

Sedentary behavior and functional disability in older adults with low economic status: Monidi Study

Comportamento sedentário e incapacidade funcional em idosos com baixa condição econômica: Estudo Monidi

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Abstract – Excess time spent in sedentary activities may intensify functional losses among the elderly; however, information on the amount of time in sedentary activities related to these losses is still incipient. The aim of this study was to determine the predictive power of sedentary behavior (SB) and to establish cutoff points for functional disability (FD) discriminators in the elderly. A cross-sectional study was carried out with sample of 310 older adults with mean age of 71.62 ± 8.15 years, randomly selected and residents in the municipality of Ibicuí-BA. Sedentary behavior was assessed by measuring the time spent sitting on a usual week day and FD weekend and FD by the Lawton scale. Receiver Operating Characteristic (ROC) curves were constructed and SB discriminant criterion for FD was determined. The areas under the curve showed that SB has reasonable potential to discriminate FD. The times spent in SB that best discriminated FD were > 330 minutes / day and > 270 minutes / day for men and women respectively. Time spent in SB is an important health indicator and can be used in the screening of FD in the elderly.

Key words: Aged; Cross-sectional studies; Functional disability; ROC curve; Sedentary lifestyle.

Resumo – O excesso de tempo despendido em atividades sedentárias pode intensificar as perdas funcionais entre idosos, no entanto, ainda são incipientes as informações sobre a quantidade de tempo em atividades sedentárias relacionadas a essas perdas. Objetivou-se determinar o poder preditivo do comportamento sedentário (CS) e estabelecer seus pontos de corte como discriminadores da incapacidade funcional (IF) em idosos. Estudo transversal com amostra de 310 idosos com média de idade de $71,62 \pm 8,15$ anos, selecionados aleatoriamente e residentes no município de Ibicuí-BA. O comportamento sedentário foi avaliado por meio de mensuração do tempo gasto sentado em um dia habitual da semana e no fim de semana e a IF pela escala de Lawton. Foram construídas curvas Receiver Operating Characteristic (ROC) e determinado um critério discriminador do CS para IF. As áreas sobre a curva mostraram que o CS tem um razoável potencial para discriminar a IF. Os tempos em CS que melhor discriminaram a IF foram de >330 minutos/dia e >270 minutos/dia para homens e mulheres respectivamente. O tempo em CS é um indicador de saúde importante e poderá ser utilizado no rastreamento da IF de idosos.

Palavras-chave: Curva ROC; Estilo de vida sedentário; Estudos transversais; Idosos; Incapacidade funcional.

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INTRODUCTION

The increase in the number of older adults due to the reduction of birth and mortality rates¹ has been accelerated in Brazil². Estimates by IBGE for the year 2017 reveal that people aged 65 years and over will represent about 8.4% of the Brazilian population³.

With the increase of the elderly population, it is necessary to increase research on aspects that can have an impact on the health and quality of life of this population. Among these, functional capacity, which can be understood as a set of physical and mental abilities necessary for autonomy and independence, is considered as one of the most relevant subjects⁴.

The prevalence of functional disability (FD) is a common condition among older people in both national⁵ and international studies^{6,7}. A survey carried out in three Brazilian cities (Caratinga-MG, Ilhéus-BA and Nova Santa Rosa-PR) showed high prevalence of functional disability, 55.3%, 59.1% and 44.3%, respectively⁵. In other countries, lower prevalence of FD was identified, 37.4% in the city of Haryana-India⁶ and 20% in Hisayama-Japan⁷.

Some modifiable behaviors may reduce or increase vulnerability to functional losses, including socioeconomic variables, schooling, polypharmacy, physical inactivity and sedentary behavior⁸⁻¹⁰.

Sedentary behavior (SB) can be characterized as time spent sitting or lying down in activities with metabolic expenditure between 1.0 and 1.5 METs¹¹. This behavior has been widely studied and discussed in the scientific community due to its associations with risk for cardiovascular diseases, mortality, obesity and diabetes, as well as increased functional disability, mainly due to its relation with the decreased muscle strength¹²⁻¹⁴.

Thus, with advancing age, older adults are more susceptible to decline in functional capacity, due to the decrease in muscle strength, balance and coordination. This condition can be aggravated by prolonged exposure to sedentary behaviors, increasing the probability of dependence¹⁵.

In this sense, considering the scarcity of studies in developing countries and especially with older adults living in regions characterized by low levels of education, income and insufficient access to health services, and the need for better understanding of the contribution of modifiable behaviors in the functional capacity of this population, the aim of this study was to determine the predictive power of SB and to establish its cutoff points as discriminators of functional disability in older adults.

METHOD

This is a cross-sectional study that used data from a population survey entitled "MONIDI: monitoring the health conditions of older adults living in a small city", held in 2014, in the municipality of Ibicuí-BA.

Ibicuí belongs to the region of Vitória da Conquista, southwestern state of Bahia, with total estimated population of 15,785, of which 2,125

are older adults, and of these, 525 were registered in the Family Health Strategy (FHS) during the study period.

Sample size was determined adopting: 5% significance level, 95% confidence interval and 3% tolerable error. In addition, 10% were added for possible losses and refusals. After accounting for losses and refusals, the response rate was 91.2% with 8.8% ($n = 31$) refusals and 9.2% ($n = 29$) exclusions, with final sample composed of 310 individuals.

The inclusion criteria were: individuals aged 60 or over residents in the rural and urban areas enrolled in the Family Health Strategy (FHS) of the city of Ibicuí-BA. Exclusion criteria were the presence of diagnosis of dementia or any other type of cognitive alteration that compromised the veracity of information obtained. Data were collected using the Elderly Health Assessment Instrument (EHAI), which was previously validated and standardized¹⁶.

In the present study, sociodemographic information was included (sex: male and female, age: in years, educational level: literate and illiterate and monthly average income in Reais (Brazilian currency)), leisure physical inactivity: those who did not participate in any physical activity in the free time were considered physically inactive.

Body Mass Index (BMI) was evaluated measuring weight with a portable digital scale (OMRON®) and stature through a stadiometer (Sanny®), both calibrated. Based on these measures, body mass index was determined using the formula [$BMI = \text{body mass (kg)} / \text{height}^2 \text{ (m)}$], and the cutoff points used were: low weight ($<22\text{kg} / \text{m}^2$), normal weight $1 - 27\text{kg} / \text{m}^2$), overweight / obese ($> 27\text{kg} / \text{m}^2$)¹⁷.

In order to evaluate the global cognitive state, the Mini Mental State Examination (MMSE) was used, and the Bertolucci et al.¹⁸ criteria were adopted, in which different cutoff points were established depending on the educational level of individuals.

Strength and resistance of lower limbs were evaluated by the maximum number of repetitions of the sitting-lifting test for 30 seconds.

The time spent sitting, independent variable, was evaluated based on the time in which the participant stays at home, in groups of people, in the doctor's office, while resting, watching television, doing manual work, making meals, among others, this variable was assessed based on a question from the International Physical Activity Questionnaire (IPAQ).

The dependent variable, functional capacity, was evaluated through the individuals' self-perception regarding instrumental activities of the daily living (IADL), like using the telephone, using transport means to move to distant places, shopping, preparing meals, house working, drug administration and accounting using the Lawton index. Individuals were classified as dependent when they needed assistance in at least one of the activities.

As for the statistical analysis of data, mean and standard deviation were used to represent the descriptive information of variables. To estimate the cutoff point of sedentary behavior in the discrimination of functional disability, the Receiver Operating Characteristic (ROC) curve was used, often used to determine cutoff points in diagnostic tests, specifying the respective

sensitivity and specificity values, and the higher the area under the curve, the better the discriminatory power of the independent variable for the dependent variable. Analyses were performed through the Statistical Package for Social Sciences - SPSS for Windows®, version 16.0, and MedCalc®.

The research project was approved by the Ethics Research Committee of the State University of “Sudoeste da Bahia” (Protocol No. 22969013.0.0000.0055), based on Resolution 466/2012 of the National Health Council (CNS).

RESULTS

Among the 310 individuals evaluated, the mean age was 71.62 ± 8.15 years. There was predominance of females (56.5%), most reporting being literate (56.1%) and with monthly average income of R\$ $708,26 \pm 303,69$.

The prevalence of overweight / obesity and cognitive deficit were 38.4% and 18.7%, respectively. The frequency of physical inactivity in free time was 69.0% (Table 1) and the mean time spent in sedentary behavior was 413.14 minutes.

The frequency of functional disability was 51.9% for instrumental activities of the daily living, as measured by the Lawton scale (Table 1).

Table 1. Sociodemographic variables and behavioral characteristics of individuals' health status. Ibicuí-BA, 2014

Variables	n	%
Sex		
Female	175	56.5
Male	135	43.5
Schooling		
Literate	174	56.1
Illiterate	136	43.9
FDL		
Yes	214	69
No	96	31
BMI		
Overweight/Obesity	119	39.7
Normal weight	117	39
Low weight	64	21.3
Cognitive deficit		
Yes	252	81.3
No	58	18.7
IADL		
Independent	149	48.1
Dependent	161	51.9

Note. FDL * physical disability at leisure; BMI * body mass index; IADL * Instrumental activity of the daily living.

Areas under the ROC curve were 0.46 (95% CI: 0.41-0.52) for men and women (Figure 1), 0.50 (95% CI: 0.43-0.58) for women (Figure 2) and 0.58 (95% CI: 0.50-0.67) for men (Figure 3).

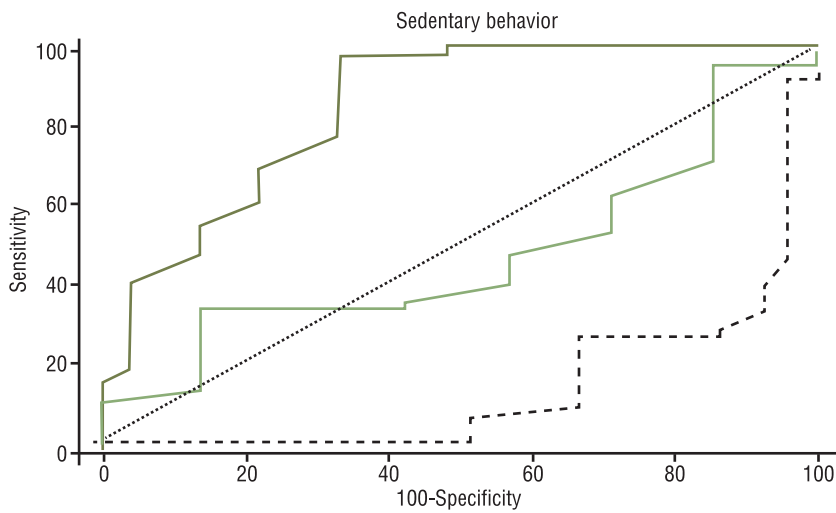


Figure 1. Area under the ROC curve between sedentary behavior and functional disability (IADL) in females and males, Ibicuí-BA, 2014.

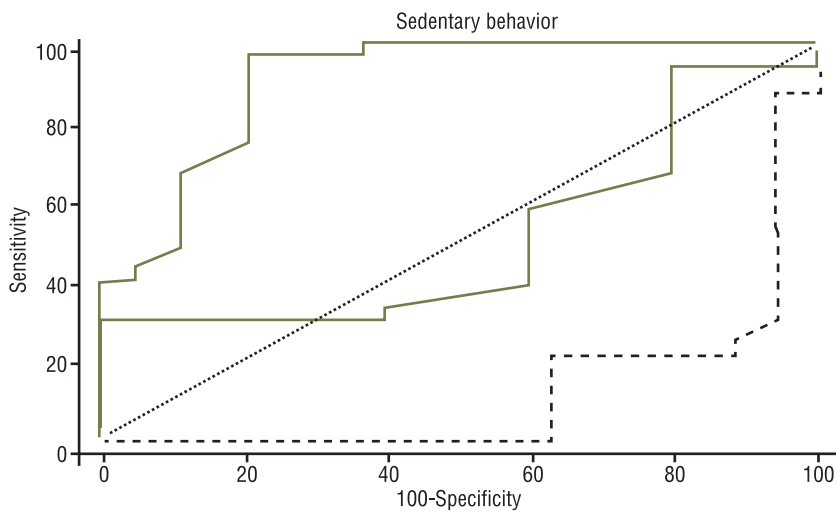


Figure 2. Area under the ROC curve between sedentary behavior and functional disability (IADL) in females. Ibicuí- BA, 2014.

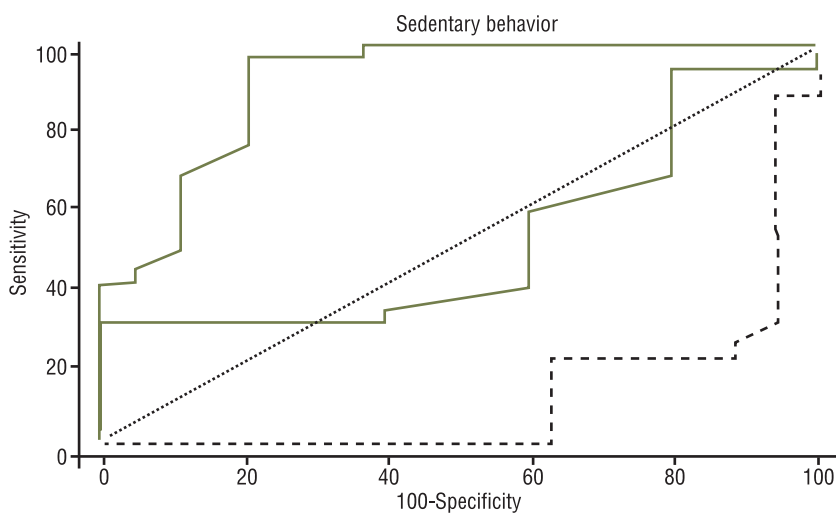


Figure 3. Area under the ROC curve between time spent sitting and functional disability (IADL) in males. Ibicuí- BA, 2014

For men, the cutoff point for SB time to discriminate FD was 330 minutes / day or more. Among women, the time of 270 min / day or more in SB was the cutoff point that best discriminated FD (Table 2).

Table 2. Cutoff points of time spent sitting as a discriminator of functional disability in older adults, Ibicuí-BA, 2014.

	Cutoff point	Sensitivity(%)	Specificity (%)
General	>360	46.7	42.9
Male	>330	75.0	53.7
Female	>270	57.4	40.0

DISCUSSION

The aim of this study was to determine the predictive power of SB and to establish its cutoff points as discriminators of functional disability in the elderly. Through the results, the values that best present a balance between sensitivity and specificity to discriminate functional disability were identified. The results showed that the predictive capacity of sedentary behavior to discriminate FD is greater among the men.

Studies that assess the discriminatory power of sedentary behavior in relation to FD in the elderly are still incipient. However, the risks and physiological implications of exposure to SB for long periods, in relation of different health outcomes and their relation with high mortality rate^{12,19} are already well established in literature.

The increase in time spent on SB appears to increase throughout life and reach high levels among the senile population. It is estimated that older adults remain about 65% to 80% of their time in sedentary behavior²⁰. This high expenditure on these activities increases the propensity to functional decline, consequently increasing their vulnerability to falls and fracture²¹.

In addition, increased time spent in sedentary activities increases the vulnerability of this population, especially the risk of dependence, since the high time spent in activities in sitting or lying position directly interferes in the work of large muscles, responsible for the maintenance of orthostasis, thus, the lack of stimulation and use of these muscles²² leads to the decrease of muscular strength and, consequently, functional disability¹⁴.

The present study identified that the predictive capacity of sedentary behavior was higher in men than in women. A longitudinal study conducted with older adults²³ showed that men with decreased metabolic expenditure or increased exposure to SB had higher probability of developing functional limitations, mainly related to the instrumental activities of the daily living. This may be due to the deleterious effects of long periods of exposure to SB during life. In this sense, social roles, occupation, leisure and commuting can determine the times, which increase the likelihood of developing FD²⁴.

On the other hand, screening actions and attempts to reduce the time spent in sedentary lifelong activities can be one of the important preventive actions to promote independence and quality of life, delaying functional

decline and allowing greater autonomy for this population²⁵.

The measurement of sedentary behavior through self-reports is among the limitations of this study, which may lead to information and memory bias. On the other hand, the study evaluated a high contingent of older adults in a region characterized by low education and income levels and insufficient access to health services, where information on the repercussions of behavioral risk factors on health is scarce. In this sense, the findings of the present study showed that sedentary behavior presents a reasonable discriminatory power for functional disability, indicating specific cutoff points for both sexes, adding useful information for health professionals.

CONCLUSIONS

SB has a reasonable discriminatory power for functional disability, with better scores among men. The cutoff points of > 270 minutes for women and > 330 minutes for men are those that present better balance between specificity and sensitivity. Further studies on this relationship should be carried out in order to offer more inputs to promote health in the elderly.

COMPLIANCE WITH ETHICAL STANDARDS

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Ethical approval

Ethical approval was obtained from the local Human Research Ethics Committee – State University of “Sudoeste da Bahia” through protocol (No. 22969013.0.0000.0055), in accordance with standards set by the Declaration of Helsinki.

Conflict of interest statement

The authors have no conflict of interests to declare.

Author Contributions

Conceived and designed the experiments: SVR. Performed the experiments: TLB, KNL, SVR. Analyzed data: TLB, KNL, SVR. Contributed with reagents/materials/analysis tools: TLB, KNL, SVR. Wrote the paper: TLB, KNL, SVR.

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