona R, Salmi R, et al. Marital Status, Cardiovascular Diseases, and Cardiovascular Risk Factors: A Review of the Evidence. J Women's Heal. 2017;26(6):624–32.

Marengoni A, Von Strauss E, Rizzuto D, Winblad B, Fratiglioni L. The impact of chronic multimorbidity and disability on functional decline and survival in older people persons. A community-based, longitudinal study. J Intern Med. 2009;265(2):288–95.

Mathews AE, Laditka SB, Laditka JN, Wilcox S, Corwin SJ, Liu R, et al. Older adults' perceived physical activity enablers and barriers: a multicultural perspective Mathews A.E. J Aging Phys Act [Internet]. 2010;18(2):119–40. Available from: http://0-ovidsp.ovid.com.lib.exeter.ac.uk/ovidweb.cgi?T=JS&PAGE=reference&D=emed9&NEWS=N&AN=20440026

Monteiro CA, Conde WL, Matsudo SM, Matsudo VR, Bonseñor IM, Lotufo PA. A descriptive epidemiology of leisure-time physical activity in Brazil, 1996-1997. Rev Panam Salud Publica/Pan Am J Public Heal. 2003;14(4):246–54.

Nelson ME, Rejeski WJ, Blair SN, Duncan PW, Judge JO, King AC, et al. Physical activity and public health in older adults: Recommendation from the American College of Sports Medicine and the American Heart Association. Med Sci Sports Exerc. 2007;39(8):1435–45.

Rao JNK, Scott AJ. On Simple Adjustments to Chi-Square Tests with Sample Survey Data. Ann Stat. 1987;15(1):385–97.

Reid KF, Price LL, Harvey WF, Driban JB, Hau C, Fielding RA, et al. Muscle Power Is an Independent Determinant of Pain and Quality of Life in Knee Osteoarthritis. Arthritis Rheumatol. 2015;67(12):3166–73.

Ribeiro AS, Pereira LC, Silva DRP, Dos Santos L, Schoenfeld BJ, Teixeira DC, et al. Physical activity and sitting time are specifically associated with multiple chronic diseases and medicine intake in brazilian older adults. J Aging Phys Act. 2018;26(4):608–13.

Rocha SV, Almeida MMG de, Araújo TM de, Santos LB, Rodrigues WKM. Factors associated with physical activity in leisure fail between older people. Rev Bras Med Esporte [Internet]. 2013;19(3):191–5. Available from: www.csep.ca

Sabia S, Cogranne P, van Hees VT, Bell JA, Elbaz A, Kivimaki M, et al. Physical activity and adiposity markers at older ages: Accelerometer Vs questionnaire data. J Am Med Dir Assoc [Internet]. 2015;16(5):438.e7-438.e13. Available from: http://dx.doi.org/10.1016/j.jamda.2015.01.086

Salive ME. Multimorbidity in older adults. Epidemiol Rev. 2013;35(1):75–83.

Santos VR dos, Gomes IC, Santos LL dos, Agostinete RR, Freitas Júnior IF. Associação entre fatores de risco cardiovascular e capacidade funcional de idosos longevos. Med (Ribeirao Preto Online). 2013;46(1):10.

Secoli SR. Polifarmácia: interações e reações adversas no uso de medicamentos por idosos. Rev Bras Enferm. 2010;63(1):136–40.

Skender S, Ose J, Chang-Claude J, Paskow M, Brühmann B, Siegel EM, et al. Accelerometry and physical activity questionnaires - A systematic review. BMC Public Health [Internet]. 2016;16(1):1–10. Available from: http://dx.doi.org/10.1186/s12889-016-3172-0

Smith L, Hamer M, Ucci M, Marmot A, Gardner B, Sawyer A, et al. Weekday and weekend patterns of objectively measured sitting, standing, and stepping in a sample of office-based workers: The active buildings study. BMC Public Health. 2015;15(1):1–9.

Tousignant-Laflamme Y, Rainville P, Marchand S. Establishing a link between heart rate and pain in healthy subjects: A gender effect. J Pain. 2005;6(6):341–7.

Tucker JM, Welk GJ, Beyler NK. Physical activity in U.S. adults: Compliance with the physical activity guidelines for Americans. Am J Prev Med [Internet]. 2011;40(4):454–61. Available from: http://dx.doi.org/10.1016/j.amepre.2010.12.016

Turi BC, Codogno JS, Fernandes RA, Monteiro HL. Baixos níveis de atividade física e síndrome metabólica: Estudo transversal com usuarios do sistema publico de saúde Brasileiro. Cienc e Saude Coletiva. 2016;21(4):1043–50.

Vaingankar JA, Chong SA, Abdin E, Picco L, Chua BY, Shafie S, et al. Prevalence of frailty and its association with sociodemographic and clinical characteristics, and resource utilization in a population of Singaporean older adults. Geriatr Gerontol Int. 2017;17(10):1444–54.

Zimmer Z, Martin LG, Nagin DS, Jones BL. Modeling Disability Trajectories and Mortality of the Oldest-Old in China. Demography. 2012;49(1):291–314.