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Association between physical activity level and consumption of fruit and vegetables among adolescents in northeast Brazil

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KEYWORDS
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Abstract
Objective: To determine the association between low levels of physical activity and consumption of fruits and vegetables among adolescents.
Methods: This cross-sectional study included 2,057 adolescents aged 13 to 18 years from the city of Aracaju, Northeastern Brazil. We analyzed the level of physical activity, consumption of fruits and vegetables by standardized and validated questionnaires. The control variables were sex, age, socioeconomic status, maternal education, alcohol consumption and smoking. For data analysis, univariate and multivariate logistic regression were used, with a significance level of 5%.
Results: The prevalence of low levels of physical activity was 81.9%; the inadequate consumption of fruits ocurred in 79.1% and the inadequate consumption of vegetables in 90.6%. Adolescents who consumed few fruits daily had an increase in 40% of chance of being insufficiently active and, for those who consumed few vegetable's the likelihood of being insufficiently active was 50% higher, compared to those who had adequate intake of these foods.
Conclusions: Low levels of physical activity were associated with inadequate fruit and vegetable intake among adolescents in a city in northeastern Brazil. These findings suggest that insufficiently active adolescents have other unhealthy behaviors that may increase the risk of chronic diseases in adulthood.

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PALAVRAS-CHAVE
Atividade motora;
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Consumo alimentar

Associação entre prática de atividade física com consumo de frutas, verduras e legumes em adolescentes do Nordeste do Brasil

Resumo
Objetivo: Verificar se há associação entre baixos níveis de atividade física e consumo de frutas, verduras e legumes em adolescentes.
Métodos: Estudo transversal, com 2.057 adolescentes na faixa de 13 a 18 anos, estudantes de escolas públicas de Aracaju (SE) e região metropolitana. Analisou-se o nível de atividade física e o consumo de frutas, verduras e legumes por meio de questionários padronizados e validados. As variáveis de controle foram: sexo, idade, nível econômico, escolaridade materna, consumo de álcool e tabagismo. Para a análise dos dados usou-se a regressão logística uni e multivariável, com nível de significância de 5%.
Resultados: A prevalência de baixo nível de atividade física foi de 81,9%, a de consumo inadequado de frutas foi de 79,1% e a de consumo inadequado de verduras e legumes foi de 90,6%. Adolescentes que consumiam poucas porções de frutas no dia apresentaram 40% mais chances de ser pouco ativos fisicamente e aqueles que consumiam poucas porções de verduras e legumes apresentaram 50% mais chances de ser pouco ativos fisicamente, comparados aos que apresentavam consumo adequado.
Conclusões: Baixos níveis de atividade física se associaram com o consumo inadequado de frutas, verduras e legumes em adolescentes de uma cidade do Nordeste do Brasil. Esses achados sugerem que adolescentes pouco ativos apresentam outros comportamentos não saudáveis que podem aumentar o risco na vida adulta de doenças crônicas não transmissíveis.

Introduction

The epidemiology of physical activity, as it is known the epidemiology branch that focus on issues related to physical activity, is a new area in the field of Public Health and started to gain importance after the epidemiological transition. The studies of this epidemiology area seek to find factors associated with low levels of physical activity, aiming to prevent and/or modify them, so that physical activity interventions are successful.[1]

Physical activity (PA) is associated with several health benefits. Insufficient levels of PA can result in damage to the individual's health and well-being, increasing the risk of cardiovascular disease, hypertension, diabetes, some types of cancer, obesity and early mortality.[2] Physical inactivity is also associated with mental disorders. Clinical and epidemiological studies have reported that individuals with insufficient levels of physical activity are more affected by depression and anxiety.[3]

In spite of the current evidence that physical activity can play a role in disease prevention and quality of life promotion, a large population group remains exposed to insufficient levels of physical activity. In Brazil, for instance, the most recent data from the Risk and Protective Factor Surveillance System for Chronic Diseases by telephone survey – VIGITEL[4] reported that 15.0% of men and 13.6% of women older than 18 years living in Brazilian capitals are physically inactive. Regarding younger individuals, data from the National Research on Schoolchildren's Health (PeNSE), a partnership between the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística - IBGE) and the Ministry of Health of Brazil found that 56.9% of Brazilian students on the 9th grade of Elementary School did not meet the recommendations for physical activity (≥300 minutes a week of physical activity).[5] A recent study showed that >70% of adolescents from different countries do not meet the recommendations for physical activity.[6]

Several studies indicate that, in adolescence and adulthood, the individual does not acquire only one unhealthy behavior.[7,8] Most people have many simultaneous unhealthy behaviors and the most distinctive ones are physical inactivity and inadequate fruit and vegetables consumption.[7,8] Thus, it is important to study these behaviors in adolescence, as habits acquired at this phase of life tend to be continue into adulthood.[9]

Insufficient fruit and vegetables consumption is one of the ten most important risk factors for the global burden of diseases.[10] Millions of deaths are attributed to an unhealthy diet with a deficit in these components.[11] However, despite this evidence, fruit and vegetables consumption is still insufficient, both in developed and in developing countries, such as Brazil.[11]

Therefore, the objective of this study is to verify whether there is an association between low levels of physical activity and fruit and vegetables consumption among adolescents from a city in Northeast Brazil.

Method

This epidemiological analytical study with a cross-sectional design was carried out in the metropolitan area of Aracaju

city, state of Sergipe, Brazil. Sergipe state is the smallest federal unit in terms of territory extension in Brazil (21,910 km^2); it is located in the Northeast, consisting of 75 municipalities and has the best Human Development Index (HDI) of the region (0.742), with a life expectancy of 70.3 years, infant mortality of 21 children per thousand live births and illiteracy rate among individuals aged 15 years and older of 16.9%, with these data being related to the year 2010 and published in 2013.[12,13] Aracaju city is Sergipe's capital and had an estimated population of 571,149 inhabitants in 2010, with an incidence of poverty of 27.5%, Gini index of 0.47 and HDI of 0.794.[12,13] The Gini index is used by the United Nations to measure the inequality of income distribution in a given location. It consists of a number between 0 and 1, with zero being full income equality and 1 corresponding to complete inequality.[13]

The target population of this study consisted of 13,373 high school students, from the Public School Network of Aracaju and its metropolitan area. Sample size was calculated to estimate the prevalence of different health outcomes investigated in the survey, considering a confidence level of 95%, prevalence for the unknown outcomes of 50%, sampling error of 3 percentage points, estimated design effect (deff) of 2.0 (due to cluster sampling) and percentage of losses estimated at 10%. Based on these parameters, we obtained a sample size of 2,174 adolescents. For association tests, considering an estimated prevalence of the outcome of 50%, 80% power and 95% confidence level, this sample size would allow detecting as statistically significant a prevalence ratio of up to 1.4 as a risk factor and up to 0.6 as protective factor for both genders.

The sample design included public schools and was determined in two phases, in which the school and the class represented, respectively, the sample units in the first and second stages. All high schools in Aracaju and its metropolitan area with number of enrollments >350 students were eligible for study inclusion. In the second stage, we considered the density of classes in the selected schools as a criterion to choose those where the questionnaires were applied, by drawing lots. All students in the selected classes were invited to participate.

Data collection was carried out in the second half of 2011. The questionnaires were applied in the classroom, without the presence of teachers. The evaluation team consisted of Physical Education undergraduate students that had been previously trained to standardize data collection procedures. The subjects were continuously assisted by the examiners so that they could answer questions and help students fill out the information.

The inclusion criteria to participate in the study included being regularly enrolled in High School in the selected units; age 13 to 18 years; not having any condition that would prevent the student from understanding the explanations and answering the questionnaire, such as, for instance, blindness and deafness. The adolescents that refused to participate and / or whose parents / guardians did not allow their participation were considered refusals.

The dependent variable was the physical activity level. This variable aimed to assess compliance with the recommendation for practice of moderate/vigorous physical activity, as recommended by the World Health Organization.[14] This variable was measured in this investigation through the item that is part of the questionnaire used in the Youth Risk Behavior Surveillance System (YRBSS), which is a monitoring program designed in the late 1980s by the Centers for Disease Control and Prevention (CDC) and used in the United States. The YRBSS questionnaire was translated into Brazilian Portuguese and validated for Brazil and the behaviors investigated in this study had a moderate to high Kappa value.[15]

The item consists of the following question: During the last 7 days, on how many days were you physically active for at least 60 minutes a day? (Consider the time you spent in any kind of physical activity that increased your heart rate and accelerated your respiratory rate for some time). Response options were: no day, one day, two days, three days, four days, five days, six days, seven days. Considering that physical activity practice guidelines for children and adolescents recommend 60 minutes of moderate to vigorous physical activity at least five days a week,[16-18] the subjects who answered five or more days a week were considered physically active and those who answered less than five days were classified as little physically active.

The independent variables of the study were fruit and vegetables consumption. The YRBSS questionnaire was used for these variables.[15] Fruit consumption was assessed on the last seven days prior to the interview, through the items: How many times did you drink 100% natural fruit juice? How many times did you eat fruit? Each one of the items had the following response options: I did not drink fruit juice or did not eat fruit; 1 to 3 times; 4 to 6 times; once a day; twice a day; 3 times a day; 4 or more times a day. The answers to the two items were analyzed concurrently, considering the fruit consumption recommendations suggested by the Food Guide Pyramid,[19] which suggests as adequate the consumption of 3 to 5 daily servings of fruit. Thus, the adolescents that consumed fruit and/or fruit juice three or more times a day were considered as having "adequate consumption" and those who consumed less were considered as "inadequate consumption".

Vegetables consumption was assessed in relation to the seven days prior to the interview, through the items: How often did you eat green salads? How often did you eat potatoes? How often did you eat carrots? How often did you eat other vegetables? For each of the items, the following response options were provided: I did not eat vegetables; 1 to 3 times; 4 to 6 times; once a day; twice a day; 3 times a day; 4 or more times a day. Responses to the items were analyzed concurrently, considering the recommendations for vegetables consumption suggested by the Food Guide Pyramid,[19] which establishes as appropriate the consumption of 4-5 daily servings of vegetables. Thus, according to the response options of the questionnaire, the adolescents that consumed vegetables four or more times a day were considered as having "adequate consumption", whereas those who consumed less were considered as having "inadequate consumption".

The control variables of the present study, which were used to characterize the sample, were gender (male/female), age, which was collected continuously and categorized as ≤16 years and 17-18 years, maternal education, which was collected continuously and categorized as ≤8

years and >8 years; and socioeconomic status. Socioeconomic status was identified by the questionnaire provided by the Brazilian Association of Research Companies – ABEP,[20] through a scoring system that classifies the Brazilian population in socioeconomic classes according to their purchasing power. There are 5 classes in the criteria adopted by ABEP: "A", "B", "C", "D" and "E" in decreasing order of purchasing power. The individuals from classes "A" and "B" were classified as the "upper" socioeconomic class; class "C" was classified as "middle" socioeconomic class and classes "D" and "E" as "lower" socioeconomic class.

In addition to sociodemographic variables, information was also collected on smoking and alcohol consumption. Smoking was assessed through the question: During the past 30 days, on how many days did you smoke cigarettes? The ones who reported having smoked at least once were considered a positive response (risk group) to smoking. Alcohol consumption was investigated through the question: During the past 30 days, on how many days did you drink at least one alcoholic beverage? The ones who reported having drunk at least once were considered a positive response (risk group) to alcohol consumption. These questions are found in the Brazilian version of the YRBSS questionnaire.[15]

Descriptive and inferential statistics were used. The chi-square test was used for linear trends and the heterogeneity test was used to assess the association between physical activity level and the independent and control variables. In the association analyses, both unadjusted and adjusted, Wald test and binary logistic regression were used to estimate odds ratios (OR) and 95% confidence intervals (95%CI). In the multivariable regression model, all variables were included, regardless of the value of p in the unadjusted analysis. Analyses were not stratified by gender because there was no interaction between gender and fruit and vegetables consumption. All analyses were performed using Stata 11.0 software.

The study was approved by the Institutional Review Board of Universidade Federal de Sergipe (CAAE 5724.0.000.107-10). All adolescents who participated in the survey provided the Free and Informed Consent Form signed by the parents or tutors (for those aged <18 years), or by themselves (aged ≥18 years).

Results

A total of 2,057 adolescents aged 14-18 years (16.2±1.1) participated in the study. Of these adolescents, most were females (62.7%), aged <17 years (56.9%), of middle socioeconomic status (63.4%) and maternal education was low (61.4%). Most of the students showed low levels of physical activity (81.9%) consumed fewer than three servings a day of fruit (79.1%) and fewer than four servings of vegetables a day (90.6%), were non-smokers (93.6%) and did not consume alcohol (61.6%). A higher frequency of adolescents with low levels of physical activity was observed in females, those whose mothers had low level of schooling, those who consumed fewer servings of fruit and vegetables and the ones that did not consume alcohol (p<0.05) (Table 1) .

The same associations were found at the unadjusted and adjusted regression models between the level of physical activity and fruit and vegetables consumption. Adolescents that consumed fewer servings of fruit a day had a 40% greater chance of being less physically active when compared to young individuals who consumed a higher amount of fruit during the day. Regarding the vegetables consumption, students who consumed fewer servings of these foods throughout the day had a 50% higher chance of being less physically active when compared to young individuals who consumed adequate amounts of these foods throughout the day (Table 2).

Discussion

The main finding of this study was that low levels of physical activity were associated with inadequate fruit and vegetables consumption in adolescents, regardless of gender, age, socioeconomic status, maternal level of schooling, consumption of alcohol and smoking status. This finding confirms the hypothesis of the present study that the adoption of an inappropriate behavior (low levels of physical activity) is associated with the adoption of other unhealthy behaviors. This result has an impact on the health of adolescents, as the behaviors adopted during adolescence tends to continue into adulthood.[9]

The present study showed that 81.9% of the adolescents did not meet the recommendations for the practice of moderate to vigorous physical activity. Studies that assessed the prevalence of this outcome in adolescents showed large discrepancy between the values found by them.[16,21] According to the criteria used and the assessed age range, the prevalence of low levels of physical activity ranged from 50.5%[16] to 85%.[21] Three operational definitions are often used to determine compliance with the recommendations. One of them corresponds to the criterion used in this study, which consists of at least 60 minutes of moderate to vigorous physical activity at least five days a week[16-18]; another recommendation suggests the accumulation of 300 minutes of moderate to vigorous physical activity in a week[22] and another one consists of 60 minutes of physical activity daily.[21] A representative study of North-American schoolchildren found a prevalence of 50.5% of non-compliance with the recommendations,[16] applying the same criterion of this study. Among Brazilian adolescents, the PeNSE[18] study was the only one with national coverage using the same criterion used in this study and reported prevalence of low levels of physical activity in 79.8% of Brazilian adolescents.

The results of the present study showed that only one fifth of adolescents reported consuming three or more daily servings of fruit and 1 in 10 adolescents reported consuming four or more servings of vegetables a day. These estimates are consistent with previous studies that also showed an insufficient fruit and vegetables consumption among adolescents.[23-25] As physical activity, fruit and vegetables consumption have several recommendations in the literature; therefore, comparisons between studies should be carried out with caution. This study used the recommendations suggested by the Food Guide Pyramid used in the USA and Brazil[19] that, in despite of being published in 1999, has good information for professionals that work with health education in different populations.[19]

Table 1 Sample distribution by level of physical activity.

Variables	Total	Physical activity				*p*
		Active		Little active		
	n (%)	n	% (95%CI)	n	% (95%CI)	
Total	2,057 (100.0)	372	18.1 (16.5-19.7)	1,685	81.9 (80.2-83.4)	
Gender						
Female	1.289 (62.7)	166	12.9 (9.3-16.5)	1.123	87.1 (83.5-90.7)	<0.01
Male	768 (37.3)	206	26.8 (20.6-33.0)	562	73.2 (67.0-79.4)	
Age (years)						
≤16	1,171 (56.9)	208	17.8 (13.5-22.1)	963	82.2 (77.9-86.5)	0.66
17-18	886 (43.1)	164	18.5 (13.4-23.6)	722	81.5 (76.4-86.6)	
Socioeconomic level						
High	499 (24.3)	92	18.4 (11.7-25.1)	407	81.6 (74.9-88.3)	
Middle	1,305 (63.4)	236	18.1 (14.0-22.2)	1.069	81.9 (77.8-86.0)	0.94
Low	253 (12.3)	44	17.4 (8.1-26.7)	209	82.6 (73.3-91.9)	
Maternal level of schooling						
≤8 years	1,262 (61.4)	199	15.8 (13.5-18.1)	1,063	84.2 (82.0-86.4)	<0.01
>8 years	795 (38.6)	173	21.8 (18.8-25.1)	622	78.2 (75.1-81.2)	
Fruit consumption						
≥3 portions/day	430 (20.9)	101	23.5 (20.5-26.5)	329	76.5 (73.6-79.5)	<0.01
<3 portions/day	1,627 (79.1)	271	16.7 (14.5-19.0)	1.356	83.3 (81.5-85.2)	
Vegetables consumption						
≥4 portions/day	194 (9.4)	50	25.8 (22.6-29.2)	144	74.2 (71.8-77.7)	<0.01
<4 portions/day	1,863 (90.6)	322	17.3 (15.6-18.6)	1.541	82.7 (81.5-84.0)	
Alcohol consumption						
No	1,267 (61.6)	208	16.4 (15.3-17.5)	1.059	83.6 (82.5-84.7)	0.01
Yes	790 (38.4)	164	20.8 (17.8-23.8)	626	79.2 (76.7-81.5)	
Smoking						
No	1,925 (93.6)	342	17.8 (16.3-19.5)	1,583	82.2 (80.4-83.6)	0.15
Yes	132 (6.4)	30	22.7 (15.7-29.2)	102	77.3 (70.7-84.2)	

CI, confidence interval.

Regardless of the criteria for classification of both physical activity and fruit and vegetables consumption, this study discloses a situation of concern in Aracaju and its metropolitan area, which is the fact that most young individuals show low levels of physical activity and low fruit and vegetables consumption. This situation is of concern because such risk behaviors are responsible for millions of deaths in low, middle and high-income countries.[11] Moreover, these findings are of such concern that further support the policies and recommendations of the World Health Organization, the US Centers for Disease Control and Prevention (CDC) and the Ministry of Health of Brazil

Table 2 Analysis of the association with odds ratio estimate and 95% confidence intervals between physical activity and fruit and vegetables consumption in adolescents.

Variables	Unadjusted analysis		*p*	Adjusted analysis		*p*
	OR	95%CI		OR	95%CI	
Fruit consumption						
≥3 portions/day	1.0		<0.01[a]	1.0		0.01[a]
<3 portions/day	1.5	1.1-1.8		1.4	1.1-1.9	
Vegetables consumption						
≥4 portions/day	1.0		0.02[a]	1.0		0.03[a]
<4 portions/day	1.5	1.1-2.0		1.5	1.1-2.1	

OR, Odds Ratio; CI, confidence interval.
[a] $p \leq 0.05$, Wald's Test.

regarding the importance to be given to the guidelines on regular physical activity and proper nutrition in all age groups.[14,18,26]

As in the present study, other studies have also found that low levels of physical activity were associated with the inadequate fruit and vegetables consumption.[7,8,27] There are several factors that might explain these results and some theories try to explain them. One theory is the ecological model of health promotion.[27,28] In this theory, the demographic (gender, age, ethnicity), intrapersonal (knowledge, personal motivation, perception of difficulties), interpersonal (social support from friends and family) and community factors (neighborhood) are directly reflected in the lifestyle of individuals. Therefore, the association found in this study can be explained, for instance, by the lack of knowledge among adolescents about the importance of having a healthy lifestyle, or the fact that these young individuals live in areas that do not have access to places for the practice of physical activity, thus prompting young individuals to stay at the computer, television and videogames, which stimulate the consumption of unhealthy foods. However, such explanations are mere speculation in this study, based on literature findings.[27]

One of the study limitations is related to the collection of information through a self-administered questionnaire, as there is a possibility of response bias for variables such as socioeconomic level, maternal education, practice of physical activity and fruit and vegetables consumption. However, the tools used in the study have been validated for the Brazilian population. Additionally, the cross-sectional design of the study does not allow establishing a cause-and-effect association between the outcome and the independent variables. Another point that may be debatable is the use of logistic regression and the estimated Odds Ratio as a measure of association between variables. Some authors report that for cross-sectional studies that show a high prevalence of the dependent variable (>20%), the Odds Ratio can overestimate the association between the variables; however, in this study, this measure of association was used because it is recommended in the literature for cross-sectional studies that seek to establish some theoretical causality between the variables.[29]

Some positive points of this survey are worth mentioning, such as sample representativeness, the data collection control and recording process. It can be concluded that the low level of physical activity was associated with inadequate fruit and vegetables consumption by adolescents from a city in Northeast Brazil. These findings suggest that adolescents that are physically little active have other unhealthy behaviors that may increase the risk of chronic diseases in adulthood. Thus, interventions in the school environment should focus not only on increased levels of physical activity, but also prioritize approaches to healthy lifestyles.

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Conflicts of interest

The authors declare no conflicts of interest.

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