

Multiple risk behaviors for non-communicable diseases and associated factors in adolescents

Múltiplos comportamentos de risco para doenças não transmissíveis em adolescentes e fatores associados

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ABSTRACT

Objective

To estimate the prevalence of risk behaviors for non-communicable diseases and analyze their associated factors in adolescents.

Methods

A school-based cross-sectional study was conducted in 2008 with 1,139 adolescents aged 14 to 19 years attending public and private high schools in *Cuiabá*, Midwestern Brazil. Data were collected using a self-administered questionnaire, including a semiquantitative Food Frequency Questionnaire. The prevalence of tobacco smoking, alcohol experimentation, physical inactivity, unsatisfactory meal pattern, and excessive intake of saturated fat and sodium were evaluated. The associations between risk behaviors and socioeconomic variables, weight status, and self-perceived health status were evaluated.

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Results

The most common risk behaviors were excessive sodium intake (88%), unsatisfactory meal pattern (72%), excessive intake of saturated fat (39%), and alcohol experimentation (39%). Four of 10 adolescents were exposed to two risk behaviors simultaneously. Among male adolescents, the main factors associated with risk behaviors were: type of school, class schedule, education level of the household head, weight status, and self-perceived health status. Among female adolescents, age, type of school, class schedule, and education level of the household head were the main factors associated with risk behaviors.

Conclusion

The prevalence of exposure to risk behaviors for non-communicable diseases was high, highlighting the simultaneous presence of tobacco smoking and experimentation of alcoholic beverages. Special attention should be given to educational activities to minimize the effects of the simultaneous occurrence of multiple risk behaviors.

Keywords: Adolescents. Adolescent behavior. Life style. Risk-taking. Social class.

RESUMO

Objetivo

Estimar a prevalência de comportamentos de risco para doenças não transmissíveis e analisar seus fatores associados em adolescentes.

Métodos

Estudo transversal de base escolar realizado em 2008 com 1 139 estudantes do ensino médio, entre 14 e 19 anos de idade, de escolas públicas e privadas de Cuiabá, Mato Grosso. Aplicou-se questionário autoadministrado, incluindo Questionário de Frequência Alimentar. Avaliou-se a prevalência de tabagismo, experimentação de álcool, inatividade física, padrão de refeições e ingestão excessiva de gordura saturada e sódio. Foram analisadas as associações entre os comportamentos de risco e variáveis socioeconômicas, status de peso e autopercepção do estado de saúde.

Resultados

Os comportamentos de risco mais comuns foram: ingestão excessiva de sódio (88%), padrão de refeições insatisfatório (72%), consumo excessivo de gordura saturada (39%) e experimentação de álcool (39%). Quatro em cada 10 adolescentes foram expostos a dois comportamentos de risco simultaneamente. Entre os meninos, os principais fatores associados aos comportamentos de risco foram: tipo de escola, turno de aula, escolaridade do chefe da família, status de peso e autopercepção do estado de saúde. Entre as meninas, a idade, o tipo de escola, o turno de estudo e a escolaridade do chefe da família foram os principais fatores associados aos comportamentos de risco.

Conclusão

A prevalência de exposição a comportamentos de risco para doenças não transmissíveis foi elevada, destacando a presença simultânea de tabagismo e experimentação de bebidas alcoólicas. Deve ser dada especial atenção às atividades educativas, visando minimizar os efeitos da ocorrência simultânea de múltiplos comportamentos de risco.

Palavras-chave: Adolescentes. Comportamentos do adolescente. Estilo de vida. Assunção de riscos. Classe social.

INTRODUCTION

Non-Communicable Diseases (NCD) are the leading causes of death in Brazil, accounting for 72% of deaths in 2007¹. The etiology of these disorders is multifactorial, involving non-modifiable factors, including age, sex, and family

history, and modifiable factors, including specific lifestyle habits that are considered risk behaviors for NCD².

Risk behaviors may be defined as those that directly or indirectly affect the health, wellness, and healthy development of an individual³ or even as attitudes that increase the

risk of developing or worsening diseases⁴. The occurrence of these behaviors in adolescence, both in Brazil⁵⁻⁹ and in other countries^{2,10-17}, has been associated with an increased risk of developing NCD in adulthood¹⁸. Furthermore, the simultaneous occurrence of multiple risk behaviors is common in adolescents^{4,6}, which may potentiate the risk for those diseases in adulthood.

Thus, evaluating the relationships between multiple risk behaviors for NCD may help to identify groups at higher risk and assist in designing intervention programs. However, few studies have been conducted in Brazil on the simultaneous occurrence of NCD risk behaviors. The aim of this study was to estimate the prevalence of NCD risk behaviors in adolescents and analyze those behaviors' associated factors.

METHODS

This was a cross-sectional, school-based study conducted in 2008 in the urban area of the municipality of *Cuiabá*, capital of the state of *Mato Grosso*, located in the midwestern region of Brazil. The subjects were male and female students aged 14-19 years from public and private high schools.

The primary objective of the main study was to evaluate risk behaviors for eating disorders. A 95% level of confidence and 3% sampling error were chosen, and because no specific studies on risk behavior for eating disorders in adolescents from *Cuiabá* have been conducted, a prevalence of 0.50 was considered for the purpose of calculating sample size. The sample size was estimated at 1,067 adolescents and increased by 20% to consider the effect of cluster sampling ($deff=1.2$), totaling 1,280 adolescents from 10 schools.

A multistage technique was used to select a stratified sample proportional to the number of students in each type of school. According to the 2006 School Census (Department of Education, State of *Mato Grosso*), 30,584 adolescents from that age group were enrolled in the schools of

Cuiabá, 22,082 attending state schools, 1,085 attending federal schools, and 7,417 attending private schools. For logistic reasons, only schools with at least 400 students were eligible for the study (23 of 62 schools, totaling 23,501 students). These 23 schools were strategically located in four geographic regions of the city. The only federal high school was included in the study because it was self-representative. Additionally, to maintain the proportionality in the number of students enrolled in each type of school, seven state schools (of 18 eligible schools) and two private schools (of four eligible schools) were systematically selected to complete the sample. In each school classrooms were randomly selected until a minimum of 128 students was reached.

Adolescents and/or their parents/guardians signed an informed consent form, agreeing to participate in the study. An authorization for data collection was also obtained from the schools. The study was approved by the Research Ethics Committee of the Júlio Muller University Hospital of the *Universidade Federal do Mato Grosso* (Protocol #459/CEP-HUJM/07).

The adolescents filled out a standardized self-administered questionnaire in the classrooms, with questions concerning socioeconomic characteristics, lifestyle and eating habits, and a semiquantitative Food Frequency Questionnaire (FFQ). The schools were visited three times to track down students absent in previous visits to decrease the non-response rate. A pretest of the research protocol and a pilot study were conducted in a school that was not included in the sample in order to test the understanding of the questionnaire, correct possible flaws, and standardize data collection.

The following risk behaviors for NCD were evaluated:

- Tobacco smoking: based on the World Health Organization (WHO)¹⁹ criteria, adolescents who reported having smoked at least one day in the 30 days before the interview were classified as smokers.

- Experimentation of alcoholic beverages: experimentation of alcoholic beverages (beer, wine, and spirits) was obtained from the FFQ. Adolescents were classified as alcoholic beverage reporters (regardless of amount, frequency, and type) and non-reporters.

- Physical activity: the type, frequency, and duration of a list of leisure-time activities performed in the last three months were examined. The weekly time devoted to leisure-time physical activity was estimated by multiplying the daily time (in minutes) by the weekly frequency with which the activities were conducted. The level of physical activity was classified as suggested by Currie *et al.*²⁰: adolescents who reported practicing no physical activity were classified as physically inactive; those who practiced up to 299 minutes/week, as insufficiently active; and those who practiced at least 300 minutes of physical activity weekly, as active.

- Meal consumption: the frequency of breakfast, morning snack, lunch, afternoon snack, and dinner consumption in the last six months was ascertained by the question: "On average, how often did you have these meals in the past six months?". The response options were: every day, three to six times/week, one to two times/week, and never. Meal consumption profile was categorized into three groups: satisfactory, irregular, and unsatisfactory. Adolescents with a satisfactory meal profile had at least the three main meals (breakfast, lunch, and dinner) daily, as recommended by the Food Guide for the Brazilian Population²¹. Adolescents who had only one or two of the three main meals daily were classified as having an irregular meal profile. Finally, adolescents who did not have any of the three main meals daily were classified as having an unsatisfactory meal profile. Satisfactory, irregular, and unsatisfactory meal profiles may or may not include one or more snacks daily.

- Inadequate food consumption: food consumption was evaluated using an FFQ validated for adults of *Cuiabá*²², which was

modified to be administered in adolescents²³. The FFQ consisted of 76 food items, with up to three options of standard portions for reporting the quantities consumed and eight response options for consumption frequency, ranging from more than three times/day to never or almost never. The FFQ timeframe was the last six months before the interview. The consumption of energy and nutrients was evaluated using the software NutWin, version 2.5 (developed by *Universidade Federal de São Paulo, Brazil*)²⁴. The nutritional composition of foods not listed in the NutWin software was found in the Brazilian "*Tabela Brasileira de Composição de Alimentos*" (Table of Food Composition)²⁵ and in the Nutrition Data System for Research²⁶. Inadequate food consumption was defined as saturated fat consumption higher than 10% of total energy consumption, as recommended by the WHO²⁷, and sodium consumption higher than 1 g/1000 kcal, as recommended by the Brazilian Ministry of Health²¹.

Socioeconomic level was assessed according to the household head education level (in years of formal education), considering the highest level reached and type of school (federal, state, and private), as used in other studies with Brazilian adolescents²⁸.

Age (in full years) was calculated by the difference between the date of data collection and the date of birth, and two groups were considered for analyses: 14-15 year-olds and 16-19 year-olds. Students were also categorized according to class schedule (morning, afternoon).

Self-perceived health status was assessed by the statement: "Compared with same-age peers, you consider your health status to be...", and the answer options: very good, good, fair, or bad. For analytical purposes, the answers were grouped into "good" (very good and good) and "bad" (fair and bad).

Body Mass Index (BMI kg/m²) was estimated to classify the adolescents' weight status using BMI Z-scores as recommended by the WHO recommendations²⁹. Adolescents with

BMI-for-age $\leq +1$ Z-score were classified not having excess weight, and those with BMI-for-age $> +1$ Z-score as having excess weight. The latter category comprised overweight and obesity. For logistic reasons, it was not possible to measure the students' weight and height, so BMI was calculated using self-reported weight and height. Self-reported weight and height has been validated by Rodrigues *et al.*³⁰ for use in epidemiological studies of adolescents from Cuiabá. There was no statistically significant difference between self-reported and measured weight and height ($p=0.30$ and 0.76 , respectively); the intraclass correlation coefficients were >0.95 in both sexes, and the mean interrater reliability, estimated according to the method of Bland-Altman, was 99% for weight and 100% for height³⁰.

The risk behaviors of each adolescent were added to evaluate the frequency of simultaneous occurrence of multiple risk behaviors: tobacco smoking, alcohol experimentation, physical inactivity, unsatisfactory meal pattern, and inadequate food consumption. The adolescents were classified according to the number of behaviors they were exposed to: no exposure or exposure to one, two, and three or more risk behaviors.

The analyses were conducted by sex because of statistically significant differences in the risk behaviors of male and female adolescents. The Chi-squared test was used in the bivariate analysis to compare prevalence of risk behaviors (when they occurred alone or in combination) according to socioeconomic level, weight status, and self-perceived health status.

Multivariate logistic regression models evaluated the associations between risk behaviors. Each behavior was considered a dependent variable in one of the models (model 1: experimentation of alcoholic beverages; model 2: physical inactivity; model 3: unsatisfactory meal consumption; model 4: inadequate food consumption), and the other behaviors were included as independent variables in each model.

If any socioeconomic variable, weight status, or self-perceived health status had $p < 0.20$ in univariate analysis, they were included in the respective models to control for the confounding factors for each behavior.

In addition, Poisson regression models evaluated the associated factors with the simultaneous occurrence of risk behaviors. Each number of risk behavior was considered a dependent variable in one of the models (model 1: at least one risk behavior; model 2: two risk behaviors; model 3: three or more risk behaviors). Socioeconomic variables, weight status, or self-perceived health status with $p < 0.20$ in univariate analysis were included as independent variables in each model to control for the confounding factors for each behavior. Thus, crude and adjusted models for Poisson regression models are presented.

The statistical analyses were performed considering the weights and sample design by using the command `weight cases` of the statistical software Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, United States) version 19.0 and Stata for Windows (Microsoft Corporation, Redmond, Washington, United States) version 12.0 (Stata Corporation, College Station, Texas, United States).

RESULTS

Of all adolescents eligible to participate in the study ($n=1,344$), 48 refused to participate; thus, 1,296 (96.4%) were examined. Of these, 87 (6.7%) did not provide complete dietary information. Seventy adolescents (5.4%) who reported usual energy intake 2 standard deviations below or above the mean (corresponding to 419 kJ and 48,953 kJ, respectively [$1 \text{ kcal}=4.19 \text{ kJ}$]) were excluded from the analysis because these values are considered a biologically implausible usual intake. A total of 1,139 adolescents (84.7% of the eligible total) were analyzed, 56.0% females, 66.0% aged 16-19 years, and 72.0%

from public schools. Seventy-five percent of the adolescents perceived their health status as good (males: 80.0%; females: 71.0%; $p < 0.01$), and 17.0% had excess weight (including obesity) (males: 24%; females: 11.0%; $p < 0.01$).

The most prevalent risk behaviors for NCD were excessive sodium intake (88%), unsatisfactory meal consumption (72%), excessive intake of saturated fat (39%), and experimentation

of alcoholic beverages (39%). Only 18% of the adolescents reported ≤ 1 risk behavior; 44% were exposed to two and 38% to three or more risk behaviors simultaneously. Male adolescents had a higher prevalence of excessive sodium intake (91 versus 85%), experimentation of alcoholic beverages (47 versus 32%), and tobacco smoking (9 versus 4%) than female adolescents ($p < 0.01$ for all). Conversely, female adolescents had a

Table 1. Distribution of risk behaviors for non-communicable diseases and their association with variables of interest among male adolescents (n=501). Cuiabá (MT), Brazil, 2008.

Characteristics	Risk behaviors for non-communicable diseases											
	Total		Tobacco smoking		Alcoholic experimentation beverages		Physical inactivity		Unsatisfactory meal consumption		Inadequate food intake	
	n	%	n	%	n	%	n	%	n	%	n	%
<i>Years of age</i>												
14-15	174	34.7	12	6.9	76	43.7	17	9.8	108	62.1	159	91.4
16-19	327	65.3	32	9.8	159	48.6	26	8.0	213	65.1	305	93.3
<i>p</i> -value*	-		0.28		0.29		0.49		0.50		0.44	
<i>Type of high school</i>												
Federal	26	5.1	1	3.8	9	3.4.6	0	0	18	69.2	24	92.3
Private	140	27.9	16	11.4	76	54.3	15	10.7	106	75.7	124	88.6
State	336	67.0	27	8.1	150	44.8	28	8.4	197	58.8	316	94.0
<i>p</i> -value	-		0.33		0.07		0.20		0.01		0.12	
<i>Class schedule</i>												
Morning	362	72.3	30	8.3	176	48.5	38	10.5	244	67.2	336	92.8
Afternoon	139	27.7	14	10.1	59	42.4	5	3.6	77	55.4	127	91.4
<i>p</i> -value	-		0.51		0.23		0.02		0.01		0.58	
<i>Education level of household head</i>												
<8 years of schooling	97	19.4	7	7.1	35	36.1	10	10.3	53	54.6	93	95.9
≥ 8 years of schooling	404	80.6	37	9.2	200	49.5	33	8.2	267	66.1	370	91.6
<i>p</i> -value	-		0.53		0.02		0.50		0.04		0.15	
<i>Weight status</i>												
Normal weight	383	76.3	32	8.4	178	46.5	30	7.9	231	60.5	358	93.5
Excess weight	119	23.7	12	10.2	57	48.3	13	10.9	89	75.4	106	89.1
<i>p</i> -value	-		0.54		0.73		0.30		<0.01		0.11	
<i>Self-perceived health status</i>												
Good	402	80.2	31	7.7	188	46.8	32	8.0	248	61.7	376	93.5
Bad	99	19.8	13	13.1	47	47.5	11	11.1	73	73.0	87	87.9
<i>p</i> -value	-		0.09		0.90		0.32		0.04		0.06	
Total			44	8.8	235	46.9	43	8.6	321	64.0	464	92.5

Note: *Chi-square test.

higher prevalence of unsatisfactory meal consumption (78 versus 64%) and physical inactivity (32 versus 9%) ($p < 0.01$ for all). Males and females had similar inadequate intake of saturated fat (males: 37 versus females: 41%, $p = 0.09$). The number of simultaneous exposure to risk behaviors differed significantly between sexes ($p = 0.01$).

Male adolescents from private schools had a higher prevalence of unsatisfactory meal consumption. Students who attended morning classes had the highest prevalence of physical inactivity and unsatisfactory meal consumption. Adolescents from families in which the household head had ≥ 8 years of schooling had a higher prevalence of alcohol experimentation and

Table 2. Distribution of risk behaviors for non-communicable diseases and their association with variables of interest among female adolescents (n=638). Cuiabá (MT), Brazil, 2008.

Characteristics	Risk behaviors for non-communicable diseases											
	Total		Tobacco smoking		Alcoholic experimentation beverages		Physical inactivity		Unsatisfactory meal consumption		Inadequate food intake	
	n	%	n	%	n	%	n	%	n	%	n	%
<i>Years of age</i>												
14-15	215	33.7	8	3.7	66	30.7	53	24.7	168	78.1	190	88.4
16-19	423	66.3	14	3.3	141	33.3	149	35.2	328	77.5	373	88.4
<i>p-value*</i>	-		0.79		0.50		0.01		0.86		1.00	
<i>Type of high school</i>												
Federal	227	4.2	2	7.4	5	18.5	2	7.4	25	92.6	24	88.9
Private	126	19.7	5	4.0	52	41.3	43	34.1	104	82.5	116	92.1
State	485	76.0	15	3.1	149	30.7	158	32.6	367	75.7	423	87.2
<i>p-value</i>	-		0.46		0.02		0.02		0.04		0.32	
<i>Class schedule</i>												
Morning	462	72.4	18	3.9	161	34.8	154	33.3	374	81.0	406	87.9
Afternoon	176	27.6	5	2.8	46	26.1	48	27.3	122	69.3	158	89.8
<i>p-value</i>	-		0.52		0.04		0.14		<0.01		0.50	
<i>Education level of household head</i>												
<8 years of schooling	179	28.1	5	2.8	53	29.4	50	27.9	134	74.9	161	89.4
≥ 8 years of schooling	458	71.9	18	3.9	154	33.6	152	33.2	362	78.9	402	87.8
<i>p-value</i>	-		0.49		0.01		0.20		0.27		0.56	
<i>Weight status</i>												
Normal weight	567	88.8	20	3.5	179	31.6	181	31.9	436	76.9	502	88.7
Excess weight	71	11.2	2	2.8	27	38.0	22	31.0	60	84.5	61	85.9
<i>p-value</i>	-		0.76		0.28		0.78		0.15		0.49	
<i>Self-perceived health status</i>												
Good	455	71.3	15	3.3	147	32.3	136	29.9	347	76.3	399	87.7
Bad	183	28.7	8	4.4	60	32.3	67	36.6	149	81.4	164	89.6
<i>p-value</i>	-		0.51		0.91		0.10		0.16		0.50	
Total			23	3.5	207	32.4	202	31.7	496	77.8	563	88.3

Note: *Chi-square test.

unsatisfactory meal consumption. Excess weight was more common among those with unsatisfactory meal consumption, and adolescents who reported a bad health status had a higher prevalence of unsatisfactory meal consumption (Table 1).

Female adolescents aged 16 to 19 years and those from private schools had a higher prevalence of physical inactivity. Attending morning classes, having a household head with ≥ 8 years of schooling, and attending private school were associated with experimentation of alcoholic beverages. The prevalence of unsatisfactory meal consumption was higher among students from the federal school and among those who attended morning classes (Table 2).

Tobacco smoking was associated with an increased likelihood of alcohol experimentation among males (*Odds Ratio*-OR=4.4; 95% Confidence Interval-95%CI=2.1; 9.3) and females (OR=7.7; 95%CI= 2.8; 20.9) (Table 3).

Concerning the simultaneous occurrence of the study risk behaviors, males from private schools had a greater prevalence of the concurrent occurrence of three or more risk behaviors. Students who attended morning classes had a smaller prevalence of the occurrence of ≤ 1 risk behavior. Adolescents whose household head had ≥ 8 years of formal education and those with excess weight had higher prevalences of the simultaneous occurrence of three or more risk behaviors. The prevalence of one or no risk

Table 3. Association among risk behaviors for Non-Communicable Diseases (NCD) in adolescents according to sex (n=1,139). *Cuiabá* (MT), Brazil, 2008.

Risk behaviors	Risk behaviors for NCD [<i>Odds Ratio</i> (95% Confidence Interval)]			
	Alcoholic experimentation beverages	Physical inactivity	Unsatisfactory meal nsumption	Inadequate food intake
Males (n=501)				
<i>Tobacco smoking</i>				
No	1.0	1.0	1.0	1.0
Yes	4.4 (2.1, 9.3)*	1.5 (0.6, 4.0)	1.9 (0.9, 4.1)	0.5 (0.2, 1.4)
<i>Alcoholic experimentation beverages</i>				
No		1.0	1.0	1.0
Yes		0.9 (0.5, 1.8)	1.0 (0.7, 1.4)	1.2 (0.6, 2.4)
<i>Physical inactivity</i>				
No			1.0	1.0
Yes			1.8 (0.9, 3.9)	0.7 (0.3, 2.2)
<i>Unsatisfactory meal consumption</i>				
No				1.0
Yes				0.6 (0.3, 1.4)
Females (n=638)				
<i>Tobacco smoking</i>				
No	1.0	1.0	1.0	1.0
Yes	7.7 (2.8, 20.9)*	0.9 (0.4, 2.4)	0.9 (0.3, 2.6)	1.9 (0.4, 10.4)
<i>Alcoholic experimentation beverages</i>				
No		1.0	1.0	1.0
Yes		0.9 (0.6, 1.3)	1.5 (1.0, 2.4)	0.8 (0.5, 1.3)
<i>Physical inactivity</i>				
No			1.0	1.0
Yes			1.1 (0.7, 1.6)	1.1 (0.6, 1.8)
<i>Unsatisfactory meal consumption</i>				
No				1.0
Yes				0.8 (0.4, 1.5)

Note: * $p < 0.01$, according to logistic regression models.

behaviors was highest among females from state schools and females who attended afternoon classes. The simultaneous occurrence of two risk behaviors was higher among students from the federal school, and the occurrence of three or more risk behaviors was higher among students who attended morning classes (Table 4). According to Poisson regression models, the main

Table 4. Distribution and prevalence ratio of simultaneous occurrence of risk behaviors for Non-Communicable Diseases (NCD) according to the variables of interest. Adolescents from *Cuiabá* (MT), Brazil, 2008.

Characteristics	Number of simultaneous risk behaviors for NCD											
	Males (n=501)						Females (n=638)					
	≤1		2		≥3		≤1		2		≥3	
	n	%	n	%	n	%	n	%	n	%	n	%
<i>Years of age</i>												
14-15	42	24.1	76	43.7	56	32.2	37	17.2	97	45.1	81	37.7
16-19	62	19.0	153	46.8	112	34.3	63	14.9	178	42.1	182	43.0
<i>p</i> -value*	0.17		0.51		0.64		0.45		0.46		0.19	
PR (95%CI) ^a	1.3	0.9; 1.8	-	-	-	-	-	-	-	-	1.1	0.9; 1.4
PR (95%CI) ^b	1.2	0.8; 1.7	-	-	-	-	-	-	-	-	1.2	1.0; 1.5
<i>Type of high school</i>												
Federal	6	23.1	13	52.0	6	23.1	2	7.4	18	69.2	6	22.2
Private	22	15.8	55	39.6	62	44.3	11	8.7	52	41.3	63	50.0
State	75	22.3	160	47.8	100	29.9	87	17.9	204	42.1	194	40.0
<i>p</i> -value	0.27		0.21		0.01		0.02		0.02		0.02	
PR (95%CI) ^a	-	-	-	-	1.4	1.2; 1.8	1.8	1.2; 2.8	1.2	1.0; 1.3	1.3	1.1; 1.6
PR (95%CI) ^b	-	-	-	-	1.3	1.1; 1.7	1.9	1.2; 2.9	-	-	1.4	1.2; 1.7
<i>Class schedule</i>												
Morning	63	17.4	171	47.1	129	35.5	63	13.6	193	41.8	205	44.4
Afternoon	41	29.5	58	42.0	40	28.8	37	21.0	81	46.0	58	33.0
<i>p</i> -value	<0.01		0.31		0.15		0.02		0.33		0.01	
PR (95%CI) ^a	1.7	1.2; 2.4	-	-	1.2	0.9; 1.7	1.5	1.1; 2.2	-	-	1.4	1.1; 1.7
PR (95%CI) ^b	1.6	1.1; 2.3	-	-	1.3	1.0; 1.8	1.7	1.1; 2.4	-	-	1.3	1.1; 1.7
<i>Education level of household head</i>												
<8 years of schooling	24	24.7	50	51.5	23	23.7	36	20.1	73	40.8	70	39.1
≥8 years of schooling	79	19.6	179	44.3	145	35.9	64	14.0	201	43.9	193	42.1
<i>p</i> -value	0.26		0.20		0.02		0.06		0.48		0.49	
PR (95%CI) ^a	-	-	-	-	1.5	1.1; 2.3	1.4	1.0; 2.1	-	-	-	-
PR (95%CI) ^b	-	-	-	-	1.4	1.0; 2.1	1.3	0.9; 1.8	-	-	-	-
<i>Weight status</i>												
Normal weight	84	21.9	180	47.0	119	31.1	91	16.0	245	43.2	231	40.7
Excess weight	20	16.9	49	41.2	49	41.5	9	12.7	29	40.8	33	45.8
<i>p</i> -value	0.24		0.27		0.04		0.46		0.70		0.41	
PR (95%CI) ^a	-	-	-	-	1.3	1.1; 1.7	-	-	-	-	-	-
PR (95%CI) ^b	-	-	-	-	1.2	0.9; 1.6	-	-	-	-	-	-
<i>Self-perception of health status</i>												
Good	88	21.9	185	46.0	129	32.1	77	16.9	200	44.0	178	39.1
Bad	16	16.0	45	45.0	39	39.4	23	12.6	75	41.0	85	46.4
<i>p</i> -value	0.19		0.86		0.17		0.17		0.49		0.09	
PR (95%CI) ^a	1.4	0.8; 2.3	-	-	1.2	0.9; 1.6	1.3	0.9; 2.1	-	-	1.2	1.0; 1.5
PR (95%CI) ^b	1.4	0.8; 2.2	-	-	1.2	0.9; 1.6	1.3	0.8; 2.1	-	-	1.2	1.0; 1.4

Note: *Chi-square test; ^aCrude Prevalence Ratio; ^bAdjusted Prevalence Ratio, each model was adjusted by independent variables that had $p < 0.20$ in the univariate analysis.

PR: Prevalence Ratio; 95%CI: 95% Confidence Interval estimated by Poisson regression.

factors associated with the simultaneous occurrence of risk behaviors in males and females were attending morning classes and private schools (Table 4).

DISCUSSION

Sodium intake higher than that recommended by the WHO, unsatisfactory consumption of main meals, saturated fat intake above 10% of total energy consumption, and experimentation of alcoholic beverages in the previous six months were the most prevalent risk behaviors for NCD among adolescents in *Cuiabá*, Brazil. Attending private high schools and morning classes were associated with a higher prevalence and simultaneous occurrence of multiple risk behaviors.

The high prevalence of risk behaviors observed in the present study are concerning because early exposure to undesirable behaviors, including poor eating habits, physical inactivity, and tobacco use, are associated with the development of metabolic disorders, including high blood pressure, hypertriglyceridemia, low levels of high-density lipoprotein cholesterol, and high levels of low-density lipoprotein cholesterol⁵. These risk behaviors can predispose people to the development of major health problems and NCD, both in adolescence^{2,16} and in adulthood¹⁸.

There was a strong association between experimentation of alcoholic beverages and tobacco smoking among the adolescents from *Cuiabá*. Similarly, a direct relationship between tobacco smoking and use of alcoholic beverages has been found in Brazilian⁶, Finnish¹¹, and Belgian¹⁵ adolescents. Paavola *et al.*¹¹ found that tobacco smoking and alcohol intake in adolescence are associated with these behaviors in adulthood, noting that these behaviors are also strongly correlated with each other. In that study the presence of these behaviors in 15- and 21-year-olds predicted their presence in 28-year-olds, showing the interdependence between these

behaviors and their maintenance throughout life. Furthermore, in adolescents tobacco smoking and alcohol consumption have often been associated with other risk behaviors, including illicit drug use, unprotected sexual intercourse, aggressive behaviors^{2,17}, and conditions including depression and low self-esteem^{10,14}.

The second most prevalent risk behavior among adolescents in *Cuiabá* was irregular consumption of meals, which has been associated with nutritionally poor diets^{8,12}, insufficient nutrient intake⁸, increased risk of overweight, higher waist circumference, higher BMI, and higher levels of low-density lipoprotein cholesterol^{7,31}. The present study emphasizes the importance of considering regular meal habits as an important component of a healthy lifestyle, as did two other studies that evaluated the irregular intake of meals as a risk behavior in adolescents^{10,13}. Yorulmaz *et al.*¹⁰ found that adolescent tobacco smokers in Turkey showed a lower frequency of having breakfast than non-tobacco smokers. Similarly, Giannakopoulos *et al.*¹³ reported that adolescent tobacco smokers in Greece had lower intake frequency of daily breakfast, cereals, and dairy products and higher intake frequency of deep-fried foods, sodas, and beverages with added sugar than non-tobacco smokers.

Regarding the association between socioeconomic level, education level of the household head, and the occurrence of risk behaviors, adolescents from higher socioeconomic levels had a higher prevalence of experimentation of alcoholic beverages (*i.e.*, household head with ≥ 8 years of schooling). In addition, male adolescents belonging to families with a higher socioeconomic status (*i.e.*, household head with ≥ 8 years of schooling) were more likely to have unsatisfactory consumption of main meals and three or more risk behaviors simultaneously.

Spring *et al.*⁴ reported that risk behaviors are more prevalent in the least favored population segments, resulting from the effects of common social determinants, including a long history of

poverty and adverse environments associated with multiple unhealthy behaviors. Accordingly, the WHO³² states that greater disease burden (e.g., infectious diseases), more lesions, and higher mortality *per liter* of alcohol consumed occur among individuals with lower socioeconomic status. Other authors^{10,15,16} have also noted that risk behaviors are more prevalent in the least favored population segments. However, still other studies have noted different associations between socioeconomic categories and the aggregation of risk behaviors; these associations vary according to sex and/or age^{9,14}. Thus, the impact of socioeconomic conditions on the occurrence of multiple risk behaviors in adolescence is a topic that deserves further examination to identify the most vulnerable groups that should be targeted by health promotion programs.

Regarding the evaluation of self-perceived health status and its relation to risk behaviors, individual perceptions and education may influence an individual's life habits³³. In the present study, although only bad self-perceived health status was associated with unsatisfactory consumption of main meals in male adolescents, this factor may denote some awareness of their lifestyle among the study adolescents. Conversely, the lack of association between self-perceived health status and other behaviors, especially among females, shows that there is still a gap to be filled between the transmission of information and concepts about healthy habits and the adoption of those behaviors. Other studies have also evaluated the association between self-perceived health status and behaviors related to lifestyle in Canadian³⁴ and Hungarian³⁵ adolescents. Tremblay *et al.*³⁴ noted that the likelihood of adolescents showing a good self-perceived health status was significantly lower among those who smoked daily, consumed alcoholic beverages, practiced no physical activity in their leisure time, failed to consume fruits and vegetables daily, or were classified as obese, even after adjusting for confounding factors.

The study risk behaviors - physical inactivity, tobacco smoking, experimentation of alcoholic

beverages, and inadequate dietary habits - typify an unhealthy lifestyle, compromise quality of life, and predispose to the development of NCD^{4,18}, and have been evaluated in various similar studies^{2,5-17}. However, comparison between studies that have evaluated the simultaneous occurrence of risk behaviors is complicated by the diversity of behaviors analyzed by the studies.

Another limitation of the present study concerns the instrument used for estimating food consumption, the FFQ. This instrument has been widely used in epidemiological studies because it is inexpensive³⁶ and not subject to the effect of intrapersonal variability, although self-reported food consumption may be affected by food preferences and availability of foods.

Finally, monitoring and planning early interventions for risk behaviors in adolescents, with the goal of minimizing their occurrence and reducing their short- and long-term effects, are necessary because adolescence is a critical period for the adoption of life habits¹⁶. It is a time when the adopted behaviors tend to persist throughout adult life^{11,37} and when health-protective behaviors are less frequent than risk behaviors⁴.

CONCLUSION

The prevalence of the main risk behaviors for NCD was high among adolescents in *Cuiabá*, highlighting the simultaneous presence of tobacco smoking and experimentation of alcoholic beverages; the higher prevalence of excessive sodium intake, experimentation of alcoholic beverages, and tobacco smoking among male adolescents; and the higher prevalence of unsatisfactory meal consumption and physical inactivity among female adolescents. Thus, educational activities, mainly focused on environmentally oriented recommendations, should be provided to adolescents to emphasize the enhanced risk for NCD upon exposure to multiple risk factors.

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CONTRIBUTORS

PRM RODRIGUES was responsible for study conception, data collection, statistical analyses, data interpretation, manuscript conception, and manuscript writing. CMP PADEZ contributed to data analysis and manuscript writing. MG FERREIRA and RMV GONÇALVES-SILVA were responsible for study conception, statistical analyses, manuscript conception, and final revision. RA PEREIRA contributed to study conception, statistical analyses, data interpretation, manuscript conception, manuscript writing, and final revision. All authors read and approved the final version.

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