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Co-occurrence of behavioral risk factors for chronic non-communicable diseases in adolescents: Prevalence and associated factors

Coocorrência de fatores de risco comportamentais para doenças crônicas não transmissíveis em adolescentes: prevalência e fatores associados

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ABSTRACT

Objective

To examine the prevalence of the behavioral risk factors – both isolated and clustered – for chronic diseases, among adolescents. Additionally, its association with various social and demographic variables was estimated.

Methods

This was a cross-sectional study conducted on 1,039 high school students, from public and private schools, elected for convenience, in *Rio de Janeiro*, Brazil. A Chi-square test, Mann-Whitney U test, as well as crude and adjusted ordinal logistic regression were used to assess the association between the variables.

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Results

The most frequently observed risk factors were sedentary behavior (68.8%), alcohol consumption (36.8%), and overweight (26.8%). The clustering of risk factors was observed in 67.5% of the students. Being a girl (OR=1.28; 95%CI=1.01–1.63), Caucasian (OR=1.35; 95%CI=1.06–1.72) or private school student (OR=1.46; 95%CI=1.12–1.88) increased the chance of the clustering of risk factors. The co-occurrence of risk factors was predominantly observed in the case of smoking (OR=4.94; 95%CI=1.46–16.75), alcohol consumption (OR=1.43; 95%CI=1.09–1.88), high consumption of ultra-processed foods (OR=1.57; 95%CI=1.19–2.07), and sedentary behavior (OR=1.40; 95%CI=1.07–1.82).

Conclusion

The co-occurrence of behavioral risk factors was observed to be higher among girls, Caucasian adolescents, and private school students, as well as, among smokers, alcohol users and adolescents with sedentary habits and a high consumption of ultra-processed foods.

Keywords: Adolescent. Chronic disease. Demographic indicators. Social class. Risk factors.

RESUMO

Objetivo

Examinar a frequência de fatores de risco comportamentais para doenças crônicas não transmissíveis, de forma isolada e agrupados, e sua associação com variáveis sociodemográficas em adolescentes.

Métodos

Participaram 1.039 adolescentes do ensino médio de escolas públicas e privadas, eleitas por conveniência, da região metropolitana do Rio de Janeiro. Os testes do Qui-quadrado, Teste U de Mann-Whitney e a regressão logística ordinal, bruta e ajustada, foram empregados para avaliar a associação entre as variáveis.

Resultados

Os fatores de risco mais frequentes foram o comportamento sedentário (68,8%), o uso de álcool (36,8%) e o excesso de peso (26,8%). A coocorrência dos fatores foi observada em 67,5% dos estudantes. Ser do sexo feminino (OR=1,28; IC95%=1,01–1,63), de cor branca (OR=1,35; IC95%=1,06–1,72) e de escola privada (OR=1,46; IC95%=1,12–1,88) aumentou a chance de coocorrência dos fatores. Houve maior chance de agrupamento dos comportamentos avaliados para tabagismo (OR=4,94; IC95%=1,46–16,75), uso de álcool (OR=1,43; IC95%=1,09–1,88), consumo elevado de alimentos ultraprocessados (OR=1,57; IC95%=1,19–2,07) e comportamento sedentário (OR=1,40; IC95%=1,07–1,82).

Conclusão

*A proporção de adolescentes com coocorrência de fatores de risco comportamentais foi elevada principalmente para as meninas, adolescentes de cor branca e de escolas privadas, assim como entre aqueles que são tabagistas, fazem uso de álcool, apresentam consumo elevado de alimentos ultraprocessados e comportamentos sed*entários.

Palavras-chave: *Adolescente. Doença crônica. Indicadores demográficos. Fatores de risco. Classe social.*

INTRODUCTION

Major Non-Transmissible Chronic Diseases (NTCDs) are usually associated with modifiable risk factors. Up to 80% of cases of cardiovascular disease, stroke, and type 2 diabetes, and 40% of cancers can be prevented by the elimination of factors such as tobacco use, inadequate diet, physical inactivity and excessive consumption of alcohol [1]. Similarly, overweight is also an important risk factor for NTCDs [2]. The co-occurrence of the above-mentioned factors potentiates the risk of the development of NTCDs, and the effect of this co-occurrence is higher than the sum of the independent effects [3].

Studies, worldwide, have reported the co-occurrence of the risk factors for NTCDs, in adolescents [4-6]. In Brazil, only one study assessed the simultaneous occurrence of the five main factors cited [7]. Nunes *et al.* [8],

also studied five factors, but did not take into account overweight to compose the variable co-occurrence. Other authors studied four factors, without evaluating the consumption of alcohol [9] or overweight [10-13], or three factors, without evaluating tobacco consumption or excess weight [14].

Sedentary behavior has been defined as a set of activities involving low energy expenditure, best characterized by the time spent on screen activities, such as watching television and playing video or computer games [15]. Such behaviour has been pointed out as an important risk factor for NTCD development, regardless of the physical activity status [16,17]; therefore, it is important to consider it as one of the risk factors that compose the variable co-occurrence. However, sedentary behavior has been investigated in only two studies focusing on co-occurrence, in Brazilian adolescents [8,14].

In spite of several studies assessing the inadequacy of food consumption, as a behavioral risk factor, most of them assessed only the low consumption of fruits and vegetables. However, a high consumption of Ultra-Processed Foods (UPF) has been identified as one of the main causes of the current obesity pandemic and NTCDs [18], and investigation of this behavior may contribute to obtaining a better understanding of the co-occurrence of the risk factors for NTCDs, in adolescents. The present study has the following objectives: (a) to examine the prevalence of the occurrence and co-occurrence of behavioral risk factors for NTCDs, in adolescents, and its association with sociodemographic variables; (b) to evaluate the association of each behavioral risk factor with the co-occurrence of these factors.

METHODS

This cross-sectional study analyzed baseline data from the Longitudinal Study of Nutritional Assessment of Adolescents (Elana), carried out in 2010, with first-year high school students of two public schools and four private schools, in the metropolitan region of *Rio de Janeiro*, chosen to meet the sampling plan provided for the base study, as described by Moreira *et al.* [19]. All of the 1,131 adolescents enrolled in this grade, who met the inclusion criteria of the Elana (not pregnant or nursing, and who had no physical or mental condition that impaired the ability to answer the questionnaire or anthropometric assessment), were considered eligible. Of these, 1,039 agreed to be part of the study, and authorization to participate was obtained from their guardians.

Data collection was performed by trained evaluators. A self-reporting questionnaire was used to obtain information on sociodemographic variables (sex, age, skin color, school type) and the behavioral risk factors for NTCDs (physical inactivity, sedentary habits, alcohol consumption, smoking, overweight and inadequate eating habits such as an non-regular consumption of fruits and vegetables and a high consumption of UPF).

Physical activity was assessed by the International Physical Activity Questionnaire, short version, validated for Brazilian adolescents [20]. For the data analysis, the following categories were set: active (very active and active) and inactive (irregularly active and sedentary). Sedentary behavior was evaluated through the practice of watching Television for two hours or more, per day [21]. This was the only kind of sedentary behaviour that was associated with the indicators of adiposity, in the adolescents evaluated in the Elana, compared to sedentary behaviors involving other media types [22,23], as also corroborated by Arango *et al.* [24]. The consumption of alcohol was considered a risk when at least one glass or one dose had been consumed in the last 30 days [25]. Current smokers were classified as being at risk [25].

The classification of the adequacy of weight took into account, as a cut-off point by sex and age, the Body Mass Index (BMI) (kg/m^2=weight/height^2), according to the World

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Health Organization recommendations [26], using the categories 'without overweight' (low weight and normal weight) and 'with overweight' (overweight and obesity). Weight was measured with a portable electronic scale, with a capacity of up to 150kg, and height was measured by an anthropometer, with a 1mm scale and length of up to 210cm.

Food consumption was assessed by a qualitative Food Frequency Questionnaire (FFQ), adapted from a FFQ validated for Brazilian adolescents [27]. Consuming fruits and vegetables five times or more per week was considered regular consumption [28,29], as obtained from the sum of the frequency of consumption of all types of fruits and vegetables, in the FFQ. According to the classification proposed by Monteiro *et al.* [30], UPFs were defined as industrial formulations made wholly or mainly of substances extracted from foods (oils, fats, sugar, and protein), derived from food constituents (hydrogenated fats, and modified starch), or synthesized in the laboratory based on organic materials (colorants, flavorings, flavor enhancers and other additives used to provide products with attractive sensory properties). Based on this definition, the following foods were considered UPF: bread loaves, powdered chocolate, stuffed biscuits or wafers, curds and cheese, instant noodles, industrialized fruit juice, industrialized tea or mate, guarana-based refreshments, soda, chips and snacks, readymade pizzas, hot dogs, hamburgers, nuggets, candy and industrialized sweets, chocolate, ice cream or popsicles, and gelatine.

The percentage of the daily energy consumed from UPFs was calculated, and the adolescents who were in the third tertile of the distribution of this variable were classified as having high consumption. Having the highest position in the percentile distribution of UPF consumption has already been associated with an increased risk of metabolic syndrome, among Brazilian adolescents [18], justifying the criterion adopted in this study.

The variable "co-occurrence of risk factors" was obtained by the sum of the factors described, grouped into three categories ("none or a single factor" (reference), "two factors" and "three or more factors"). A Chi-square test was used to compare the frequencies, and a Mann-Whitney U test was used to compare the medians between the categories of sociodemographic variables. Ordinal logistic regression was used to assess the magnitude of the association between the occurrence of risk factors and the sociodemographic variables, and each of the risk factors alone. Bivariate and multivariate analyses were performed, in which the effect of each variable on co-occurrence was adjusted for the other sociodemographic variables that showed a p-value <0.20 in the bivariate analysis. In the multivariate analysis, those with $p<0.05$ were considered significantly associated. The assumption of proportionality between the categories of the ordinal variable was verified by the Brant test, and the significance of the coefficients, by the Wald test. Stata 12.0 (Stata Corporation, College Station, Texas, United States) software was used for the statistical analyses.

The Longitudinal Study of Nutritional Assessment of Adolescents Project was approved by the Research Ethics Committee at the Institute of Social Medicine of the *Universidade do Estado do Rio de Janeiro* (CAAE 0020.0.259.000-09) according to Resolution nº 196/96 of the National Health Council.

RESULTS

The age range of the adolescents was 13 to 19 years, and most them were younger than 15 years (68.4%). Girls made up 53.6% of the evaluated population; 53.8% of the sample comprised black/brown individuals and 50.7% were private school students. The most prevalent risk factors were sedentary behavior (68.8%), alcohol consumption (36.8%) and overweight (26.8%) (Table 1).

Table 1. Sociodemographic characteristics and risk factors for non-transmissible chronic diseases in high school adolescents, in *Rio de Janeiro* (RJ) Brazil, 2010.

Categorical variables	n	%	95%CI
Sex			
Male	482	46.4	42.3–49.7
Female	557	53.6	50.3–57.6
Age			
≤15 years	710	68.3	65.5–71.2
>15 years	329	31.7	28.8–34.5
Skin color[*]			
Caucasian	470	46.2	43.1–49.3
Black/brown	547	53.8	50.7–56.8
Type of school			
Public	512	49.3	46.0–53.4
Private	527	50.7	46.6–54.0
Physical inactivity[*]			
Yes	246	24.4	26.0–32.0
No	761	75.6	68.3–73.9
Sedentary behavior – TV[*]			
Yes	700	68.8	66.7–72.5
No	318	31.2	27.5–33.3
Weight status[*]			
Without overweight	743	73.2	70.4–75.9
With overweight	272	26.8	24.1–29.5
Current consumption of alcohol[*]			
Yes	372	36.8	33.8–39.8
No	638	63.2	60.2–66.1
Smoking[*]			
Yes	28	2.8	1.7–3.8
No	990	97.2	96.2–98.3
Non-regular consumption of fruits and vegetables[*]			
Yes	167	16.4	13.9–18.6
No	849	83.6	81.4–86.0
Continuous variable	n	Median (% of DEI)	Min. and Max (% of DEI)
Consumption of UPF	981	54.7	0–89.2
1st Tertile	-	40.2	0–48.0
2nd Tertile	-	54.7	48.0–60.4
3rd Tertile	-	66.8	60.4–89.2

Note: [*]The number of adolescents varies for each attribute due to unknown information.
95%CI: 95% Confidence Interval; % of DEI: percentage of Daily Energy Intake of the adolescents; Min. and Max: Minimum and Maximum value; UPF: Ultra-Processed Foods.

Physical inactivity was more prevalent in girls, as was the consumption of UPF. Adolescents aged 15 years or more had higher rates of alcohol consumption and smoking than

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those younger than 15 years. However, excess weight, physical inactivity and sedentary habits were more prevalent in younger individuals. Caucasian adolescents were more inactive, had more sedentary lifestyles, and had a lower frequency of fruits and vegetables consumption compared to black/brown individuals. Overweight and the non-regular consumption of fruits and vegetables were more prevalent in adolescents from private schools than those from public institutions. However, individuals from public schools smoked more than those from private schools (Table 2). The median daily intake of energy from UPF was 54.7%, and the medians for the adolescents classified in the first, second and third tertiles were 40.2%, 54.7%, and 66.8%, respectively (Table 1).

A total of 91.9% of the adolescents had at least one behavioral risk factor for NTCD; 24.4% of them had at least one risk factor, and 67.5% displayed a clustered occurrence of the factors under study (32.1% had two risk factors, and 35.4% had three or more risk factors).

The bivariate ordinal regression analysis showed that private school and Caucasian

Table 2. Prevalence of the risk factors for non-transmissible chronic diseases, according to sociodemographic variables, among high school adolescents, in *Rio de Janeiro* (RJ) Brazil, 2010.

Variables	Sex		Age		Color		School	
	Male	Female	≤15 years	>15 years	Black/ Brown	White	Public	Private
*Physical inactivity**								
% (n)	17.2 (81)	30.7 (165)	26.9 (185)	19.1 (61)	21.8 (118)	27.6 (128)	22.1 (112)	26.7 (134)
p-value	*p*≤0.01		*p*≤0.01		*p*≤0.05		*p*=0.09	
*Sedentary behavior**								
% (n)	70.9 (336)	66.9 (364)	71.1 (492)	63.8 (208)	65.4 (357)	72.7 (341)	67.9 (347)	69.6 (353)
p-value	*p*=0.17		*p*≤0.05		*p*≤0.05		*p*=0.55	
*Overweight**								
% (n)	29.2 (138)	24.7 (134)	30.1 (208)	19.8 (64)	24.6 (132)	28.2 (129)	22.2 (113)	31.5 (159)
p-value	*p*=0.11		*p*≤0.01		*p*=0.19		*p*≤0.01	
*Alcohol consumption**								
% (n)	35.6 (167)	37.9 (205)	32.8 (226)	45.5 (146)	35.8 (194)	38.1 (177)	38.2 (193)	35.4 (179)
p-value	*p*=0.45		*p*≤0.01		*p*=0.45		*p*=0.36	
*Smoking**								
% (n)	2.7 (13)	2.8 (15)	1.2 (8)	6.2 (20)	3.1 (17)	2.3 (11)	5.1 (26)	0.4 (2)
p-value	*p*=0.98		*p*≤0.01		*p*=0.45		*p*≤0.01	
*Non-regular consumption of FV**								
% (n)	16.5 (78)	16.5 (89)	16.9 (117)	15.5 (50)	12.5 (68)	20.9 (98)	10.6 (54)	22.3 (113)
p-value	*p*=0.99		*p*=0.59		*p*≤0.01		*p*≤0.01	
*% of energy consumed daily from UPF***								
Median (n)	52.4 (457)	53.6 (524)	52.9 (685)	53.4 (296)	54.4 (507)	53.8 (453)	53.3 (466)	52.9 (515)
p-value	*p*≤0.05		*p*=0.84		*p*=0.48		*p*=0.34	

Note: *X^2: Chi-square test; **Mann-Whitney U test.
UPF: Ultra-processed Foods.

students presented a greater probability of co-occurrence. This clustering remained in the multivariate analysis (private school students: *Odds Ratio* (OR)=1.46; 95% Confidence Interval (95%CI)=1.12–1.88; Caucasian adolescents: (OR=1.35; 95%CI=1.06–1.72) compared to in the case of public school and black/brown students, respectively. In the multivariate analysis, girls presented a greater probability of co-occurrence (OR=1.28; 95%CI=1.01–1.63) than boys (Table 3). The hypothesis of proportionality between the categories of the ordinal variable was not rejected.

The behavioral risk factors with the greatest chance of co-occurrence were smoking (OR=4.94; 95%CI=1.46–16.75), high consumption of UPF (OR=1.57; 95%CI=1.19–2.07), alcohol consumption (OR=1.43; 95%CI=1.09–1.88) and

Table 3. Ordinal Regression for the co-occurrence of the risk factors for non-transmissible chronic diseases, according to sociodemographic variables, of high school adolescents, in *Rio de Janeiro* (RJ), Brazil, 2010

Variables	Crude OR	95%CI	*p*-value	Adjusted OR	95%CI	*p*-value
Sex						
Male	1	-	0.08	1	-	0.04
Female	1.24	0.98–1.57		1.28	1.01–1.63	
Age						
≤15 years	1	-	0.54	1	-	0.58
>15 years	0.92	0.71–1.19		1.08	0.82–1.42	
Skin color						
Black/brown	1		≤0.01	1		0.02
Caucasian	1.45	1.14–1.84		1.35	1.06–1.72	
School						
Public	1	-	≤0.01	1	-	≤0.01
Private	1.48	1.17–1.88		1.46	1.12–1.88	

Note: OR: *Odds Ratio*; 95%CI: 95% Confidence Interval.

Table 4. Ordinal Regression for the simultaneous occurrence of the avoidable risk factors for non-transmissible chronic diseases, according to the presence of each isolated risk factor in first-year high school adolescent students, in the metropolitan region of *Rio de Janeiro* (RJ), Brazil, 2010.

Risk factors for NTCDs	Crude OR	95%CI	*p*-value	Adjusted OR	95%CI	*p*-value
Current alcohol consumption	1.33	1.02–1.73	<0.05	1.43	1.09–1.88	<0.01
Smoking	3.80	1.13–12.7	<0.05	4.94	1.46–16.75	<0.05
Overweight	1.24	0.93–1.67	0.15	1.25	0.92–1.69	0.15
Physical inactivity	1.23	0.90–1.66	0.19	1.17	0.85–1.59	0.33
Sedentary behavior	1.41	1.09–1.83	<0.05	1.40	1.07–1.82	<0.05
Non-regular consumption of FV	1.48	1.02–2.14	<0.05	1.38	0.95–2.02	0.09
High consumption of UPF	1.54	1.17–2.03	<0.01	1.57	1.19–2.07	<0.01

Note: Current alcohol consumption: Analysis adjusted for age; Smoking: Analysis adjusted for age and type of school; Overweight: Analysis adjusted for age, sex, skin color and type of school; Physical inactivity: Analysis adjusted for age, sex, skin color and type of school; Sedentary behaviour: Analysis adjusted for age, sex and skin color; non-regular consumption of fruits and vegetables: Analysis adjusted by skin color and type of school; High consumption of UPF: Analysis adjusted for sex, skin color and type of school.

OR: *Odds Ratio*; 95%CI: 95% Confidence Intervals; FV: Fruits and Vegetables; UPF: Ultra-processed Foods; NTCD: Non-Transmissible Chronic Disease.

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sedentary habits (OR=1.40; 95%CI=1.07–1.82), in the multivariate analysis. The non-regular consumption of fruits and vegetables, which was shown to be associated with occurrence in the crude analysis, lost statistical significance after the adjusted analysis, by skin color and type of school (Table 4).

DISCUSSION

The high prevalence of the behavioral risk factors for NTCDs, both isolated and clustered, is highlighted in this study. Caucasian adolescents, students from private schools, and girls were found to be the subgroups that were at a higher risk. Smoking, high consumption of UPF, alcohol consumption and sedentary habits significantly increased the chance of the co-occurrence of risk factors.

The high frequency of the co-occurrence of risk factors for NTCDs (almost 70.0%), observed in this study, has also been described by other authors (ranging from 45.0% to 72.2%) [7-14]. However, comparison with the findings of those studies should be performed with caution due to the diversity in the risk behaviors assessed. Such diversity also limits the comparison of the results, with regards to the association of the occurrence of risk factors with the variables related to the socioeconomic level, as well as the use of the different indicators used to build this construct. In this study, being a Caucasian adolescent and having private school education were considered markers of a better socioeconomic situation [31], and presented a higher chance of the co-occurrence of risk factors compared to the case of black/brown and public school students. Rodrigues *et al.* [13], observed a similar relationship in adolescents from private schools of *Cuiabá, Mato Grosso*, while Tassitano *et al.* [11] observed a higher chance of exposure to three or more risk behaviors, in adolescents with a higher family income. However, Silva *et al.* [14], reported a lower chance of the clustering of risk factors among those whose mothers had a higher level of schooling.

The high consumption of UPF, and physical inactivity were more prevalent in girls, which may explain the fact that girls exhibit a greater chance of co-occurrence. The higher consumption of UPF [32] and physical inactivity [33], in female adolescents, in comparison to their male counterparts, has already been demonstrated in studies conducted in Brazil.

Of the isolated risk behaviors, our study highlights the high prevalence of sedentary habits, which affect almost 70% of adolescents; this is similar to what has already been described in other studies, conducted on Brazilian adolescents [8,25]. In this study, both sedentary habits and physical inactivity were more prevalent among the youngest adolescents. This result corroborates the data obtained by Nunes *et al.* [8] who also showed that younger adolescents are at a greater risk of being both physically inactive and sedentary, compared to their peers. However, this association is still not well-established, as another study reported no association between physical inactivity and adolescents' age [7]; in yet another study, this association was observed only among older adolescents [34].

Alcohol consumption, among adolescents, can lead to health problems in adulthood, and is also associated with an increased risk of excessive alcohol consumption throughout life [35]. The frequency of alcohol consumption (36.8%) was similar to that observed in a school-based study conducted in *Cuiabá* (39.0%) [13]. However, this frequency was higher than that found in the *Pesquisa Nacional de Saúde do Escolar* (PeNSE, National Adolescent School-based Health Survey) study (27.3%), in 2009; this may be explained by the difference in the studied adolescents' age range. In the PeNSE study, the population comprised ninth-year high school students, while the present study assessed first-year high school students. Only age was associated with the consumption of alcohol, which was found to be more prevalent

among older adolescents, as shown by Strauch *et al.* [35].

Another high-frequency risk factor observed in our study was the prevalence of overweight (26.8%), which was higher than the national average (20.5%) found in the 2008/2009 Household Budget Survey [36], and a little above the prevalence in the Southeast region (24.4%). Overweight was more prevalent among those aged 15 years or less (30.1%) and students from private schools (31.5%). This may be related to the higher prevalence of physical inactivity and sedentary behavior observed among the younger students, as such behaviors are directly associated with being overweight [37].

The non-regular consumption of fruits and vegetables, as observed in this study (16.4%), was lower than that found by other authors [7,9,11,14]. However, the different methods used for the assessment of food consumption, as an indicator of risk or as a protective factor against NTCDs, make comparison difficult. In this study, food consumption was evaluated based on the sum of the consumption frequency of each of the fruits and vegetables, as obtained through the FFQ. It is believed that this strategy could have led to an overestimation of the frequency of consumption of these foods. No difference was observed in the consumption of these foods between the sexes, confirming the findings of other studies [38,39], or between age groups [38].

With regards to the comparison of fruits and vegetables consumption, according to socioeconomic indicators, the results of this study, which suggest that Caucasian adolescents and those from private schools consumed fruits and vegetables with lower regularity, are corroborated by data from the PeNSE study [39] which also revealed a higher consumption of vegetables by private school students. This might be explained by a possible effect of the National School Meal Program on the consumption of healthy foods by adolescents in public schools, since one of the priorities of this program is the incentive of the consumption of fruits and vegetables [40].

The contribution of UPF consumption to the percentage of calories ingested, as observed in this study (54.7%), was similar to that found in young adults in *Pelotas, Rio Grande do Sul* (51.2%) [32] and higher than that found in the general Brazilian population (29.6%), across ages [41]; this could be attributed to the fact that the consumption of such foods is more frequent in adolescents, according to the results of a National Food Survey [42].

A limitation of the study is the convenience allocation of the participating schools, which limits the generalization of the results. However, the results obtained, in general, are in agreement with studies that evaluated probabilistic samples of adolescents. Another limitation is the application of self-reporting questionnaires, which presupposes a good ability to read and interpret the questions that make up the instruments used, which is not always the case among students. However, the team responsible for collecting the data was present to clarify possible doubts during the entire duration in which the adolescents responded to the questionnaires. This strategy aimed at minimizing errors of interpretation and response. It is also worth noting that the use of a FFQ, as a method to assess food consumption, tends to overestimate the reported consumption [43]. However, this tendency of overestimating makes the presence of a risk factor even more evident among those who were classified as having a non-regular consumption of fruits and vegetables, which is considered a marker of a healthy diet.

The positive points of this study include the use of instruments validated for use in Brazilian adolescents [20,27] or those already used in the main PeNSE [39], for the assessment of risk factors. In addition, unlike in the case of other national studies with a similar focus, we assessed the chance of the occurrence of seven avoidable risk factors for NTCDs, including

the five most important factors which were recognized in the literature as strongly associated with these diseases [1-3].

CONCLUSION

In conclusion, sedentary habits, alcohol consumption and overweight were found to be the modifiable risk factors for NTCDs that affected the investigated adolescents the most. A high proportion of these young individuals were exposed to two or more factors, concurrently. Caucasian female adolescents, and private school students were likelier to exhibit concurrent behavioral risk factors for NTCDs, alongside those who smoked, consumed alcohol and excess UPA, and exhibited sedentary behavior.

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CONTRIBUTORS

All authors participated in all phases of the research article.

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