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Body Composition, Physical Activity and Active Transportation in Adolescents of Metropolitan Region of Curitiba, Brazil

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Abstract

Background: Physical activity is a part of a healthy lifestyle, however sedentary habits are currently prevalent among adolescents which impacts rates of overweight and obesity in this group. This study aims to describe the relationship of physical activity with the use of active transportation to school (ATS) and its relationship with body composition in adolescents. **Materials and Methods:** Information about physical activity, sedentary behavior and active transportation were collected through two survey instruments, one completed by a responsible parent/guardian and other by the adolescent. Body composition was assessed by dual-energy x-ray absorptiometry (DXA). Excess body fat was defined as ≥ 25% in male and ≥ 30% among female adolescents. Less than 60 minutes of moderate to vigorous daily physical activity defined one as sedentary and greater than 2 hours of screen time per day was defined as excessive. **Results:** The prevalence of excess body fat was 46.5%. Only 24.7% of the sample performed recommended amounts of physical activity and 92.3% engaged in excess screen time. Approximately one-fifth of our sample (19.2%) used ATS. The main barriers to active transport were traffic, distance and safety. Those that used ATS had lower body fat and fewer hours of sedentary behavior.

Key words: Adolescents, Physical Activity, Sedentarism, Active Transportation, Body Composition

1. Introduction

A lifestyle that includes healthy habits is beneficial because it is related to the prevention of diseases, decreased mortality and increased life expectancy (Pereira et al., 2012). One of those habits is regular physical activity (PA) which is essential for healthy development (Tenório et al., 2010). For children and adolescents PA also aids in the development of motor, social, cognitive and emotional domains (Gallahue & Ozmun, 2001).

PA during adolescence is also related to positive physiological outcomes including bone mineralization and muscle development. Psychosocial benefits, including improved sleep, and reductions in mood disorders have also been noted (Gallahue & Ozmun, 2001; Gonçalves et al., 2009; Mello, 2004).

According to Silva and collegues (Silva et al., 2009), adolescence has historically been a life stage typified by regular PA. But it is disappointing to note that this phenomenon has changed in recent years.Studies have shown that like adults, adolescents spend much of their time in sedentary peursuits. These inactive lifestyles compound the obesity problem because they are associated with other unhealthy habits such as eating high fat and high calorie foods (Celestrino & Costa, 2006; Fermino et al., 2010; Guedes et al., 2001; Pires et al., 2004; Silva, et al., 2008; Tenório et al., 2010).

In efforts to reduce obesity and increase PA organizations such as the American Heart Association (AHA) have created behavioral guidelines.The AHA recommends that children and adolescents should incorporate at least 60 minutes of moderate to vigorous activities daily. The AHA also recommends that screen time be limited to 120 minutes per day (Silva, 2009).

Because these recommendations are not being met by many adolescents (Celestrino & Costa, 2006; Fermino et al., 2010; Silva et al., 2008; Tenório et al., 2010) public health officials have sought ways to increase physical activity.One potential way to increase PA is to promote ATS. ATS is defined as any means of transport that is human-powered, such as walking and cycling (Carvalho & Freitas, 2012; Silva et al., 2007).

Accordingly this study aims to assess the level of physical activity, the rate of sedentarism and the prevalence of the use of ATS and its relationship with body composition of adolescents in the metropolitan region of Curitiba, Brazil.

2. Materials and Methods

This investigation is composed of three parts: anthropometric data, body composition assessment and a survey. The study was reviewed by the Ethics Committee in Research of the Federal University of Technology - Paraná, and was approved under number 11583113.7.0000.5547.

A convenience sample ofadolescents residing in the metropolitan region of Curitiba was identified. All participants were aged 12 to 17 years. The study included only individuals who completed the Informed Consent (IC) prodedure.

The ATS questionnaire assessed the usual form of transport used by adolescents to commute to school, as well as barriers to AT. There were nine Likert type questions which covered three areas: traffic, geography and safety. For each question there were five response

options: Totally disagree, neither agree nor disagree, agree and strongly agree. For purposes of tabulation, the responses were grouped into three categories: Disagree (strongly disagree and disagree), Indifferent (neither agree nor disagree) and Agree (agree and strongly agree).

The anthropometric data consisted of the measurement of total body mass (TBM) by a Tanita electronic scale with precision of 0.1 kg. Height was measured by a stadiometer with resolution of 0.1 cm. Individuals, with feet together stood in the Frankfurt plane and were asked to take a deep breath at which time the measurement was taken (Petroski, 1999).

The assessment of body composition was obtained by DXA with radiological densitometer Hologic Discovery QDR (Hologic Inc, Bedford Massachussetts) in the Biochemical and Densitometric Laboratory of Federal University of Technology – Paraná. For the assessment individuals were positioned supine for the mapping of muscle, bone and fat tissues. The results provided by the examination show total body composition, and body composition by segment (left and right arms, torso, left and right legs and head).Cut points for excess body fat were ≥ 25% for male and ≥ 30% for female adolescents (Farias Júnior et al., 2009).

Our sample was also required to complete an instrument that assessed physical activity and sedentary behavior. This instrument was a modified version of the IPAC (International Physical Activity Questionnaire). The adaptations made by the authors, included ananalysis of screen time, including the use of video games.

The reported regular physical activity was classified as vigorous, moderate or light. This data was used to determine whether students met the American Heart Association guidelines (Silva, 2009).Those adolescents who accumulated at least 420 minutes of moderate to vigorous physical activity per week were labeled as meeting guidelines.

Usual sedentary habits (SH - television, computer and video game) were measured for week days and weekends. These sedentary behaviors were categorized as excessive if they exceeded 2 hours /day (Silva, 2009).

Statistical analysis included descriptive measurements (mean), dispersion (standard deviation) and frequency. The comparison of genders was verified by a t test for independent samples. Those differences at the $p<0.05$ level were considered to be significant (Maroco, 2007).

3. Results

This study included 73 adolescents, 42 males and 31 females.The mean age was 16.11 ± 0.99 years, with a range of 12 and 17 years. A description of the sample's fat percentage, physical activity and sedentary habits is presented in Table 1.

Table 1. Characteristics of the Sample as the percentage of fat (% BF), Moderate to Vigorous Physical Activity (MVPA) and Sedentary Habits (SH)

Variables	Boys		Girls		All	
	%	N	%	N	%	N
% Fat						
Elevated (boys ≥25%; girls ≥30%)	16,7	7	87,1	27	46,6	34
Normal (boys <25%; girls <30%)	83,3	35	12,9	4	53,4	39
MVPA						
Satisfatory (≥7 hours/week)	26,2	11	22,6	7	24,7	18
Unsatisfying (<7 hours/week)	73,8	31	77,4	24	75,3	55
Sedentary Habits						
Normal ≤14 hours/week)	9,5	4	3,2	1	6,8	5
Elevated (>14 hours/week)	90,5	38	96,8	30	93,2	68

The prevalence of excess body fat (overweight plus obesity) as measured by DXA was 46.5% (Table 1) of which 26.84% were obese (Table 2). When stratified by gender it is clear that girls have a higher percentage of fat than males, with a mean of 34.54%. The boys have an average body fat of 21.16% which is below the maximum recommended of 25%. This gender difference in body fat % was significant ($p<0.05$).

Only 24.7% of participants met MVPA guidelines (26.2% of boys and 22.6% girls which is defined as performing at least seven hours of that type of PA weekly. Stratified averages by gender are below recommended levels with boys accumulating an average of 5.29 and the girls 4.28 hours / week (Table 2).

Screen time of more than two hours per day was reported by most participants (93.2%). Girls spent slightly more time in front of screens as their average was 38.42 while the boys was 36.20 hours / week (Table 2).

Computers were primarily responsible for the high average number of sedentary hours (25.92 hours / week), followed by television (8.50 hours / week) and use of video games (2.72 hours / week).

The adolescents were asked about owning electronic games with motion control, because this type of computer use could provide physical activity of moderate intensity. Only 26.02% of the sample owned this type of equipment. Those who possessed this equipment used it an average of 4.40 hours / day. We specifically found that our sample used computers an average of 30.17 and television for 8.75 hours per week.

Table 2. Descriptive analysis for % Body Fat, Physical Activity and weekly hours of Sedentarism

Variables	Boys		Girls		All	
	Average	DP	Average	DP	Average	DP
% Body Fat*	21,16	5,16	34,54	4,51	26,84	8,25
Physical Activity						
(h/week)**	7,51	5,29	5,99	4,97	6,86	5,17
Vigorous	3,51	3,10	2,05	2,84	2,89	3,06
Moderate	1,78	2,14	2,23	2,20	1,97	2,16
Walk	2,22	2,60	1,71	2,32	2,00	2,48
Sedentary Habits						
(h/week)**	36,20	17,52	38,42	18,37	37,14	18,01
Television	7,82	8,16	9,42	7,98	8,50	8,17
Computer	24,81	13,37	27,69	16,83	25,92	14,9
Videogame	3,77	4,8	1,31	3,28	2,72	4,37

*p<0.05 between genders ** no statistical difference between genders

Another important component of PA behavior was the utilization of active transportation. Only 10.9% of individuals used ATS regularly and 8.2% did so sporadically, from one to three times a week.

Table 3 shows the differences of the Body Fat, PA and SH between the group that used ATS and those that did not. The differences were not significant.This is likely because of small samples sizes and differences in group sizes which make it difficult to detect differences.

Table 3. Descriptive analysis from the group that uses active transportation and the group that does not use

Variables	Use		Do not use		All	
	Average	DP	Average	DP	Average	DP
% Body Fat	22,86	7,06	27,70	8,28	26,84	8,25
Physical Activity						
(hours/week)	8,69	5,61	6,47	5,04	6,86	5,17
Vigorous	3,97	3,45	2,66	2,95	2,89	3,06
Moderate	2,44	2,03	1,87	2,19	1,97	2,16
Walk	2,28	2,09	1,94	2,57	2,00	2,48
Sedentary Habits						
(hours/week)	32,71	15,33	37,85	15,84	37,14	18,01
Television	6,79	6,76	8,86	6,28	8,50	8,17
Computer	21,15	9,57	26,72	14,77	25,92	14,9
Videogame	4,77	7,06	2,28	2,71	2,72	4,37

The parent questionnaire revealed barriers to ATS for teenagers. One barrier is that only 19.2% of parents allow their children to use active transportation.This is likely a factor in explaining the low AT rates. Other barriers are presented in Figures 1,2 and 3.

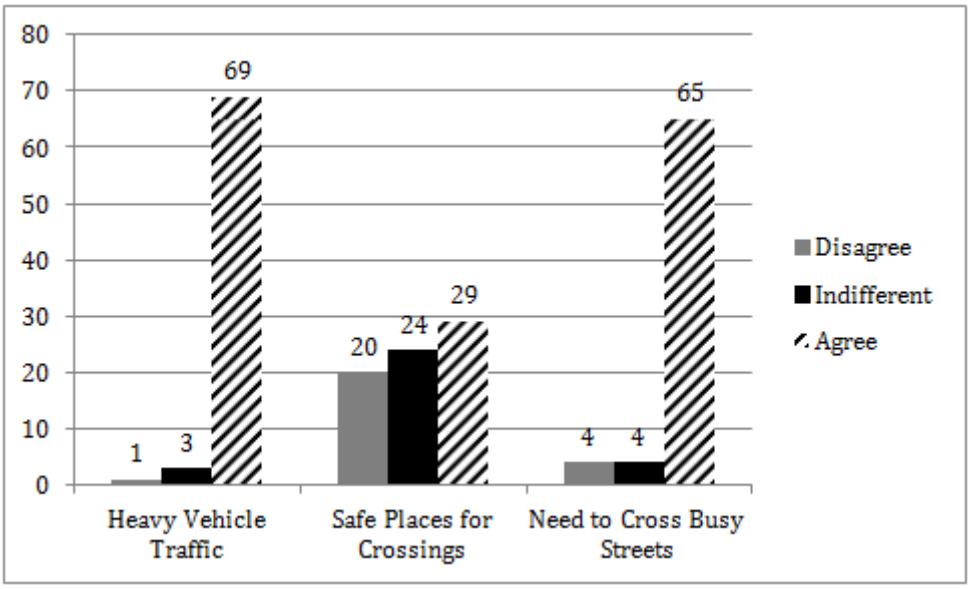

Figure 1. List of parent responses for not using active transportation in the category of traffic-relatedbarriers

Related potential causes of the low ATS rates were traffic (94.5% of agreement), and the need for safer places to cross busy streets (89% of agreement).

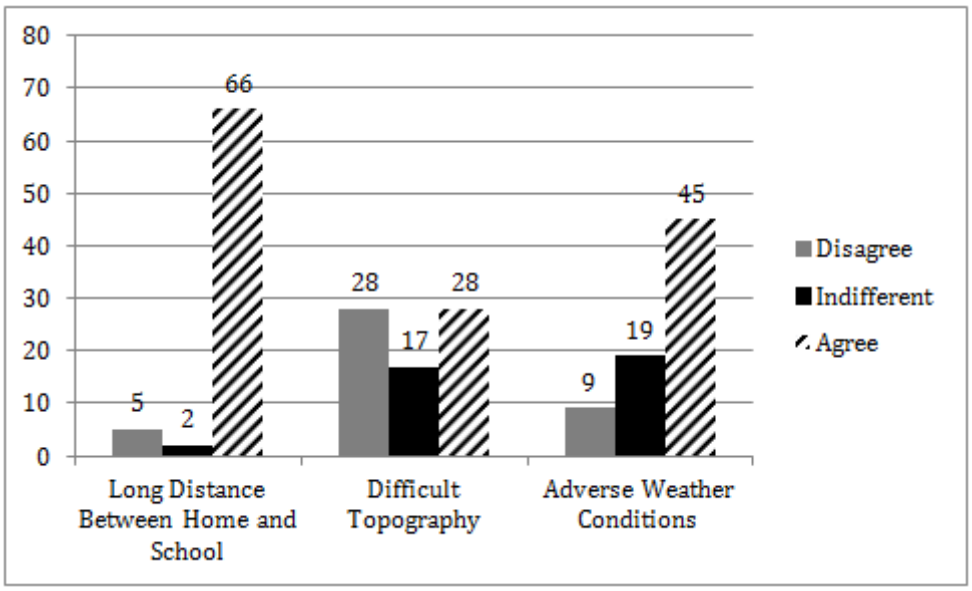

Figure 2. Parents responses for not using active transportation in the category of geographical barriers

With respect to geographical issues, it was noted that distance is the most prevalent barrier (90.4% of agreement), followed by the weather (61.6% of agreement). The topography data showed that 38.4% responded that they agreed and 38.4% responded that they disagreed. The value of the two responses was the same. Probably due to the different locations of the homes of the participants, since the southern districts of Curitiba has flat relief and the north region has hilly neighborhoods, which modifies the view of parents at this aspect.

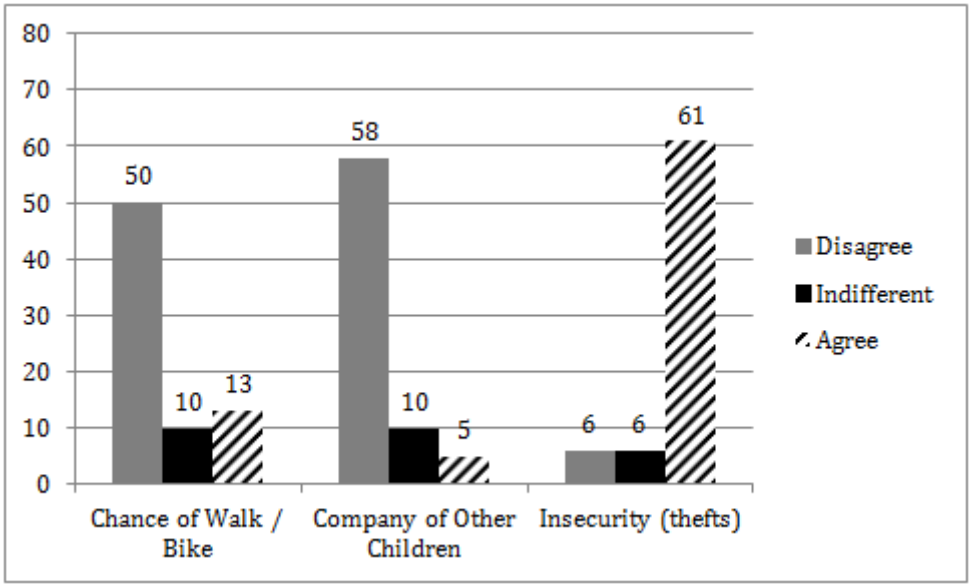

Figure 3. Parents responses for not using active transportation in the category of social barriers

We also learned that the fear of theft is a prevalent barrier to ATS (83.6% agreement). Even in the the company of other children, parents believe that their children can have their belongings stolen (79.5% of disagreement).

4. Discussion

In the present study it was found that the rate of regular practice of moderate to vigorous physical activity among Curitiba's children is 24.7%. Boys were more active than girls. Hallal and colleagues (Hallal et al., 2010) conducted a survey of 60,973 adolescents aged 13 to 15 years in all state capitals and the Federal District, and found that the city of Curitiba stood out, along with Florianópolis, as having active children because they are the only two cities where the percentage of active adolescents was greater than 50%. This difference between the values can be understood by the variation in average age between studies, indicating that older adolescents are showing lower levels of physical activity compared to younger adolescents.

One possible way to increase PA among Brazilian youth is to enhance ATS rates. But it was disappointing that we found that only 19.2% of our sample used this type of transportation. Our ATS rate is lower than what other studies have reported in Brazil. In the city of João Pessoa 70.4% of students are regular users of ATS (Silva et al., 2007). And, in the city of Pelotas Hallal and colleagues (Hallal et al., 2006) found that 72.8% of children

used ATS. However our rate is higher than what a study in the United States found, where fewer than 5% of participants reported using ATS (Bungum et al., 2009).

There are several likely reasons that produced these differing results across Brazil.One of which is weather. Rainfall, an intervening factor of great importance in the practice of outdoor activities could explain the differences. However, Curitiba has an average annual rainfall of 1483.4 mm (Instituto Nacional de Meteorologia, 1992),a value that is less than the city of João Pessoa, 2145.4 mm (Instituto Nacional de Meteorologia, 1992) and more than the city of Pelotas, 1143.3 mm (Ministério da Agricultura Pecuária e Abastecimento, 2013). Thus it does not appear that rainfall is the cause of the differing ATS rates.

Another point to be considered is the issue of safety associated with active transit. Traffic deaths are common in Brazil. According to Waiselfisz (Waiselfisz, 2012) 40,989 traffic deaths occurred in Brazil in 2010. And in Paraná rates are high. Of the 27 states in Brazil, Paraná ranks fifth in deaths (32.9 per 100,000 inhabitants), Paraíba is 15th (22.2 per 100,000 inhabitants) and Rio Grande do Sul in the 17th place (20.9 per 100,000 inhabitants). Of the 2010 traffic deaths young people, ages 1-19 years, accounted for 5456 of them. Comparing these death rates by state, Paraná is highest (497 deaths). The state of Rio Grande do Sul is 15th highest (273 deaths) and Paraíba 19th (110 deaths). We believe that safety issues are associated with transitand maybe an important factor in explaining low AT rates.

It is noteworthy that the group that uses active transport demonstrated lower mean% BF, sedentary habits and had the highest physical activity scores. This suggests that there is a relationship between ATS and obesity, although thedifferences are not statistically significant. The study by Hallal and colleagues (Hallal et al., 2006) that showed that high active transportation rates are associated withlower rates of sedentarism. This relationship can also be seen in the study by Silva and colleagues (Silva et al., 2007).

With respect to sedentary behavior, it was determined that 93.2% of the participants are exposed to greater amounts than the recommended 14 hours per week. This was a disappointing finding, but it is in agreement with other studies conducted in Brazil (Rivera et al., 2010; Silva et al., 2008; Silva & Malina, 2000) These results point to the high prevalence of sedentary habits among Brazilian adolescents.

5. Conclusions

The prevalence of excess body fat (46.5%), excessive sedentarism (93.2%) and physical inactivity (75.3%) were striking in the sample of this study. However he group that uses ATS presented lower body fat percentages and fewer hours of sedentary behaviors. This suggests that ATS might have a positive impact on reducing rates of obesity. Unfortunately ATS rates among the sample were low (19.2%). To increase ATS it would likely be beneficial to reduce heavy traffic, or find routes to school that avoid busy streets. Building safer ways to cross streets are also recommended. These changes will not be easy or inexpensive undertakings, but they can be done.

However, it can be observed that the use of active transportation is an important factor to be considered for the general improvement of health variables addressed in this research.

Studies assessing ATS rare in Barziland investigating its association with overweight and obesity are even fewer. In order to enhance ATS rates broader efforts that involve education for active lifestyles, and increasing road safety for pedestrians and cyclists will be needed.

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