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# Determinants of physical inactivity among urban adolescents

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**Abstract**

**Objective:** To investigate determinants of physical inactivity among adolescents aged 15 to 19 years in the city of Recife, northeastern Brazil.

**Method:** This case-control study involved 597 private school students aged 15 to 19 years selected by convenience sampling. Exclusion criteria were adolescents with diseases that interfered with or hindered anthropometric measurements, who were being treated with drugs or diet for excess weight or who had changed their physical activity over the past 30 days. The students were recruited according to physical activity, as determined by the International Physical Activity Questionnaire: cases – inactive (sedentary or insufficiently active); and controls – active (active and very active). The adolescents reported the number of hours per day of television watching and computer use to identify the number of sedentary hours/day. Anthropometry (weight and height) of the adolescents was measured by Gibson's technique and used to calculate the body mass index. Weight, height and educational level of mothers were self-reported. Data were analyzed by multiple logistic regression, using the SPSS software, version 11.5, in order to control for confounding variables.

**Results:** Female adolescents were twice as likely to be inactive (odds ratio = 1.94; 95% confidence interval = 1.35-2.79) compared to male adolescents. Watching television for more than 1 hour/day showed increased risk for physical inactivity compared to less than 1 hour/day (odds ratio = 1.55; 95% confidence interval = 1.01-2.39).

**Conclusion:** Physical inactivity among adolescents was associated with females and longer time spent per day watching television.

*J Pediatr (Rio J). 2010;86(6):520-524:* Physical activity, risk factors, overweight, television, case-control studies, adolescents.

## Introduction

Physical inactivity reduces morbidity and mortality from chronic degenerative diseases, optimizing an individual's physical and psychological health and quality of life.[1] It is an important means to increase energy expenditure in order to balance food energy intake and prevent chronic degenerative diseases and their consequences.[2] Physical activity is a complex phenomenon involving any bodily movement that allows muscle contraction, including daily

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activities, mobility, personal care, free time (unintentional physical activity), exercise, and sports (intentional physical activity).[3]

Physical activity has decreased around the world, especially among adolescents, with high rates of physical inactivity observed in studies conducted in the last decade.[4-7] Sedentary habits are established in childhood and adolescence and tend to perpetuate into adulthood, with biological, family and cultural factors involved in physical inactivity.[8] Adolescents around the world are adopting an increasingly passive lifestyle, with less physical activity and changes in eating habits.[9] Although studies have shown that factors such as sex, overweight adolescents and mothers, mother's education, and time spent on sedentary activities are highlighted as some of the determinants of physical inactivity, there is still controversy over this.[6,7,9-15] Furthermore, only a few studies have addressed physical inactivity among Brazilian adolescents.

Therefore, identifying determinants of physical inactivity in adolescents in different populations is critical for the development of programs to promote physical activity according to local needs, which may thus contribute to the reduction of chronic diseases in adults. The objective of this study was to investigate determinants of physical inactivity among private school adolescents aged 15 to 19 years in the city of Recife, northeastern Brazil.

## Methods

This is a case-control study involving all adolescents aged 15 to 19 years enrolled in six private schools in the city of Recife, selected by convenience sampling. Exclusion criteria were adolescents with diseases that interfered with or hindered anthropometric measurements (congenital malformation, orthopedic changes, edema), who were being treated with drugs or diet for excess weight/obesity or who had changed their physical activity over the past 30 days. After the interview, we verified whether or not the adolescents showed physical inactivity, according to the International Physical Activity Questionnaire (IPAQ),[16] thus defining the following study groups: cases – inactive adolescents (categorized as sedentary or insufficiently active A and B of IPAQ); and controls – active adolescents (categorized as active and very active of IPAQ).

To estimate sample size, we used the Epi-Info® software, version 6.04b (CDC, USA). We considered a frequency of 2 or more hours watching television on a weekday of 41% in adolescents without sedentary behavior,[17] a risk of physical inactivity 1.8 higher in adolescents watching television for over 2 hours per day, a ratio of one case to one control, with 80% statistical power and significance level < 5%. The minimum sample size to be studied was 197 cases and 197 controls.

Data were collected by research assistants previously trained to administer the questionnaires and perform anthropometric measurements. Initially, the short version of IPAQ was applied to assess the level of physical activity. To ensure the quality of responses, the questionnaire was applied directly to the adolescents during individual interviews (face to face, as recommended for developing countries). The interview ended with the following questions answered by the adolescents: "On a normal school day, how many hours do you spend watching television?" and "On a normal school day, how many hours do you spend on the computer?," in order to identify the number of sedentary hours/day, adopting a normal school day to avoid recall bias, since regular activities could be a fixed reference to recall these time periods with more reliability of response. The cutoff point adopted was time ≥ 1 hour/day.[18]

Anthropometry of the adolescents was measured by Gibson's technique.[19] The students were weighted using a platform scale (Filizola, Brazil), with maximum capacity of 150 kg and sensitivity of 0.1 kg, and their height was measured with a stadiometer (Professional Gofeka, Brazil), with accuracy of 0.1 cm. With data on weight and height, it was possible to calculate the body mass index (BMI), according to the reference standards by the Centers for Disease Control and Prevention.[20] BMI was then categorized as overweight (BMI ≥ 85th percentile for age and sex) and adequate weight (BMI < 85th percentile and > 5th percentile for age and sex).

BMI of mothers was calculated based on the written responses received on mothers' weight and height, being then categorized, according to the reference standards by the Centers for Disease Control and Prevention,[21] as overweight (BMI ≥ 25 kg/m$^2$) and adequate weight (BMI < 24.9 kg/m$^2$). Reported maternal educational level was classified as ≤ 8 years and ≥ 9 years of schooling.

To detect variables associated with physical inactivity, data were analyzed by multiple logistic regression to control for confounding variables using the Statistical Package for the Social Sciences (SPSS), version 11.5, for Windows (IBM, USA). The hierarchical model was used for data analysis, with the inclusion of exploratory variables in the following order, provided they obtained a p value < 0.20 in the univariate analysis (chi-square test): model 1 – adolescent's biological variables (sex and BMI); model 2 – mother's variables (education and BMI); model 3 – cultural variables (time spent watching television and using the computer). Variables that remained significant at a level of 20% were maintained and included in the adjustment of the subsequent model. Baseline category to estimate adjusted and unadjusted odds ratio (OR) was defined as that with less risk for physical inactivity. For acceptance of the final model of physical inactivity, we used 95% confidence interval (95%CI) of the OR and a significance level of 5%.

This study was approved by the Research Ethics Committee of the Center for Health Sciences of Universidade Federal de Pernambuco, Brazil. The adolescents and their parents or legal guardians signed the written consent form upon agreeing to participate in this study.

## Results

Of all adolescents participating in the study (n = 597), 50.6% (302/597) were male. Regarding age, 45.1% (269/597) were 15 years old; 34.5% (206/597) were 16 years old; 16.1% (96/597) were 17 years old; 3.7% (22/597) were 18 years old; and 0.7% (4/597) were 19 years old. Physical inactivity was detected in 35.2% (210/597) of adolescents, more frequently among female adolescents (63.3%; 133/210), with adequate weight (75.7%; 159/210), who watched television (73.3%; 154/210) and used the computer (55.2%; 116/210) less than 1 hour/day, whose mothers had 9 years or more of schooling (52%; 105/210), and who were not overweight (56.3%; 112/210). According to the univariate analysis, female sex was the only determinant of physical inactivity (OR = 2.23; 95%CI 1.58-3.15).

Sex and overweight adolescents were included as variables in the multiple logistic regression model 1. In model 2, adolescent's sex and mother's education and excess weight were included; the variable "overweight adolescent" was not used to adjust this model due to a p value = 0.66 in the previous model, being then removed from the analysis. In model 3 (final model), adolescent's sex, mother's education and excess weight, time spent watching television and using the computer were included as variables. The variables associated with physical inactivity among adolescents were female sex and watching television for over 1 hour per day.

Female adolescents were twice as likely to be inactive (OR = 1.94; 95%CI 1.35-2.79) compared to male adolescents (Table 1). Watching television for more than 1 hour/day was not associated with physical inactivity in the univariate analysis (p = 0.06), but was statistically significant in the multivariate analysis (OR = 1.55; 95%CI 1.01-2.39) (Table 1). There was no statistically significant association

**Table 1 -** Determinants of physical inactivity among adolescents

| Variables | Physical inactivity | | | Statistics | |
|---|---|---|---|---|---|
| | Yes | No | Total | Unadjusted OR (95%CI) | Adjusted OR (95%CI) |
| Sex* | | | | | |
| Male | 77 | 218 | 295 | 1.00 | |
| Female | 133 | 169 | 302 | 2.23 (1.58-3.15)† | 1.94 (1.35-2.79)† |
| Overweight adolescent* | | | | | |
| No | 159 | 290 | 449 | 1.00 | |
| Yes | 51 | 97 | 148 | 0.96 (0.65-1.42)‡ | § |
| Maternal level of education‖ | | | | | |
| ≥ 9 years | 105 | 168 | 273 | 1.00 | |
| ≤ 8 years | 97 | 200 | 297 | 0.78 (0.55-1.09)‡ | 0.78 (0.54-1.12)‡ |
| Overweight mother‖ | | | | | |
| No | 112 | 218 | 330 | 1.00 | |
| Yes | 87 | 125 | 212 | 1.35 (0.95-1.93)‡ | 1.35 (0.93-1.93)‡ |
| Television watching¶ | | | | | |
| ≤ 1 hour/day | 154 | 310 | 464 | 1.00 | |
| > 1 hour/day | 56 | 77 | 133 | 1.46 (0.99-2.17)‡ | 1.55 (1.01-2.39)** |
| Computer use¶ | | | | | |
| ≤ 1 hour/day | 116 | 183 | 299 | 1.00 | |
| > 1 hour/day | 94 | 204 | 298 | 0.73 (0.52-1.02)‡ | 0.80 (0.56-1.15)‡ |

95%CI = 95% confidence interval; OR = odds ratio.
* Model 1.
† p < 0.001.
‡ p > 0.05.
§ Variable without adjusted OR, since it did not enter the adjusted model (p > 0.20).
‖ Model 2.
¶ Model 3.
**p < 0.05.

with overweight adolescent and mother's education and excess weight.

## Discussion

The results of this study indicate that physical inactivity is more common among female adolescents with the habit of watching television.

Studies have shown that female adolescents are less active than male adolescents.[6,7,22,23] The factors responsible for most physical inactivity in females have not yet been fully elucidated in the literature. Female adolescents have reported internal barriers (engagement in technology-related activities) and external barriers (family influence), which contribute to physical inactivity, emphasizing the preference to perform individual activities with lower energy expenditure.[24] Encouraging physical activities of greater interest, combined with family support and information on the importance of this practice to health, seems to guarantee an increase in physical activity among girls.[24,25]

The relationship between excess weight and physical inactivity demonstrates that overweight people have more difficulty in performing physical activities, thus reducing their motivation to practice exercises and establishing obesity as one of its determinants.[10,14,26] The study showed no relationship between physical inactivity and excess weight, probably because most (75.2%) adolescents had adequate weight. However, some authors have reported that physical inactivity may result from excess weight, not only because of impaired mobility, but also due to emotional factors related to perceived competence to perform planned physical activities and dissatisfaction with excess weight, which favors sedentary behaviors.[8,11,12,23,25,27]

Although not detected in this sample, other studies found lower maternal educational level and excess weight to be associated with physical inactivity.[9,27,28] In general, lower educational level and low income are associated with higher rates of physical inactivity and reflect the lack of information on the benefits of physical activity to health, as well as the lack of suitable environments (infrastructure and safety) to practice exercises.[9,29] Improved levels of physical activity are related to families with higher educational level, who understand the benefits of exercise, are more active and act as a social support, encouraging their children to practice exercises.[8,9,23] Overweight mothers who are physically inactive may negatively affect the decision of adolescents about physical activity.[9,30,31] Although the family can influence the adoption of healthy behaviors, it is worth noting that many adolescents tend to dismiss such attitudes as a way of asserting their autonomy, becoming physically inactive, regardless of family habits.[24]

Time spent watching television has been positively associated with physical inactivity, which is consistent with our findings.[6,9,24,32] The interrelationship between sedentary behaviors and physical inactivity is complex.[23] Sedentary behaviors are likely to consume time that might otherwise be spent on physical activity.[33] However, increasing physical activity does not interfere with time spent by adolescents on sedentary activities (television watching and computer use), confirming that specific measures to reduce time spent on sedentary behaviors should be developed.[13]

This study has some limitations. Objective assessment of physical activity (accelerometer, pedometer) is more accurate than using a questionnaire, but costs increase and individual behaviors can change during measurements.[2] However, IPAQ is a validated questionnaire that assesses total physical activity rather than simply assessing activities performed during free time. The use of self-reported weight of mothers can affect BMI real value, with a tendency to underestimate it; however, self-reported data are commonly used in epidemiological studies due to the convenience and low cost.[34]

Our study found that female adolescents are at greater risk for physical inactivity, in addition to spending more time watching television. Health professionals and families should encourage adolescents to incorporate physical activity into their daily life and observe the influence of media on adolescents' attitudes, which may be encouraging the adoption of sedentary behaviors in daily activities.

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