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Prevalence and factors associated with sedentary behavior in adolescents

ABSTRACT

OBJECTIVE: To analyze the prevalence of sedentary behavior and associated factors in adolescents.

METHODS: A cross-sectional study with adolescents aged 10 to 17 years, of both sexes, belonging to a 1994-1999 birth cohort in the city of Cuiabá, MT, Central Western Brazil. Data were collected using a questionnaire containing sociodemographic, economic, lifestyle and anthropometric variables. Sedentary behavior was determined as using television and/or computer/video games for a time greater than or equal to 4 hours/day. Associations with sedentary behavior were evaluated using body mass index in childhood and adolescence and sociodemographic and behavioral variables using hierarchical logistic regression.

RESULTS: The overall prevalence of sedentary behavior was 58.1%. Of the 1,716 adolescents evaluated, 50.7% (n = 870) were male. In multivariate analysis, after adjustment for confounding factors, the variables that remained associated with sedentary behavior were: age (14 and over) (OR = 3.51, 95%CI 2.19;5.60); higher socioeconomic class (OR = 3.83, 95%CI 2.10;7.01), higher level of maternal education (OR = 1.81, 95%CI 1.09;3.01); living in the country (OR = 0.49, 95%CI 0.30;0.81); insufficient physical activity (OR = 1.25, 95%CI 1.02;1.53); experimentation with alcoholic beverages (OR = 1.34, 95%CI 1.08;1.66) and being overweight in adolescence (OR = 1.33, 95%CI 1.06;1.68).

CONCLUSIONS: The high proportion of adolescents in sedentary activities and the lack of association with being overweight in childhood, indicates the need for educational initiatives to reduce multiple risk behaviors. Encouraging physical activity in young people as a way of reducing sedentary behavior and, consequently, being overweight is fundamental.

DESCRIPTORS: Adolescent. Sedentary Lifestyle. Life Style. Socioeconomic Factors.

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INTRODUCTION

In low and medium income countries, the prevalence of being overweight in childhood and adolescence has increased, largely driven by economic growth and rapid urbanization.[14] The process of urbanization, often accompanied by increased levels of violence, can be associated with limitations to doing activities outside of the home, leading children and adolescents to substitute outdoor games and playing in the street with sedentary activities.[5] Moreover, technological advances and facilities resulting from modernization seem to favor modifications to individuals' habits, especially concerning the adoption of a sedentary lifestyle.[22]

Sedentary behavior involves low intensity activities with reduced energy expenditure, such as watching television, playing video games or using the computer.[17] This type of behavior has also been associated with other habits damaging to child and adolescent health, such as experimentation with alcohol and smoking.[20] Moreover, the habit of watching television may influence adolescents' food choices, as the majority of foods appearing in the media are of high energy density, contributing to increased obesity among adolescents.[2]

Studies have shown a strong association between increased sedentary behavior and being overweight in adolescents.[21,22] However, it is not clear whether children who are overweight in childhood have a greater chance of presenting sedentary behavior in adolescence.

Regular physical activity is one of the factors which may be inversely associated with time spent doing sedentary activities.[14] However, some authors have reported sedentary activities irrespective of doing physical activity, with a decline in one not encouraging an increased level of the other.[7,12]

Thus, the aim of this study was to analyze the prevalence of factors associated with sedentary behavior in adolescents.

METHODS

Cross-sectional study with adolescents from a birth cohort born between 1994 and 1999, aged from 10 to 17 years, of both sexes, attending public and private elementary and high schools. The baseline study was conducted between August 1999 and January 2000, in health care centers around the city of Cuiabá, MT, Central Western Brazil, and 2,405 children under 5 years were assessed, as described by Gonçalves-Silva et al.[8] To conduct the current study, these children, now adolescents, were located using the EducaCenso, between 2009 and 2011, in public and private schools in Cuiabá and other cities in the interior of the state of Mato Grosso, as well as in another five Brazilian state capitals (Brasília, Sao Paulo, Rio de Janeiro, Goiânia and Campo Grande). A total of 1,716 adolescents were interviewed, representing a follow up rate of 71.4%. Details on the strategies used to find these adolescents can be found in Gonçalves-Silva et al[9] (2012).

The data for this second stage were collected using a questionnaire on sociodemographic, economic and lifestyle data, and the adolescents' weight and height were measured. The questionnaire had been previously tested with 114 adolescents randomly selected from a public and private school in Cuiabá, with the aim of correcting possible errors and to standardize the data collection instrument. The interviews and anthropometry were conducted in the schools by trained interviewers.

The anthropometric assessment was conducted according to the techniques standardized by Gordon et al[10] (1988). Height was measured twice, with a maximum variation of 0.5 cm permitted between the two measurements, with the procedure repeated if this variation was exceeded, and the mean of the two measurements was considered as the value for analysis. These measurements were taken barefoot and using light clothing, in a standing position with the head positioned respecting the Frankfurt plan.

Self-reported skin color was classified into five categories: white, black, mixed race, Asiatic and Indigenous. For data analysis purposes, Asiatic and Indigenous were grouped into the category "other" due to their low frequency. The adolescents' age was defined in years, categorized into: 10, 11, 12, 13 and ≥ 14. The 14 and over age group was formed due to the low frequency of individuals in the 15, 16 and 17 years old category.

The classification recommended by the Brazilian Association of Research Companies,[a] based on the accumulation of consumer goods in the household, living conditions, number of domestic employees and head of household's level of schooling was used to analyze the families' socioeconomic levels. The categories vary from A (the highest) to E (the lowest). Only one individual was classed as belonging to class E, thus, for purposes of data analysis, categories D and E were combined.

Parents' level of schooling was defined using the number of completed years of study, which were classified into four categories: 0 to 4, 5 to 8, 9 to 11 and 12 or more years. Among other variables, type of school (public or private) and place of residence, categorized as state capital (which included Cuiabá and Várzea Grande – a city geographically and economically integrated with

[a] Associação Brasileira de Empresas de Pesquisa. Códigos e guias: CCEB – Critério de Classificação Econômica Brasil. São Paulo: ABEP; 2008 [cited 2010 Oct 10]. Available from: http://www.abep.org/novo/Content.aspx?ContentID

Cuiabá – as well as the other five state capitals included in the study) or interior, were evaluated.

BMI in childhood (zero to five years old) and in adolescence was assessed according to sex and age, expressed as a z score on the World Health Organization (WHO) reference curve.[25,26] They were classified according to WHO recommendations,[30] with individuals with BMI/age < -2 z-scores classed as having low BMI, overweight individuals those with BMI/age between > +1 and ≤ +2 z-scores and obese individuals those with BMI/age > +2 z-scores. For the multiple analysis, individuals were classified into two categories: not overweight (low and appropriate BMI for age) and overweight (overweight and obese).

The adolescents' physical activity was assessed using questions covering travelling to school, leisure activities and school PE classes, quantified according to duration and frequency of the activity.[6] For purposes of analysis, the individuals were classified as active (those who did 300 min or more of moderate to vigorous physical activity per week) or insufficiently active (those who did less than 300 min of moderate to vigorous physical activity per week).

Regarding alcoholic drinks, adolescents who reported having ever drunk at least a mouthful of any alcoholic drink were classed as having tried alcohol. Adolescents who reported having smoked a cigarette at least once in their life were classed as having tried smoking.

To assess eating patterns, a score adapted from Estima et al[7] (2009) was calculated, in which adolescents scored points according to the frequency with which they consumed breakfast, lunch and dinner, in the following way: 0 points (five times a week to daily), one point (three or four times a week), two points (once or twice a week) and three points (never or almost never). This variable was categorized as satisfactory (total points of one or less) and unsatisfactory (total points greater than one).

Regarding sedentary behavior (hours per day watching television, playing video games or using the computer), the adolescents responded to two objective questions: "On a normal weekday, how many hours do you spend watching television?" and "On a normal weekday, how many hours do you spend on the computer or playing video games?". The World Health organization recommends that children and adolescents do not spend more than two hours/day in front of the television or a video game.[7] However, in this study, sedentary behavior was defined as four hours or more/day spent watching television and/or on the computer/video games as the high frequency of adolescents in the two hours or more/day of sedentary behavior category meant there was no power to discriminate the outcome.[23]

In the bivariate analysis, the prevalence and prevalence ratio of sedentary behavior (dependent variable) were calculated with their respective 95% confidence intervals, according to the independent variables. The Chi-square test was used to test differences between proportions. Linearity of associations was assessed using the Chi-square test. The variables which had p-values ≤ 0.20 in the bivariate analysis were then selected for the hierarchized multiple logistic regression analysis.[24] In this way, the variables were included in blocks, with more distal factors (sociodemographic and economic – level one) being the first to be included in the analysis, followed by those related to lifestyle (level two) and, in the most proximal level, the variable BMI for age in childhood and adolescence (level three). The variables in the distal level were kept in the model and were included in the adjustment for the next level. The same procedure was used for level two, i.e., variables introduced at this level were kept in level three. All variables with a level of significance less than or equal to 5% for the categories remained in the model, with the exception of BMI in childhood, which was kept in the model as it was deemed important for the fit.

The statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) software, version 17.0 for Windows (SPSS Inc., Chicago, IL, EUA) and EpiInfo™ 7 version 7.0.9.3.4.

The project was approved by the Ethics Committee of the *Hospital Universitário Júlio Muller* of the *Universidade Federal de Mato Grosso* (Protocol 651/CEPHUJM/2009). Parents or guardians consented to the adolescents' participation in the research and signed an informed consent form.

RESULTS

Of the 1,716 adolescents studied, 50.7% were male. Overall prevalence of sedentary behavior was 58.1% (n = 997), with a higher proportion in those belonging to economic class "A" (68.6%), those attending private schools (65.9%), living in a state capital (58.7%) and those whose mothers had 12 or more years of schooling (63.7%). The prevalence of sedentary behavior increased with age. No statistically significant difference in sedentary behavior according to sex, skin color or fathers' level of schooling was found (Table 1).

Variables related to the adolescents' lifestyle and BMI for age classification are shown in Table 2. The prevalence of sedentary behavior was high among adolescents who did less than 300 min of physical activity per week and among those who reported having tried alcohol and/or cigarettes at least once in their life. There was a higher prevalence of sedentary behavior in adolescents with unsatisfactory eating patterns compared with those with satisfactory patterns. As for individuals' BMI/age

Table 1. Prevalence (%), Prevalence ratio (PR) and 95% confidence interval (95%CI) of sedentary behavior according to sociodemographic, economic, lifestyle and body mass index (BMI) variables of adolescents aged from 10 to 17, 2009 to 2011.

Variables	n	Sedentary behavior (≥ 4 hours/day)		
		%	PR	95%CI
Sex				
Male	870	56.8	1	
Female	846	59.5	1.04	0.96;1.13
Age[a]				
10	105	40.0	1	
11	603	52.6	1.31	1.02;1.68
12	443	59.8	1.49	1.17;1.91
13	236	63.6	1.59	1.23;2.04
≥ 14	329	67.8	1.69	1.32;2.16
Skin color				
White	371	56.6	1	
Black	259	57.9	1.02	0.89;1.17
Mixed race	1,005	59.0	1.04	0.94;1.15
Other	81	54.3	0.96	0.77;1.19
Economic class[a,b]				
A	86	68.6	2.33	1.57;3.46
B	603	62.5	2.12	1.46;3.08
C	959	56.4	1.92	1.32;2.78
D and E	68	29.4	1	
Type of school				
Public	1,357	56.1	1	
Private	358	65.9	1.17	1.07;1.28
Maternal schooling (years)[a,c]				
0 to 4	103	43.7	1	
5 to 8	460	56.3	1.29	1.02;1.62
9 to 11	841	59.2	1.35	1.08;1.70
≥ 12	259	63.7	1.46	1.15;1.85
Paternal schooling (years)[d]				
0 to 4	128	57.8	1	
5 to 8	490	60.2	1.04	0.88;1.22
9 to 11	665	57.4	0.99	0.84;1.17
≥ 12	226	61.5	1.06	0.88;1.27
Place of residence				
State Capital	1,641	58.7	1	
Interior	75	45.3	0.77	0.60;0.99
Physical activity				
< 300 min/week	852	61.9	1.13	1.05;1.23
≥ 300 min/week	864	54.4	1	
Eating pattern				
Unsatisfactory	586	61.6	1.09	1.01;1.19
Satisfactory	1,130	56.3	1	
Tried alcohol				
Yes	668	63.3	1.15	1.07;1.25
No	1,048	54.8	1	
Tried smoking				
Yes	65	69.2	1.20	1.01;1.42
No	1,651	57.7	1	

Continue

Continuation

Childhood BMI/Age classification				
Low BMI	41	68.3	1.18	0.95;1.46
Appropriate BMI	1,325	57.8	1	
Overweight	270	54.8	0.94	0.84;1.06
Obese	80	68.8	1.19	1.02;1.39
Adolescence BMI/Age classification				
Low BMI	56	48.2	0.85	0.64;1.12
Appropriate BMI	1,185	56.8	1	
Overweight	315	65.1	1.14	1.04;1.26
Obese	160	57.5	1.01	0.88;1.16

[a] p of linear trend < 0.01.
[b] Classification according to Brazilian Association of Research Companies (ABEP, 2008).
[c] Data for 53 individuals missing.
[d] Data for 207 individuals missing.

classification, regarding being overweight, there was a statistically significant association with sedentary behavior in both childhood and adolescence.

In the final model obtained by hierarchized logistic regression, the sociodemographic and economic variables which remained associated with the outcome were age, economic class, maternal schooling and place of residence. Of the lifestyle variables, it was observed that those adolescents who did less physical activity had a 25.0% greater chance of demonstrating sedentary behavior compared with those who were more active (OR = 1.25; 95%CI 1.02;1.53). In the same way, the trying alcohol variable remained associated with sedentary behavior, showing that adolescents who had tried alcoholic drinks had a higher chance of demonstrating sedentary behavior than those who had not. However, eating patterns and trying smoking ceased to be associated with sedentary behavior (Table 1).

Having tried smoking or alcohol were co-related variables, with 84.6% of adolescents having tried both, which could explain the lack of association with having tried smoking in the final model. However, additional analysis, excluding trying alcohol and including trying smoking did not show a statistically significant association either (p = 0.14). Similar analysis was performed for BMI as adolescents who were overweight were probably more frequently overweight in childhood, this being verified in the study value of 44.3%. Thus, analysis which only included being overweight in childhood was not statistically significant either (p = 0.67).

DISCUSSION

Being older, belonging to a higher economic class, not doing physical activity and being overweight all had an independent effect on sedentary behavior in adolescents. Living in the interior had a protective effect on this behavior. The prevalence of sedentary behavior observed (58.1%) was higher than that observed by Silva et al[23] (2009), in students aged 15 to 19 in the state of Santa Catarina, Southern Brazil. Adolescents from higher economic classes, as well as those at private schools, had a higher chance of sedentary behavior, which corroborates the results found by Oliveira et al[18] (2010). It is probable that adolescents attending private schools have more access to technology, especially those related to computers and video games. In the same way, parents with higher levels of schooling have higher purchasing power and, therefore, more facility in acquiring electronic apparatus for their children, thus increasing the prevalence of sedentary behavior among them.[21]

Adolescents living in the interior were shown to be protected from sedentary behavior compared with their peers in the state capitals. Young big city residents probably have greater access to electronic devices, whereas children and adolescents living in the interior may have more chances to participate in activities which expend energy, such as riding a bicycle and playing in the streets. A similar result was found by Silva et al[23] (2009), with the prevalence of sedentary behavior being more frequent in adolescents living in urban areas.

As regards the adolescents' age groups, the older ones showed a higher prevalence of sedentary behavior. It can be speculated that older adolescents are not very attracted to other activities, including doing physical exercise, deeming them unimportant for their expectations and substituting them for sedentary behavior. According to Mathews et al[16] (2008), older adolescents spend approximately 60% of their free time in sedentary activities, compared with younger adolescents. Oliveira et al[18] (2010) state that younger adolescents spend less time doing sedentary activities.

Some authors have shown that the relationship between sedentary activities and doing physical activity is independent,[1,5] as an individual may do sedentary activities yet still follow recommendations for physical activity.

Table 2. Hierarchized multiple logistic regression for sociodemographic and economic (level 1), lifestyle (level 2) and body mass index (level 3) variables for adolescents aged 10 to 17, 2009 to 2011.

Variable	$OR_{adjusted}$ [a]	$OR_{adjusted}$ [b]	95%CI
Level 1			
Age (years)			
10	1	1	
11	1.66	1.63	1.06;2.51
12	2.23	2.34	1.50;3.65
13	2.61	2.74	1.69;4.44
≥ 14	3.15	3.51	2.19;5.60
Economic class			
A, B	3.10	3.83	2.10;7.01
C	4.13	3.01	1.68;5.38
D, E	1	1	
Maternal schooling (years)			
0 to 4	1	1	
5 to 8	1.66	1.59	1.02;2.48
9 to 11	1.87	1.66	1.07;2.56
≥ 12	2.26	1.81	1.09;3.01
Place of residence			
Capital	1	1	
Interior	0.58	0.49	0.30;0.81
Level 2			
Physical activity			
< 300 min/week	1.36	1.25	1.02;1.53
≥ 300 min/week	1	1	
Tried alcohol			
Yes	1.42	1.34	1.08;1.66
No	1	1	
Level 3			
Childhood classification of BMI/Age			
Not overweight	1	1	
Overweight	0.99	0.88	0.69;1.14
Adolescence classification of BMI/Age			
Not overweight	1	1	
Overweight	1.29	1.33	1.06;1.68

[a] Unadjusted odds ratio.
[b] Odds ratio adjusted for the other variables included in the model.

However, this study showed that insufficiently active adolescents had a higher chance of sedentary behavior compared with active ones. Such divergences may occur due to the difficulty and variability in measuring and classifying both parameters. However, the decreased amount of time spent on sedentary activities seems to be a strategy for reducing physical inactivity.[13] Different studies have shown that low levels of physical activity in children and adolescents has been attributed to more time spent in front of the television, computer or video games[3,15] which would also explain the association between level of physical activity and increased obesity.[3]

Overweight adolescents have a greater chance of sedentary behavior, a finding in agreement with various epidemiological surveys.[3,5,12] It is probable that time spent on sedentary activities may affect both level of physical activity and eating habits of the individual, possibly increasing the prevalence of being overweight.[2,3]

One of the aims of this research was to verify whether BMI in childhood was associated with sedentary behavior in adolescence, in other words, whether a young person who was overweight in childhood had a higher chance of acquiring sedentary behavior in adolescence.

The results of the bivariate analysis show that there was an association between sedentary behavior and obesity in childhood, although, after adjusting for confounding factors in the multiple analysis, they ceased to be associated.

Sedentary behavior was associated with other behavior deemed to be risky such as trying alcohol and smoking, and unsatisfactory eating patterns. However, after adjusting for sociodemographic and economic variables, only having tried alcohol remained associated. It was verified that adolescents who reported having tried alcohol had a higher chance of sedentary behavior compared with those who reported not having tried alcohol. Among other factors, alcoholic drinks are frequently shown in the media through advertising, films, soap operas and music,[19] meaning that adolescents who spend more time in sedentary activities are more encouraged to consume alcoholic drinks.

This research originated from a cohort study, which allowed variables from early childhood to be evaluated with the variables from adolescence, which was a positive point of this study. However, as it is a cross-sectional study, a limitation is that causality cannot be inferred in the association between sedentary behavior and the variables investigated, as risk factors and outcomes are seen at one single moment. Moreover, the data on risk factors evaluated, such as trying alcohol or smoking and doing physical activity were obtained through a questionnaire and there may have been errors in classification from the adolescents' statements, which tend to omit experiences with alcohol and other drugs as well as difficulties in remembering their activities.

To conclude, a high proportion of adolescents with sedentary behavior was observed, especially among older adolescents and those with a higher socioeconomic level. The inverse association of sedentary activities and physical activity suggests the need for intervention strategies for this population, with educational actions, through the family, schools and health care professionals. These interventions, especially concerning encouraging doing activities which burn energy, should reduce sedentary behavior and, consequently, excess weight among young people.

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