Cross-sectional association between healthy and unhealthy food habits and leisure physical activity in adolescents

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Abstract

Objective: To analyze associations between two physical activity domains during leisure time and different food habits in adolescents.

Methods: The sample comprised 1,630 adolescents (46% male and 54% female). Physical activity level, television (TV) viewing, and eating behaviors were assessed through an interview. According to the results of the assessment, adolescents were classified as physically active or engaged in high amounts of TV viewing and unhealthy/healthy diets.

Results: Male adolescents were more active than females (21.7 and 9.4%, respectively; p = 0.001), while TV viewing was more frequent in females (44.0 and 29.2%; p = 0.001). Physical activity level was related to higher consumption of fruits (OR = 1.90; 95%CI 1.39-2.60) and vegetables (OR = 1.48; 95%CI 1.09-2.01), while higher consumption of fried foods (OR = 2.13; 95%CI 1.64-2.77) and snacks (OR = 1.91; 95%CI 1.49-2.45) was associated with TV viewing.

Conclusion: This study presented epidemiological information indicating that active and inactive behaviors were differently and independently associated with healthy and unhealthy diets.

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Introduction

Physical activity level (PAL) has decreased in the last decades, and it is considered one of the main modifiable risk factors for a wide variety of chronic diseases; therefore, recommendations for appropriate amount of physical activity for the general population, including school-age youth, have been published by several organizations and agencies.[1,2] Recommendations contained in these position stands indicate that changes in some behaviors that support optimal nutrition and increase PAL are fundamental for the improvement of the health status of the population.

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However, the assessment of PAL is complex, because it is a multidimensional behavior, which takes place in a variety of domains, such as transportation, domestic activities, leisure time, work (adults) or school (children and adolescents), and each domain probably needs to be assessed separately, not only because this approach allows the information to be more specific, but also because the information is more likely to be valid.[3] Additionally, different physical activity domains can be associated in different ways with the same health outcome.[4,5]

Another concern among adolescents is their food habits. Recent data indicate a high rate of unhealthy behaviors in adolescents of both genders; for example, more than 80% have low fiber intake and approximately 35% have high fat intake.[6] Regarding dietary behaviors, adolescents engaged in organized sports show higher frequency of healthy dietary behavior,[7] while previous epidemiological studies reported that less consumption of fruits and vegetables, as well as higher consumption of more energy-dense snacks, are associated with sedentary behaviors, such as television (TV) viewing.[8]

Recent cross-sectional[9,10] and longitudinal[11] studies have shown that active and sedentary behaviors are dissociated, and, therefore, must be considered two independent physical activity domains, indicating that higher physical activity practice is not associated with less time spent in sedentary activities, such as TV viewing or computer use. These results are important to achieve public health outcomes, because it does not offer support to the concept that sedentary behavior allows less time for pediatric populations to be physically active. Although PAL and TV viewing can be analyzed as separated entities, it is not clear whether both habits independently affect food intake habits of adolescents. Therefore, the purpose of the present study was to analyze the possible existence of an association between these two physical activity domains (practice of organized sports during leisure time and TV viewing) and different food habits in adolescents.

Methods

A cross-sectional study was carried out, from July to October 2007, in the city of Presidente Prudente, which has a high Human Development Index (HDI = 0.846), is located in the western region of São Paulo state, and has approximately 200,000 inhabitants, of whom around 37,000 are students. The sample size of 1,495 students was estimated by means of an assumed percentage of physical activity practice of 41.8%[12] (error of 2.5%), with a statistical power test of 80%, and alpha error of 5%. From 36 schools located in the city, six were selected randomly. In these schools, the students were invited to participate and received an informed written consent form, which was filled out by parents and students before participating in

the survey. From 2,200 eligible adolescents, 1,752 returned with the form, but 122 were excluded due to errors in reported food intake data, totaling 1,630 adolescents of both genders (final response rate of 74.1% from total eligible sample). The Ethical Committee of the College of Science and Technology from Universidade Estadual Paulista (UNESP) approved this study.

Data about leisure-time behaviors were collected through interviews, by one trained researcher, during physical education class. The questionnaire developed by Baecke et al.[13] was used to assess the engagement in sport-related physical activities during leisure time. The adolescents were considered regularly engaged if they had participated in moderate to vigorous intensity activities for more than 4 hours per week (> 240 minutes per week) in the 4 months prior to the study. This amount of time is similar to the 300 minutes per week recommended in guidelines for adolescents.[2] Considering that information from the prior 4 months from the date of assessment was used, interviews were conducted in early July and October to avoid the holiday period of the adolescents.

Data regarding TV viewing were collected as an indicator of sedentary behavior through the same questionnaire.[13] The adolescents' reported frequency of TV viewing (never, seldom, sometimes, often, always) and the possible responses were categorized as a nominal variable, in which the response "always" was used as indicator of high frequency of TV viewing and as the main outcome for sedentary behavior.

Data about eating behaviors were collected through a pre-tested, pre-coded and structured questionnaire. Four questions about frequency of consumption of certain foods (fruits, vegetables, snacks, fried foods) in the last week (none, 1 or 2 days, 3 -5 days, all days)[14] were taken into account. The answers "all days" were adopted as indicators of "unhealthy behavior" for snacks and fried foods, and of "healthy behavior" for fruits and vegetables.

Three variables were treated as potential confounders, and were therefore inserted into adjusted models for logistic regression: (i) age (from 11 to 17 years old); (ii) gender (male and female); (iii) family socioeconomic status (F-SES), which was estimated through a questionnaire based on the Brazilian Criterion for Economic Classification, proposed by Associação Nacional de Empresas de Pesquisa.[15] The questionnaire for F-SES involved the parents' educational level and the number of domestic appliances, vehicles, and rooms in the adolescent's home; the family was subsequently classified into social classes from A (wealthiest) to E (poorest).

To analyze the consistency of the reported data, 170 adolescents from the sample were randomly selected and invited to participate in a second interview at school, where a researcher re-administered eating behaviors, F-SES and physical activity questionnaires. The agreement results

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(kappa [k]) between these two measures was high for those who reported to be physically active (k = 0.85), and for the values of high frequency of TV viewing (k = 0.85), eating behaviors (fruits: k = 0.75; vegetables: k = 0.75; snacks: k = 0.76; fried foods: k = 0.76), and F-SES (k = 0.87).

The Student's *t* test for independent samples was applied to compare the age between genders (Table 1). Chi-square test (χ^2) analyzed association among categorical variables, while logistic regression, represented by values of odds ratio (OR) and 95% confidence interval (95%CI), indicated the magnitude of these associations. Additionally, in the multivariate model, OR values were adjusted for potential confounder variables (gender, family income, and age). Statistical significance was set at 5%, and the software SPSS 13.0 (SPSS, Chicago, USA) was used in all analyses.

Results

The general characteristics of the sample are presented in Table 1. The sample was composed of 54% of female and 46% male (χ^2 = 10.368; p = 0.001). There was no difference between male and female for the comparison between age groups (15-17 years of age: female = 38.1% vs. male = 36.1%; p = 0.435). Moreover, eating behaviors were similar for both genders, except for high snack intake.

Male adolescents were more active than female and were also classified as highest F-SES (class A: female = 19.9% vs. male = 24.3%; p = 0.012). On the other hand, the female group reported higher frequency of TV viewing during leisure time. Higher F-SES was associated with lower frequency of TV viewing (class A = 26%, B = 38%, and C-E = 50%; p = 0.001) and higher sport practice (class A = 21%, B = 13%, and C-E = 13%; p = 0.001). On the

other hand, there was association between lower age and higher frequency of TV viewing (11-14 years of age = 45% and 15-17 years of age = 24%; p = 0.001). For this reason, F-SES and age were also included in the adjusted model for logistic regression.

In the adjusted model (Table 2), sport practice was associated with higher consumption of fruits (OR = 1.90; 95%CI 1.39-2.60) and vegetables (OR = 1.48; 95%CI 1.09-2.01), while higher consumption of fried foods (OR = 2.13; 95%CI 1.64-2.77) and snacks (OR = 1.91; 95%CI 1.49-2.45) were associated with high frequency of TV viewing.

Eating behaviors were clustered into two groups (healthy [fruits and vegetables] and unhealthy [fried foods and snacks]) of three categories each (none, only one, and both) (Tables 3 and 4). Independently of confounders, adolescents engaged in sport practice presented 2.20 more chance to have higher consumption of both vegetables and fruits, and adolescents with high frequency of TV viewing presented 2.54 more chance to have higher consumption of both fried foods and snacks.

Discussion

This cross-sectional study enrolled adolescents of both genders and showed that physical activity and TV viewing, both of which considered as physical activity domains, presented independent effects on healthy and unhealthy eating behaviors, respectively.

A high occurrence of unhealthy eating behaviors was observed, as well as a low daily consumption of fruits and vegetables. Unhealthy diets are a relevant concern in adolescents,[6,16,17] and this data is in accordance with the findings of the present research. Our results showed a high occurrence of TV viewing and low engagement in sport practices, which also agrees with previous studies[12,16,18,19], indicating that effective public health strategies are necessary, targeting the promotion of physical activity and healthy food habits in this specific population.

The findings of the present study indicate that there is an association between higher engagement in sport practices and TV viewing with healthy and unhealthy food habits, respectively. For sedentary behaviors, a possible reason for this association would be that, during TV viewing, the adolescents are exposed to advertisements promoting the consumption of industrialized foods.[20] Therefore, the consumption of such foods during this sedentary activity would be increased. In children, Jackson et al.[21] identified that physical activity does not mediate the positive relation between TV viewing and body fatness, and that TV viewing was not related to lower total energy expenditure. Thus, TV viewing and obesity must be linked by other mechanisms instead of lower energy expenditure.

Table 1 - General characteristics of the adolescents grouped according to gender

Variables	Male (n = 750)	Female (n = 880)	p
Age*, mean (SD)	13.8 (2.1)	13.7 (1.8)	0.609
Sport practice (%)			
Active (≥ 240 minutes/week)	21.7	9.4	0.001
Television viewing			
High frequency (%)	29.2	44.0	0.001
Food habits†			
Fruits	21.5	21.6	1.000
Vegetables	24.1	24.2	1.000
Fried foods	18.1	21.3	0.131
Snacks	22.4	26.7	0.051

SD = standard deviation.
* In years.
† 7 days.

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Table 2 - Multivariate model for association between sport practice, TV viewing, and eating behaviors

Foods	Sport practice (≥ 240 minutes/week)				TV viewing (high frequency)		
	%	OR* (95%CI)	p		%	OR* (95%CI)	p
Vegetables							
7 days	19.5	1.48 (1.09-2.01)	0.012		36.5	1.01 (0.79-1.30)	0.905
< 7 days	13.7	1.00			37.4	1.00	
Fruits							
7 days	22.2	1.90 (1.39-2.60)	0.001		40.2	1.14 (0.88-1.48)	0.294
< 7 days	13.1	1.00			36.4	1.00	
Fried foods							
7 days	18.3	1.43 (0.99-1.99)	0.058		51.4	2.13 (1.64-2.77)	0.001
< 7 days	14.3	1.00			33.7	1.00	
Snacks							
7 days	18.1	1.36 (0.99-1.86)	0.059		47.6	1.91 (1.49-2.45)	0.001
< 7 days	14.1	1.00			33.7	1.00	

95%CI = 95% confidence interval; OR = odds ratio; TV = television.
* Adjusted for gender, age groups, and socioeconomic status.

On the other hand, previous epidemiological surveys demonstrate that adolescents regularly engaged in sports activities present higher occurrence of other healthy behaviors, such as lower levels of cigarette smoking, lower likelihood of pregnancy, and adequate fiber intake,[22,23] indicating that healthy behaviors could present a cluster trend among them. In this specific case, a possible explanation could be based on the fact that sport practice requires the inclusion of a variety of positive habits in the adolescent's lifestyle, and that these attitudes include better food intake, as observed in the analyzed sample. Additionally, sport practice during adolescence increases the likelihood of being characterized as physically active during adulthood[24]; consequently, the relationship among healthy behaviors also could be maintained lifelong. Therefore, the promotion of sports during adolescence may be an effective public health promotion. However, longitudinal studies are warranted to reach consistent evidence of this conceptual model.

The cross-sectional design constitutes a limitation of the presented study, because such design does not offer support for the causal relationship for the analyzed associations. The adopted cutoff of 240 minutes of moderate to vigorous sport activities excludes many adolescents engaged in non-sportive activities, such as fitness clubs and, therefore, must be taken into consideration in the analysis of the findings. Furthermore, the absence of computer use in the analysis of sedentary behaviors must be also considered. Finally, the absence of other potential confounders related to physical activity practice must be considered: overweight and

Table 3 - Multivariate model for association between sport practice and food habits

High consumption of healthy foods	Sport practice (≥ 240 minutes/week)	
	%	OR* (95%CI)
None	13	1.00
Either vegetable or fruit	17	1.45 (1.01-1.92)
Both	25	2.20 (1.43-3.34)

95%CI = 95% confidence interval; OR = odds ratio.
* Adjusted for gender, age groups, and socioeconomic status.

Table 4 - Multivariate model for association between TV viewing and food habits

High consumption of unhealthy foods	TV viewing (high frequency)	
	%	OR* (95%CI)
None	29	1.00
Either fried food or snacks	46	2.23 (1.75-2.85)
Both	51	2.54 (1.76-3.66)

95%CI = 95% confidence interval; OR = odds ratio; TV = television.
* Adjusted for gender, age groups, and socioeconomic status.

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obesity,[19] family support,[25] and the influence of friends.[26]

In summary, this study presented epidemiological information indicating high prevalence of physical inactivity during leisure time and TV viewing among analyzed adolescents. Additionally, it was found that active and inactive behaviors were differently associated with economic condition, and both have an independent effect on healthy and unhealthy eating behaviors, respectively.

Acknowledgements

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