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Changes in prevalence of overweight in adolescents living in areas highly vulnerable to food insecurity

Danilo Dias Santana (https://orcid.org/0000-0002-9769-7435) [1]
Erica Guimarães Barros (https://orcid.org/0000-0001-5083-2399) [1]
Rosana Salles-Costa (https://orcid.org/0000-0002-2307-4083) [1]
Gloria Valeria da Veiga (https://orcid.org/0000-0002-7985-0213) [1]

Abstract *This study ascertained changes, over 5 years, in the prevalence of overweight in adolescents and associations with socio-demographic variables and food insecurity. Two cross-sectional population-based studies were conducted with 511 (2005) and 314 (2010) adolescents resident in Campos Elíseos (Duque de Caxias-RJ). Overweight was evaluated by sex and age specific cut-off points of BMI (weight/height²). The prevalence of food insecurity was investigated using the Brazilian Food Insecurity Scale. Logistic regression was used to determine the association between changes in overweight over time and sex, age, skin colour, and food insecurity. Overweight was found to increase significantly, between 2005 and 2010, in boys who were younger (from 20.1% to 49.5%), black or brown (22.2% to 37.3%), those with per capita income of up to half a minimum wage (13.6% to 32.5%) and those experiencing moderate or severe food insecurity (9.2% to 36.3%). It was concluded that overweight increased significantly in adolescents living in an area of food insecurity, and that younger, black or brown, lower-income adolescents, and those living with moderate and severe food insecurity, were more exposed to that increase.*

Key words *Overweight, Obesity, Food and nutrition security, Adolescent*

[1] Instituto de Nutrição Josué de Castro, Universidade Federal do Rio de Janeiro. Av. Carlos Chagas Filho 373, Bloco J, 2º andar, Cidade Universitária. 21941-902 Rio de Janeiro RJ Brasil. dias.danilo@hotmail.com

Introduction

That prevalence of overweight has increased significantly in Brazil is evident[1,2], and follows a world trend[3]. From 1974 to 2009, overweight increased among adolescents, approximately six times among males (from 3.7% to 21.7%) and nearly three times among females (from 7.6% to 19.4%), and that rising trend is also seen in obesity[1], qualifying it as a severe public health problem. Arising in a context of strong food and nutrition insecurity, this situation is intriguing and raises questions as to possible associations between the two problems.

Food and Nutrition Security (FNS) is defined in Brazilian law as the fulfilment of the right of all to regular and permanent access to quality food in sufficient quantity, without jeopardising satisfaction of other essential needs, based on healthy eating practices that respect cultural diversity and are socioeconomically and environmentally sustainable[4]. Situations of food insecurity can be detected through problems of various types, including hunger, consumption of foods that are of dubious quality or harmful to health, with consequent obesity and other diseases associated with poor diet[5].

International studies with children and adolescents have shown that food insecurity is directly associated with overweight[6-9] and with poor-quality diet characterised by the presence of less healthy foods more likely to lead to nutrient deficiencies[10,11]. In Brazil, that association has been observed in adults[12], but is not yet clear in adolescents, where the relations found have been inverse[13] or null[14,15].

Salles-Costa et al.[16], in a study in 2005 in the Campos Elíseos district of Duque de Caxias, Rio de Janeiro State, noted that food insecurity was present to differing degrees in 53.8% of households (31.4% with mild food insecurity, 16.1% moderate food insecurity and 6.3% severe food insecurity). Meanwhile, Ferreira et al.[17] reported that 16.8% of adolescents living in households with food insecurity were overweight and 7.2% were obese. A new survey conducted in Campos Elíseos in 2010 to reassess issues addressed in the 2005 study[16] asked how the prevalence of overweight in adolescents had changed in the period between the two studies.

The purpose of this article is thus to report on the changes in the prevalence of overweight in adolescents resident in Campos Elíseos, Duque de Caxias, and its association with sociodemographic factors and food insecurity over a five-year period.

Methods

This study used data from two cross-sectional, population-based studies conducted in 2005 and 2010 by way of home visits to investigate variables relating to residents in permanent private households (PPHs) in the second district (Campos Elíseos) of the municipality of Duque de Caxias in Rio de Janeiro State. At the time of the second study (2010), the population of Duque de Caxias, estimated at 855,048, was predominantly urban and with a Municipal Human Development Index of 0.711. In 2005, Campos Elíseos was notable for being one of the districts with the lowest per capita income of Duque de Caxias: only 26.8% of families had incomes greater than one minimum wage, around 83% of families were in social classes C and D, as classified by the Brazilian Association of Market Research Institutes (ABIPEME) and 52.3% of heads of family had not completed lower secondary schooling. More information on the municipality can be found in Salles-Costa et al.[16].

The studies were performed with probability samples of 1,125 PPHs selected in three stages (census tract, household and individual). In both 2005 and 2010 sample size was set on the basis of an estimate of 14.5% extreme poverty, with 5% maximum relative error. In 2005, in the first stage, 75 census tracts with probabilities proportional to the number of PPHs observed by the 2000 Population Census were selected systematically from among the 322 census tracts in the 2000 Geographic Operational Base of Brazil's official bureau of statistics (IBGE). Detailed information on the sampling criteria can be found in Salles-Costa et al.[16].

In the second survey, conducted in 2010, the sampling design chosen was inverse sampling[18] of clusters (census tract, households and individuals). In the first stage selection, the same 75 census tracts were sampled and a new screening was performed to update the PPHs by age strata. With that information, the PPHs of the child stratum were randomly sampled (a maximum of eight households per tract), then the PPHs with adults and/or adolescents were sampled until completing a total of 15 PPHs per tract (the second selection stage).

In the third stage, which involved selecting the individuals to be assessed in each PPH, one individual was selected in each age bracket (child, adolescent or adult), while in the stratum of PPHs of adults only, two adults were selected. The adults interviewed as regards the fami-

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lies' socioeconomic conditions were the 'woman of reference', that is the woman responsible for managing shopping and preparing meals, and her partner, except when the woman did not live with her partner or when the partner was not present. In the latter situation, another male adult was selected for interview. In 2005 the final sample totalled 1,089 households distributed over the 75 census tracts and in 2010 the final sample was 1,121 households distributed over the same census tracts.

This study considered data for adolescents from 12 to 18.9 years of age. In the two studies, adolescents were considered eligible if they had no physical disability that would prevent anthropometric evaluation and application of the questionnaires and were not pregnant. In 2005, to begin with, 561 eligible adolescents were interviewed. Fifty adolescents were excluded for inconsistencies in completing the questionnaires, and data on 511 adolescents (91.0% of those eligible) were analysed. In 2010, all 314 eligible adolescents were interviewed (100%).

Given an estimated 20.5% prevalence of overweight in adolescents[1], a 95% level of confidence, with 5% absolute precision in 2005 and 4% in 2010 and the cluster design effect, the sample sizes of 511 and 314, respectively, enabled the prevalence of overweight to be estimated in the study population[19].

Data were collected in both 2005 and 2010 by a team of interviewers duly trained for the stages of questionnaire application, diet assessment and anthropometric measurement. The team comprised nutritionists or students of nutrition, who were trained for one week (total 40 hours) by the same team that coordinated the two population surveys, so as to maintain data collection standardisation and quality. Specifically, as regards taking the anthropometric measurements, the team was standardised on the basis of the criteria of Habicht[20]. The home visits and measurements were made after a free and informed consent form was signed by the person responsible for the household, and only adolescents who so desired participated. The projects were approved by the research ethics committees of the Instituto de Medicina Social of the Universidade Estadual do Rio de Janeiro and the Instituto de Estudos de Saúde Coletiva of the Universidade Federal do Rio de Janeiro.

In both studies, weight and height were measured with the participants wearing light clothes and barefoot. The equipment used (portable scales and stadiometer) were calibrated over the course of the data collection period so as to control for possible measurement biases. Weight was obtained using portable electronic scales (Kratos PPS®, São Paulo, Brazil), with capacity of 150 kilograms and graduations of 50 grams. Height was measured using a portable stadiometer (Leicester®, United Kingdom), with graduations of 0.1 centimetre (cm), with which two measurements were taken and the mean recorded. Maximum variation of 0.5 cm was allowed between the two measurements and, in the event the variation exceeded that value, the measurements were repeated. Weight and height were measured following the techniques proposed by Gordon et al.[21]. The weight and height measurements were used to calculate Body Mass Index (BMI=weight/height²). Appropriate weight was classified by specific BMI cut-off points, by sex and age, as proposed by the World Health Organisation[22]: low BMI for age (<Z-score=-2), appropriate BMI (≥Z-score=-2 and <Z-score=+1), overweight (≥Z-score=+1 and <Z-score=+2) and obesity (≥Z-score=+2). The overweight and obesity categories were grouped into one overweight category in the analyses of association.

Prevalence of food insecurity was investigated by means of the Brazilian Food Insecurity Scale (*Escala Brasileira de Insegurança Alimentar* - EBIA), adapted and validated for the Brazilian population[23] and recommended for use in population-based studies[24]. The EBIA was answered by the person responsible for the family's meals. Each affirmative response scored "one point" and the sum of the number of affirmative responses was used to classify by degree of food insecurity (food security and mild, moderate and severe food insecurity). Note that the EBIA evaluates food and nutrition security in the dimension of access to acquisition of food only; accordingly, the term "food security" is more appropriate, because it excludes the nutritional dimension which is not assessed by this method[25].

The demographic variables evaluated were sex, age and skin colour, the latter self-reported from the options used by the IBGE[26]. As the socioeconomic indicator, the study considered monthly per capita family income (the family's total earnings divided by the number of residents), expressed in multiples of a minimum wage: R$ 300 in 2005 and R$ 510 in 2010.

Data were analysed using the Statistical Program for the Social Sciences (SPSS version 19.0, Chicago, IL, USA). The analyses contemplated the sample weight of each individual in order to expand the sample and the effect of the cluster

study design by using the SPSS Complex Sample procedure.

The descriptive analysis considered the frequencies and 95% confidence intervals (95%CI) in the two periods (2005 and 2010) for the outcome variables (presence or absence of overweight) and exposure variables: sex (male and female), age (12 to 14.9 and 15 to 18.9 years), skin colour (black or brown and white), per capita income (up to ½ minimum wage, greater than ½ minimum wage and less than 1 minimum wage, and greater than 1 minimum wage) and food insecurity classification (variable in four categories: food security, and mild, moderate and severe food insecurity). Frequencies were compared between the two studies on the basis of chi-square tests. In cases of variables with more than two categories, the chi-square test was partitioned using the statistical programme *WinPepi*[27]. The association between outcome and exposure variables in each study period was investigated on the basis of the chi-square test. Logistical regression for complex samples was used so as to ascertain the association between change in overweight over time, by the sociodemographic variables and food insecurity. A p-value of <0.05 was considered for statistical significance.

Results

Approximately 80% of the adolescents were black- or brown-skinned and some 50% had per capita income of up to 1 minimum wage. Underweight was found to have diminished (from 4.5% to 0.9%), while overweight had increased (16.3% to 22.8%) (p=0.033). No significant change was found in food insecurity, although approximately 60% of the adolescents lived in homes with food insecurity in 2005 and that prevalence had declined to around 50% in 2010 (Table 1).

In the analyses stratified by sex, in 2010 the prevalence of overweight among boys was greater in the 12- to 14.9-year-olds (49.5%) than among the 15- to 18.9-year-olds (18.6%), p=0.003). In 2005 boys with per capita income greater than 1 minimum wage showed greater prevalence of overweight (46.0%) than those with incomes between 1/2 and 1 minimum wage (25.2%) or less than 1/2 minimum wage (13.6%) (p=0.012) (Table 2).

Between 2005 and 2010 overweight increased significantly among the youngest boys (from 20.1% to 49.5%), among those with self-reported black or brown skin (22.2% to 37.3%), those with per capita income of up to 1/2 minimum wage (13.6% to 32.5%) and those with moderate and severe food insecurity (9.2% to 36.3%) (Table 2).

Among the girls, neither prevalence of overweight nor variation between the two study periods showed associations with the sociodemographic variables and food insecurity (Table 3).

Discussion

The main findings of this study were the 7.5% increase in overweight between 2005 and 2010. Particularly the youngest boys, those with black or brown skin, with least per capita income and moderate and severe food insecurity displayed the greatest increases in prevalence between the two study periods.

Meanwhile, food insecurity was found to have decreased by 10.3%. Considering the direct association between overweight and food insecurity already demonstrated by studies with adolescents[7-9,12], the decrease in food insecurity observed in this study might be supposed to associate with a reduction in overweight in adolescents. However, this finding underlines the problem that, in developing countries, without a process of better access to education in traditionally poorer populations, the improved socioeconomic conditions, which may be related to improvements in food insecurity, may also result in consumption of less expensive but more energy-dense foods[28,29] and, consequently, in an increase in overweight.

In this context, Segall-Corrêa and Salles-Costa[28], in a nationwide population-based study with 5,000 families in Brazil, found that a considerable percentage of families, after being included in the conditional cash-transfer programme, the Family Allowance Programme (*Programa Bolsa Família* - PBF), reported a significant increase in the quantity and variety of the foods they consumed. However, the study stressed that increased purchasing power had not resulted in improved diet quality, because consumption of high energy-density foods had increased. Lignani et al.[29] also noted that, after entering the PBF, families resident in Duque de Caxias reported eating more of all food groups, particularly cereals, processed foods, meat, milk and dairy products and sugar. In addition, the degree of dependence on income from the programme associated positively with increased ingestion of sugar and soft drinks.

The studies above underscore the importance of measuring nutrition education together with

Table 1. Adolescents' sociodemographic characteristics, weight classification by BMI and food insecurity. Campos Elíseos, Duque de Caxias-RJ, 2005 and 2010.

	2005		2010		Variation	p-value[1]
	n*	% (95%CI)	n*	% (95%CI)		
Sex	511		314			0.668
Male		49.3 (44.5-54.1)		51.0 (44.3-57.7)	+ 1.7	
Female		50.7 (45.9-55.5)		49.0 (42.3-55.7)	- 1.7	
Age (years)	511		314			0.178
12 to 14.9		44.9 (39.3-50.6)		50.3 (42.7-57.9)	+ 5.4	
15 to 18.9		55.1 (49.4-60.7)		49.7 (42.1-57.3)	- 5.4	
Skin colour	510		308			0.572
Black/Brown		81.2 (76.7-85.0)		78.9 (70.9-85.1)	- 2.3	
White		18.8 (15.0-23.3)		21.1 (14.9-29.1)	+ 2.3	
Per capita income**	503		304			0.470
Up to ½ minimum wage		47.7 (41.2-54.3)		50.5 (40.7-60.2)	+ 2.8	
½ - 1 minimum wage		42.3 (36.8-47.9)		36.5 (28.5-45.3)	- 5.8	
>1 minimum wage		10.1 (7.1-14.1)		13.1 (7.4-22.1)	+ 3.0	
BMI classification	511		301			0.033
Underweight		4.5 (2.7-7.2)		0.9[#] (0.3-2.8)	- 3.6	
Appropriate weight		72.2 (66.9-76.9)		68.2 (60.5-74.9)	- 4.0	
Overweight		16.3 (12.7-20.6)		22.8[#] (17.3-29.5)	+ 6.5	
Obesity		7.1 (4.8-10.5)		8.1 (5.1-12.8)	+ 1.0	
FI***	506		314			0.051
Food security		40.2 (33.9-46.8)		50.5 (41.1-59.8)	+ 10.3	
Mild FI		35.6 (30.1-41.5)		35.0 (27.5-43.3)	- 0.6	
Moderate and severe FI		24.2 (19.4-29.8)		14.5 (9.2-22.0)	- 9.7	

*The values differ due to losses on each variable. **Value of minimum wage: 2005 = R$ 300.00; 2010 = R$ 510.00. ***FI: Food insecurity. [1] Chi-square test. [#] Chi-square partition test < 0.05.

Source: Elaborated by the authors.

improved access to foods. However, Henriques et al.[30] highlight the influence of the obesogenic environment to which the population is exposed. That environment involves the supply, availability, convenience and practicality of preparing food, the cost-satiety relationship, the hyper-palatability of ultra-processed products, the different marketing strategies involving such foods and other factors. In that context, these factors can interfere in food-related decision-making processes. Note also that the relationship between food insecurity and obesity is complex and, although food and nutrition education actions do play an important part in promoting appropriate, healthy eating, other structural measures are necessary, as signalled by Cotta and Machado[31].

As regards the prevalence of adolescent overweight found in this study in 2010 (30.9%), it was higher than the 22.6% found in the corresponding Southeast region by the Family Budget Survey (*Pesquisa de Orçamentos Familiares* - POF 2008-2009)[1], but smaller than the 33.1% found for the region by the National Schoolchildren's Health Survey (*Pesquisa Nacional de Saúde do Escolar* - PeNSE 2015)[32]. Those findings may indicate that, even in an area characterised by a clear situation of food insecurity, young people display prevalence of overweight higher than, or similar to, the average found in Brazilian adolescents. In opposite, Guerra et al.[33], studying adolescents in an area of the Legal Amazon (Mato Grosso state) also notable for high prevalence of food insecurity, found a smaller prevalence of overweight (13.8%) than in this study, lower even than the average for the Midwest region (21.9%)[1], in the same period as the surveys in Duque de Caxias (Rio de Janeiro). As a result, further studies need to be carried out to ascertain the regional differences in prevalence of overweight in areas affected by food insecurity in Brazil.

Note also that sex was a differential variable in the associations investigated. Among the boys,

Table 2. Prevalence of overweight in male adolescents, by sociodemographic variables and food insecurity. Campos Elíseos, Duque de Caxias-RJ, 2005 and 2010.

	Overweight						Variation %
	2005			2010			
	n*	% (95%CI)	p	n*	% (95%CI)	p	
Age (years)		0.589			0.003		
12 to 14.9	112	20.1 (12.1-31.5)		80	49.5 (35.1-64.0)		+ 29.4#
15 to 18.9	140	23.9 (16.4-33.4)		74	18.6 (10.1-31.9)		- 5.3
Colour/Race		0.951			0.352		
Black/Brown	204	22.2 (15.9-30.0)		119	37.3 (25.8-50.4)		+ 15.1#
White	47	22.7 (11.9-38.9)		34	26.0 (12.3-46.9)		+ 3.3
Per capita income**		0.012			0.638		
Up to ½ minimum wage	105	13.6 (8.0-22.2)		65	32.5 (19.5-49.0)		+ 18.9#
½ - 1 minimum wage	114	25.2 (16.3-36.7)		63	41.2 (25.6-58.8)		+ 16.0
>1 minimum wage	25	46.0 (23.9-69.9)		18	26.8 (7.8-61.2)		- 19.2
Food insecurity		0.109			0.986		
Food security	105	25.8 (16.5-37.8)		73	34.0 (21.6-49.0)		+ 8.2
Mild food insecurity	94	24.8 (15.7-36.8)		50	34.8 (18.9-55.1)		+ 10.0
Moderate and severe food insecurity	50	9.2 (3.7-21.2)		29	36.3 (16.5-62.1)		+ 27.1#

*The values differ due to losses on each variable. **Value of minimum wage: 2005 = R$ 300.00; 2010 = R$ 510.00. # Logistic regression, p<0.05.

Source: Elaborated by the authors.

age range, skin colour, income and food insecurity were associated with overweight and change in prevalence; in the girls, no associations were found. The fact that the younger adolescent boys (12- to 14-year-olds) showed higher prevalence and significant increase in overweight agrees with the findings of the POF 2008-2009[1], which observed that overweight was higher precisely in early adolescence. That panorama gives cause for great concern, because young people are becoming overweight earlier and earlier, a factor that has been associated with early onset of metabolic alterations such as high blood pressure, diabetes mellitus, cardiovascular diseases and metabolic syndrome[34]. It is to be emphasised that such alterations have been observed in overweight Brazilian adolescents[35,36].

As regards income, the POF 2008-2009, a survey carried out at the same time as this study, found that adolescents – and particularly boys – in the lowest-income strata displayed lower prevalences of overweight than their counterparts at higher socioeconomic levels[1]. In a survey of secondary school students in the Rio de Janeiro metropolitan region, Moreira et al.[37] found that boys at private schools gained more BMI than those at public schools. In this study, overweight increased significantly, precisely among the poorest boys, which runs counter to the findings mentioned above. However, some authors have found that the relation between overweight and socioeconomic position may be changing in low- and middle-socioeconomic-status countries, with substantial prevalence of overweight in individuals of lower socioeconomic status[38,39].

Overweight also increased more among the black and brown boys and it is known that, in Brazil, this variable relates more to the social context than to any biological factor as such[37,40]. In addition, overweight was seen to increase significantly precisely among the boys with moderate and severe levels of food insecurity. Salles-Costa et al.[16], studying the population resident in Caxias in 2005, found that among families with monthly per capita income of less than ¼ of a minimum wage, 88.0% reported some degree of food insecurity. Note also that, as family income diminished, so the percentage of families in food insecurity increased. That association found between income and food insecurity indicates that, for those adolescents, increasing overweight is strongly associated with lower socioeconomic status, prompting efforts to understand that association.

Experiencing a situation of food insecurity in adolescence is known to be important be-

Table 3. Prevalence of overweight in female adolescents, by sociodemographic variables and food insecurity. Campos Elíseos, Duque de Caxias-RJ, 2005 and 2010.

	Overweight						Variation %
	2005			2010			
	n*	% (95%CI)	p	n*	% (95%CI)	p	
Age (years)		0.400			0.636		
12 to 14.9	118	27.8 (18.0-40.3)		68	29.4 (18.1-44.1)		+ 1.6
15 to 18.9	141	21.8 (15.0-30.6)		80	25.1 (14.8-39.3)		+ 3.3
Colour/Race		0.070			0.932		
Black/Brown	210	27.0 (20.3-35.0)		120	27.2 (18.3-38.4)		+ 0.2
White	49	13.8 (6.4-27.1)		28	28.0 (14.3-47.4)		+ 14.2
Per capita income**		0.077			0.386		
Up to ½ minimum wage	135	30.9 (22.7-40.5)		78	29.1 (17.5-44.2)		- 1.8
½ - 1 minimum wage	98	18.6 (11.2-29.3)		46	16.0 (5.6-37.9)		- 2.6
>1 minimum wage	26	14.1 (4.7-35.5)		22	37.1 (13.3-69.2)		+ 23.0
Food insecurity		0.411			0.824		
Food security	99	24.3 (14.6-37.6)		79	25.0 (14.7-39.4)		+ 0.7
Mild food insecurity	86	19.6 (12.5-29.3)		54	28.0 (14.5-47.2)		+ 8.4
Moderate and severe food insecurity	73	31.2 (19.3-46.3)		16	33.8 (14.0-61.6)		+ 2.6

*The values differ due to losses on each variable. **Value of minimum wage: 2005 = R$ 300.00; 2010 = R$ 510.00.

Source: Elaborated by the authors.

cause this stage of life is marked by intense physical, cognitive and emotional development[1]. It is important to have continuous access to food of appropriate quality and in sufficient quantity to guarantee proper growth and development[42]. This study found that, between 2005 and 2010, the prevalence of food security increased, while more severe levels of insecurity declined. One explanation may be the greater access to conditional cash transfer programmes, such as the PBF. That fact may have assisted decisively in reducing the prevalence of the more severe levels of food insecurity. Palmeira et al.[43] concluded that this type of programme can contribute to reducing food insecurity in populations vulnerable to poverty. Note, however, the current scenario of cutbacks in social programmes and resurgence of more severe situations of food insecurity[44], which may have adverse impact at the site where the study was conducted.

The results of this study should be considered in the light of its limitations and strong points. As regards the former, the first consideration is that the concept of food insecurity, as measured by the EBIA, does not correspond to the extended, comprehensive concept of Food and Nutrition Security (FNS) adopted by Brazil[45]. The EBIA does, nonetheless, constitute an instrument that, since 2003, has been validated for measuring this outcome in Brazil on the basis of the United States food insecurity scale[23]. Also, it has proven to be psychometrically valid[46], which reinforces is suitability for monitoring food insecurity by way of studies of prevalence to identify populations at risk, and for studying causes such as poverty[47]. In that respect, it is possible to think in these adolescents' food consumption, which reflects the extended dimension of FNS, so as to determine the association between increasing overweight and food insecurity observed in this study.

Note also that, as this study was conducted on the basis of two cross-sectional studies, it suffers from the limitation of not being able to determine the causality of the associations between overweight and the study variables. Also, sample power was not calculated to ascertain the variation in overweight between the two studies or for the stratified analysis, but care was taken to calculate sample power in each period for estimating prevalence of overweight in adolescents.

An outstanding strong point is that the study evaluates a representative sample of adolescents residing in an area of high social vulnerability, unlike most studies, which evaluate populations more heterogeneous in social class. Accordingly, the study can assist more specifically in clarifying

the evolution of overweight among these adolescents.

It was thus concluded that, over a five-year period, prevalence of overweight increased substantially among adolescents resident in an area of low socioeconomic status and high prevalence of food insecurity, where the youngest, black or brown boys, with least income and resident in households with moderate and severe food insecurity were most exposed to that increase. Thus, in the present context in which the synergy among pandemics of obesity, malnutrition and climate change is being discussed, as being issues that feature common causes[48], the findings of this study help underline the need for public policies to improve the panorama observed, focussing on this age stratum of the population with a view to controlling and combating obesity in groups exposed to poverty and food insecurity.

Collaborations

DD Santana participated in the study conception, statistical analyses and drafting of the article. EG Barros participated in the statistical analyses. R Salles-Costa participated in the study conception and final drafting of the article. GV Veiga participated in the study conception, statistical analyses and final drafting of the article.

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