Title: Association between selected individual and environmental characteristics in relation to health behavior of Brazilian adolescents

Section: Research Article

Authors and affiliations:

Mariana R. Haddad, PhD

Department of Integrated Education in Health, University of Espirito Santo

Flavia M. Sarti, PhD

School of Arts, Sciences and Humanities, University of Sao Paulo

Marislei Nishijima, PhD

Institute of International Relations, University of Sao Paulo

Corresponding author:

Mariana R. Haddad

Department of Integrated Education in Health, University of Espirito Santo

Av. Marechal Campos 1468

Vitoria, Espirito Santo, Brazil

ZIP Code 29040-090

E-mail: mariana.haddad@ufes.br

Association between selected individual and environmental characteristics in relation to health behavior of Brazilian adolescents

ABSTRACT

Objective: To investigate association between health behaviors (healthy foods consumption and level of physical activity) in relation to self-assessment of the body weight, adoption of practices for weight control, school environment, familiar and individual characteristics among Brazilian adolescents. **Design:** Analysis of two cross-sectional surveys representative at national level in Brazil during 2012 and 2015. **Setting:** Public and private schools in Brazil. **Participants:** Adolescent students attending 9th. grade of elementary level selected using two-stage sampling process. **Main Outcome Measures:** Frequency of healthy foods consumption and practice of physical activity. Variables of interest were: self-assessment of body weight, attitudes adopted towards weight control, type of school environment (public or private), individual and familial characteristics. **Analysis:** Robust errors estimates of Ordinary Least Square (OLS) regression analyses, clustered by geographical location. **Results:** There was higher frequency of healthy foods consumption and physical actitivy among male adolescents studying in public schools, who indicated normal body weight assessment, especially considering international recommendations for exercise. Watching television during meals was negatively associated with frequency of healthy foods consumption. **Conclusions and Implications:** Healthy behavior was connected with adequate body image. Brazilian public school environment was associated with healthy behaviors, especially due to government programs towards school feeding and physical activity, which may favor the adoption of healthy lifestyles among youngsters.

Keywords: adolescents, eating habits, physical activity, body weight.

INTRODUCTION

Adolescence is a life stage marked by psychosocial and cognitive changes that, in addition to physiological changes, contribute to the typical vulnerability of this population group.[1,2] Besides dealing with these changes, adolescents face significant social pressures to attain an ideal physical appearance that is often unachievable.[3] Excessive concerns with body weight may cause social isolation, generating an increasing distance of adolescents from leisure and sport activities, and causing anxiety, which promotes unhealthy eating behaviors, and deleterious health attitudes. These may include unhealthy foods consumption, binge eating, and inadequate weight control practices (use of medication and self-induced vomiting) in order to achieve satisfaction.[3-5]

Due to its negative impacts on health, it is important to investigate whether body weight dissatisfaction tends to dissipate or remain during the phase of changes into adulthood.[6] The focus on social network strategies to monitor health behaviors among adolescents is vital for detection of early signs of harmful attitudes, especially including colleagues, parents, educators, and health professionals in the process of developing strategies to reduce the adoption of inappropriate nutritional practices, and to contribute to improve body satisfaction among adolescents.[7] Considering this scenario, the school may be a privileged space for promoting healthy lifestyles, and early detection of risk behaviors among children and adolescents, due to the bond established among diverse individuals in this social environment. In Brazil, the investigation of adolescent students' health behavior has been targeted for monitoring in public and private schools due to priorities established by the Brazilian Ministry of Health to prevent

exposure to risk factors and to foster healthy behaviors during this stage of development into adulthood.[8-10]

In partnership established with the Brazilian Institute for Geography and Statistics (IBGE), the Ministry of Health proposed to carry out National Surveys on Students' Health (PeNSE) since 2009, representative at national level, in order to regularly assess and monitor health-related characteristics and behaviors among Brazilian students, including among other: self-assessment of body weight, adoption of attitudes towards weight control, food consumption habits, and physical activity level. The school environment was chosen due to easiness in accessing adolescents for interview: according to the National Household Sample Survey (PNAD) in 2007, 97.6% of the children aged between 7 and 14 years were enrolled in schools in Brazil.[11,12]

Therefore, the objective of the study was to investigate associations between self-assessment of body weight and adoption of weight control attitudes in relation to health behaviors regarding frequency of healthy foods consumption and physical activity level among Brazilian adolescents, taking into account the type of school environment (public or private school networks), based on datasets from PeNSE surveys in 2012 and 2015.

METHODS

Study Design

The study analyzed data from two editions of the National Surveys on Students' Health (PeNSE), a cross-sectional survey representative at national level, conducted in 2012 and 2015.

Sample

The sample of the survey was comprised of students enrolled in the 9th. year of regular daytime elementary schools from public and private networks, based on probabilistic sampling process in two stages for Brazilian state capitals (schools and 9th. grade classes within each school), and three stages in other Brazilian municipalities (groups of municipalities, schools within each group of municipalities, and 9th. grade classes within each school), based on the School Census in effect at the time of the survey planning (2010 and 2013, respectively).[12,13] The sample size was calculated within geographical strata to allow estimation of a proportion of 50%, with a maximum error of 3% and a 95% confidence level, being considered that minimum sample size should be 3,738 adolescent students in 2012 and 2015.[12,13]

The school samples were designed to estimate population parameters in different geographical levels: (1) Adolescent students in the 26 Brazilian states capitals and the Federal District; (2) Adolescent students in the five Brazilian geographical regions; and (3) Adolescent students in the Brazilian population.[12-14] In 2012, a sample of 109,104 adolescent students was interviewed in the National Survey on Students' Health and a sample of 102,301 adolescent students was interviewed in 2015.

Datasets

In 2012 and 2015, self-applicable structured questionnaires installed on standard smartphones from IBGE were adopted to perform the survey, including thematic modules and questions that varied according to year of the survey. Only part of the modules and questions applied in 2012

and 2015 were comparable, since from one survey to the next there could be new questions added in the modules, while others were changed or deleted.[12,13]

The following thematic modules were available for comparison: sociodemographic aspects; family context; food consumption habits; practice of physical activity; use of cigarette, alcohol, and other drugs; sexual and reproductive health; violence, safety, and accidents; personal hygiene habits; oral health; self-assessment of body weight and attitudes towards weight control; mental health; use of health services; and asthma.[15] Although the last edition of PeNSE in 2015 encompasses two independent samples, being the first sample referring to students who attended 9th. year of elementary school, and the second sample including students who attended from the 6th. year of elementary school until the 3rd. year of high school, the study adopted only the first sample for analysis, in order to enable valid comparison between comparable samples from 2012 and 2015.[13]

Variables

The analysis performed in this study focused on the associations between the frequency of consumption of healthy foods and the level of physical activity on the one hand, and the self-assessment of body weight and the adoption of weight control measures according to the type of school environment (public or private) on the other hand. The analysis included only variables that were directly comparable, i.e., remaining similar in its contents in the two surveys.

Healthy foods consumption pattern was evaluated based on the declared frequency of healthy foods consumption during the week (times per week), using markers of healthy eating habits: beans, fruits, and vegetables. The healthy food consumption markers included in the

questionnaire were selected according to evidences in the literature,[16] and adapted by the Brazilian Ministry of Health to the food consumption patterns in the country.[17] The selection of healthy food consumption markers adopted in the study were based on availability of the information for both surveys, in order to allow comparison along the period analyzed.

Physical activity level was investigated using two strategies: declared frequency of physical activity per day (in minutes), and information on daily physical activity (in minutes) performed due to transportation to and from school on foot or bicycle, attending physical education classes at school, and other extracurricular physical activities during the week preceding the interview. The information was converted into physical activity per week, and categorized into two groups, according to WHO recommendations for children and adolescents from 5 to 17 years-old: inactive or insufficiently active (from 0 to 59 minutes of daily physical activity), and active (60 minutes or more of daily physical activity).[18]

Target variables representing type of school environment, self-assessment and attitudes regarding body weight among adolescent students interviewed included:

- Self-assessment of body weight (appropriate, low, or excess weight);
- Attitudes for body weight control (none, loose, maintain, or gain weight).
- Type of school (public or private);
- Gender (male and female);
- Family status (living with both parents, other familiar composition);
- Eating habits in the household (having meals while watching TV, or not).

Regarding self-assessment of body weight, the surveys included a question on the students' perceptions referring to body size in relation to their ideal body weight, being validated using

actual body weight in a previous edition of the survey.[14] Attitudes adopted for body weight control among students were defined in categories indicating none or actions to loose, maintain or gain weight according to examples given to students regarding practice of exercises, vomiting, and using medication or supplements.

Statistical Analysis

Statistical analysis was performed using software Stata, version 12.0 for Windows, applying survey module commands in order to allow population level representativeness. Descriptive analysis of demographic, behavioral, family, and school characteristics according to year of the survey was carried out. Chi-square test was used to compare frequencies between years, with statistical significance set at 5%.

In order to evaluate the association between interest variables with health behaviors (healthy food consumption and physical activities), Ordinary Least Square (OLS) models were employed based on clustered errors by geographical strata (27 strata representing 26 Brazilian states capitals and 1 Federal District, and 5 strata representing other municipalities from each Brazilian region), where schools and individuals were sampled to account for specific local differences in public policies and cultural habits. Regression models were estimated including individual, behavioral, and socioeconomic variables with significance was $p < 0.05$; maintaining control variables for region, state, and year, and target variables for type of school, self-assessment of body weight, and adoption of attitudes towards weight control. Thus, the main focus was to study the simple conditional correlations between health behavior and interest variables such as self-assessment of the body weight, adoption of practices for weight control, school environment, familiar and individual characteristics among Brazilian adolescents.

$$y_{it} = \alpha + \partial.SSAA_{it} + \beta.X_{it} + \lambda_t + \rho_s + \lambda_t\rho_s + \mu_{it} \qquad (1)$$

Where y_{it}, the dependent variable, is the frequency of weekly physical activities or the weekly frequency of healthy food consumption of an individual i at year t (considering that data include information from two cross-section surveys, thus, different individuals are observed in different years); α is a constant; $SSAA_{it}$ is a matrix of interest independent variables (See Table 1), thus ∂ is a vector of interest parameters of association; and X_{it} is a set of control variables including individual and family characteristics, geographical localization, and other controls that may be correlated with health behavior (Table 1). λ_t, ρ_s, and $\lambda_t\rho_s$ represent, respectively, a set of time t dummies, a set of strata dummies, s, and its crossed product, in order to control for the existence of state and regional programs or policies affecting the school environment or the food and physical activity practices among adolescents throughout time. Finally, μ_{it} is the usual error term.

Table 1. Characterization of variables in the study. Brazil, 2012 and 2015.

Variable	N	Mean	SD	Min	Max
Dependent Variable					
Frequency of healthy foods consumption per week	209,601	11.0706	5.4106	0	21
Frequency of physical activity ≥ 60 minutes per day	208,690	2.3717	2.3246	0	7
Level of physical activity ≥ 300 minutes per week	209,601	0.3887	0.4875	0	1
Independent Variables - Variables of Interest					
Self-assessment of excess body weight	209,601	0.1705	0.3761	0	1
Self-assessment of low body weight	209,601	0.2396	0.4269	0	1
Attitudes towards loosing weight	207,034	0.0657	0.2478	0	1
Attitudes towards gain weight	207,369	0.0565	0.2309	0	1

Public school	209,601	0.7935	0.4048	0	1
Female	209,601	0.5205	0.4996	0	1
Living with both parents	209,601	0.5826	0.4931	0	1
Having meals while watching TV	209,233	0.5452	0.498	0	1
Independent Variables - Control Variables					
Age	209,601	14.3844	1.1827	12	17
White or yellow skin color	209,601	0.3834	0.4862	0	1
Mother with college degree or higher	166,129	0.4905	0.4999	0	1
Middle income family	209,601	0.2256	0.418	0	1
High income family	209,601	0.0147	0.1204	0	1
Year of survey	209,601			2012	2015
State	209,601			1	27

Obs.: N = observations; SD = standard deviation; Min = minimum; Max = maximum.

Source: Authors, based on data from IBGE (2013 and 2016).

Institutional Review Board

During data collection, Informed Consent Form (ICF) was presented to students interviewed; pointing the objective of the survey, and asking whether they agreed to participate in the study in order to proceed filling out the questionnaire. The ICF also informed the adolescents of their right to refuse to participate or answer any question of the study, and to quit their participation in the study at any moment. The datasets of the PeNSE surveys are publicly available.[15] PeNSE surveys were submitted and approved by the National Committee of Ethics in Research (CONEP), opinions nr. 16,805/2012 and nr. 1,006,467/2015, according to the resolution of the National Health Council (NHC) of 10 October 1996.[12,13,19]

RESULTS

Most students interviewed were female adolescents living with both parents from low socioeconomic level, enrolled in public schools (Table 2).

Table 2. Sociodemographic characteristics of adolescent students, according to year of the survey. Brazil, 2012 and 2015.

Sociodemographic characteristics	2012 (n = 109,104)	2015 (n = 100,497)	*P*-value
Sex			0.0767
Male	47.84	48.67	
Female	52.16	51.33	
Ethnicity			0.4765
White/Yellow	40.87	40.29	
Other	59.13	59.71	
Family type			<0.001*
Living with both parents	62.07	59.32	
Living with one parent/other relatives	37.93	40.68	
Maternal education			<0.001*
Complete high school or lower	60.34	50.74	
College degree or higher	39.66	49.26	
Socioeconomic strata			0.476
Low	81.02	80.40	
Medium	18.26	18.76	
High	0.72	0.84	
Region			0.1149
North	7.96	9.43	
Northeast	25.28	27.78	
Southeast	44.32	43.36	
South	14.55	11.93	
Midwest	7.89	7.50	
School type			0.0941
Private	17.17	14.59	
Public	82.83	85.41	

Data presented in number of individuals, *n* (%). *P*-values obtained from chi-square test.

Source: Authors, based on data from IBGE (2013 and 2016).

There were significant changes in predominant type of family (decrease in the proportion of adolescents living with both parents), and maternal educational attainment (increase in the proportion of adolescents whose mother had college degree or higher).

There was small but significant decrease in the proportion of physically active adolescents from 2012 to 2015; and also decline in the frequency of consumption of healthy foods during the period analyzed (Table 3).

Table 3. Evolution in health behaviors regarding healthy foods consumption and physical activity, according to year. Brazil, 2012 and 2015.

Variables	2012	2015	Difference	*P*-value
Frequency of healthy foods consumption per week	11.10	11.03	-0.07	0.00
Frequency of physical activity ≥ 60 minutes per day	2.50	2.23	-0.27	0.00
Level of physical activity ≥ 300 minutes per week	0.43	0.34	-0.08	0.00

P-values obtained from chi-square test.

Source: Authors, based on data from IBGE (2013 and 2016).

In terms of frequency of healthy foods consumption, there was a significant association with male adolescents, youngsters who study at public schools, living with both parents, students in middle socioeconomic level, adolescents with normal self-assessment of body weight, and who do not consume meals while watching television (Table 4).

Table 4. Results of regression models regarding frequency of healthy foods consumption among Brazilian adolescents. Brazil, 2012 and 2015.

Variables	Brazil	North	Northeast	Southeast	South	Midwest
α	15.4134***	14.2945***	14.9819***	14.1755***	13.6605***	15.1578***
	(0.311)	(0.560)	(0.467)	(0.652)	(0.650)	(0.591)
Self-assessment of excess body weight	-0.5980***	-0.7159***	-0.8531***	-0.5879***	-0.3884***	-0.8159***
	(0.064)	(0.113)	(0.105)	(0.121)	(0.115)	(0.108)
Self-assessment of low body weight	-0.4540***	-0.4007***	-0.4769***	-0.4747***	-0.4809***	-0.4623***
	(0.052)	(0.093)	(0.079)	(0.101)	(0.111)	(0.097)

Attitudes towards loosing weight	-0.2513**	-0.2820	-0.3851**	-0.3123	-0.0084	-0.1258
	(0.106)	(0.173)	(0.165)	(0.205)	(0.237)	(0.180)
Attitudes towards gaining weight	0.1135	0.4268***	0.0813	-0.0271	0.5988**	-0.2309
	(0.104)	(0.160)	(0.151)	(0.212)	(0.241)	(0.186)
Public school	0.8041***	0.3204*	0.9978***	0.8770***	0.9286***	0.6482***
	(0.089)	(0.175)	(0.174)	(0.128)	(0.195)	(0.155)
Female	-0.5919***	-0.4494***	-0.6871***	-0.5792***	-0.4408***	-0.3574***
	(0.045)	(0.078)	(0.071)	(0.087)	(0.096)	(0.074)
Age	-0.2465***	-0.3166***	-0.2331***	-0.1188***	-0.1283***	-0.1753***
	(0.020)	(0.035)	(0.031)	(0.043)	(0.046)	(0.041)
White or yellow skin color	-0.1374***	0.3299***	-0.0830	-0.2968***	-0.1959**	-0.1102
	(0.048)	(0.088)	(0.077)	(0.090)	(0.099)	(0.082)
Living with both parents	0.3684***	0.2629***	0.4997***	0.3463***	0.4702***	0.4092***
	(0.046)	(0.082)	(0.073)	(0.091)	(0.094)	(0.076)
Mother with college degree or higher	0.3572***	0.7942***	0.3233***	0.3610***	-0.1168	0.2959***
	(0.054)	(0.097)	(0.090)	(0.097)	(0.112)	(0.090)
Having meals while watching TV	-1.0656***	-0.7387***	-1.0374***	-1.2975***	-1.2429***	-1.2189***
	(0.043)	(0.084)	(0.073)	(0.080)	(0.095)	(0.073)
Middle SES	0.4096***	1.1927***	0.4144***	0.2201*	0.4884***	0.5046***
	(0.069)	(0.122)	(0.120)	(0.123)	(0.136)	(0.108)
High SES	0.2311	1.0864***	-0.2990	0.0303	1.4761***	1.1154***
	(0.204)	(0.404)	(0.298)	(0.385)	(0.538)	(0.337)
Year 2015	-0.2118***	0.3858**	-0.6536***	0.3183**	-0.8576***	-0.5026***
	(0.078)	(0.192)	(0.121)	(0.129)	(0.152)	(0.142)
Observations	165,899	36,744	53,460	28,354	19,649	27,692
R^2	0.038	0.051	0.043	0.033	0.032	0.029

Obs.: SES = socioeconomic strata. *P < .05; **P < .01; ***P < .001.

Source: Authors, based on data from IBGE (2013 and 2016).

Additionally, adolescents who declared adopting attitudes towards reducing body weight had a lower frequency of healthy foods consumption in comparison to others, especially in the Northeast region.

Regarding frequency of adequate daily physical activity ($\geq$ 60 minutes), there was predominance among male students, adolescents with normal self-assessment of body weight whose mother

have a college degree or higher, and adolescents with attitudes towards losing or gaining weight in middle and high-income families. Attending public schools was not significantly associated with self-assessment of daily level of physical activity by the students (Table 5).

Table 5. Results of regression models regarding frequency of adequate daily physical activity among Brazilian adolescents. Brazil, 2012 and 2015.

Variables	Brazil	North	Northeast	Southeast	South	Midwest
α	3.4651***	3.6997***	3.3372***	3.2585***	3.7858***	3.1674***
	(0.121)	(0.239)	(0.176)	(0.258)	(0.290)	(0.256)
Self-assessment of excess body weight	-0.2705***	-0.2905***	-0.2987***	-0.2274***	-0.3916***	-0.2341***
	(0.025)	(0.050)	(0.040)	(0.047)	(0.051)	(0.040)
Self-assessment of low body weight	-0.3221***	-0.3449***	-0.3398***	-0.3163***	-0.3053***	-0.2606***
	(0.023)	(0.040)	(0.034)	(0.044)	(0.049)	(0.041)
Attitudes towards loosing weight	0.2361***	0.1823**	0.2678***	0.1912**	0.3186***	0.1762**
	(0.044)	(0.085)	(0.068)	(0.087)	(0.099)	(0.079)
Attitudes towards gaining weight	0.3697***	0.3532***	0.2917***	0.4137***	0.5502***	0.2580***
	(0.045)	(0.078)	(0.065)	(0.091)	(0.108)	(0.076)
Public school	0.0020	0.0472	0.0645	-0.1087*	0.1113*	0.0508
	(0.034)	(0.062)	(0.045)	(0.058)	(0.067)	(0.052)
Female	-1.1777***	-1.0628***	-1.1597***	-1.2020***	-1.1430***	-1.2382***
	(0.019)	(0.036)	(0.029)	(0.036)	(0.042)	(0.034)
Age	-0.0225***	-0.0359**	-0.0312***	-0.0001	-0.0336*	-0.0043
	(0.008)	(0.015)	(0.012)	(0.018)	(0.020)	(0.018)
White or yellow skin color	-0.0740***	-0.0997***	-0.1176***	-0.0964***	-0.0680*	-0.0305
	(0.019)	(0.038)	(0.032)	(0.036)	(0.040)	(0.037)
Living with both parents	0.0063	0.0137	0.0588**	0.0064	-0.0744	0.0178
	(0.019)	(0.036)	(0.029)	(0.038)	(0.046)	(0.030)
Mother with college degree or higher	0.1547***	0.2409***	0.2474***	0.0822**	0.1204**	0.1413***
	(0.022)	(0.041)	(0.036)	(0.040)	(0.050)	(0.043)
Having meals while watching TV	-0.1354***	-0.0521	-0.1057***	-0.1453***	-0.1722***	-0.1654***
	(0.019)	(0.032)	(0.030)	(0.039)	(0.040)	(0.034)
Middle SES	0.2923***	0.2780***	0.2189***	0.2891***	0.4101***	0.2878***
	(0.028)	(0.048)	(0.051)	(0.051)	(0.061)	(0.047)
High SES	0.6926***	0.6778***	0.5264***	0.6801***	0.7416***	1.0815***
	(0.082)	(0.190)	(0.116)	(0.161)	(0.192)	(0.121)
Year 2015	-0.2282***	-0.2270***	-0.1543***	-0.2149***	-0.3897***	-0.1081**
	(0.026)	(0.055)	(0.040)	(0.051)	(0.052)	(0.050)

Observations	163,601	36,227	52,777	28,032	19,343	27,222
R^2	0.087	0.071	0.084	0.089	0.094	0.091

Obs.: SES = socioeconomic strata. *P < .05; **P < .01; ***P < .001.

Source: Authors, based on data from IBGE (2013 and 2016).

As concerns the level of physical activity per week (≥ 300 minutes), including active transport to and from school, the results point different evidence regarding the self-reported frequency of adequate daily physical activity (Table 6).

Table 6. Results of regression models regarding level of physical activity per week among Brazilian adolescents. Brazil, 2012 and 2015.

Variables	Brazil	North	Northeast	Southeast	South	Midwest
α	0.6409***	0.6450***	0.5324***	0.5758***	0.6761***	0.6772***
	(0.027)	(0.050)	(0.043)	(0.057)	(0.064)	(0.057)
Self-assessment of excess body weight	-0.0228***	-0.0316***	-0.0232***	-0.0331***	-0.0191	-0.0226**
	(0.005)	(0.010)	(0.008)	(0.010)	(0.012)	(0.009)
Self-assessment of low body weight	-0.0397***	-0.0421***	-0.0315***	-0.0428***	-0.0455***	-0.0418***
	(0.005)	(0.009)	(0.007)	(0.010)	(0.011)	(0.009)
Attitudes towards loosing weight	0.0011	0.0009	-0.0059	-0.0135	0.0438*	-0.0061
	(0.009)	(0.016)	(0.015)	(0.018)	(0.022)	(0.016)
Attitudes towards gaining weight	0.0376***	0.0336**	0.0155	0.0529***	0.0546**	0.0485***
	(0.009)	(0.016)	(0.012)	(0.018)	(0.023)	(0.017)
Public school	0.0150*	0.0412**	0.0112	-0.0125	0.0665***	0.0527***
	(0.008)	(0.018)	(0.013)	(0.013)	(0.016)	(0.011)
Female	-0.1671***	-0.1366***	-0.1543***	-0.1677***	-0.1933***	-0.1563***
	(0.004)	(0.008)	(0.006)	(0.009)	(0.009)	(0.007)
Age	-0.0104***	-0.0140***	-0.0073***	-0.0030	-0.0093**	-0.0125***
	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
White or yellow skin color	-0.0092**	-0.0357***	-0.0211***	-0.0182**	-0.0178*	-0.0288***
	(0.004)	(0.008)	(0.007)	(0.008)	(0.009)	(0.008)
Living with both parents	-0.0244***	-0.0298***	-0.0342***	-0.0095	-0.0347***	-0.0172**
	(0.004)	(0.007)	(0.006)	(0.008)	(0.010)	(0.007)
Mother with college degree or higher	0.0430***	0.0663***	0.0529***	0.0280***	0.0379***	0.0283***
	(0.005)	(0.008)	(0.008)	(0.009)	(0.011)	(0.009)
Having meals while watching TV	-0.0011	-0.0041	0.0178***	-0.0121	-0.0105	-0.0171**
	(0.004)	(0.007)	(0.006)	(0.008)	(0.009)	(0.007)
Middle SES	0.0297***	0.0155	0.0173*	0.0259**	0.0564***	0.0243***

	(0.006)	(0.010)	(0.010)	(0.012)	(0.013)	(0.009)
High SES	0.0334*	0.0919**	-0.0085	0.0115	0.1032**	0.1442***
	(0.017)	(0.040)	(0.024)	(0.034)	(0.044)	(0.027)
Year 2015	-0.0664***	-0.0547***	-0.0522***	-0.0556***	-0.1002***	-0.0644***
	(0.007)	(0.014)	(0.010)	(0.013)	(0.014)	(0.013)
Observations	163,902	36,294	52,868	28,073	19,391	27,276
R^2	0.042	0.036	0.040	0.040	0.057	0.040

Obs.: SES = socioeconomic strata. *P < .05; **P < .01; ***P < .001.

Source: Authors, based on data from IBGE (2013 and 2016).

Considering the weekly level of physical activity, although male students with normal self-assessment of body weight whose mother have college degree or higher are still the group with higher level of activity, the role of public school in promoting regular physical activity presented significant influence among non-white/yellow students in Brazil, especially in North, South and Midwest region.

DISCUSSION

The results of the study indicate that a higher frequency of healthy foods consumption occurred among adolescents attending public schools. Potential influence on the consumption of healthy foods among students in Brazil may be the distribution of meals in public schools throughout the country within the National School Feeding Program, which has been highlighted for its role in the promotion of healthy eating through assurance of balanced menus based on national nutritional guidelines for students. However, it is important to indicate that a recent integrative literature review found that the main factors influencing adherence and acceptance of school meals among students were socioeconomic level, the presence of canteens in competition within the school environment, and students' eating preferences.[20]

Additionally, the models indicate that living with both parents showed significant association with healthy foods consumption. According to recent evidence, parents' attitudes influence the developing and the decision-making about adopting relevant strategies to promote health.[21-23] In a recent literature review of the subject on an international level, the habit of having meals with family was associated with the maintenance of the Body Mass Index (BMI) and good eating habits of children and adolescents.[24]

On the other hand, a study carried out at an outpatient general clinic demonstrated that some adolescents reported that having meals with their families could be damaging due to harmful eating habits of relatives.[25] It is important to point out that habits, like consuming meals while watching television, may be markers of undesirable food consumption practices adopted within the household. The results presented in the study showed a significant negative association between consuming meals while watching television and frequency of healthy foods consumption.

Studies among European and Saudi adolescents showed that adolescents' eating habits are related to time spent in sedentary behaviors.[26,27] A recent meta-analysis indicated that sedentary behaviors (e.g., watching TV) contribute to obesity, encouraging excessive food intake, whereas physical activity showed an influence on the adoption of healthy lifestyles among adolescents.[28,29]

Healthy food consumption was frequent among adolescents who had self-assessment of normal body weight; however, it is important to highlight that there were important differences among Brazilian regions regarding trends in the frequency of healthy foods consumption across

socioeconomic strata and regarding adolescents' attitudes towards weight control throughout the period analyzed. Food consumption patterns are influenced by a combination of environmental, biological, social, and cultural factors, which may explain the diversity in results referring to the frequency of healthy foods consumption in different geographical regions.[17] Although several studies on food choices indicate differences according to sex, usually showing that female adolescents tend to prefer healthier foods than male adolescents.[30-33], the evidence presented in the study pointed that Brazilian male adolescents consumed healthy foods more frequently than female adolescents.

Regarding physical activity level, the results obtained indicate that higher frequency of physical activity is significantly associated with sex: male adolescents usually presented adherence to WHO recommendations regarding daily and weekly levels of physical activity among Brazilian students in 2012 and 2015. There are pieces of evidence from previous studies indicating that male adolescents report social support from parents and friends to sports practice; noticing fewer barriers to engage in physical activity in comparison to female adolescents.[34-38]

There was a lower association between school environment and physical activity level among Brazilian adolescent students, in comparison to the promotion of healthy foods consumption. Recent evidences published in other studies have shown that private schools usually provide access to technologically advanced facilities, possibly inducing sedentary activities among students.[39,40] In addition, enrollment in private schools may be proxy to socioeconomic status in Brazil, considering private school fees in comparison to free access granted by public schools.[41]

The practice of physical activity prevailed among students who declared themselves non-white/yellow whose mother have a college degree or higher. There is a lack of evidence in the literature on differences in physical activity level among adolescents referring to ethnic diversity, most studies focus on practice of physical activity among adults. A study conducted in Baltimore found that racial differences in physical activity among black and white individuals were attributable to social context, instead of ethnicity. The findings demonstrate the importance of considering social and environmental factors in the analysis of racial disparities in physical activity level.[42]

Adolescents with self-assessment of normal body weight presented a higher level of physical activity. Adolescents adopting attitudes towards losing or gaining weight in middle and high-income families also declared a higher frequency of physical activity at recommended levels. Other studies showed that active adolescents usually considered themselves overweight. One of the main reasons given by adolescents for performing physical activity was to improve physical appearance.[43] Evidence from cross-sectional study Health Behavior in School-Age Children (HBSC) carried out in Slovakia during 2010 showed that negative body image among boys was linked to the small probability of achieving the recommended level of moderate to vigorous physical activity, while among girls presented no influence.[44]

The main limitation of the study refers to the design of the cross-sectional survey applied in schools, which prevent the identification of causal relations among health behaviors (food consumption patterns and physical activity level), school environment, self-assessment of body weight, and attitudes regarding weight control. Furthermore, the information was obtained using self-applicable questionnaire, thus, it may contain biases due to underreporting, subjective interpretation of the questions, and/or social acceptance regarding the health behaviors

investigated; factors that may either underestimate or overestimate indicators studied. However, it is important to highlight that the analysis performed in the study has been adopted in diverse studies worldwide, due to easiness in accessing the population group of interest. Additionally, the sampling process was designed to ensure representativeness at the national level, and the coverage of the Brazilian education system approaches universality, especially considering that the samples encompassed public and private schools, widening the representativeness of the target population.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The self-assessment of body weight causes concerns during adolescence, potentially generating harmful attitudes towards weight control, including problems regarding food consumption patterns and physical activity. There are relevant gender-related differences regarding self-assessment of body weight: girls that are usually more sensitive to sociocultural pressure to achieve and maintain an ideal body weight were found with a worse association with healthy behaviors regarding boys, which potentially can indicate negative feedback in their health behavior. The results of the study demonstrate the importance of considering socioeconomic, cultural environments, and public policies regarding the influence on adolescents' health habits. The evidence showed in the study must be considered for the promotion of healthy lifestyles among adolescents, in order to address excessive concerns with body weight and its consequences on health behaviors. In order to reformulate and implement effective actions directed to youngsters, the results from PeNSE must be widely disseminated, considering its role in monitoring adolescents' health in Brazil.

REFERENCES

1. Voelker DK, Reel JJ, Greenleaf C. Weight status and body image perceptions in adolescents: current perspectives. *Adolesc Health Med Ther.* 2015;6:149-158.

2. Das JK et al. Nutrition in adolescents: physiology, metabolism, and nutritional needs. *Ann N Y Acad Sci*. 2017;1393(1):21-33.

3. Miranda VPN et al. Body image in different periods of adolescence. *Rev Paul Pediatr*, 2014;32(1):63-69.

4. Sampasa-Kanyinga H et al. Perceptions and attitudes about body weight and adherence to the physical activity recommendation among adolescents: the moderating role of body mass index. *Public Health*, 2017;146:75-83. Accessed February 7, 2018.

5. Scherer FC et al. Body image among adolescents: association with sexual maturation and symptoms of eating disorders. *J Bras Psiquiatr*, 2010;59(3):198-202.

6. Bucchianeri MM et al. Body dissatisfaction from adolescence to young adulthood: findings from a 10-year longitudinal study. *Body Image*. 2013;10(1):1-7.

7. Carmo CC et al. Socioeconomic and behavioral factors related to body dissatisfaction in adolescents from public school in Juiz de Fora, MG. *HU Revista*, 2014;40(3-4):249-255.

8. Miranda VPN et al. Body dissatisfaction in Brazilian adolescents from small municipalities of Minas Gerais. *J Bras Psiquiatr*, 2011;60(3):190-197.

9. Sharif Ishak SI et al. School-based intervention to prevent overweight and disordered eating in secondary school Malaysian adolescents: a study protocol. *BMC Public Health*. 2016;16(1):1101-1112.

10. Pimentel ZNS et al. Concern with body image and associated factors in adolescents of public education in a municipality of Amazônia. *Adolesc Saude*, 2017;14(2):94-103.

11. IBGE. *Pesquisa Nacional por Amostra de Domicílios 2007*. Rio de Janeiro, 126p., 2007. https://biblioteca.ibge.gov.br/visualizacao/periodicos/59/pnad_2007_v28_br.pdf.   Accessed February 12, 2018.

12. IBGE. *Pesquisa Nacional de Saúde do Escolar 2012*. Rio de Janeiro, 256p., 2013. http://biblioteca.ibge.gov.br/visualizacao/livros/liv64436.pdf. Accessed October 17, 2015.

13. IBGE. *Pesquisa Nacional de Saúde do Escolar 2015*. Rio de Janeiro, 131p., 2016. http://biblioteca.ibge.gov.br/visualizacao/livros/liv97870.pdf. Accessed August 27, 2016.

14. IBGE. Pesquisa Nacional de Saúde do Escolar 2009. Rio de Janeiro, 138p., 2009. https://biblioteca.ibge.gov.br/visualizacao/livros/liv43063.pdf. Accessed October 17, 2015.

15. Oliveira MM et al. Characteristics of the National Adolescent School-based Health Survey – PeNSE, Brazil. *Epidemiol Serv Saude*, 2017;26(3):605-616.

16. World Cancer Research Fund / American Institute for Cancer Research. *Policy and action for cancer prevention - Food, nutrition, and physical activity: a global perspective.* Washington, DC: American Institute for Cancer Research; 2009.

17. Brazil. Ministry of Health. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. *Guia alimentar para a população brasileira*. 2. ed., 1. reimpr. Ministério da Saúde, Brasília,

2014. 158 p. http://bvsms.saude.gov.br/bvs/publicacoes/guia_alimentar_populacao_brasileira_2ed.pdf. Accessed February 20, 2018.

18. WHO. *Global recommendations on physical activity for health*. Geneva, 60pp., 2010. https://apps.who.int/iris/bitstream/handle/10665/44399/9789241599979_eng.pdf;jsessionid=00131693DD001756F691022F5BF436D1?sequence=1. Acessed October 9, 2018.

19. Brazil. Ministry of Health. Conselho Nacional de Saúde. *Resolução nº. 196, de 10 de outubro de 1996*. http://bvsms.saude.gov.br/bvs/saudelegis/cns/1996/res0196_10_10_1996.html. Accessed February 20, 2017.

20. Cesar JT et al. School feeding in Brazil and United States: an integrative review. *Cienc Saude Coletiva*, 2018;23(3):991-1007.

21. Barufaldi LA et al. ERICA: prevalence of healthy eating habits among Brazilian adolescents. *Rev Saude Publica*, v. 50, suppl. 1, p. 1s-9s, 2016.

22. D'Avila GL et al. The association between nutritional status of the mother and the frequency and location of and company during meals and overweight/obesity among adolescents in the city of Florianópolis, Brazil. *Rev Bras Saude Mater Infantil*, 2015;15(3):289-299.

23. Hammons AJ, Fiese BH. Is frequency of shared family meals related to the nutritional health of children and adolescents? *Pediatrics*, 2011;127(6):e1565-e1574.

24. Tosatti AM et al. Does family mealtime have a protective effect on obesity and good eating habits in young people? A 2000-2016 review. *Rev Bras Saude Mater Infantil*, 2017;17(3):425-434.

25. Costa ALF, Duarte DE, Kuschnir MCC. Family and eating behavior in adolescence. *Adolesc Saude*, 2010;7(3):52-58.

26. Askovic B, Kirchengast S. Gender differences in nutritional behavior and weight status during early and late adolescence. *Anthropol Anz.* 2012;69(3):289-304.

27. Al-Hazzaa HM et al. Association of dietary habits with levels of physical activity and screen time among adolescents living in Saudi Arabia. *J Hum Nutr Diet.* 2014;27(Suppl 2):204-213.

28. Santaliestra-Pasías AM et al. Increased sedentary behaviour is associated with unhealthy dietary patterns in European adolescents participating in the HELENA study. *Eur J Clin Nutr.* 2014;68(3):300-308.

29. Chapman CD et al. Lifestyle determinants of the drive to eat: a meta-analysis. *Am J Clin Nutr*. 2012;96:492-497.

30. Groth MV et al. Disparities in dietary habits and physical activity in Denmark and trends from 1995 to 2008. *Scand J Public Health*. 2014;42(7):611-620.

31. Monge-Rojas R et al. The influence of gender stereotypes on eating habits among Costa Rican adolescents. *Am J Health Promot.* 2015;29(5):303-310.

32. Musaiger AO, Al-Mufty BA, Al-Hazzaa HM. Eating habits, inactivity, and sedentary behavior among adolescents in Iraq: sex differences in the hidden risks of noncommunicable diseases. *Food Nutr Bull.* 2014;35(1):12-19.

33. Cooke LJ, Wardle J. Age and gender differences in children's food preferences. *Br J Nutr*. 2005;93(5):741-746.

34. Fernandes RA et al. Cross-sectional association between healthy and unhealthy food habits and leisure physical activity in adolescentes. *J Pediatr*, 2011;87(3):252-256.

35. Cureau FV et al. ERICA: leisure-time physical inactivity in Brazilian adolescentes. *Rev Saude Publica*, 2016;50(suppl. 1):1s-11s.

36. Dias DF, Loch MR, Ronque ERV. Perceived barriers to leisure-time physical activity and associated factors in adolescents. *Cienc Saude Coletiva*, 2015;20(11):3339-3350.

37. Farias Júnior JC et al. Physical activity practice and associated factors in adolescents in Northeastern Brazil. *Rev Saude Publica*, 2012;46(3):505-515.

38. Gonçalves H et al. Sociocultural factors and physical activity level in early adolescence. *Rev Panam Salud Publica*, 2007;22(4):246-253.

39. Seabra AF et al. Biological and socio-cultural determinants of physical activity in adolescents. *Cad Saude Publica*, 2008;24(4):721-736.

40. Nascente FMN et al. Sedentary lifestyle and its associated factors among adolescents from public and private schools of a Brazilian state capital. *BMC Public Health.* 2016;16(1):1177-1185.

41. Oliveira TC et al. Physical activity and sedentary lifestyle among children from private and public schools in Northern Brazil. *Rev Saude Publica*, 2010;44(6):996-1004.

42. Wilson-Frederick SM et al. Examination of race disparities in physical inactivity among adults of similar social context. *Ethn Dis.* 2014;24(3):363-369.

43. Zach S et al. Perceived body size versus healthy body size and physical activity among adolescents: Results of a national survey. *Eur J Sport Sci.* 2013;13(6):723-731.

44. Kopcakova J et al. Is being a boy and feeling fat a barrier for physical activity? The association between body image, gender and physical activity among adolescents. *Int J Environ Res Public Health.* 2014;11(11):11167-11176.