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Prevalence of Insufficient Physical Activity and Associated Factors in Brazilian Adolescents

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Background: We aimed to describe levels of physical activity (PA) in adolescents living in southern Brazil and to explore associations between PA levels and demographic, socioeconomic, health-related, and parental variables. A further aim was to test the validity and reliability of the questionnaire used. ***Methods:*** We conducted a population-based, cross-sectional study including 857 adolescents selected randomly. Insufficient PA was defined as <300 min/wk of MVPA. PA data collected by questionnaire were compared with pedometer counts and with a longer version of the questionnaire in a subsample of 92 adolescents. ***Results:*** Reliability of the questionnaire was good, and its validity in comparison with a longer questionnaire was also satisfactory. In comparison with pedometer data, the questionnaire presented moderate agreement. The prevalence of insufficient PA in the whole sample was 69.8% (95% CI = 66.7–72.9). Boys were more active than girls. The prevalence of insufficient PA increased with age in girls but not in boys. Among boys, those from low socioeconomic levels were more likely to be sedentary. Among girls, paternal PA was directly associated with adolescent activity levels. ***Conclusions:*** Urgent strategies aimed at increasing levels of activity of adolescents are necessary in Brazil given the high prevalence of insufficient PA detected in this study. The variables associated with insufficient PA varied between boys and girls.

Keywords: exercise, epidemiology, questionnaire, youth, Brazil

Regular physical activity practice decreases the risk of a series of diseases, such as hypertension, coronary heart disease, type 2 diabetes, osteoporosis, some cancers, depression, anxiety, obesity, and others.[1] Increased levels of physical activity are also related to a decreased risk of premature all-cause mortality.[2] Several typical adult chronic diseases start to develop in childhood and adolescence, and thus, it is essential to promote active lifestyles early in life.[3] In spite of the growing scientific knowledge on the benefits of active lifestyles for health, levels of physical activity seem to be declining among children and adolescents in various countries, particularly in poor urban areas.[4]

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In Brazil, there are few population-based studies on physical activity in adolescents. Such studies have used different instruments and operational definitions of insufficient physical activity, hindering comparability.[5–7] Investigating the effect of parental variables, for example activity levels and body mass index (BMI), on physical activity levels of adolescents is a research topic that deserves further research; studies on this are still rare,[8] and we could not locate studies on this issue in Brazil.

The aims of this study were to describe levels of physical activity among adolescents (10–19 years) living in an urban area in southern Brazil and to explore the association between insufficient physical activity and demographic, socioeconomic, health-related, and parental variables. A further aim was to test the validity and reliability of the questionnaire used.

Methods

A cross-sectional, population-based study was carried out in Pelotas, a southern Brazilian city (population of 320,000 inhabitants). The city is located in the Rio Grande do Sul state, near the border with Uruguay and Argentina. Although Rio Grande do Sul is one of the richest states in Brazil, Pelotas is located in the poorest area of Rio Grande do Sul. The fieldwork started in October and ended in December 2005 (end of spring to beginning of summer).

A multistage sampling strategy was used to select these households. First, all 404 census tracts (geographically defined areas comprising approximately 300 households each) of the city were listed and sorted by mean family income. Census tracts were systematically sampled (guaranteeing stratification by socioeconomic level) with probability proportionate to the size. In each of the 120 census tracts sampled, all households were listed, and a systematic sampling method was used to select those to be included in the sample (mean of 12 households per tract). The number of households per tract slightly varied according to the size of the tract. In each sampled household, all individuals age 10 to 19 years were eligible for this study, except those unable to answer the questionnaire by themselves because of mental or physical disability.

Sample size calculations before data collection showed that for studying the prevalence of insufficient physical activity, it was necessary to include 384 adolescents, based on an estimate of 50% of insufficient physical activity, margin of error of 5 percentage points and confidence level of 95%. An extra 80% were added to cover nonresponse and the design effect due to the clustering of the sample. Therefore, it would be necessary to include 691 adolescents. Using data from the Brazilian Institute of Geography and Statistics (2000 census), it was estimated that the number of adolescents per household was 0.5, and thus, 1382 households should be included in the sample. A total of 1507 households in 120 census tracts were included in the sample.

Thirty-eight interviewers performed data collection. They had at least a secondary education and were not aware of the objectives and hypothesis of the study. Subjects who were not at the household in the first contact of the interviewer were revisited at least 3 times, and if the subject was not found after that, he/she was considered to be lost and no replacements were done. To assure quality of the data collected, 10% of the sample was reinterviewed by a field supervisor.

A standardized and pretested questionnaire was applied to all adolescents in their homes by face-to-face interviews. Interviewers were trained for 40 hours before data collection. The physical activity questionnaire addressed transportation to and from school or work and leisure-time physical activities. It comprised 7 questions on transport-related physical activity and a box with a list of leisure-time activities (copies of the questionnaire are available on request). Only activities practiced for 10 consecutive minutes or more were considered. The first question on transportation mode to and from school or work was, "Are you currently at school?" If yes, "How do you usually go to school?" If an active mode (walking or cycling) was reported, the subject was asked about the duration of the activity. The same structure of questions was repeated replacing school with work. In terms of leisure-time activities, a pilot study was carried out to detect the most frequently practiced physical activities in adolescents. The most frequent ones were included in the questionnaire, and a question on other activities was placed at the end of the questionnaire. For each activity, the typical structure of the questions was (example for soccer), "In the previous 7 days, excluding physical education classes, have you played soccer?" If the answer was no, the question was repeated for the next activity. If the answer was yes, a question on number of days of practice in the previous week and another on average time spent per day were asked. A longer version of the questionnaire[5] was used in the 1993 Pelotas (Brazil) Birth Cohort Study for adolescents age 10 to 12 years. The first difference between the 2 questionnaires is that the long one has more activities listed (13 vs 11, respectively). In addition, the long questionnaire includes specific questions on housework physical activity; those questions were excluded for the short version given that their contribution to the final score was shown to be small.[5]

In a subsample of 92 adolescents, we compared our questionnaire with the longer version used in the 1993 Pelotas (Brazil) Birth Cohort Study and with pedometer counts (Digi Walker SW 700). Subjects included in the subsample were visited on Wednesday. On that occasion, the short and long questionnaires were applied (half of the sample answered the short and then the long questionnaire, and the other half answered them in the opposite order) and pedometers were given to the adolescents. Pedometers were used from Thursday to Sunday. Average number of steps per weekday and weekend day was calculated. The total number of steps per week was calculated as the sum of weekday steps times 5 plus the sum of weekend day steps times 2. This final number was divided by 7 for providing the mean number of steps per day. A cutoff of 10,000 steps for days was used in some analyses.[9] Fourteen days (±2) after the first interview, subjects answered the short questionnaire again to test reliability.

Insufficient physical activity was defined as less than 300 minutes per week of moderate- to vigorous-intensity physical activity practice, in accordance with current physical activity guidelines for adolescents.[10] A cutoff point of 150 minutes per week, the same used for adults,[11] was also calculated. Regular physical education classes at school were not computed because they were previously shown to be performed at a light intensity most of the time.[12]

The independent variables included in this study were sex, age, socioeconomic level (Brazil Criterion of Economic Classification, which divides families into 5 groups, of which "A" is the wealthiest one), number of school failures, parental schooling, type of household (house or apartment), type of school (private or

public), parental smoking, parental physical activity level, adolescent self-reported health status, and parental body mass index (BMI).

Data were entered twice in an Epi-Info database with automatic checks for consistency and range. A map of improbable or impossible combinations of answers was developed in Stata 9.0, and data were cleaned using this map. Data analyses were carried out in Stata 9.0. Descriptive statistics were used to characterize the sample. The prevalence of insufficient physical activity was calculated for the categories of the independent variables for both sexes combined and for boys and girls separately. Unadjusted and adjusted prevalence ratios taking into account the sampling strategy were calculated using Poisson regression, as recommended for highly prevalent outcomes.[13] The adjusted analysis was based on a 2-level hierarchical framework: the first level incorporated sex, age, socioeconomic level, maternal and paternal schooling and the second level included number of school failures, type of household, type of school, adolescent self-reported health status, maternal and paternal BMI, maternal and paternal leisure-time physical activity, maternal and paternal smoking status. All tests were two-tailed, and the significance level used was .05.

The Ethics in Research Committee of the Federal University of Pelotas Medical School provided ethical clearance for the project. Confidentiality was ensured, and informed consents were obtained from each subject.

Results

Reliability of the short questionnaire was good. The Spearman correlation coefficient comparing both visits was .62 ($P < .001$), and 73% of the subjects were classified consistently in the first and second visits using insufficient physical activity <300 min/wk as a yes/no variable; the kappa value was .58. In comparison with the longer questionnaire, the instrument used in our study also performed well. The Spearman correlation coefficient was .66 ($P < .001$), and 77% of the subjects were classified consistently in both questionnaires using the cutoff of 300 min/wk for insufficient physical activity; the kappa value was .63. Treating the long questionnaire as a reference method, the sensitivity of the short questionnaire was 87.3% (95% CI = 76.5–94.4), and its specificity was 75.9% (95% CI = 56.5–89.7). However, in comparison with pedometer counts, our questionnaire presented only weak to moderate comparability. The Spearman correlation coefficient was .26 ($P = .02$), and 57% of the subjects were classified consistently as sedentary in the questionnaire and with pedometers (using a cutoff point of 10,000 steps per day). The kappa value was very low (.18). Treating the pedometer counts as the reference method, the sensitivity of our questionnaire was 77.1% (95% CI = 59.9–89.6), but its specificity was only 42.6% (95% CI = 28.3–57.8).

Within the 1507 households sampled, there were 873 adolescents eligible for the investigation, of whom 857 (98.2%) answered the questionnaire. Out of the 720 adolescents who were currently studying, 497 (69%) reported an active transportation (walking or cycling) to school most days of the week. Out of the 132 who reported working outside home, 77 (58%) reported an active transportation to work. Active transportation to and from school or work was more frequent for boys (73.4%) than girls (66.3%). It was also inversely associated with socioeconomic level; the prevalence of active transportation ranged from 52.9% among those in the wealthiest groups to 79.6% among those in the poorest groups.

Approximately half of the adolescents (52%) reported any kind of leisure-time physical activity in the week before the interview. After summing transportation and leisure-time physical activity, a score (in minutes per week) was created. Figure 1 describes the physical activity score; a marked positive skewness was observed. The mean score was 298 (SD = 463) minutes per week, but the median value was only 120 minutes per week. Using the cutoff point of 300 minutes per week recommended for adolescents, 69.8% (95% CI = 66.7–72.9) of the subjects were not sufficiently active; such prevalence was 56.5% (95% CI = 51.6–61.3) among boys and 82.1% (95% CI = 78.5–85.6) among girls. Even using the cutoff recommended for adults (150 minutes per week), more than half of the adolescents 54.6% (95% CI = 51.3–57.9) were classified as insufficiently active. If we consider the time spent in physical education classes per week in the activity score (estimated to be 60 min/wk), the prevalence of insufficient physical activity would decrease from 69.8% to 65.5%. The next sections evaluating the variables associated with insufficient physical activity use the cutoff point of 300 minutes per week and do not consider physical education classes given that such classes are usually performed at light intensity.[12]

In the whole sample, 48% of the subjects were boys, 36.3% were from socioeconomic levels D or E, and 9.8% lived in an apartment. In terms of parental variables, 29.7% of the fathers had, at least, a secondary education, 36.4% were classified as current smokers, 16.6% were obese, and 23.1% reported to practice at least 20 minutes of leisure-time physical activity on 3 or more days per week. Among mothers, 35.5% had, at least, a secondary education, 33.3% were classified as current smokers, 18.4% were obese, and 21.6% reported to practice at least 20 minutes of leisure-time physical activity on 3 or more days per week. In terms

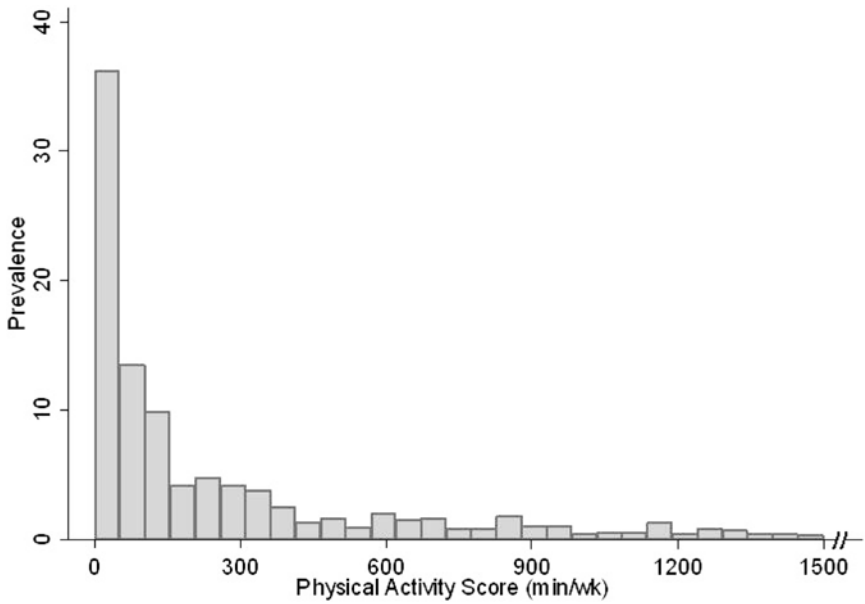

Figure 1 — Distribution of the physical activity score (minutes per week) in adolescents. The graph was discontinued at 1500 minutes per week (15 individuals—1.8% of the sample—with scores above 1500 min/wk were not included in the graph).

of adolescent variables, 30.8% were between 14 and 16 years of age, 86.5% studied in public schools, 37.1% experienced at least 1 school failure, and 13.2% classified his/her own health as regular or poor. The maximal number of missing values was 49 (6.2%) for maternal schooling. Table 1 shows a description of the sample and the prevalence of insufficient physical activity stratified by sex.

Table 2 presents unadjusted and adjusted analyses of the variables associated with insufficient physical activity among boys. In the unadjusted analysis, those from a low socioeconomic level were more likely to be insufficiently active, and maternal education was inversely associated with insufficient physical activity. Adolescents with mothers who are physically active were less likely to be active. All other variables were not significantly associated with insufficient physical activity in boys in the unadjusted analysis. After adjustment, only low socioeconomic status and high maternal physical activity were associated with insufficient physical activity. Maternal smoking presented a borderline association with insufficient physical activity both in the unadjusted and in the adjusted analyses.

In Table 3, the same analyses are presented for girls. Paternal and maternal physical activity were associated with lower prevalence of insufficient physical activity in the unadjusted analysis. Age was positively associated with insufficient physical activity in girls; activity levels tended to decline during adolescence. After adjustment, the effect of maternal activity levels on adolescent insufficient physical activity lost statistical significance.

Table 4 shows the physical activities reported more frequently by boys and girls. Among boys, outdoor soccer, cycling, indoor soccer, and walking were the most frequently mentioned ones. Among girls, walking, cycling, volleyball, and outdoor soccer were the most popular activities.

Discussion

This is the first population-based study on levels of physical activity in Brazilian adolescents age 10 to 19 years. Previous studies in Brazil included adolescents from narrower age ranges[5,7] or used school-based samples.[6] For young adolescents, studies using school-based samples are unlikely to be biased, given the fact that most adolescents below 15 years of age are at school in Brazil. However, for correctly addressing levels of physical activity in older adolescents (16–19 years), population-based studies are required because a substantial proportion of them is not at school anymore. A possible limitation to this study is that gender-stratified analyses were not considered in the sample size calculations. However, in our view, the sample size was big enough to detect as statistically significant the differences that were relevant in terms of public health.

The prevalence of insufficient physical activity found in this sample is not easy to compare with that obtained in other studies because the instruments and cutoff points vary considerably across publications. For example, a study in the same city including adolescents age 15 to 19 years found a prevalence of insufficient physical activity of 39%[7] using a threshold of 60 minutes per week in the PAQ-A questionnaire; in comparison, our study found a prevalence of 28.8% if we restrict the analyses to subjects at the same age range. In Rio de Janeiro, a study including adolescents age 14 to 15 years found a prevalence of insufficient

Table 1 Description of the Sample in Terms of Family, Parental, and Adolescent Variables and Prevalence of Insufficient Physical Activity in Each Subgroup Stratified by Sex

	Description of the sample	% of insufficient physical activity			
Variable[a]	N (%)	Boys	*P*	Girls	*P*
Family variables					
Socioeconomic level			.02[b]		.60[b]
A+B (wealthiest)	216 (25.4)	51.9		83.9	
C	326 (38.3)	51.0		78.4	
D+E	309 (36.3)	65.3		85.5	
Type of household			.19[c]		.24[c]
house	773 (90.2)	57.5		82.7	
apartment	84 (9.8)	46.0		76.6	
Parental variables					
Paternal schooling (y)			.77[b]		.40[b]
0–4	155 (27.0)	56.8		84.0	
5–8	249 (43.3)	48.8		82.0	
≥9	171 (29.7)	53.9		78.8	
Maternal schooling (y)			.05[b]		.47[b]
0–4	171 (23.1)	67.1		84.9	
5–8	306 (41.4)	50.0		82.7	
≥9	263 (35.5)	51.9		81.1	
Paternal current smoking status			.97[c]		.29[c]
never smoker	207 (33.5)	53.0		77.2	
former smoker	186 (30.1)	53.8		80.7	
current smoker	225 (36.4)	53.3		83.1	
Maternal current smoking status			.75[c]		.83[c]
never smoker	380 (48.2)	57.8		82.6	
former smoker	146 (18.5)	40.9		80.0	
current smoker	263 (33.3)	60.9		83.7	
Paternal body mass index (kg/m^2)			.67[b]		.85[b]
<25	240 (39.4)	58.9		79.7	
25–29.9	268 (44.0)	45.7		80.8	
≥30	101 (16.6)	58.5		80.6	
Maternal body mass index (kg/m^2)			.46[b]		.21[b]
<25	370 (49.3)	56.4		80.2	
25–29.9	243 (32.4)	47.8		83.1	
≥30	138 (18.4)	54.0		86.7	

(continued)

Table 1 *(continued)*

Variable[a]	Description of the sample N (%)	% of insufficient physical activity Boys	*P*	Girls	*P*
Paternal leisure-time physical activity level (habitual)			.75[c]		.01[c]
≥20 min, at least 3 d/wk	143 (23.1)	51.5		69.3	
<20 min, 3 or more d/wk	475 (76.9)	53.9		84.2	
Maternal leisure-time physical activity level (habitual)			.08[c]		.006[c]
≥20 min, at least 3 d/wk	170 (21.6)	65.4		74.2	
<20 min, 3 or more d/wk	619 (78.5)	53.1		84.8	
Adolescent variables					
Age (y)			.94[b]		.05[b]
10–13	342 (39.9)	57.5		78.3	
14–16	264 (30.8)	54.3		82.2	
17–19	251 (29.3)	57.4		86.8	
Type of school			.98[c]		.54[c]
public	623 (86.5)	55.9		80.6	
private	97 (13.5)	56.1		83.9	
Number of school failures			.35[c]		.09[c]
none	533 (62.9)	54.1		79.9	
≥1	314 (37.1)	58.9		86.1	
Self-reported health status			.08[b]		.34[b]
excellent	143 (16.7)	48.0		79.4	
very good	148 (17.3)	49.3		77.2	
good	453 (52.9)	62.2		84.7	
regular/poor	113 (13.2)	52.4		81.7	

[a] Maximum of 49 missing values (maternal schooling).

[b] Wald test for trend.

[c] Wald test for heterogeneity.

physical activity of 85% among boys and 94% among girls.[6] In that study, adolescents who scored 2 or less in a score including sports practice and leisure-time activities ranging from 0 to 5 were classified as insufficiently active. In our sample, using the same age range, these proportions were, respectively, 52.2% and 81.6%, for boys and girls.

In accordance with previous studies in Brazil and worldwide, boys were more active than girls.[5,7,14] It was previously shown that cultural and social variables are more likely to explain this difference than biological factors.[15] Previous studies in adults suggest that the variables associated with activity levels might differ by

Table 2 Unadjusted and Adjusted Prevalence Ratios (PR) for Independent Variables in Relation to the Outcome for Boys

		Unadjusted analysis		Adjusted analysis	
Level[a]	Variable	PR (95% CI)	*P*	PR (95% CI)	*P*[b]
	Family variables				
1	Socioeconomic level		.04[c]		.04[c]
	A+B (wealthiest)	1.00		1.00	
	C	0.98 (0.76–1.27)		0.98 (0.76–1.27)	
	D+E	1.26 (0.99–1.60)		1.26 (0.99–1.60)	
2	Type of household		.23[d]		.61[d]
	house	1.00		1.00	
	apartment	0.80 (0.55–1.15)		0.91 (0.64–1.30)	
	Parental variables				
1	Paternal schooling (y)		.77[c]		.36[c]
	0–4	1.00		1.00	
	5–8	0.86 (0.62–1.19)		0.97 (0.68–1.37)	
	≥9	0.95 (0.71–1.27)		1.18 (0.81–1.73)	
1	Maternal schooling (y)		.05[c]		.30[c]
	0–4	1.00		1.00	
	5–8	0.75 (0.60–0.93)		0.79 (0.58–1.09)	
	≥9	0.77 (0.61–0.98)		0.82 (0.58–1.15)	
2	Paternal current smoking status		1.00[d]		.88[d]
	never smoker	1.00		1.00	
	former smoker	1.01 (0.74–1.38)		0.93 (0.65–1.33)	
	current smoker	1.00 (0.75–1.35)		0.91 (0.62–1.34)	

(continued)

Table 2 *(continued)*

Level[a]	Variable	Unadjusted analysis PR (95% CI)	Unadjusted analysis *P*	Adjusted analysis PR (95% CI)	Adjusted analysis *P*[b]
2	Maternal current smoking status		.06[d]		.04[d]
	never smoker	1.00		1.00	
	former smoker	0.71 (0.50–0.99)		0.71 (0.51–0.98)	
	current smoker	1.05 (0.86–1.29)		1.08 (0.88–1.31)	
2	Paternal body mass index (kg/m^2)		.67[c]		.86[c]
	<25	1.00		1.00	
	25–29.9	0.78 (0.61–0.99)		0.91 (0.69–1.21)	
	≥30	0.99 (0.73–1.36)		1.07 (0.70–1.63)	
2	Maternal body mass index (kg/m^2)		.46[c]		.32[c]
	<25	1.00		1.00	
	25–29.9	0.85 (0.66–1.09)		0.86 (0.67–1.09)	
	≥30	0.96 (0.73–1.26)		0.91 (0.70–1.19)	
2	Paternal leisure-time physical activity level (habitual)		.75[d]		.79[d]
	≥20 min, at least 3 d/wk	1.00		1.00	
	<20 min, 3 or more d/wk	1.05 (0.79–1.39)		1.04 (0.77–1.42)	
2	Maternal leisure-time physical activity level (habitual)		.05[d]		.02[d]
	≥20 min, at least 3 d/wk	1.00		1.00	
	<20 min, 3 or more d/wk	0.81 (0.66–1.00)		0.77 (0.63–0.95)	
	Adolescent variables				
1	Age (y)		.94[c]		.29[c]
	10–13	1.00		1.00	
	14–16	0.94 (0.78–1.15)		0.91 (0.69–1.20)	
	17–19	1.00 (0.81–1.23)		0.85 (0.62–1.16)	

(continued)

Table 2 *(continued)*

Level[a]	Variable	Unadjusted analysis		Adjusted analysis	
		PR (95% CI)	*P*	PR (95% CI)	*P*[b]
2	Type of school		.98[d]		.84[d]
	public	1.00		1.00	
	private	1.00 (0.75–1.34)		0.95 (0.61–1.50)	
2	Number of school failures		.34[d]		.63[d]
	none	1.00		1.00	
	≥1	1.09 (0.91–1.30)		0.95 (0.77–1.17)	
2	Self-reported health status		.08[c]		.22[c]
	excellent	1.00		1.00	
	very good	1.03 (0.74–1.43)		1.09 (0.77–1.54)	
	good	1.30 (1.01–1.67)		1.30 (0.99–1.71)	
	regular/poor	1.09 (0.70–1.69)		1.06 (0.67–1.67)	

[a] The effect of each variable on the outcome is adjusted for other variables in the same level or above in the hierarchical model.

[b] Variables with $P > .2$ were excluded from the model.

[c] Wald test for trend.

[d] Wald test for heterogeneity.

Table 3 Unadjusted and Adjusted Prevalence Ratios (PR) for Independent Variables in Relation to the Outcome for Girls

		Unadjusted analysis		Adjusted analysis	
Level[a]	Variable	PR (95% CI)	*P*	PR (95% CI)	*P*[b]
	Family variables				
1	Socioeconomic level		.54[c]		.97[c]
	A+B (wealthiest)	1.00		1.00	
	C	0.93 (0.82–1.06)		0.92 (0.81–1.05)	
	D+E	1.02 (0.93–1.12)		0.98 (0.86–1.12)	
2	Type of household		.29[d]		.45[d]
	house	1.00		1.00	
	apartment	0.93 (0.80–1.07)		1.10 (0.86–1.39)	
	Parental variables				
1	Paternal schooling (y)		.40[c]		.84[c]
	0–4	1.00		1.00	
	5–8	0.98 (0.87–1.10)		1.00 (0.88–1.13)	
	≥9	0.94 (0.80–1.09)		0.98 (0.81–1.18)	
1	Maternal schooling (y)		.47[c]		.41[c]
	0–4	1.00		1.00	
	5–8	0.97 (0.86–1.10)		0.99 (0.87–1.12)	
	≥9	0.95 (0.84–1.08)		0.95 (0.84–1.08)	
2	Paternal current smoking status		.60[d]		.84[d]
	never smoker	1.00		1.00	
	former smoker	1.04 (0.89–1.23)		1.01 (0.82–1.23)	
	current smoker	1.08 (0.93–1.24)		1.05 (0.89–1.23)	

(continued)

Table 3 *(continued)*

Level[a]	Variable	Unadjusted analysis PR (95% CI)	Unadjusted analysis *P*	Adjusted analysis PR (95% CI)	Adjusted analysis *P*[b]
2	Maternal current smoking status		.80[d]		.59[c]
	never smoker	1.00		1.00	
	former smoker	0.97 (0.84–1.11)		1.05 (0.88–1.27)	
	current smoker	1.01 (0.93–1.10)		1.06 (0.94–1.21)	
2	Paternal body mass index (kg/m^2)		.85[c]		.87[c]
	<25	1.00		1.00	
	25–29.9	1.01 (0.88–1.16)		1.05 (0.91–1.21)	
	≥30	1.01 (0.84–1.21)		0.99 (0.79–1.23)	
2	Maternal body mass index (kg/m^2)		.21[c]		.07[c]
	<25	1.00		1.00	
	25–29.9	1.04 (0.94–1.14)		1.11 (0.96–1.28)	
	≥30	1.08 (0.97–1.20)		1.14 (0.98–1.33)	
2	Paternal leisure-time physical activity level (habitual)		.04[d]		.04[d]
	≥20 min, at least 3 d/wk	1.00		1.00	
	<20 min, 3 or more d/wk	1.21 (1.01–1.46)		1.22 (1.01–1.49)	
2	Maternal leisure-time physical activity level (habitual)		.02[d]		.47[d]
	≥20 min, at least 3 d/wk	1.00		1.00	
	<20 min, 3 or more d/wk	1.14 (1.02–1.28)		1.06 (0.91–1.22)	
	Adolescent variables				
1	Age (y)		.05[c]		.04[c]
	10–13	1.00		1.00	
	14–16	1.05 (0.96–1.15)		1.05 (0.96–1.15)	
	17–19	1.11 (1.01–1.22)		1.11 (1.01–1.22)	

(continued)

Table 3 *(continued)*

Level[a]	Variable	Unadjusted analysis		Adjusted analysis	
		PR (95% CI)	*P*	PR (95% CI)	*P*[b]
2	Type of school		.51[d]		.14[d]
	public	1.00		1.00	
	private	1.04 (0.92–1.18)		1.12 (0.96–1.30)	
2	Number of school failures		.08[d]		.85[d]
	none	1.00		1.00	
	≥1	1.08 (0.99–1.17)		0.99 (0.85–1.15)	
2	Self-reported health status		.34[c]		.67[c]
	excellent	1.00		1.00	
	very good	0.97 (0.84–1.12)		1.02 (0.85–1.24)	
	good	1.07 (0.95–1.20)		1.05 (0.89–1.25)	
	regular/poor	1.03 (0.89–1.19)		1.03 (0.81–1.32)	

[a] The effect of each variable on the outcome is adjusted for other variables in the same level or above in the hierarchical model.

[b] Variables with $P > .2$ were excluded from the model.

[c] Wald test for trend.

[d] Wald test for heterogeneity.

Table 4 Physical Activities Performed More Frequently by Boys and Girls

Activity	Boys, %	Girls, %
Outdoor soccer	63.4	20.9
Cycling	44.0	32.8
Indoor soccer	27.5	10.7
Walking	22.0	45.2
Volleyball	13.9	23.2
Running	11.7	11.9
Basketball	10.6	6.2
Weightlifting	9.2	3.4
Dancing	5.1	15.3
Gymnastics	3.3	5.1

sex,[16] and therefore, we opted to present gender-stratified analyses in this article. Our findings confirm that risk factors for insufficient physical activity differ between boys and girls.

Several studies suggest that levels of physical activity tend to decline during adolescence.[6,7] In our sample, this was observed among girls but not among boys. This finding confirms that the difference in the proportion of insufficient physical activity among boys and girls tends to increase with age (see Table 1). It is essential for public health researchers to detect the period in which girls decrease their activity levels more markedly. A previous study[17] has shown that girls tend to change habits in early adolescence (10–11 years), and therefore, future interventions could focus on girls at this age.

A previous study[5] detected that adolescents from high socioeconomic levels in Brazil present a greater level of practice of structured physical activities than those from low socioeconomic groups, but they present a lower level of transportation and unstructured physical activities. In that publication, adolescents were not stratified by sex. In our sex-stratified analysis, this finding was confirmed for boys but not for girls. The effect of socioeconomic level on physical activity in Brazil depends markedly of the domains of activity evaluated. In adults, it was previously shown that leisure-time walking was more frequent among the rich, whereas active transportation to work was more frequent among the poor.[18] Interestingly, data for maternal schooling were not consistent, and after adjustment, there was no association between this variable and prevalence of insufficient physical activity in adolescents. Paternal education was unrelated to insufficient physical activity both in the crude and in the adjusted analyses.

Parental anthropometry, expressed as BMI, was not associated with insufficient physical activity among adolescents. One previous study has shown that adolescents are more likely to be sedentary when parents are overweight,[19] but another study did not find such an association.[20] Adolescents born to former smoker mothers were more active in the unadjusted analysis, but this effect was

no longer significant after adjustment for confounders, suggesting that other variables were responsible for such an association.

The role of parental activity levels on adolescent physical activity was explored in several publications. A previous study reported that high levels of paternal and maternal participation in physical activity are associated with high levels of activity in adolescents.[8] Again, not all studies are consistent. In a previous publication, DiLorenzo and colleagues showed that parental physical activity was inversely related to adolescent activity levels.[21] However, this was the only study we could find showing an inverse association between parental activity levels and adolescent physical activity. In our sample, results differed by sex. Among girls, the traditional direct association was found; those with active fathers were more likely to be active. Among boys, there was no association with paternal physical activity, and an inverse relationship with maternal activity levels was found. In-depth studies are needed to help explain such a surprising finding.

The validity and reliability of the questionnaire used were tested in a subsample of adolescents. In summary, reliability indicators were good, and validity indicators were good in comparison with a longer version of the questionnaire and weak to moderate in comparison with pedometer data. Because the questionnaire collects data using a 7-day recall and the reliability was tested 14 days after the original application, a certain degree of inconsistency is not surprising. Measuring physical activity is a challenge for public health researchers. Direct measurements, particularly using accelerometers or doubly labeled water, provide more valid data on physical activity and energy expenditure. However, in epidemiological research, most studies use questionnaires because of costs and logistics limitations. Pedometers are a potential alternative, with intermediate costs and validity. However, most studies comparing questionnaire data with pedometer counts found weak to moderate comparability regardless of the age of the participants.[22–24] The validity of our questionnaire in comparison with pedometers was, at least, as good as other questionnaires.[25] In the subsample of 92 adolescents, 42.6% were classified as insufficiently active by pedometers and 67.4% by the short questionnaire. Therefore, our insufficient physical activity prevalence in the whole sample might be overestimated if we consider pedometer counts as the gold standard. In terms of the associations, our questionnaire data seem to be consistent with pedometer counts. Using pedometers, 53.5% of the girls and 30.8% of the boys were classified as insufficiently active (<10,000 steps per day), a sex difference similar to that obtained using our questionnaire data. In both sexes, the lowest prevalence of insufficient physical activity defined by pedometers was found among younger adolescents, which is also similar to the analyses of the questionnaire data.

Data from this study provide the first estimate of the prevalence of insufficient physical activity among adolescents (all ages) in Brazil. However, one should consider that our data arise from a single city in the south of the country. In spite of this limitation, we believe our prevalence estimates are likely to be valid for several parts of Brazil, particularly for cities and states with similar socioeconomic and environmental aspects.

In summary, the prevalence of insufficient physical activity was high among Brazilian adolescents regardless of the cutoff used or the subgroup investigated.

The Ministry of Health is launching a behavioral surveillance system for adolescents, which will contribute substantially to a better understanding of trends in physical activity in Brazil. Urgent strategies for increasing levels of activity among youth are necessary in Brazil. Publications such as the CDC Community Guide may be used for identifying the interventions that are more likely to be effective.

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