

Original Article (short paper)

Association between insufficient level of physical activity and multiple health risk behaviors in adolescents

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Abstract — Aim: To verify the association between insufficient level of physical activity and multiple health risk behaviors (HRB) in adolescents. **Methods:** This is an epidemiological study with cross-sectional design carried out in 2016 with 3,617 adolescents aged 14-19 years and enrolled in the public-school system of Sergipe, northeast Brazil. Data were collected using the Global School-based Student Health Survey (GSHS/WHO). The insufficient level of physical activity was defined as not achieving at least 60 minutes of moderate to vigorous physical activity for 5 days a week. The HRB analyzed were smoking, alcohol consumption, low fruit consumption and exposure to sedentary behavior. The analysis of prevalence odds ratio was used to identify the association between insufficient level of physical activity and HRB, as well as unadjusted and adjusted binary logistic regression for the association between socioeconomic and demographic variables. **Results:** The prevalence of insufficient level of physical activity was 83.3%. There was association between physical inactivity and low fruit consumption and alcohol consumption ($p < 0.001$). Insufficient level of physical activity was also associated with female sex (OR=1.90, 95% CI, 1.56-2.32), family income of up to 2 minimum wages (OR=1.57, 95% CI, 1.17-2.11), maternal schooling less than 8 years (OR=1.55, 95% CI, 1.28-1.86) and exposure to two different HRB at the same time (OR=1.76, 95% CI, 1.27-2.45). **Conclusion:** The prevalence of insufficient level of physical activity is high and was associated with multiple HRBs in this understudied population. These findings may support interventions focusing on the cluster of risk behaviors in youth.

Keywords: motor activity, sedentary lifestyle, simultaneity, adolescents.

Introduction

Evidence has highlighted the insufficient level of physical activity as one of the main health risk factor^{1,2}, including negative effects on vascular outcomes³, metabolic diseases⁴ and some types of cancers⁵. International estimates have indicated that these diseases account for millions of deaths worldwide and, if the insufficient level of physical activity was decreased, these deaths could be prevented¹. In Brazil, the level of physical activity among young people is below international recommendations, which recommend 60 minutes daily of moderate to vigorous physical activity for at least 5 days per week to obtain health benefits⁶. The National Student Health Survey (PeNSE) pointed out that only 20% of young Brazilians reach this recommendation⁷.

In addition to their direct negative effects¹, some evidence has shown that the insufficient level of physical activity may be clustered with more than one health risk behavior (HRB)⁸ at the same time in adults and youth⁸⁻¹⁰. In Brazil, this may

be worrying for some reasons. Firstly, a high prevalence of insufficient level of physical activity was observed in adolescents throughout the Brazilian national territory^{7,11}. Secondly, there are reports of an increasing aggregation of different HRB among Brazilian adolescents in recent years^{9,12}, including exposure to alcohol consumption, smoking, sedentary behaviors and low fruit consumption which, in aggregate, may increase health risks¹⁰.

Although the harm of exposure to insufficient level of physical activity is very extensive in literature¹, little is known about the joint exposure of this behavior with alcohol consumption, smoking, sedentary behavior and low fruit consumption in adolescents from specific sociocultural contexts. Thus, this study aimed to verify the association between insufficient level of physical activity and multiple HRB (alcohol consumption, smoking, sedentary behavior, and low fruit consumption) and related factors in adolescents from the State of Sergipe, in Northeast Brazil. We hypothesized that insufficient levels of physical activity are associated to other HRB in this population.

Method

Study design

The current study is part of a broad epidemiological survey with a cross-sectional design titled “Secular trend on health risk behaviors in adolescents: CRiS_adolescentes study”. The study received approval from the Ethics Research Committee of the Federal Institute of Education, Science and Technology (IFS) under the number 1522.876/2016/CEP/CONEP/CNS.

Sample

The population was composed of 14 to 19 year-old school adolescents of both sexes, enrolled in the day and night shifts of the state public school system during the year of 2016. Considering data available in the State Department of Education, high school enrollment was 60,548 students¹³. The enrollment number represented about 80% of high school students across the state. Some criteria were adopted for the sample composition. First, schools were selected according to the number of students, distributed in municipalities in each territory. Next, classes were randomly selected by grades and shift that would be used in data collection. To perform the sample calculation, the complex sampling process available in SPSS software was used (version 15).

For the general project, some criteria were adopted for estimating sample size. The first one was to consider the population size, the estimated prevalence of 50% as the maximum expected, 95% confidence interval, and tolerable sample error of 5%. Because it is a sample process per cluster, the sample size was multiplied by 1.5 as a function of the correction of the design effect ($def = 1.5$), estimating the need of student for each territory (StatCal.Epiinfo). In order to account for sample loss, 20% of school adolescents were added for several reasons, such as: not being present on the day of data collection, refusal to participate, age different from criteria established in the study and not answering important questions such as sex or age.

For this study, an association analysis was used, respecting statistical power of 80% and the odds ratio of 1.2 requiring a minimum sample of 3,875 adolescents. These criteria were adopted because of the lack of information on the prevalence of the different variables that would be investigated. The two-stage stratified sampling process was used in the sample selection: a) The stratified sampling process proportional to the territory and size of the teaching unit was used (1=up to 199 students, 2=200-499 students, 3=500 + students), according to criteria of the “Anísio Teixeira” National Institute of Studies and Educational Research (INEP)¹⁴. Thus, in order to ensure that all territories were representatively surveyed, respecting territories established in the research, a 25% draw of the state teaching units (160 schools) was established surveys, totaling 42 schools in 30 municipalities; and b) Classes were selected, according to grade and study shift, using a simple random process, considering an average of 20 students per class.

The consent term was used, respecting the anonymous and voluntary participation of students in the research. In addition, other criteria were established: to be properly enrolled in the 1st to 3rd grade of selected High Schools; presence at the time of application of the data collection instrument; adequately fill in the distributed questionnaire, duly marking the questions on the answer sheet with the established colors (blue or black); to be aged 14-19 years. Data were collected by Physical Education professionals properly trained in the domain of the questions of the instrument, form of application, support and conference of answers. Questionnaires were applied on a school day, in the classroom, with the presence of two professionals in each class to assist in completing the questionnaire. The instrument used was a Portuguese version of the Global School-Based Student Health Survey, proposed by the World Health Organization¹⁵. The mean time in the instrument application was 45 minutes.

Dependent variable: insufficient level of physical activity

Physical activity was obtained from an objective question: “During the last 7 days, on how many days have you been physically active for a time of 60 minutes?” Adolescents who did not perform 60 minutes of moderate to vigorous physical activity in at least 5 days in the last week were considered insufficiently active⁶.

Independent variables

The multiple HRB investigated consisted of: a) alcohol consumption; b) smoking; c) low fruit consumption; and d) sedentary behaviors. These behaviors were obtained from the objective questions: a) “Do you consume alcohol?” Adolescents who reported consuming alcoholic beverages were considered exposed¹⁶; b) “During the past 30 days, on how many days did you smoke cigarettes or other forms of tobacco?” Adolescents who reported smoking one or more days in the last 30 days were considered exposed¹⁷; c) “During the past 30 days, how many times a day did you eat fruits?” Those who consumed up to three servings of fruits per day were considered exposed¹⁸; d) “On a typical day, how much time do you spend sitting, watching TV, using the computer, talking to friends, playing cards or dominoes?” Adolescents who spent 2 hours or more per day in activities in the seated position were considered exposed¹⁹.

Covariates

Sex, chronological age, study shift, place of residence, skin color, maternal schooling, family income, and main source of income were assessed as covariates.

Data were tabulated electronically, using an optical reader and the Intelligent Character Recognition-Teleform software (HS Informática, Rio de Janeiro, Brazil) and the FI-6230 scanner (Fujitsu, Tokyo, Japan). Also, a manual conference

of questionnaires that presented problems in the electronic stage was carried out.

included in the adjusted model, and a p-value of 0.05 was adopted for the entire statistical treatment. For this, SPSS software for Windows (Version 15.0) was used.

Statistical analysis

Data analysis was divided into four steps. The first one consisted of a descriptive analysis to verify the sample characteristics. The chi-square test was used to associate the insufficient level of physical activity with socioeconomic and demographic variables, as well as the others HRB. In the third step, the prevalence odds ratio (POR) was used to calculate the association between insufficient level of physical activity with the sum of the other HRB. Finally, unadjusted and adjusted binary logistic regression were used to verify the association between insufficient level of physical activity and multiple HRB, demographic and socioeconomic factors. In these models, the insufficient level of physical activity was adopted as covariate and sex, age, study shift, family income and main source of income were considered exposures. After the unadjusted analysis, variables with p-value <0.20 were

Results

The questionnaires were answered by 4,721 adolescents (2,720 females and 1,980 males) in total. According to the inclusion criteria, some adolescents were excluded from the analysis as follow: those younger than 14 years old (12 subjects); those older than 19 years old (549 subjects); those who did not answered to relevant questions such as age (6 subjects) and gender (12 subjects); and those who did not present complete information about the four HRB investigated (504 subjects). The final sample resulted in 3,617 individuals, being 61.4% of females (n=2,109) and 56.7% of males (n=1,508). For 61.1% (1,734 adolescents), the family income was up to one minimum wage and the main source of income among families consisted of the work of father or mother 58.0% (2,097 adolescents) (Table 1).

Table 1. Characteristics of the sample (n=3,617), Sergipe, Brazil, 2016.

Variable	n (%)	Insufficient level of physical activity	% (95% CI)	p-value
Sex				
Male	1,508 (41.7)	1,164	38.6 (36.9-40.4)	<0.001
Female	2,109 (58.3)	1,850	61.4 (59.6-63.1)	
Age				
14-15	657 (18.2)	568	18.8 (18.8-18.8)	0.059
16-17	1,945 (53.7)	1,607	53.3 (51.5-55.1)	
18-19	1,015 (28.1)	839	27.8 (26.1-29.6)	
Study shift				
Day	2,575 (71.2)	2,170	72 (70.4-73.6)	0.017
Night	1,042 (28.8)	844	28 (26.4-29.6)	
Maternal schooling				
≤8 years	1,807 (56.1)	1,552	58 (56.1-59.8)	<0.001
>8 years	1413 (43.9)	1,126	42 (40.2-43.9)	
Family income				
1 MW or less	2,025 (59.4)	1,734	61.1 (61.1-61.1)	<0.001
1-2 MW	994 (29.1)	812	28.6 (27.0-30.3)	
>2 MW	391 (11.5)	291	10.3 (8.6-12.0)	
Place of residence				
Urban	2,072 (58.2)	1,681	56.7 (54.9-58.5)	<0.001
Rural	1,489 (41.8)	1,284	43.3 (41.5-45.1)	
Main source of income				
Retirement	477 (13.2)	410	20.6 (19.7-21.6)	<0.001
Federal Benefits	623 (17.2)	555	27.8 (26.9-28.8)	
Parent's work	2,097 (58.0)	695	34.9 (34-35.8)	
Pension	110 (3.0)	97	4.9 (4.0-5.9)	
Other	310 (8.6)	236	11.8 (11.0-12.9)	

CI=Confidence interval. MW= Brazilian minimum wage (R\$ 880). Data were analyzed using Chi-square tests.

Table 2 shows the prevalence of insufficient level of physical activity and others HRB as well as the cluster of HRB: a) low exposure to tobacco 5%; b) 69.2% exposure to alcohol; c) low fruit consumption 45.2%; d) students exposed to sedentary behavior 64.6%; e) high exposure between 1 HRB 33% and 2 HRB 44.5%.

Figure 1 shows the interrelationship between the association of insufficient level of physical activity with others HRB. Insufficient level of physical activity was associated with alcohol

consumption (OR=1.48, 95% CI, 1.24-1.77, p<0.001) and with low fruit consumption (OR=1.36, 95% CI, 1.13-1.63, p=0.001).

Table 3 shows the association of physical inactivity with sex, family income and exposure to multiple HRB. Female students (OR = 1.90, 95% CI, 1.56-2.32), those with family income up to two minimum wages (OR = 1.57, CI 95% 1.17-2.11), those with maternal schooling less than 8 years (OR = 1.37, 95% CI 1.12-1.69) and those who are exposed to at least two HRB (OR = 1.76, 95% CI 1.27-2.45) were more likely to physical inactivity.

Table 2. Distribution of health risk behaviors among adolescents (n=3,617), Sergipe, Brazil, 2016.

Variable	n (%)	Insufficient level of physical activity	% (95% CI)	p-value
Smoking				
Yes	193 (5.3)	151	5.0 (4.3-5.8)	0.051
No	3,424 (94.7)	2,863	95.0 (94.2-95.7)	
Alcohol use				
Yes	2,463 (68.1)	2,087	69.2 (67.6-70.9)	0.001
No	1,154 (31.9)	927	30.8 (29.1-32.4)	
Fruit consumption				
≤ 3 days	1,922 (53.1)	1,651	54.8 (53.0-56.5)	<0.001
>3 days	1,695 (46.9)	1,363	45.2 (43.5-47.0)	
Sedentary behavior				
≤ 2h/day	1,272 (35.4)	1,063	35.4 (33.8-37.2)	0.817
> 2h/day	2,345 (64.6)	1,936	64.6 (62.8-66.2)	
Multiple HRB				
0	331 (9.1)	253	8.4 (7.5-9.5)	<0.001
1	1,236 (34.2)	991	33.0 (31.4-34.7)	
2	1,545 (42.8)	1,335	44.5 (42.7-46.3)	
3	490 (13.5)	408	13.6 (12.4-14.9)	
4	15 (0.4)	12	0.4 (0.2-0.7)	

CI=Confidence interval. HRB=Health risk behaviors. Data were analyzed using Chi-square tests.

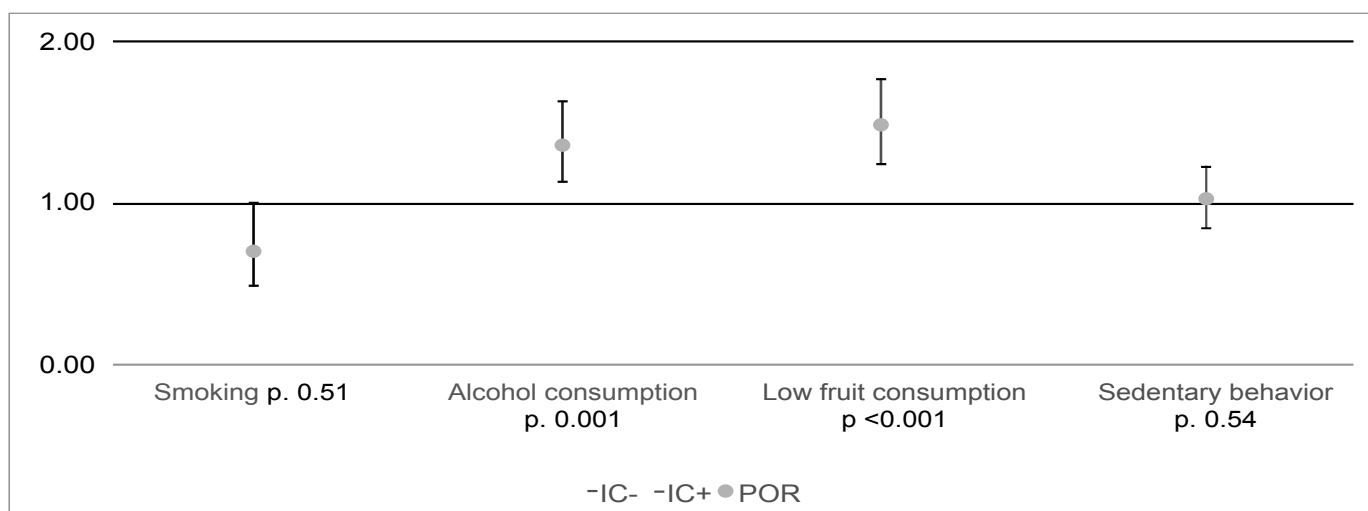


Figure 1. Prevalence Odds Ratio (POR) for insufficient level. Note. CI=95% confidence interval. "Smoking" was defined as having any amount of cigarettes in the past 30 days; "alcohol consumption" was defined as consuming alcoholic beverages; "low fruit consumption" was defined as consuming less than three servings of fruits per day; and "sedentary behavior" was defined as spending two hours or more per day in activities in the seated position.

Table 3. Binary logistic regression to estimate the association of insufficient level of physical activity with multiple health risk behaviors in adolescents, Sergipe, Brazil, 2016.

Variable	Unadjusted		Adjusted	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Sex				
Male	1	0.019	1	<0.001
Female	2.11 (1.76-2.52)		1.90 (1.56-2.32)	
Age				
14-15	1	0.060	1	0.101
16-17	1.33 (1.01-1.76)		0.75 (0.57-0.99)	
18-19	0.99 (0.81-1.21)		0.87 (0.31-1.20)	
Study shift				
Day	1	<0.001	1	0.049
Night	1.25 (1.04-1.51)		1.25 (1.00-1.56)	
Maternal schooling				
> 8 years	1	0.007	1	0.002
≤ 8 years	1.55 (1.28-1.86)		1.37 (1.12-1.69)	
Family income				
1 MW or less	1	0.009	1	0.009
1-2 MW	2.04 (1.58-2.65)		1.57 (1.17-2.11)	
≥ 2 MW	1.53 (1.6-2.02)		1.34 (0.99-1.80)	
Multiple HRB				
0	1	0.008	1	<0.001
1	1.19 (0.88-1.60)		1.02 (0.73-1.41)	
2	1.87 (1.39-2.53)		1.76 (1.27-2.45)	
3	1.52 (1.07-2.18)		1.49 (1.00-2.20)	
4	1.15 (0.37-4.20)		0.88 (0.22-3.45)	

OR=Odds ratio. Test Hosmer-Lemeshow = 0.489. CI=Confidence interval. MW= Brazilian minimum wage (R\$ 880). HRB=Health risk behaviors.

Discussion

High prevalence of insufficient level of physical activity was found among adolescents from Sergipe, Brazil. Only 16.7% reached the international recommendations of physical activity for obtaining health benefits⁶. There was association between insufficient level of physical activity and sex, maternal schooling, alcohol consumption, and low fruit consumption. There was insufficient physical activity level with the aggregation of two and three HRB. These results confirm previous studies involving adolescents from other regions/countries.

Research conducted in China revealed that 80% of young people do not perform satisfactory physical activity for health⁴. Similarly, studies conducted with adolescents from public schools in Kuwait also found that only 20% of school adolescents performed 300 minutes or more of physical activity per week²⁰. It is worth mentioning that data in the global sphere are alarming^{1,21}, and that this evidence corroborates the international literature on “physical inactivity pandemic”²².

In Brazil, insufficient level of physical activity is the most frequent HRB among young people²³. Northeast states such as Piauí (25.2%), Sergipe (28.1%) and Maranhão (28.2%) stood out with the worst rates⁷ of insufficient level of physical activity which was usually observed in high-income countries²⁴, but nowadays it is perceived that young people from middle- and low-income countries are less and less physically active²⁵.

In Sergipe, the socioeconomic level was an important predictor for insufficient level of physical activity. It was found that adolescents with low schooling mothers (> 8 years) and family income up to two minimum wages are more likely not to reach the international recommendations of physical activity (PA)⁶. These findings show the importance of directing interventions and public policies for underserved youth, especially in the context of low to middle-income countries²⁵. Female adolescents were almost two times more likely to be physically inactive when compared to boys. These findings are consistent with the literature being that girls perform less physical activity than boys regardless of the evaluation method and instrument in the

collection of information²⁶. It is noteworthy that this prevalence follows the global trend involving the insufficient level of physical activity when stratified by sex²⁴, and that this trend should subsidize differentiated strategies to make adolescents more active, especially girls.

Studies have shown that HRB tends to act in an associated form, that is, the exposure of one HRB can increase the risk of other²⁷⁻²⁸. Although this is not well established, it is supposed that exist a profile of adolescent who is more prone to adopt unhealthy behaviors. This is especially alarming considering the moderate tracking of some health behaviors lifelong. Thus, this subgroup should be prioritized in public health actions since early ages. In Sergipe, adolescents who do not perform 60 minutes of moderate to vigorous physical activity for at least five days a week are more likely to be exposed to alcoholic beverages. These findings were also reported in different socio-cultural realities, such as among the population of England²⁷. There was also association between insufficient level of physical activity with eating habits, which means that insufficient levels of physical activity increase the odds of adolescents failing to meet international recommendations on fruit consumption. In agreement with previous studies conducted with adolescents from the Southern and Northeast regions of Brazil^{10,12}. In this way, it is noticed that the interrelationship between insufficient level of physical activity and other multiple HRB is not an isolated fact in Sergipe.

The study has limitations. The transversal design is one of them because it prevents the analysis of causality. The use of questionnaires for the assessment of insufficient physical activity level and other HRB can provide bias. However, we used a validated questionnaire for this population. The study represents the first investigation on the association between HRB in the context of Northeast Brazil adolescents based on a State representative sample.

In conclusion, our results highlighted that reducing physical inactivity is a global challenge, especially because this unhealthy habit is associated with several predictive factors, including demographic, economic, and behaviors aspects. This fact requires the conviction that the health benefits from increasing youth physical activity do not mean that adolescents reach physical activity guidelines, but rather promote actions that may minimize other HRBs in this population.

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