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Physical activity and sedentary lifestyle among children from private and public schools in Northern Brazil

ABSTRACT

OBJECTIVE: To analyze factors associated with physical activity and the mean time spent in some sedentary activities among school-aged children.

METHODS: A cross-sectional study was carried out in a random sample of 592 schoolchildren aged nine to 16 years in 2005, in São Luís, Northern Brazil. Data were collected by means of a 24-Hour Physical Activity Recall Questionnaire, concerning demographic and socioeconomic variables, physical activities practiced and time spent in certain sedentary activities. Physical activities were classified according to their metabolic equivalents (MET), and a physical activity index was estimated for each child. Sedentary lifestyle was estimated based on time spent watching television, playing videogames and on the computer/internet. Chi square test was used to compare proportions. Linear regression analysis was used to establish associations. Estimates were adjusted for the effect of the sampling design.

RESULTS: The mean of the physical activity index was 605.73 MET-min/day (SD = 509.45). School children that were male (coefficient=134.57; 95%CI 50.77; 218.37), from public schools (coefficient.= 94.08; 95%CI 12.54; 175.62 and in the 5th to 7th grade (coefficient.=95.01; 95%CI 8.10;181.92 presented higher indices than females, children from private schools and in the 8th to the 9th grade (p<0,05). On average, students spent 2.66 hours/day in sedentary activities. Time spent in sedentary activities was significantly lower for children aged nine to 11 years (coefficient.= -0,49 hr/day; 95%CI -0.88; -0.10) and in lower socioeconomic classes (coefficient.=-0.87; 95%CI -1.45;-0.30). Domestic chores (59.43%) and walking to school (58.43%) were the most common physical activities.

CONCLUSIONS: Being female, in private schools and in the 8th to 9th grade were factors associated with lower levels of physical activity. Younger schoolchildren and those from low economic classes spent less time engaged in sedentary activities.

DESCRIPTORS: Child. Adolescent. Sedentary Lifestyle. Motor Activity. Socioeconomic Factors. Cross-Sectional Studies.

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INTRODUCTION

According to the World Health Organization, the practice of regular physical activity prevents excess weight (reducing the risk of obesity), helps prevent or reduce arterial hypertension and osteoporosis, promotes well-being and reduces stress, anxiety and depression. Physical activity also reduces the risk of early

death, type 2 diabetes, cardiopathies, cerebral vascular accident, and colon and breast cancer. Especially among children and youth, physical activity interacts positively with strategies to promote a healthy diet, discourage use of alcohol, drugs and tobacco, reduce violence and promote social integration.[a]

Despite its relevance to epidemiology, tools utilized in Brazil for the evaluation of physical activity are infrequent and sometimes imprecise. The limitations are greater when the analysis is restricted to children and adolescents, since the majority of population-level studies involve adults.[2,4,9]

Physical inactivity results in greater economic costs for the individual, family and society. Sedentary lifestyle in children and adolescents is considered a public health problem due to its association with childhood obesity and increased adult morbity.[5] Children, induced by technological advances, have become less active in the past decades. A positive relationship has been demonstrated between time spent watching television and the increase in body fat among schoolchildren.[18] The American Heart Association reports that children watch, on average, 17 hours of television per week. Another study concluded that the risk of obesity is five times greater in children that watch more than five hours of television per day, compared to those that watch from zero to two hours per day.[10]

Varying results have been identified in the national literature on physical activity and sedentary lifestyles among Brazilian children and adolescents. This is probably an expression of discrepancies resulting from the use of different tools, the sample types and the methodological procedures utilized in studies that evaluate physical activity.[6,8,9] In addition, difficulty in standardizing evaluation tools for levels of physical activity – there are more than 30 techniques – has limited the precise measuring of physical activity in children and adolescents.[11,19]

The present study aimed to analyze factors associated with the practice of physical activity and the average time spent in sedentary activities among schoolchildren.

METHODS

This study is part of a larger research study involving 1,103 students in the 2nd to 9th grade, attending public and private schools in São Luís, Maranhão state, Northern Brazil, where the dietary profile and prevalence of undernutrition, underweight and obesity were evaluated. Since the literature shows that children under nine years old do not provide consistent responses to questionnaires on physical activity,[24] it was decided to administer the evaluation tool, concerning physical activity level and average time in sedentary activities, only to schoolchildren at least nine years or older.

Regarding the calculation of sample size, in order to detect 12% differences in the prevalence of physical activity between groups, assuming a power of 80%, significance level of 0.05 and unilateral testing, 536 children would be required, using a design effect of two (an estimated sampling error two times greater than in simple random sampling). The questionnaire was administered to students in and above the 5th grade, totaling a sub-sample of 592 students. The study is representative of students in São Luís and the rate of losses was low (1.5%).

A cross-sectional study was performed in a random cluster sample, representative of schoolchildren from nine to 16 years old, during the months of January and October of 2005. The random cluster selection was performed from a list, provided by the State Council of Education in Maranhão, on the amount of students enrolled by grade in public and private schools. In 2004, there were 189,642 students enrolled in 560 schools: 140,644 in 317 public schools and 48,998 in 243 private schools. The public system is composed of municipal and state schools and the private system consists of private, community and philanthropic schools.

The sample was stratified according to education system (public and private). The random selection had three stages: first, the schools were selected within each stratum, with a probability proportional to the number of enrolled students. Second, four grades were selected per school; third, utilizing the student numbers from the daily class roles, a simple random sample without replacement was performed, in increasing order beginning with the number one and selecting nine students per grade. There were 34 schools and 36 students per school included in the study. There was a break in the proportionality between the strata and therefore selection bias, due to the equal division of the sample between the public and private systems and the greater number of students in the public system. The sample of students in the public system was proportionally smaller than the sample of students in the private system. The estimates were considered and corrected through the sample design, and the stratification by public and private system was considered. The break in proportionality was a deliberate strategy to increase the study power.[13] Each student from the public system represented 88 students, and each student for the private system represented 239.

Students excluded from the random selection did not appear in class during three days after study initiation, were less than nine and greater than 17 years old or were sick the day before the interview, considered an atypical day.

The data were obtained through direct collection by previously trained nutritionists and academics in the health field. Questionnaires were administered about demographic and socioeconomic variables, physical activities and time spent in certain sedentary activities.

The Brazilian Economic Classification Criteria (CCEB) proposed by the Brazilian Association of Research Companies (ABEP),[b] was utilized, and it stratifies the population in economic classes, estimating the purchasing power of people and urban families based on ownership of goods and the education level of the head of household. The five economic classes were grouped into three groups (A/B, C and D/E) in order to obtain more precise estimates.

To evaluate the level of physical activity and the time spent in certain sedentary activities, the 24-Hour Physical Activity Recall Questionnaire was utilized, which was developed by adapting the Self Administered Physical Activity Checklist. This tool has been validated and allows one to estimate physical activity by frequency and duration of activities involving physical exertion and includes the daily amount of time dedicated to certain sedentary activities, such as television, videos, electronic games and computer use.[22,24]

The questionnaire was composed of two parts: one concerned activities more frequently performed, with a list of 40 activities, such as locomotion, leisure, sports and domestic activities; and the other concerned time spent in certain sedentary activities, such as use of television, DVD, video cassette, videogame, computer games and internet. For each activity, the time spent (in minutes) was asked, and only activities practiced for five minutes or more were registered.

Physical activities were classified according to their metabolic equivalents (MET) and evaluated for intensity (METs/day), according to the Physical Activity Compendium (*Compêndio de Atividades Físicas*, CAF).[1] Some activities reported by students were not included in the CAF, and MET values were assigned according to activities with similar energy expenditure. The MET unit is used to estimate the metabolic expenditure of physical activity, in relation to body weight corresponding to approximately 3.5mL of oxygen/kg/min. By convention, 1 MET is considered as the resting metabolic rate. The MET values of physical activity vary from 0.9 during sleep to 18 when running 17.5 km/hour.

The Physical Activity Index (PAI) was calculated by the product of the time spent in each activity and the corresponding MET. Then the products of all the physical activities were summed to obtain the final PAI in METs-min/day for each student. The method to obtain the PAI was adapted from the International Physical Activity Questionnaire (IPAQ),[3] which evaluates the level of physical activity by obtaining MET-min/week.

Physical inactivity was estimated by summing the daily time dedicated to certain sedentary activities reported by the student. Other forms of physical inactivity, involving sitting time for activities such as studying, talking, resting and playing are not included in the utilized self-administered retrospective tool and were not evaluated in the present study. Therefore, the tool did not measure all sedentary lifestyle behaviors but partially estimated it by time spent in certain sedentary activities referred to as "screen time".

Data analysis was performed with Stata 8.0. The mean and standard deviation were used and linear regression analysis was implemented to establish associations between the dependent and independent variables. Multiple linear regression was performed for variables that had a p-value <0.20 in univariate analysis. Variables with a p-value < 0.10 remained in the adjusted model, and those with a p-value < 0.05 after adjustment were considered as associated with the outcomes.

Calculations of rates and confidence intervals were utilized for the comparison of frequency of physical activities, according to sex and education system. The chi-square test was used to compare two or more rates, employing a significance level of 5%.

The study procedures were submitted to analysis and were approved by the Research Ethics Committee of the Hospital Universitário da Universidade Federal do Maranhão, process number 00495/04, on May 11, 2004. Selected students participated in the study if they wanted to participate and their parents or guardians signed the voluntary informed consent form.

RESULTS

For the 592 participants, mean age was 12.18 years (SD = 1.72), with 49.5% boys and 50.5% girls. Among the participants, 57.1% belonged to public schools and 42.9% attended private schools, with a predominance of students from the D/E economic classes (45.1%) (Table 1).

The overall mean for PAI was 605.73 MET-min/day (SD = 509.45). PAI (MET-min/day) was 141.52 greater in boys, 95.68 greater in public system students, 104.12 higher in students of the 5th to 7th grade and 119.00 greater among those in the D/E economic class, when, respectively compared to girls, students in the private system, in the 8th and 9th grade and the A/B class. Students attending private school had a PAI 172.63 MET-min/day less than students of public municipal schools. Children from parents with less than four years of schooling had a PAI 189.19 MET-min/day greater than those from parents with 11 or more years of study (Table 1).

There were practically no changes in the adjusted analysis, except for economic class, which lost statistical significance. Students of the male sex (coefficient=134.57), the public system (coefficient=94.08) and the group from the 5th to 7th grade (coefficient=95.01) showed greater PAIs when compared to the female sex, the private sector and the group in 8th and 9th grade, respectively (Table 2).

On average, students spent 2.66 hours/day (SD=2.16) in sedentary activities. When classifying them into groups, 46.1% spent up to 2 hours/day in sedentary activities, 28.2% more than 3.5 hours/day and 25.7% between 2 and 3.5 hours/day.

The mean time spent on sedentary activities diminished 0.49 hours per day for children from nine to 11 years when compared to the group from 12 to 13 years. Students from the A/B economic classes spent significantly more time in sedentary activities (3.33 hours/day) than those in class C (2.77 hours/day) and D/E (2.43 hours/day). Students from the private system showed greater time spent in sedentary activities (coefficient=0.65 hours/day) in the unadjusted analysis (Table 3).

Statistically significant differences were not observed in the adjusted analysis for sex, education system, grade and education level of head of household (Table 4).

The physical activities with greatest frequencies were: domestic tasks (59.4%), active transportation (by foot)

Table 1. Mean physical activity index according to sex, school system, school category, age, academic grade, education of head of household and student economic class. São Luís, Northern Brazil, 2005-2006.

Variable	n	%	Mean (METs-min/dia)	SD	Weighted linear coefficient	95%CI	p
Sex							0.001
Male	293	49.5	676.65	552.98	141.52	58.42;224.61	
Female	299	50.5	535.13	452.04	0.00	-	
School system							0.023
Public	338	57.1	626.53	511.09	95.78	13.33;178.23	
Private	254	42.9	530.74	498.04	0.00	-	
School category							0.131
Municipal	119	20.1	667.01	488.18	0.00	-	
State	219	36.9	604.54	522.90	-62.46	-205.90;80.97	
Private	199	33.6	494.37	487.62	-172.63	-326.19;19.07	
Philanthropic and community	55	9.3	662.34	517.50	-4.66	-219.89;210.55	
Age (years)							0.272
9 to 11	264	44.6	627.84	507.05	73.26	-81.18;227.72	
12 to 13	197	33.2	615.69	493.23	61.12	-61.83;84.08	
14 to 16	131	22.1	554.57	535.96	0.00	-	
Grade							0.029
5th to 7th	423	71.4	635.69	526.81	104.12	11.11;197.14	
8th to 9th	169	28.5	531.56	456.74	0.00	-	
Education of head of household (years)							0.191
< 4	55	9.3	734.32	558.46	189.19	42.43;335.94	
4 to 7	123	20.7	564.22	479.83	19.08	-88.77;126.94	
8 to 10	142	24.0	623.34	512.71	78.20	-24.56;180.97	
≥ 11	272	46.0	545.13	501.66	0.00	-	
Economic class							0.060
A/B	139	23.5	496.41	515.03	0.00	-	
C	186	31.4	608.93	497.93	112.52	1.14;223.89	
D/E	267	45.1	615.41	506.35	119.00	15.10;222.90	

Table 2. Multiple linear regression analysis of factors associated with physical activity index. São Luís, Northern Brazil, 2005-2006.

Variable	Linear coefficient	95%CI	p
Sex			0.003
Male	134.57	50.77;218.37	
Female	0.00	-	
School system			0.024
Public	94.25	12.54;175.62	
Private	0.00	-	
Academic grade			0.033
5th to 7th	95.01	8.10;181.92	
8th to 9th	0.00	-	

to school (58.4%), street games (tag, hide-and-seek, hopscotch, dodgeball - 41.4%), walking (34.8%) bicycle riding (31.9%), football (28.1%) and playing with animals (25.4%). The percent differences in participation for each activity in regards to sex were evaluated, and the following activities were practiced with a significantly greater frequency among boys than among girls: football, street games and bicycle use. Activities such as domestic tasks and dance were significantly more frequent in girls than in boys (p<0.05) (Table 5).

Differences according to education system were observed in the most frequent type of activity, with a predominance of domestic tasks and active transportation to school among students in public schools.

DISCUSSION

Male students in the public system and the 5th to 7th grade, showed a higher PAI. Students spent 2.66 hours per day on average in certain sedentary activities, with less time spent in the group from nine to 11 years old and those in lower economic classes. Domestic tasks and foot transportation to school were the most cited physical activities.

Table 3. Average time spent in certain sedentary activities according to sex, school system, school category, age, academic grade, education and economic class of students. São Luís, Northern Brazil, 2005-2006.

Variable	n	%	Mean (hours/day)	SD	Weighted linear coefficient	95%CI	p
Sex							0.803
Male	293	49.5	2.69	2.08	0.00	-	
Female	299	50.5	2.62	2.24	-0.07	-0.62;0.48	
School system							0.081
Public	338	57.1	2.58	2.15	0.00	-	
Private	254	43.0	2.93	2.19	0.35	-0.05;0.75	
School category							0.108
Municipal	119	20.1	2.39	1.96	0.00	-	
State	29	37.0	2.69	2.24	0.29	-0.26;0.86	
Private	199	33.6	3.04	2.18	0.65	0.11;1.19	
Philanthropic and community	55	9.3	2.55	2.21	0.15	-0.58;0.90	
Age (years)							0.015
9 to 11	264	44.6	2.44	1.79	-0.49	-0.88;-0.1	
12 to 13	197	33.2	2.93	2.53	0.00	-	
14 to 16	131	22.1	2.58	2.07	-0.35	-0.94;-0.24	
Grade							0.702
5th to 7th	423	71.4	2.61	2.15	-0.10	-0.67;0.46	
8th to 9th	169	28.5	2.72	2.14	0.00	-	
Education of head of household (years)							0.042
< 4	55	9.3	2.37	2.85	0.00	-	
4 to 7	123	20.8	2.70	2.18	0.33	-0.81;1.48	
8 to 10	142	24.0	2.40	1.72	0.03	-1.03;1.10	
≥ 11	272	45.9	2.90	2.16	0.53	-0.45;1.53	
Economic class							0.016
A/B	139	23.5	3.33	2.47	0.00	-	
C	186	31.4	2.77	1.89	-0.55	-1.02;-0.07	
D/E	267	45.1	2.43	2.20	-0.89	-1.48;-0.30	

Table 4. Multiple linear regression of factors associated with average duration of sedentary activities. São Luís, Northern Brazil, 2005-2006.

Variable	Linear coefficient	95%CI	p
Age			0.023
9 to 11	-0.15	-0.60;0.30	
12 to 13	0.35	-0.22;0.93	
14 to 16	0.00	-	
Economic class			0.017
A /B	0.00	-	
C	-0.50	-0.98;-0.03	
D/E	-0.87	-1.45;-0.30	

The higher physical activity level among men than women in this study confirms the finding of another study.[15] Sallis (1993) reported that the difference between sexes varied from 15% to 25% at school age.[21] A study performed with students in Belo Horizonte, Minas Gerais state, utilizing a 24-hour recall questionnaire, detected greater energy expenditure among males.[20]

The greater time spent by boys in the practice of physical exercise and sports can be understood by the distribution of roles in society, traditionally attributed to each sex. Boys and girls are directed to assume different roles and from an early age boys' participation in more intense physical exertion and sports is valued more highly. Among women, there appears to be a greater propensity to engage in less intense activities, such as domestic tasks, and there exists less social support for the practice of physical exercise and sports. Due to these societal values, some adolescents may acquire the view that the practice of sports and physical exercise is less appropriate for females, with little change to this social stereotype.[8,25] Besides the social factor, female biology appears to be more adapted to less intense physical exertion.[19]

A decrease was observed in the PAI of schoolchildren in the 8th and 9th grade when compared to the 5th to 7th grade. This decline over time in physical activity levels has been widely reported in other studies, although it is not well understood, since it is not known if this decrease is explained by biological or environmental processes.[23] Studies of adolescents in the United States found an important reduction in the levels of physical activity at the end of adolescence, leading the researchers to view school as an appropriate place for the implementation of public policies to promote physical activity in children and adolescents.[24]

Students enrolled in the public system had higher PAI than those in the private system. This finding is probably related to the greater time dedicated to leisure activities that do not require expenses, such as street games and football, in addition to the greater frequency of active transportation to school by students in the public system. It is also possible that youth from lower economic classes frequently assume domestic tasks that involve moderately intense manual labor, while those that belong to higher economic classes are not responsible for these activities, which helps lead to sedentary lifestyles. Besides this, students of private schools have greater access to facilities with advanced technologies and therefore, dedicated more time to sedentary activities. The school system was evaluated as a socioeconomic indicator, since students of private schools had greater representation in the higher classes and more educated parents than students in public schools.

Hallal et al[9] (2006), studied 4,452 adolescents and observed a sedentary lifestyle prevalence of 49% among boys and 67% among girls, with greater physical inactivity in higher socioeconomic levels. In another national study, students enrolled in public schools and from lower socioeconomic levels had higher energy expenditure when compared to those from the private system and of higher socioeconomic level.[20] These findings are consistent with the present study.

Domestic tasks and active transportation (by foot) to school were the most frequently cited activities among students, the former most often cited by girls and the latter by boys. These two activities were also more frequent in students in the public system compared to those in the private system. The practice of football (50%) was prominent among boys and is part of the national culture. The greater reporting of domestic tasks by girls was also expected due to cultural practices and the distribution of roles in society.

Table 5. Most practiced physical activities among schoolchildren according to sex. São Luís, Northern Brazil, 2005-2006.

Physical activity	Total		Male	Female	p
	n	%	%	%	
Domestic tasks	356	59.4	49.3	69.1	< 0.001
Active transportation	350	58.4	56.8	60.0	0.427
Street games	248	41.4	42.5	32.4	< 0.001
Walking	208	34.7	34.6	38.3	0.387
Bicycle	191	31.9	39.4	24.6	< 0.001
Football	168	28.0	50.0	6.9	< 0.001
Play with animals	152	25.3	27.5	23.2	0.109

The mean hours spend in sedentary activities was less than the values found in the Brazilian literature and similar to values in the international literature. Study data from samples in São Paulo state, Southeastern Brazil, showed that the average varied between 3.6 and 3.9 hours/day between schoolchildren with an average age of 13 years.[2] Adolescents in London watch television/video, on average, 3.5 to 4.0 hours/day (girls and boys, respectively).[8] For youth in the United States and Europe, studies report average durations around 2.3 hours/day.[7,16]

It is possible that regional, socioeconomic and cultural factors have positively interfered with the time spent in sedentary activities. For example, the municipality of São Luís has high temperatures throughout the year. For McGuire et al[14] (2002), individuals tend to practice more physical activity during the summer. In addition, it is believed that activities frequently cited by the students, such as transportation, domestic tasks and street games, represent a substantial proportion of individual physical activity in developing countries.[9] This is explained by the fact that various electronics are less accessible for the population studied.

In the present study, schoolchildren from lower economic levels devoted significantly less time in front of television/videos/videogames/computer than those from more privileged classes. The relationship encountered between higher income individuals and sedentary behavior appears to occur because of greater access to technology, principally in regards to videogame and computer use, both of which are less frequent in lower economic classes. Other studies, though, found less sedentary activity among higher income individuals. This can result from better parental understanding of the benefits of physical activity due to higher level of education and greater access to sporting activities, such as gymnasiums.[16]

We found less time devoted to sedentary activities and a greater PAI in the group from nine to 11 years old. It is has been established that children are more receptive to the practice of physical activity, with a reduction tending to occur with increased age, and therefore, these individuals will become more exposed to sedentary lifestyles.[23,24] In the adjusted analysis, there was no difference in time spent on sedentary activities, in regards to sex, school system and education. In contrast to the findings for physical activity, there was no association between time spent in sedentary activities and the sex of the student, probably because modernity influences school age adolescents independent of their sex and they are equally interested in television, videogames and computer use, leading them

to equally dedicate themselves to these activities. The education system and education variables, did not show associations potentially due to confounding, since only economic class showed an association in the adjusted model. In Salvador, Leão et al[12] (2003) did not observe a significant difference between the type of school in a sample of 387 students, since the prevalence of sedentary lifestyle was 57.3% among public school students and 55.3% among private school students.[12]

Studies with children and adolescents have utilized the practice of physical activity and time dedicated to television/videos/computers as indicators for level of physical activity and inactivity, respectively.[8,10,17] Hallal et al[9] (2006) found a positive relationship between daily number of hours watching television and sedentary behavior among schoolchildren. There is a current trend towards using "screen time" as an indicator of sedentary lifestyle, since it is an easy variable to obtain and it could decrease the practice of physical activity.

Although the study only measured time spent in certain sedentary activities, we believe that the tool utilized did not underestimate actual sedentary behavior, since schoolchildren in São Luís showed they were actually more active and therefore less sedentary. High temperatures, street games, transportation and less urbanization are factors that should contribute to schoolchildren dedicating less daily time to sedentary activities. Nonetheless, the absence of large-scale studies, which have measured physical activity using standards and tools similar to this study, complicates the comparison of these findings with other studies.

The present study is representative of schoolchildren in São Luís, and the loss rate was low. The main limitation of this study was that the research tool did not allow for evaluation of habitual physical activity. Therefore, atypical days of physical activity could have caused confirmation bias. To reduce this likelihood, students that were sick the day before questionnaire administration were excluded and interviews were not performed on Mondays.

The Healthy People 2010 program recommends that schools should perform an important role in the promotion of physical activity and in incentivizing healthy dietary habits.[c] The identification of at risk population groups and of factors that influence harmful health habits during childhood and adolescence, through studies such as ours, are fundamental for the development of policies, programs and interventions to control chronic disease among adults. The study results suggest priority groups for intervention: girls, schoolchildren in 8th and 9th grade, students in the private system and students from higher socioeconomic level.

[c] US Department of Health and Human Services. Healthy people 2010: Understanding and improving Health. Washington; 2000.

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