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Original research

# Sedentary behavior during school-time: Sociodemographic, weight status, physical education class, and school performance correlates in Brazilian schoolchildren

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ABSTRACT

*Objectives:* To investigate whether sedentary behavior during school-time is associated with gender, age, mother's education, having physical education classes, weight status, and academic performance.
*Design:* Cross-sectional study.
*Methods:* A sample of 571 children (7–12 years old) from five elementary schools in Florianopolis, South Brazil had their height and weight measured, and wore accelerometers during class time. Teachers completed a form to evaluate children's reading and writing skills. Parents provided sociodemographic and educational information. Data was analyzed using multilevel linear regression analyses.
*Results:* Children spent an average of 132 min in sedentary behavior during school-time (64% of total school-time). Girls (137.5 min), obese children (138.1 min), older children (144.2 min), and those who did not have physical education classes (140.2 min) spent more time engaged in sedentary activities than their peers. Academic performance and mother's education were not associated with sedentary behaviors.
*Conclusions:* Children spent most of their school-time in sedentary activities, with girls, older students, and obese students being even more sedentary than their peers. Physical education classes were a protective factor against excessive sedentary behavior in school. Interventions for reducing sedentary behavior during school-time could employ additional strategies to benefit the at risk groups. In addition, encouraging student's participation in physical education classes could minimize the time spent in sedentary behavior during school hours.


## 1. Introduction

Increasing levels of sedentary behavior in children have been associated with early health problems such as increased body fat mass, elevated blood pressure, and depressive symptoms,[1,2] independent of physical activity levels.[1,3,4] According to recent international guidelines, children should not engage in screen-based activities for more than 2 h per day during leisure time.[5,6] However, sedentary activities are not limited to the leisure domain.[7] A great amount of sedentary time during weekdays occurs during school-time[8] as children participate in sedentary behaviors, such as sitting during long class periods with few or no activity breaks.[9,10]

In Brazil, many schools work with two four-hour shifts, and children attend to one of them, either in the afternoon or in the morning, where school-time consist of five 45-min classes, with one 15 min recess between the third and fourth classes. Children also engage in sedentary activities during recess[11]; thus it is important to investigate this behavior. Physical education (PE) classes provide children an opportunity to be physically active, and these classes have been associated with a decrease in sedentary activities during school-time.[12] However, some studies have indicated that children are engaging in sedentary activities, such as sitting, even during PE classes.[13,14]

In many countries evidence indicates that girls engage in more sedentary behaviors in school settings than boys.[8,10,13] Although

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this pattern is not completely explained, it is believed that boys and girls may engage in different amounts of light and moderate-to-vigorous intensity physical activities. Boys engage in more opportunities to be physically active, such as playing ball games, whereas girls prefer sedentary games and activities, such as sitting and chatting.[15]

Academic performance appears to be related to sedentary behavior, but this relation may be dependent on the type of activity performed. Lower grades are positively associated with television watching, but not with reading and doing homework.[17] While some studies have found that objectively measured sedentary behavior does not seem to be related to academic performance in children,[16,17] further research is required to investigate this relationship. In addition, intrapersonal factors such as age,[18] weight status,[19] and maternal education[18] have shown to be related to sedentary behavior in schoolchildren.

The aim of the present study was to investigate whether sedentary behavior during school-time is associated with gender, age, mother's education, having physical education classes, weight status, and academic performance.

## 2. Methods

The project "Development and evaluation of a monitoring system for food consumption and physical activity of 7–12-year-old schoolchildren – the CAAFE study"[20] was conducted during 2012 in the city of Florianopolis, Southern Brazil. Five public schools with children aged 7–11 years, attending 2nd–5th grades, were selected by the Board of Education. The inclusion criterion for school selection was based on the need to cover the geographical regions of the municipality (North, South, East, West, and Central) and the need to have an information technology room for child use with computers and internet access. Inclusion criterion for class selection was based on the classes having all activities undertaken in the school (no holidays, or activities outside the school) on the week of the research. In each school six classes from 2nd to 5th grades were selected by the school's principals, and all students within the selected classes were invited to participate ($n = 778$). Out of 660 (85%) students that provided written informed consent signed by their parents, 571 (86.5%) had valid accelerometer data and were included in the analyses. Data for parental level of education was obtained for 458 (69.4%) students. The project was approved by the Ethics Committee on Human Research at the Federal University of Santa Catarina (protocol 2250/11).

The administrative department of each school provided information on students' age, gender, and physical education schedule. Anthropometric measurements were performed in each school by a team of five trained researchers. Children wore light clothes and no shoes during the anthropometric measurements. Weight was measured with a digital-solar 180 kg scale. Height was measured using a portable stadiometer, with the child standing upright with the head, back, and buttocks on the vertical land of the height gauge. Weight was equally distributed on both feet and the head was held in the Frankfort plane. Body mass index (BMI) was computed as weight in kg divided by height in $m^2$.

Children received an Actigraph GT3×+ accelerometer on the right hip, to measure sedentary behavior. Wear time was determined by subtracting the time when the accelerometer was given to children (beginning of school), from the time the accelerometer was retrieved (end of school). Children wore the accelerometer for two days, but only data from the second day was analyzed to avoid the first day's reactivity. Some children had PE classes on the day the accelerometer was used (42.7% of the sample), and the variable was dichotomized as "having PE class" and "not having PE class". Sedentary time in school (absolute minutes and proportion of time) was estimated in 15 s epochs, with cut-off points from Evenson et al.[21] used to classify behavior as active or sedentary. Weight status was determined using *z* scores for BMI and children were classified as underweight, normal weight, overweight, or obese according to the World Health Organization (WHO).[22] Students classified as underweight (1.27%) were combined with the normal weight category. Children's writing and reading skills were evaluated by teachers who filled in a questionnaire designed specifically for this study with the question "In relation to the expected writing and reading skills according to the school's grade, how do you classify the skills of this student?" The answer's options were "advanced", "average", and "below average". Parents provided information in the written consent form regarding mother's education level: no education (0–3 years), elementary school (4–7 years), secondary school (8–10 years), high school (11 years), or college (≥12 years), and was categorized as <12 years or ≥12 years.

Due to the hierarchical structure of the data (students nested within schools), multilevel linear regression models (crude and adjusted) were used to verify the relationships of gender (male or female), age (7–9 years or 10–12 years), mother's educational level (<12 years or ≥12 years), weight status (normal weight, overweight, or obese), having PE classes (yes or no), and writing and reading skills (below average, average, or advanced), with sedentary behavior (analyzed in absolute minutes and proportion of daily school-time).

Multilevel regression analyses were used to estimate two-level fixed-effects models (409 students and 5 schools). The analysis for each model used a 3-step modeling procedure. Step 1 examined whether there are statistically significant differences within-schools and between-schools, for both the sedentary behavior in proportion and in absolute minutes (empty model). If significant differences within-school and between-school variations were identified in Step 1, the analysis proceeded to Step 2, in which a series of univariate analysis assessed whether each individual covariate was associated with the outcomes. In Step 3, a multivariate model with all covariates simultaneously included was performed to examine how the student characteristics were associated with the outcomes. Regression models provided unadjusted and adjusted coefficients and 95% confidence intervals (95% CI). Analyses were performed in Stata software version 13.0 (StatCorp., College Station, TX, USA). Statistical significance was set at $p$-value <0.05.

## 3. Results

Study participant characteristics and mean sedentary time in school are shown in Table 1. The sample was composed by: 45.9% boys, 65.3% 7–9 years-old, 20% overweight, 14.2% obese, and 42.7% engaged in PE classes. Children spent, on average, 132.6 min (95% CI 130.7; 134.6) engaged in sedentary activities in a school day, equivalent of 64% of the school-time. Based on 95% confidence intervals, boys engaged in less sedentary time in school compared to girls (126.9 min *vs.* 137.5 min; 61% *vs.* 66% of the school day). Additionally, 7–9 year-old children were less sedentary than 10-12 year-old children (126.3 min *vs.* 144.2 min; 61% *vs.* 69% of the school-time). Children who had physical education classes engaged in less sedentary time than children who did not (140.2 min *vs.* 127 min; 68% *vs.* 60% of the school day). Mother's educational level, weight status, and writing and reading skills were not significantly associated to the sedentary behaviors in school-time (Table 1).

Crude and adjusted multilevel linear regression analysis of sedentary time on school (min/school day and proportion) and its correlates are presented in Table 2. Crude analysis showed that gender, age, engagement in PE classes, and weight status were correlated with the time spent in sedentary behavior. After further

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