



Original Research Article

## Sedentary Behavior in Brazilian Adults: A Population Based Study

Meirele Rodrigues Inácio da Silva<sup>1</sup>, Giana Zarbato Longo<sup>1</sup>, Paulo Roberto dos Santos Amorim<sup>2</sup>, Patrícia Feliciano Pereira<sup>1</sup>, Fernanda Karina dos Santos<sup>2</sup>, Danielle Cristina Guimarães da Silva<sup>1</sup>, Wellington Segheto<sup>1</sup>, Andréia Queiroz Ribeiro<sup>1</sup>

<sup>1</sup>Nutrition and Health Department, Federal University of Viçosa, Minas Gerais, Brazil.

<sup>2</sup>Physical Education and Sports Department, Federal University of Viçosa, Minas Gerais, Brazil.

Corresponding Author: Meirele Rodrigues Inácio da Silva

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### ABSTRACT

**Introduction:** The alarming increase of sedentary behavior (SB) in recent years, mainly by the increasing screen time, emerges as an important public health problem in different population groups.

**Objectives:** this study aimed to identify the distribution of sociodemographic, behavioral and health knowledge for time in SB in adults.

**Materials and Methods:** This is a cross-sectional study, with sampling by conglomerates. 970 adults were evaluated, aged 20-59 years, residents in Viçosa, MG. Sociodemographic and behavioral variables and the SB were evaluated through a structured interview.

**Results:** Participants spent, in average, 329 min/day sitting (CI 95 % 317.61-340.26) and 147 min/day watching TV (CI 95 % 140.07-153.41). The younger age, being student, living without partner, meeting the physical activity recommendations, having higher schooling and higher socioeconomic level, having meals in front of TV and presenting a greater caloric consumption were identified as factors related to the "sitting time". Among the factors possibly related to the "TV time", working, socioeconomic level C, living with partner, knowing the physical activity recommendations and the relationship between SB and cardiovascular disease, having meals in front of TV and higher caloric consumption can be listed.

**Conclusions:** Knowing how traits are distributed according to the time in sedentary behavior, helps in planning effective actions to reduce physical inactivity. It is recommended that sedentary behavior be considered independently of the level of physical activity form in planning health interventions.

**Keywords:** Sedentary behavior, lifestyle, health.

### INTRODUCTION

The technological development and automation, associated with modern life amenities, characterized by the increasing reduction of physical effort needs, provide an environment with less energy expenditure, <sup>(1-3)</sup> triggering behavioral changes such as the reduced physical activity and the increased sedentary lifestyle in daily life. This scenario has led to an increase, in recent years, in the interest to investigate the sedentary behavior dynamics

and its effects in different aspects of daily life. <sup>(4,5)</sup>

Sedentary behavior (SB) refers to the adoption of positions that involve low energy expenditure (1.0-1.5 METs), such as being sat or reclined, during vigil <sup>(6)</sup> and covers a set of different activities, such as watching TV, sitting at work or study, <sup>(7,8)</sup> with complex and multifactorial origin, involving biological, behavioral, sociocultural and environmental determinants. <sup>(6)</sup>

It is estimated that, on average, adults spend 50-60% of their vigil time in SB <sup>(3,9-11)</sup> and this behavior has been observed in different countries with different social, economic and cultural characteristics. <sup>(12)</sup> In the Brazilian context, it has been reported that adults spend between 180 <sup>(13)</sup> and 345 <sup>(7)</sup> minutes a day in SB.

The exponential increase of SB in recent years, mainly represented by the increased screen time, <sup>(3,9,10)</sup> is emerging as an major public health problem, given its association with adverse effects on the health-disease process, in different age groups, aggravated by physical activity levels below the recommended. <sup>(3)</sup> In this context, studies evidence the association between SB and an increase in the prevalence of chronic diseases and non-transmissible diseases, especially the cardiometabolic diseases. <sup>(14,15)</sup> Additionally, the SB, combined with low physical activity levels, has been considered the greatest global risk for mortality from all causes, <sup>(11,16)</sup> being responsible for, approximately, 3.2 million deaths in the world and 32.1 million of physically disabled per year. <sup>(16)</sup>

Studies developed in Brazil, on SB, usually involve samples from southern Brazil, with few studies being conducted in small cities, <sup>(17)</sup> and there are few studies that have investigated about the characteristics of the most exposed to SB groups. <sup>(7)</sup> In this sense, identifying those most individuals most exposed to SB, seems to be relevant for developing and directing public health intervention strategies in as the social, economic and cultural differences are important between the various Brazilian subpopulations, so that the effectiveness of the actions of promoting physical activity and combat the sedentary lifestyle is influenced by these different reality. <sup>(18)</sup> In view of the exposed, the purpose of this study was to describe the distribution of sociodemographic and behavioral factors and the knowledge in health, according to time in SB.

## MATERIALS AND METHODS

This is a population-based cross-sectional study, conducted in Viçosa, which data collection occurred in the period from 2012 to 2014. Viçosa is a university city, located in state of Minas Gerais, with total population is 72,220 inhabitants. <sup>(19)</sup> The study reference population consists of adults from 20 to 59 years, residents in the urban area, which corresponded, at the time of the study, about 60% of the total population. <sup>(19)</sup> This study is inserted in an extensive health survey named “Study of Health and Nutrition”, <sup>(20)</sup> with different investigated outcomes.

### Sampling Plan

For calculating the sampling size, the confidence level of 95%, SB prevalence of 50%, sampling error of 4.0% and study design effect of 1.4. Were considered 10% was added to compensate losses and 10% for controlling confusion factors, totaling 1008 individuals to be evaluated.

Sampling was performed by conglomerates, in two stages. First, 30 of the 99 census sectors were raffled through simple casual sampling, without replacement. Then, a block was raffled and, in it, a corner was drawn, starting the fieldwork in a clockwise direction.

Institutionalized individuals, those with a physical or mental impairment (pregnant women, amputees, bedridden, bearers of plastered body parts) and those who did not have conditions to remain in adequate position for obtaining the anthropometric measurements were not included. The losses corresponded to non-located residents of raffled houses visited at least four times, including visits on weekends and at night, or refusal to participate, and those that were not present for the research second stage.

The data collection was primarily performed at the home by two trained interviewers and, later, in the Laboratory of Population Groups of UFV for a dietary and physical activity level survey. For standardizing the measurements, training sections and a pre-test of the questionnaire

were performed, as well as the interviewers' calibration, in 30 adults aged from 20 to 59 years. The pilot study was conducted with 87 people in one of the raffled census sectors, but not included in the study. The data collection quality control was performed on 10% of the sample by telephone interview. <sup>(20)</sup>

### Study variables

The SB was evaluated in two domains, time watching TV and time sitting daily - daily average in a typical week, through questions about the time spent sitting in a typical week day in different contexts: Workplace or school/university; time watching TV/videos or using a computer at home.

Sociodemographic, behavioral and health knowledge variables were evaluated on the relation between SB and diseases. Sociodemographic variables comprised age (completed years); schooling (completed years); gender (male and female); occupation type (worker; student; worker and student; none); socioeconomic level, <sup>(21)</sup> classifying in A/B (high), C (intermediate) and D/E (low), <sup>(21)</sup> and marital status (with partner and without partner).

Behavioral variables comprised the physical activity level (PAL) and usual food consumption. The PAL was determined by the full version of the *International Physical Activity Questionnaire* (IPAQ). This questionnaire, including 27 questions related to physical activity, allows estimating the weekly time spent on physical activities in 4 different domains of daily life: work, transport, household tasks and leisure. <sup>(22)</sup> For this study, the PAL was not considered in the work and household tasks domains, according to the guidelines of the application report of IPAQ in Brazil. <sup>(23)</sup> The usual intake (kcal/day) was evaluated by the frequency and size of food portion, in a day of the week, through the analysis of the Food Consumption Frequency Questionnaire (QFCA), quantitative, developed from the application of 83 reminders of 24 hours in the pilot phase of this study <sup>(20)</sup> and included

questions relating to the customary consumption of 95 food items during a period of one year. The habit of having meals in front of TV (yes/no) was also evaluated.

The knowledge level on the minimum recommendation of moderate physical activity (frequency and duration) for health benefits was also evaluated. For that, a variable was defined, based on the responses provided by individuals, by multiplying the frequency by duration, having the responses classified as satisfactory (product  $\geq 150$ min/week) or unsatisfactory ( $< 150$ min/week). In addition, the awareness of the relationship between SB and cardiovascular disease was questioned, which responses were classified into satisfactory (knows the relationship) and unsatisfactory (does not know the relationship).

### Data analysis

The data was double entered into *Epidata* software, version 3.01 and the consistency was checked. All analysis were adjusted by the sampling delimitation effect and weighted by the frequency per gender, schooling and age, and the weights were determined by the ration between the proportions of these variables in the city population, obtained in the Brazilian Institute of Geography and Statistics <sup>(19)</sup> and in the sample. The distribution of interest variables was evaluated in time quartiles of SB, by means of ratio and average estimates with its respective 95% confidence intervals (95 % CI). The statistical significance was evaluated by 95% CI, of averages and interest variables ratios within each quartile.

All analyses were performed within the set of *SURVEY* commands in the *Stata software*, version 13.0.

### Ethical aspects

The study protocol was approved by the Ethics Committee in Researches with Human Beings of Universidade Federal de Viçosa (No. 008/2012/CEPH).

## RESULTS

308 families were visited in the 30

census sectors raffled. 970 individuals participated in the two stages, and this was the sample final size. The individuals' average age in this study was 37.56 ± 1.03 years, the average schooling was 10.94 ± 0.68 years and 50.06% were male.

The ratio of those that met the recommendations for physical activities

(150 min/week or more) was 29.69% (CI 95 % 26.89-32.65). On average, individuals were practicing 145min/week (CI 95 % 114.31-174.93) of moderate to vigorous physical activity and spending 329 min/day (CI 95% 317.61-340.26) sitting, from which 147min (CI 95% 140.07-153.41) were spent watching TV.

**Table 1: Distribution of socioeconomic variables by quartile time in different types of sedentary behavior in adults, Viçosa-MG, 2014 (n = 970).**

		Sedentary Behavior, minutes per day			
Characteristics	Type of SB*	1 <sup>st</sup> Quartile	2 <sup>nd</sup> Quartile	3 <sup>rd</sup> Quartile	4 <sup>th</sup> Quartile
		Mean (CI)	Mean (CI)	Mean (CI)	Mean (CI)
Age (years)	Sitting	44.96 (43.36-46.57) <sup>a</sup>	40.07 (37.82-42.33) <sup>b</sup>	33.03 (30.74-35.32) <sup>c</sup>	32.58 (29.93-35.24) <sup>c</sup>
	Watch TV	38.88 (35.11-42.65)	35.85 (32.36- 39.33)	38.39 (36.47- 40.31)	36.72 (34.56-38.88)
Schooling (years)	Sitting	7.27 (6.17-8.36) <sup>a</sup>	9.86 (8.32-11.40) <sup>a</sup>	13.14 (12.02-14.25) <sup>b</sup>	13.37 (12.19-14.55) <sup>b</sup>
	Watch TV	10.19 (8.24-12.15)	11.07 (9.04-13.09)	11.26 (9.70-12.81)	11.18 (10.08-12.29)
Gender		% (CI)	% (CI)	% (CI)	% (CI)
	Male (50.06%)	Sitting	16.01 (10.31-24.02)	26.43 (20.92-32.80)	29.04 (22.63-36.40)
Female (49.94%)	Watch TV	22.10 (18.19-26.57) <sup>a</sup>	20.84 (15.95-26.77) <sup>a</sup>	30.92 (27.07-35.05) <sup>b</sup>	26.14 (20.08-33.27)
	Sitting	28.32 (21.56-36.24)	29.14 (23.32-35.73)	21.56 (17.67-26.03)	20.97 (16.54-26.22)
Type occupation	Watch TV	26.46 (22.48-30.87)	19.93 (15.87-24.72) <sup>a</sup>	29.71 (25.02-34.87) <sup>b</sup>	23.90 (20.58-27.57)
	Worker (47.47%)	Sitting	28.61 (22.33-35.85)	34.28 (27.57-41.69) <sup>a</sup>	20.53 (16.55-25.17) <sup>b</sup>
Student (31.99%)	Watch TV	22.79 (19.05-27.02)	20.25 (15.92-25.40) <sup>a</sup>	31.39 (25.65-37.76) <sup>b</sup>	25.57(19.87-32.25)
	Sitting	01.06 (0.38-2.90) <sup>a</sup>	10.71 (7.87-14.41) <sup>b</sup>	40.13 (32.62-48.14) <sup>c</sup>	48.10 (40.92-55.36) <sup>c</sup>
Worker and Student (10.53%)	Watch TV	26.15 (19.04-34.77)	25.23 (19.88-31.45)	27.17 (22.00-33.04)	21.45 (17.24-26.37)
	Sitting	9.38 (3.48-22.93) <sup>a</sup>	24.80 (15.91-36.50)	32.34 (22.73-43.71)	33.49 (23.49-45.23) <sup>b</sup>
None (10.01%)	Watch TV	25.39 (17.43-35.43)	23.23 (15.82-32.77)	28.50 (18.59-41.03)	22.88 (14.29-34.55)
	Sitting	41.03 (28.46-54.89) <sup>a</sup>	30.77 (20.45-43.46)	15.12 (9.72-22.75) <sup>b</sup>	13.08 (6.28-25.27) <sup>b</sup>
Level socioeconomic	Watch TV	27.66 (17.45-40.89) <sup>a</sup>	8.36 (3.86-17.16) <sup>b</sup>	32.66 (21.15-46.72) <sup>a</sup>	31.32 (23.24-40.71) <sup>a</sup>
	A e B (26.61%)	Sitting	11.13 (7.94-15.39) <sup>a</sup>	30.19 (22.80-38.77) <sup>b</sup>	29.33 (24.87-34.23) <sup>b</sup>
C (65.99%)	Watch TV	22.34 (16.70-29.21)	21.42 (15.31-29.15)	31.33 (26.06-37.12)	24.91 (19.14-31.73)
	Sitting	23.43(16.93-31.47)	28.79 (23.14-35.20)	25.22 (20.33-30.84)	22.55 (17.63-28.38)
D e E (7.4%)	Watch TV	22.48 (18.67-26.81) <sup>a</sup>	20.42 (17.40-23.80) <sup>a</sup>	30.86 (26.92-35.11) <sup>b</sup>	26.24 (21.23-31.96)
	Sitting	51.89 (30.65-72.48) <sup>a</sup>	9.13 (4.52-17.57) <sup>b</sup>	10.16 (4.19-22.66) <sup>b</sup>	28.81 (15.24-47.67)
Marital status	Watch TV	47.73 (32.28-63.61)	15.52 (7.19-30.35)	22.04 (13.87-33.17)	14.72 (4.92-36.52)
	Without Partner (48.01%)	Sitting	15.74 (9.69-24.55) <sup>a</sup>	20.04 (16.13-24.63) <sup>a</sup>	30.94 (26.32-35.98) <sup>b</sup>
With Partner (51.99%)	Watch TV	26.76 (21.44-32.85)	20.72 (16.53-25.64)	29.41 (25.25-33.96)	23.11 (18.82-28.04)
	Sitting	27.97 (22.66-33.98) <sup>ab</sup>	34.87 (28.90-41.36) <sup>a</sup>	20.17 (15.79-25.42) <sup>bc</sup>	16.98 (12.96-21.94) <sup>c</sup>
	Watch TV	21.97 (18.43-25.98) <sup>a</sup>	20.08 (15.51-25.60) <sup>a</sup>	31.15 (26.41-36.33) <sup>b</sup>	26.79 (19.59-35.47)

CI: confidence interval; \*Sitting: average of all the time sitting in a day all week: work, transportation, watching TV, computer use, reading; Watch TV: average of all the time watching TV in a day all week; Sitting week: average of all the time sitting in a day between Monday and Friday; Minutes in sedentary behavior 1<sup>st</sup> Quartile: sitting time (0|-180); TV time ( 0|-77.14), 2<sup>nd</sup> Quartile : sitting time (180|-308.57); TV time ( 77.14|-120 ), 3<sup>rd</sup> Quartile: sitting time (308.57|-445.71); TV time ( 120|-200 ); 4<sup>th</sup> Quartile: sitting time (445.71|-985.71); TV time (>200). Statistical difference: values in bold and letters different.

Table 1 shows the sociodemographic variables distribution according to the time quartiles in SB. Considering the average values, younger adults were the most sitting time. Similarly, a positive relation was observed between the SB quartiles and the schooling level, where adults with higher education were in the greater time quartiles of time sitting. Greater ratios of men and women were in the 3<sup>rd</sup> quartile of TV time.

Regarding the occupation type, a higher ratio of those who reported working in the 2<sup>nd</sup> quartile of the time sitting was

noted, while for the TV time, those who reported working were distributed, in greater ratio, in the 3<sup>rd</sup> quartile. Among those who reported “study” the greater ratio was observed in the 3<sup>rd</sup> and 4<sup>th</sup> quartiles for time sitting, and those who reported “study and work”, in the 4<sup>th</sup> quartile. Those who reported no occupation, greater distribution in the 1<sup>st</sup> quartile of time sitting and lesser distribution in the 2<sup>nd</sup> quartile for TV time.

Considering the socioeconomic level, the two extreme levels (A/B, D/E), opposite behaviors are observed. Individuals

with higher socioeconomic level (A/B) the greater ratio was observed in quartiles 1, 2 and 3 of time sitting. On the other hand, individuals with lower socioeconomic level (D/E) were more distributed in the 1<sup>st</sup> quartile, suggesting that they tend to be less sedentary. Most of the intermediary level stayed in the 3<sup>rd</sup> quartile of time TV (Table 1).

Among the individuals who declared as “without partners”, a greater frequency of cases was observed, in general, in the 3<sup>rd</sup> and 4<sup>th</sup> quartiles for the time sitting; however, those who declared as “with partner”, showed distinct distributions, where they trend to spend less time sitting, in quartile 2 and more time watching TV in the 3<sup>rd</sup> quartile.

**Table 2: Distribution of behavioral variables and health knowledge by quartile of time in different types of sedentary behavior in adults, Viçosa-MG, 2014 (n = 965).**

Characteristics	Type of SB*	Sedentary Behavior, minutes per day			
		1 <sup>st</sup> Quartile	2 <sup>nd</sup> Quartile	3 <sup>rd</sup> Quartile	4 <sup>th</sup> Quartile
		Mean (CI) <sup>a</sup>	Mean (CI)	Mean (CI)	Mean (CI)
PAL total (min/week)	Sitting	74.15 (42.75-105.55) <sup>a</sup>	166.75 (108.81-224.68) <sup>b</sup>	162.49 (115.23-209.76) <sup>b</sup>	165.24 (118.76-211.72)
	Watch TV	129.58 (83.15-176.01)	133.99 (83.88-184.09)	158.26 (110.24-206.28)	152.00 (110.02-193.98)
PAL Transport (min/week)	Sitting	19.26 (-1.26-39.78)	54.83 (2.30-107.36)	21.85 (11.26-32.44)	22.81 (13.57-32.06)
	Watch TV	35.66 (6.85-64.47)	24.10 (9.59-38.61)	41.29 (9.07-73.50)	18.31 (9.03-27.60)
PAL leisure (min/week)	Sitting	54.89 (25.58-84.19) <sup>a</sup>	96.65 (61.53-131.77)	140.65 (90.80-167.83) <sup>b</sup>	129.31 (90.80-167.83)
	Watch TV	87.72 (49.97-125.48)	109.89 (62.90-156.87)	114.93 (69.47-160.39)	112.14 (77.07-147.20)
Energy intake (kcal/day)	Sitting	2418.16 (2257.85-2578.48) <sup>a</sup>	2742.73 (2531.85-2953.62)	2805.18 (2622.86-2987.50) <sup>b</sup>	2720.76 (2599.79-2841.73) <sup>b</sup>
	Watch TV	2606.72 (2400.18-2813.26)	2676.91 (2441.51-2912.31)	2570.88 (2456.64-2685.11) <sup>a</sup>	2914.70 (2759.44-3069.95) <sup>b</sup>
Know the PA		% (CI)	% (CI)	% (CI)	% (CI)
Recommendation (71.59%)	Sitting	23.79 (17.50-31.49)	26.90 (22.70-31.55)	25.82 (20.94-31.37)	23.50 (18.86-28.87)
	Watch TV	23.79 (19.92-28.16)	19.23 (15.51-23.58) <sup>a</sup>	31.99 (27.98-36.28) <sup>b</sup>	24.99 (20.56-30.02)
Know the relationship	Sitting	20.78 (15.8-26.84)	27.79 (23.96-31.96)	25.94 (21.96-30.36)	25.49 (21.19-30.34)
	Watch TV	24.21 (20.96-27.79)	20.61 (17.48-24.15) <sup>a</sup>	29.47 (26.47-32.65) <sup>b</sup>	25.71 (21.57-30.34)
Having meals in front of TV (62.20%)	Sitting	16.39 (10.99-23.74) <sup>a</sup>	25.35 (20.68-30.67)	28.38 (23.65-33.63)	29.88 (25.28-34.92) <sup>b</sup>
	Watch TV	15.07 (10.96-20.36) <sup>a</sup>	19.79 (16.56-23.48) <sup>a</sup>	32.72 (29.09-36.57) <sup>b</sup>	32.42 (27.64-37.60) <sup>b</sup>

CI: confidence interval; PAL: physical activity level; PA: physical activity; CVD: cardiovascular disease; <sup>a</sup>Sitting: average of all the time sitting in a day all week: work, transportation, watching TV, computer use, reading; Watch TV: average of all the time watching TV in a day all week; <sup>b</sup>Sitting week: average of all the time sitting in a day between Monday and Friday; Minutes in sedentary behavior 1<sup>st</sup> Quartile: sitting time (0-180); TV time (0-77.14), 2<sup>nd</sup> Quartile: sitting time (180-308.57); TV time (77.14-120); 3<sup>rd</sup> Quartile: sitting time (308.57-445.71); TV time (120-200); 4<sup>th</sup> Quartile: sitting time (445.71-985.71); TV time (>200). Statistical difference: values in bold and letters different.

In Table 2, the distribution of behavior variables and health knowledge are presented by time quartiles in SB. The average total PAL was lower among individuals of the 1<sup>st</sup> quartile of time sitting, while, overall, the greater averages were observed among individuals of the 2<sup>nd</sup> and 3<sup>rd</sup> quartiles. When analyzing the physical activity domains, differences were observed only on the average to the leisure PAL in time sitting, with greater averages of physical activity observed in the 3<sup>rd</sup> and 4<sup>th</sup> quartiles.

As regards knowledge of individuals about the physical activity recommendations or the relationship between sedentary lifestyle and cardiovascular disease, a greater ratio of individuals with knowledge of both topics was observed in the 3<sup>rd</sup> quartile of TV time. Finally, regarding the usual intake, individuals of 3<sup>rd</sup> and 4<sup>th</sup> quartiles of time sitting and 4<sup>th</sup> quartile of TV time, showed greater averages of caloric

intake. Similarly, individuals with habits of having meals in front of TV trended to have higher values of SB, 4<sup>th</sup> quartile for time sitting and 3<sup>rd</sup> and 4<sup>th</sup> quartiles for TV time (Table 2).

## DISCUSSION

This study had the purpose of presenting the distribution of different factors related to SB among adults. As far as we know, this is one of the first population-based studies in different region of southern Brazil to present a description of the factors related to sedentary behavior.

A recent literature review reported that most of the studies developed on SB use samples from European countries or other developed countries, highlighting the lack of information from low and middle-income countries. (18) Although the studies in high-income countries may suggest directions in terms of associations, the extrapolation of these results to countries

like Brazil must be performed with some caution, since the environmental, social and cultural factors have a great influence on SB<sup>(7)</sup> and are different among countries.

In this study, it was observed that older adults were in the sitting times lower quartiles. These results corroborate with the results of another study in adults in the South of Brazil, where the authors reported a lower average of sitting time among the elderly.<sup>(7)</sup> Similarly, to this study, this investigation was conducted in a university city, characterized by a great number of young adults that spend part of the time in vigil sitting to meet the study demands, as an academic characteristic, which, in part, can justify the results found, given that this difference of age group was only significant for the sitting time. It is also added that, in this study, among those that reported study or study/work they showed a higher distribution frequency in the 3<sup>rd</sup> and/or 4<sup>th</sup> in the sitting time, reinforcing the hypothesis that academic life can be a relevant factor for determining the SB in these individuals. Despite these Brazilian studies show a trend of younger adults have higher time sitting, and other international studies also,<sup>(12,24,25)</sup> some authors have reported finding a positive linear relationship between age and SB time in developed countries,<sup>(26)</sup> suggesting that age is positively associated to CS.<sup>(18)</sup> These results seem to demonstrate a difference between the distribution of age at time sitting between low and middle-income countries compared to developed countries.

Regarding the socioeconomic indicators, these seem to have a positive relation with the sitting time, and individuals with better socioeconomic conditions were in the most sitting time, while their lower socioeconomic level peers were in the lower quartiles (less sedentary) in both, sitting time and TV time. These results match with the results reported by other studies, such as in the South of Brazil,<sup>(7)</sup> in a study that evaluated 20 countries with different social, economic and cultural characteristics<sup>(12)</sup> as well as in regions of

developed countries, such as Scotland,<sup>(26)</sup> Singapore,<sup>(24)</sup> Ireland,<sup>(25)</sup> and also the conclusions reported by Chastin et al<sup>(18)</sup> in a systematic review that had the purpose of evaluating the SB determinants. This appears to be a standard SB most of the world. The possible explanation for these findings may be related to differences in the occupations and task types in which individuals of different socioeconomic levels are involved with. Generally, at the highest levels, works are of executive or intellectual type, demanding more sitting time for performing activities such as meetings, lectures, among others. At the same time, the financial return for these occupations trends to be higher.<sup>(1,7)</sup> On the other hand, individuals of lower socioeconomic level trend to engage in occupations with greater demand of physical effort.<sup>(1)</sup>

A recent review of Chastin et al,<sup>(18)</sup> suggests the schooling as a possible cultural factor for determining the SB, since the inverse association was observed in European population studies, opposite to the observed in studies in Asia. Thus in low and middle income countries tend to have higher education distributed in more time in SB, unlike developed countries, as a study with a representative sample of adults in Scotland, it was found that those with less schooling and living in needy neighborhoods, spent more time watching TV or other screens.<sup>(24)</sup> The authors suggest that those that spend much of the day in manual tasks at work compensate it during leisure in SB and due to the financial deprivation factor; the most affordable form of entertainment becomes that based on screen, such as watching TV.<sup>(7)</sup> In our study, schooling was higher in longer times sitting and no difference was observed between screen time.

The social pattern of SB is complex<sup>(7)</sup> and the relation observed in this study should be interpreted with caution. Results show that different social groups, from different regions or countries for the development require differentiated

interventions of SB prevention. For example, among those with higher socioeconomic level, strategies could include the promotion of active pauses in the sitting work and stimulus for using active transportation. For those in lower socioeconomic levels, actions are needed to increase access to spaces that promote a more active time and strategies that promote the involvement in leisure physical activities. <sup>(7)</sup>

The existence of a gender dichotomy for the SB does not seem to be consensual. <sup>(12,18)</sup> The time sitting in adults of 20 countries was investigated, and no association between gender and SB was observed, and similar results were observed in an American sample <sup>(11)</sup> and in Singapore. <sup>(24)</sup> On the other hand, a study in Brazil <sup>(7)</sup> and Scotland <sup>(26)</sup> observed that men spent more time in SB. These studies suggest that the region of origin of the study do not interfere in the distribution pattern of sex by sitting time. Evidences suggest that men and women engage in different SBs. For example, among the young, men trend to spend more time in screen SB (such as computer and games), <sup>(24)</sup> while women spend more time on social activities (chatting with friends/on the phone) and/or studying. <sup>(27)</sup> In our study, both genders are distributed in greater ratio in the 3<sup>rd</sup> quartile of TV time.

Regarding the marital status, it is noticed, also, an inconsistency between the results of different studies from different regions, as stated in the review of Chastin et al. <sup>(18)</sup> In our study, the distribution varied depending on the SB type. For example, among those who declared that live without partner, a higher ratio was observed in greater times in SB (3<sup>rd</sup> and 4<sup>th</sup>) for the sitting type. This result is opposite to the observed in the study of Win et al <sup>(24)</sup> in Singapore, when a greater time sitting was observed among those who declared living with partner.

In this study, those with less sitting time (1<sup>st</sup> quartile), also showed lower averages of total PAL and in leisure. These

results match with evidences that both behaviors are distinct constructs and can independently coexist. <sup>(3,9,28)</sup> However, it is not known, still, how these phenotypes act increasing or reducing the effect of one or another on health risk indicators. <sup>(3,9,14,28)</sup>

A worrisome result in this study refers to the relationship between SB and eating habits. It was noted that groups with higher average values of caloric intake and those who were having meals in front of TV were more sedentary, regardless of the SB type. This scenario raises the hypothesis of a relationship between the consumption of food in front of TV and the SB. This hypothesis is corroborated by other studies that report that SB, mainly watching TV, can promote excess power consumption and ingestion of nutritionally poor foods, <sup>(4,28)</sup> favoring the development of obesity that is associated with several deleterious effects to health. <sup>(29)</sup> However, the mechanism of the “TV-eating-overweight” ratio is not well defined yet; may studies have shown an association between the TV time and various adiposity indicators, <sup>(10,27)</sup> even when other SB domains coexist. <sup>(10,27)</sup> Other authors even suggest that obesity may be a determining factor of SB, rather than a consequence of the increased time in SB. <sup>(18)</sup>

These results are relevant in terms of public health, since an exponential increase of the time spent in SB has been observed, especially in the time watching TV. <sup>(3,9,10)</sup> In the Brazilian context, a study with a representative sample across the country reported that the frequency of individuals that watch TV for 3 hours or more/day was 35.7%, <sup>(30)</sup> and another identified that the frequency of young adults that reported watching TV for more than 2 hours per day was 79.8%. <sup>(31)</sup> In our study, individuals spent an average 17 hours/week watching TV. Moreover, in the USA, it is estimated that an American adult spends, on average, over 35 hours/week watching TV and over 10 hours/week in other screen types, and the screen time is the most common SB. <sup>(28)</sup> it seems that in most developed countries spend more time watching TV.

In this study, individuals aware of the recommendations for physical activity or about the relationship between sedentary lifestyle and cardiovascular disease did not show, necessarily, the lowest times in SB. This result corroborates other studies that suggest that, despite the broad disclosure of evidences that associate the SB to various negative outcomes in health, the modern lifestyle induces to spend a great time in SB. (3,9,10) In the light of this result, it is evidenced that strategies to fight SB should include actions beyond the provision of information about the harmful effects of SB. (7) These should come from an approach that comprises the effects of the contexts in which individuals live on the SB. (32) Many factors influence the adoption of sedentary lifestyle. For example, in addition to the technology and economic incentives that discourage the human movement, (1) other factors can be crucial, such as the knowledge level about health, access to professional guidance, financial restrictions, service costs and spaces availability for practicing physical activities, urban violence, exhausting working hours, functions accumulation (work, study, family, social groups), traffic, among others. (33)

It is highlighted that most of the factors related to SB identified in this study are of modifiable nature, which draws attention to the importance of public policies to reduce social inequalities and, consequently the inequalities in health. Additionally, effective policies for promoting healthy eating should be in harmony with policies to fight the sedentary lifestyle.

However, a limitation is related to the instrument type used for evaluating the SB, because self-referred measures of time in SB, despite being easy to manage, having a low cost and not changing the behavior, they can notoriously underestimate the SB and, in some cases, may impair the data validity. (18) Objective measures, such as inclinometers and accelerometers, are more reliable; however these do not provide

contextual information with qualitative approach of SB. Therefore, this study presents an important contribution to a qualitative and contextualized analysis of the distribution factors for time in sedentary behavior.

## CONCLUSION

This work suggests the existence of a relationship between the SB and sociodemographic, behavioral and health knowledge characteristics in adults. Given that SB is a complex phenotype, some characteristics appear to have a distribution pattern in different regions of the world, while others are distributed according to socioeconomic development.

The younger age, being student, living without partner, meeting the physical activity recommendations, having higher schooling and higher socioeconomic level, having meals in front of TV and presenting a greater caloric consumption were identified as factors related to the "sitting time". Among the factors possibly related to the "TV time", working, socioeconomic level C, living with partner, knowing the physical activity recommendations and the relationship between SB and cardiovascular disease, having meals in front of TV and higher caloric consumption can be listed.

It is believed that the observed results are relevant in the scope of public policies for promoting the health, in order to subsidize the development of prevention and reduction strategies of SB, with emphasis on various related factors, especially those that can be modified. The importance of considering the PAL and the SB as distinct constructs is highlighted, both in researches and in the planning of health interventions, aiming effective from the perspective of social causality and the population groups' characteristics in the contexts that they are involved.

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