Factors associated with overweight and obesity among public high school students of the city of Caruaru, Northeast Brazil

Fatores associados ao sobrepeso e à obesidade em estudantes do ensino médio da rede pública estadual do município de Caruaru (PE)

Factores asociados al sobrepeso y la obesidad en estudiantes de la secundaria de la red pública provincial del municipio de Caruaru (Pernambuco, Brasil)

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ABSTRACT

Objective: To investigate the prevalence and factors associated with overweight and obesity among public high school students of Caruaru, Northeast Brazil.

Methods: Cross-sectional study, with a representative sample. The study evaluated anthropometric (weight and height), socio-demographic and economic variables (gender, age, marital status, place of residence, family income and school grade) and those related with lifestyle (physical activity, sedentary behavior, dietary intake, stress levels, smoking, alcohol consumption and quality of sleep). Binary logistic regression was conducted, considering overweight and obesity as the main outcomes, being significant $p<0.05$.

Results: The final sample consisted of 600 students (62.5% females), with a mean age of 17.5±1.6 years. The prevalence of overweight and obesity was 19.0% (95%CI 15.9-22.4) and 5.5% (95%CI 3.8-7.7), respectively, without differences between genders. The proportion of overweight was higher among those who reported a negative perception of stress, those with insufficient physical activities, and the individuals who reported alcohol consumption. There was a higher proportion of obesity among the students with a negative perception of sleep, those with insufficient physical activities, and those who reported watching TV more than three hours per day and having candies four times or more per week.

Conclusions: This study showed a high prevalence of overweight and obesity associated with modifiable risk factors such as physical inactivity, alcohol consumption, negative perception of sleep, time in front of TV greater than three hours per day and consumption of candies four times or more per week.

Key-words: overweight; obesity; adolescent health; risk factors; prevalence; adolescent nutrition.

RESUMO

Objetivo: Investigar a prevalência e os fatores associados ao sobrepeso e obesidade em estudantes do ensino médio da rede pública estadual do município de Caruaru (PE).

Métodos: Estudo transversal, com amostra representativa. Foram avaliadas variáveis antropométricas (peso e estatura), sociodemográficas e econômicas (sexo, idade, estado civil, local de residência, renda familiar e série escolar) e relacionadas ao estilo de vida (atividade física, comportamento sedentário, consumo alimentar, nível de estresse, tabagismo,

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etilismo e qualidade de sono). Realizou-se regressão logística binária, adotando-se a ocorrência do sobrepeso e obesidade como desfechos. Para as análises inferenciais, considerou-se significante $p<0,05$.

Resultados: A amostra final foi composta de 600 estudantes (62,5% do sexo feminino), com idade média de 17,5±1,6 anos. A prevalência de sobrepeso e obesidade foi de 19,0% (IC95% 15,9-22,4) e 5,5% (IC95% 3,8-7,7), respectivamente, sem diferença entre os sexos. A proporção de sobrepeso foi maior entre aqueles que relataram uma percepção negativa de estresse, os insuficientemente ativos e os que relataram consumir álcool. Verificou-se maior proporção de obesos entre os estudantes com percepção negativa do sono, os insuficientemente ativos, os que relataram assistir TV por mais de três horas por dia e com consumo de doces igual ou superior a quatro vezes por semana.

Conclusões: Observou-se elevada prevalência de sobrepeso e obesidade associada a fatores de risco modificáveis, como inatividade física, consumo de álcool, percepção negativa de sono, tempo de TV superior a três horas por dia e consumo de doces igual ou superior a quatro vezes por semana.

Palavras-chave: sobrepeso; obesidade; saúde do adolescente; fatores de risco; prevalência; nutrição do adolescente.

RESUMEN

Objetivos: Investigar la prevalencia y los factores asociados al sobrepeso y la obesidad en estudiantes de la secundaria de la red pública provincial del municipio de Caruaru (Pernambuco, Brasil).

Métodos: Estudio transversal, con muestra representativa. Se evaluaron variables antropométricas (peso y estatura), sociodemográficas y económicas (sexo, edad, situación civil, local de residencia, ingresos familiares, año y turno escolar) y relacionadas al estilo de vida (actividad física, comportamiento sedentario, consumo alimentar, nivel de estrés, tabaquismo, alcoholismo y calidad del sueño). Se realizó regresión logística binaria, adoptándose la ocurrencia del sobrepeso y la obesidad como desenlaces. Para los análisis inferenciales, se consideró significante $p<0,05$.

Resultados: La muestra final fue compuesta por 600 estudiantes (62,5% del sexo femenino), con promedio de edad de 17,5± 1,6 años. La prevalencia de sobrepeso y obesidad fue de 19,0% (IC95% 15,9-22,4) y 5,5% (IC95% 3,8-07,7), respectivamente, sin diferencia significativa entre los sexos. La proporción de sobrepeso fue significativamente mayor entre aquellos que relataron una percepción negativa de estrés, los insuficientemente activos y los que relataron consumir alcohol. Se verificó mayor proporción de obesos entre aquellos estudiantes con percepción negativa de sueño, los insuficientemente activos, los que relataron asistir TV por más de tres horas al día y con consumo de dulce igual o superior a cuatro veces por semana.

Conclusiones: Se observó elevada prevalencia de sobrepeso y obesidad asociada a factores de riesgo modificables, como inactividad física, consumo de alcohol, percepción negativa del sueño, tiempo de TV superior a 3 horas al día y consumo de dulce igual o superior a 4 veces por semana.

Palabras clave: sobrepeso; obesidad; salud del adolescente; factores de riesgo; prevalencia; nutrición del adolescente.

Introduction

Obesity is a chronic disease. The ever-increasing prevalence of obesity and its associations with a wide variety of morbid conditions mean that it is considered one of the public health problems of greatest magnitude[1]. These concerns are also relevant in developing countries, including Brazil, which are undergoing rapid transformations in their economic growth patterns and demographic profiles[2].

Over recent decades, studies that have investigated the incidence of obesity in childhood and adolescents have highlighted its importance on the basis of its severity in adulthood, when it contributes to increased morbidity and mortality[1,3-5]. Adolescence is particularly important because of the rapid physical and psychosocial changes that take place during this period which facilitate the development of risk factors for obesity[2,6]. It is during this phase that habits such as those that affect eating patterns and physical activity are laid down and unhealthy behaviors will make it more likely that obesity will set in or exacerbate[7].

Recent studies in Brazil have shown an elevated prevalence of overweight and obesity among adolescents[8,9], and that rates are higher in the country's Southeast administrative region, when compared with its Northeast region[10]. Gomes and Alves[11] conducted a populational cross-sectional study of students from public schools in Greater Recife, PE, and observed overweight and obesity prevalence rates of 6.9% and 3.7%, respectively.

The increase in the number of individuals with overweight and obesity is associated with to factors that are linked to lifestyle changes[12], including little physical activity[1,13,14], certain sedentary behaviors (watching TV or using computer and video games)[13-15], means of transport (passive displacement methods)[16], eating in front of the television[15], habitually unhealthy diets[1,3,8,12,14] and the habit of skipping meals[17]. Studies that have reported on the risk factors for obesity merit attention because of the condition's large number of harmful consequences, such as reduced quality of life[18], low self-esteem, which affects academic performance and relationships[10], arterial hypertension[14,16,19], elevated total cholesterol and LDL cholesterol levels and low HDL cholesterol, which increase the risk of developing atherosclerosis[14], and the metabolic syndrome[4].

Few studies have yet been conducted focusing on overweight among adolescents that could be considered representative of a specific town in Brazil's Northeast region, and especially not of the region's provincial cities. In response to the above, this study was conducted with the objective of investigating the prevalence rates of, and factors associated with, overweight and obesity among students enrolled at state-run public secondary schools in the city of Caruaru (PE).

Method

This was a cross-sectional study of students aged 15 to 20 years enrolled at state-run public secondary schools in the city of Caruaru, which is in the Brazilian state of Pernambuco. The city of Caruaru is in the Arid Area of State of Pernambuco, 134km from the state capital Recife. The city has a population of approximately 300,000 inhabitants and a tropical semi-arid climate. The city has been identified as a potential economic center, is currently developing at great speed and has a Human Development Index (HDI) of 0.713.

The sample size was calculated using SampleXS with the following parameters: population (n=8,833); 95% confidence interval; maximum error of five percentage points; design effect of 1.5; and, since several other health-risk behaviors in addition to overweight were also being investigated, prevalence was set at 50%. The resultant estimated sample size was 541 subjects. This sample size was then multiplied by 1.2 making a total of 649 subjects.

The sample was a two-stage cluster selection and both stages were randomized. The first stage sample units were schools, and all state secondary schools were eligible for the initial pool, stratified as follows: (a) school and student density for each of the city's microregions and (b) school size (small [<200 students], medium [>200 and <499 students] or large [≥500 students]). All classes in the selected schools were eligible for the second stage. Selection was by simple randomization, based on class density and number of students enrolled. *Randomizer* (www.randomizer.org) was used to generate the random numbers used for selection. According to the school census of 2007, there were an average of 41 students enrolled in each secondary school class. Sixteen classes from eight different schools were therefore chosen (59% of the total number of schools).

A questionnaire entitled "Risk-behaviors in Adolescents from Santa Catarina" (COMCAP -*Comportamentos de Risco em Adolescentes Catarinenses*) was chosen since it had already been validated with students at public schools in Brazil[20]. Additionally, a pilot study was conducted with a population in the same age group and reproducibility was shown to be moderate to high for students from Caruaru. The questionnaire is designed to survey lifestyle and comprises one section on general information (sociodemographic and economic variables) and five health-related sections (dietary habits, physical activity, risk behaviors, preventative behaviors and health perception). Data collection took place during October of 2007 and all students in the chosen classes were present on the days data were collected.

The variables collected were subdivided into the following groups: anthropometric (weight and height), sociodemographic and economic (sex, chronological age, marital status, location of residence, monthly family income, class at school, period studied [daytime or evening]) and lifestyle (physical activity, sedentary behavior, dietary intake of fruit, vegetables, sweets and sodas, stress level, smoking, alcoholism and quality of sleep).

The dependent study variables were overweight and obesity, defined according to the Body Mass Index (BMI) cutoff points proposed by the International Obesity Task Force and published by Cole *et al*[21] height (cm) and body weight (kg) were measured using a Plenna electronic balance and stadiometer, according to measurement standards published in the specialized literature[22]

Frequency, intensity and duration of physical activity were investigated in four domains (leisure, household, displacement and work). Subjects were classified as insufficiently active if they reported that they engaged in less than 60 minutes' moderate to vigorous physical activity on at least 5 days per week. Sedentary behavior was assessed on the

basis of the number of hours spent watching television per day and subjects were defined as exposed to this risk if they reported watching more than 3 hours per day. Dietary intake of fruit, greens and vegetables was defined as insufficient if a student reported eating less than 5 portions of fruit, greens and/or vegetables per day and intake of sweets and sodas was considered unhealthy if more frequent than 3 times per week.

The students described what they perceived to be the level of stress in their lives as one of four possible responses: a) rarely stressed, life is good; b) sometimes stressed, life is reasonably good; c) almost always stressed, often facing problems; d) excessively stressed, finding it difficult to cope with daily life. These responses were then categorized. Students who reported "almost always stressed" or "excessively stressed" were classed as having a negative perception of their stress levels and those who reported "rarely stressed" or "sometimes stressed", were classed as having a positive perception of their stress levels. Adolescents who reported they were currently smoking or drinking alcohol were classified as exposed, irrespective of frequency. Individuals were also asked about the frequency with which they considered that they slept well, with the following response options: always, almost always, sometimes or never. These responses were also categorized as positive perception ("always" or "almost always") or negative perception ("sometimes" or "never").

Data were tabulated using Epi-Data (version 3.1). Data were then input a second time on a different computer and the "validate" option used to check for data entry errors. Once verified, data were exported to the analysis program (SPSS, version 15.0).

The descriptive analysis employed frequency distribution for categorical variables and means with standard deviations for continuous variables. Associations between variables were tested using the chi-square test and chi-square for tendencies (for ordinal variables). Multivariate analysis was performed using binary logistic regression, taking overweight and obesity as outcomes. After the crude analysis, a hierarchical model that had been defined in advance, according to recommendations in the literature[17,23,24], was used to set the order in which independent variables were brought into the model.

The hierarchical model employed contained three levels: (a) distal, covering the sociodemographic and economic variables; (b) intermediate, with quality of sleep, stress, smoking and alcohol and (c) proximal, with intakes of fruit, greens and vegetables, sweets and sodas plus physical activity and time watching TV. The model was constructed with an analysis adjusted for each level and for the previous level. The significance level adopted for all inferential analyses was $p<0.05$.

The study was designed to conform to the ethical standards for research involving human beings contained in the Brazilian National Health Council's resolution number 196 and was approved by the Human Research Ethics Committee at the *Associação Cararuense de Ensino*. Students who agreed to take part were provided with complete information about the study and signed free and informed consent forms. The study also received approval from the Pernambuco State Department of Education and Culture, which provided the school census data.

Results

Twenty-four (24) out of the total of 624 students who were in class on the data collection days refused to take part (3.8%). The final sample comprised 600 students (62.5% female) with a mean age of 17.5±1.6 years. Sociodemographic and economic variables relating to the sample are shown in Table 1 along with details of the students' grades and study periods.

The prevalence rates of overweight and obesity were 19.0% (95%CI 15.9-22.4%) and 5.5% (95%CI 3.8-7.7%), respectively. No significant differences were detected between boys and girls classified as "overweight" and "obese". Additional information about nutritional status is illustrated in Graph 1, stratified by sex.

The bivariate analyses indicated that overweight was associated with the variables study period, perceived stress, physical activity and alcohol consumption and the proportion of overweight was greater among those who studied during the day, those who had negative perception of stress, those who were insufficiently active and those who reported drinking alcohol. A tendency towards increased prevalence of overweight among smokers was also observed (Table 2).

The variables perceived quality of sleep, physical activity, time spent watching TV and eating sweets were associated with obesity. It was observed that there was a greater proportion of obese students among those who had a negative perception of sleep quality, those who were insufficiently active, those who reported watching TV more than 3 hours per day and those who ate sweets four or more times per week (Table 2).

The independent variables perceived stress level, alcohol consumption and physical inactivity were still associated with overweight after adjustment for confounding variables. The following prevalence ratios (PR) were calculated: negative stress perception = 1.80 (95%CI 1.07-3.11); alcohol consumption = 1.91 (95%CI 1.08-2.64) and physical inactivity = 1.60 (95%CI 1.02- 2.55). In addition to these variables, time spent watching TV, which had not been associated with overweight in the crude analysis, proved to be associated in the adjusted analysis, to the extent that those who watched TV for more than 3 hours per day had a PR of 1.49 (95%CI 1.01-2.30) for overweight, when compared with those who watched up to 3 hours per day, as shown in Table 3.

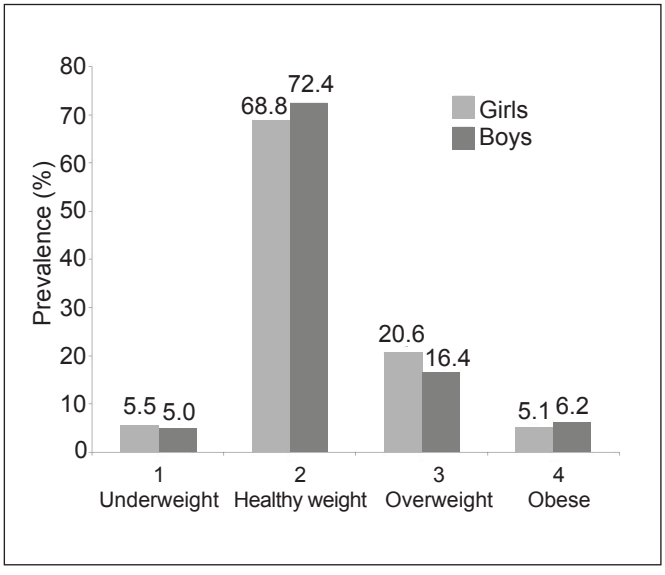
With regard to obesity, in addition to the variables which were significantly associated with the outcome in the crude analysis, location of residence and perceived stress level were also significantly associated with the outcome when adjusted for confounding variables. Intake of sweets, which in the crude analysis had a PR of 2.09 (95%CI 1.14-3.01) had almost double that PR in the adjusted analysis (PR 3.98; 95%CI 1.42-5.98) as shown in Table 4.

Table 1 - Distribution of sociodemographic and economic variables, school grade and study period (daytime or evening) of students at state-run secondary schools in Caruaru (PE)

Variables	Males		Females		All	
	n	%	n	%	n	%
Age						
15	14	6.2	43	11.5	57	9.5
16	43	19.0	84	22.5	127	21.2
17	62	27.4	85	22.7	147	24.5
18	41	18.1	76	20.3	117	19.5
19	33	14.6	41	11.0	74	12.3
20	33	14.6	45	12.0	78	13.0
Marital status						
Single	219	97.3	353	94.0	572	95.2
Married	1	0.4	12	3.3	13	2.2
Other	5	2.2	10	2.7	15	2.5
Location of residence						
Rural area	24	10.9	40	10.6	64	10.7
Urban area	201	89.1	335	89.4	536	89.3
Monthly family income (reais)						
Up to 500.00	85	37.3	142	38.2	227	37.8
501.00-1,000.00	69	30.0	135	36.5	204	34.0
1,001.00-2,000.00	46	20.5	73	19.5	119	19.9
2,001.00 or more	27	12.3	23	5.8	50	8.3
School grade						
1st grade	101	44.1	183	49.1	284	47.3
2nd grade	73	31.9	116	31.3	189	31.5
3rd grade	53	23.9	74	19.6	127	21.2
Study period						
Daytime	80	35.3	188	50.3	268	44.7
Evening	145	64.7	187	49.7	332	55.3

Discussion

The objective of this study was to investigate the prevalence rates of, and factors associated with, overweight and obesity among students enrolled at state-run public secondary schools in the city of Caruaru, PE, Brazil. One of the study's highlights was the fact that data collection went according to plan and the proportion of students sampled respected the proportion of students enrolled per class and the size of the schools, which means that the results could be scaled to the population of secondary school students enrolled at state-run public schools in Caruaru. However, a significant limitation of the study is the fact that its cross-sectional design means that causal relationships cannot be established between overweight and the



Graph 1 - Nutritional status of students at state-run secondary schools in Caruaru, PE, Brazil, according to Body Mass Index

independent variables, which means that the results should be interpreted with caution.

The study identified elevated prevalence rates of overweight and obesity (19.0 and 5.5%, respectively), which are similar to results that have been found in the United States (18.3 and 6.8%) and higher than results for the majority of European countries (Switzerland: 7.6 and 1.3%; Germany: 9.7 and 1.7%; France: 10.0 and 1.6%; Italy: 14.9 and 2.5%; Portugal: 15.0 and 3.0%; England 13.3 and 5.1% and Spain: 16.3 and 2.5%, for overweight and obesity respectively)[25]. Other similar studies conducted in Brazil have also reported lower prevalence rates of overweight and obesity than observed in this study[11,14,26,27], including a study conducted by Tassitano *et al*[24] who assessed a representative sample of adolescent secondary school students in the state

Table 2 - Associations between nutritional status and sociodemographic factors, dietary variables and physical activity for overweight students at state-run secondary schools in Caruaru, PE, Brazil

		Overweight		*p*	Obesity		*p*
		n	%		n	%	
Sex	Male	37	16.4	0.20	14	6.2	0.56
	Female	77	20.6		19	5.1	
Age	15-17	68	20.5	0.28	18	5.4	0.94
	18-20	46	17.1		15	5.6	
Marital status	Single	107	18.8	0.41	32	5.6	0.64
	Married/ other	7	25.0		1	3.6	
Location of residence	Rural area	11	15.5	0.42	2	2.8	0.10
	Urban area	103	19.5		31	5.9	
Family income (reais)	Up to 500	41	16.3	0.15	10	4.0	0.16
	501 or more	73	20.9		23	6.6	
School grade **	1st grade	47	16.9	0.38	14	5.0	0.82
	2nd grade	43	21.9		11	5.6	
	3rd grade	23	18.9		8	6.6	
Study period	Daytime	64	23.8	<0.001	14	5.2	0.77
	Evening	50	15.1		19	5.7	
Perceived stress level	Positive	70	14.8	0.02	23	4.8	0.14
	Negative	34	26.8		10	8.7	
Perceived quality of sleep	Positive	86	18.7	0.88	20	4.4	0.02
	Negative	26	19.3		13	9.3	
Smoker	No	103	13.4	0.08	31	5.3	0.90
	Yes	11	23.4		2	5.5	
Alcohol consumption	No	91	14.4	<0.001	10	3.9	0.09
	Yes	23	29.4		23	6.5	
Physical activity	Physically active	54	15.6	0.02	13	3.8	0.02
	Insufficiently active	57	23.1		20	8.1	
Time watching TV	Up to 3 hours	54	17.1	0.17	11	3.5	0.02
	More than 3 hours	58	21.6		21	7.8	
Fruit, greens and vegetables	<5 portions per week	77	19.4	0.79	21	5.3	0.91
	≥5 portions per week	37	18.5		11	5.5	
Sodas	≤3 times per week	50	16.7	0.13	12	4.0	0.24
	≥4 times week	64	21.5		20	6.7	
Sweets	≤3 times per week	37	16.2	0.16	8	3.1	0.03
	≥4 times week	77	20.8		25	8.1	

* Chi-square test for heterogeneity ** Chi-square test for tendencies

of Pernambuco and found prevalence rates of 11.5% for overweight and 2.4% for obesity. However, Terres *et al*[17] assessed adolescents from urban regions in the municipality of Pelotas, and recorded prevalence rates of overweight and obesity similar to those observed here (20.9 and 5.0%, respectively). This finding is worthy of attention since it indicates that the prevalence of overweight and obesity among adolescents in the town of Caruaru, PE, has reached the magnitudes observed in developed countries and that studies are needed to identify the determining factors of this phenomena in order that appropriate control measures can be adopted.

Table 3 - Crude logistic regression and adjusted hierarchical model for overweight against independent variables in students at state-run secondary schools in Caruaru, PE, Brazil

Level*	Variables		Crude PR	95%CI	*p*	Adjusted PR**	95%CI	*p*
1	Sex	Male	1.0			1.0		
		Female	1.32	0.85-2.04	0.20	1.31	0.85-2.03	0.21
	Age	15-17	1.0			1.0		
		18-20	0.79	0.52-1.20	0.28	0.80	0.52-1.24	0.33
	Marital status	Single	1.0			1.0		
		Married/other	1.44	0.59-3.48	0.41	1.30	0.53-3.18	0.54
	Location of residence	Rural area	1.0			1.0		
		Urban area	1.31	0.67-2.59	0.42	1.25	0.63-2.49	0.51
	Family income (reais)	Up to 500	1.0			1.0		
		501 or more	1.35	0.85-2.06	0.15	1.33	0.87-2.04	0.18
	School grade	1st grade	1.0			1.0		
		2nd grade	1.38	0.87-2.19	0.17	1.12	0.49-2.52	0.78
		3rd grade	1.14	0.65-1.98	0.63	1.32	0.54-3.24	0.54
	Study period	Daytime	1.0			1.0		
		Evening	0.57	0.37-0.86	<0.001	1.10	0.54-2.25	0.77
2	Perceived stress level	Positive	1.0			1.0		
		Negative	1.84	1.10-3.12	0.02	1.80	1.07-3.11	0.02
	Perceived quality of sleep	Positive	1.0			1.0		
		Negative	1.03	0.64-1.67	0.88	1.01	0.54-1.81	0.91
	Smoker	No	1.0			1.0		
		Yes	1.74	0.92-1.87	0.08	1.61	0.81-1.80	0.18
	Alcohol	No	1.0			1.0		
		Yes	2.04	1.19-2.75	<0.001	1.91	1.08-2.64	0.02
3	Physical activity	Physically active	1.0			1.0		
		Insufficiently active	1.62	1.07-2.45	0.02	1.60	1.02-2.55	0.04
	Time watching TV	Up to 3 hours	1.0			1.0		
		More than 3 hours	1.32	0.87-2.00	0.17	1.49	1.01-2.30	0.05
	Fruit, greens and vegetables	<5 portions/ week	1.0			1.0		
		≥5 portions/ week	0.94	0.61-1.45	0.79	0.96	0.60-1.54	0.88
	Sodas	≤3 times/ week	1.0			1.0		
		≥4 times/ week	1.36	0.90-2.06	0.13	1.43	0.94-2.89	0.10
	Sweets	≤3 times/ week	1.0			1.0		
		≥4 times/ week	1.35	0.88-2.09	0.16	0.98	0.45-2.14	0.96

*Sociodemographic and economic factors (distal level), factors related to health perception, smoking and alcohol (intermediate level) and behavioral factors (proximal level); ** All variables are controlled for the others at the same level and for variables in the previous level. 95%CI: Confidence interval of 95%; PR: prevalence ratio.

No significant differences were observed between girls and boys with respect to the prevalence rates of overweight or obesity. Silva *et al*[2], Campos *et al*[26] and Tassitano *et al*. all reported the same result[24]. However, other Brazilian studies have detected differences between the sexes, such as Silva *et al*[13] who found that the prevalence of overweight was greater among males, and Abrantes *et al*[10] who observed a higher prevalence among females.

Investigations have found that prevalence rates of overweight and obesity are greater among people who live in urban areas[13,24] and with higher socioeconomic status[17,28]. Initially, there was no significant difference between

Table 4 - Crude logistic regression and adjusted hierarchical model for obesity against independent variables in students at state-run secondary schools in Caruaru, PE, Brazil.

Level*	Variables		Crude PR	95%CI	*p*	Adjusted PR **	95%CI	*p*
1	Sex	Male	1.0			1.0		
		Female	0.81	0.39-1.65	0.56	0.83	0.41-1.70	0.62
	Age	15-17	1.0			1.0		
		18-20	1.02	0.50-2.07	0.94	0.94	0.50-2.09	0.92
	Marital status	Single	1.0			1.0		
		Married/ other	0.62	0.23-4.71	0.64	0.57	0.19-4.93	0.58
	Location of residence	Rural area	1.0			1.0		
		Urban area	2.14	0.77-7.71	0.30	2.23	1.10-6.56	0.04
	Family income (reais)	Up to 500	1.0			1.0		
		501 or more	1.71	0.79-3.69	0.16	1.69	0.80-3.65	0.17
	School grade	1st grade	1.0			1.0		
		2nd grade	1.56	0.96-2.73	0.08	1.08	0.46-2.55	0.84
		3rd grade	1.34	0.81-2.84	0.22	1.28	0.47-3.51	0.62
	Study period	Daytime	1.0			1.0		
		Evening	0.51	0.32-0.83	<0.001	1.04	0.46-2.34	0.91
2	Perceived stress level	Positive	1.0			1.0		
		Negative	1.89	0.89-4.29	0.14	1.93	1.01-5.01	0.05
	Perceived quality of sleep	Positive	1.0			1.0		
		Negative	2.24	1.10-4.64	0.02	2.20	1.06-4.61	0.03
	Smoker	No	1.0			1.0		
		Yes	0.96	0.54-1.72	0.90	0.97	0.61-1.78	0.91
	Alcohol	No	1.0			1.0		
		Yes	1.68	0.91-2.10	0.09	1.66	0.89-2.01	0.10
3	Physical activity	Physically active	1.0			1.0		
		Insufficiently active	1.62	1.07-2.45	0.02	2.97	1.32-6.75	<0.001
	Time watching TV	Up to 3 hours	1.0			1.0		
		More than 3 hours	2.34	1.10-4.94	0.02	2.74	1.25-5.91	0.01
	Fruit, greens and vegetables	<5 portions week	1.0			1.0		
		≥5 portions week	0.94	0.61-1.45	0.91	1.15	0.52-2.53	0.71
	Sodas	≤3 times per week	1.0			1.0		
		≥4 times week	1.72	0.82-3.60	0.24	1.75	0.87-4.67	0.40
	Sweets	≤3 times per week	1.0			1.0		
		≥4 times week	2.09	1.14-3.01	0.03	3.98	1.42-5.98	0.00

*Sociodemographic and economic factors (distal level), factors related to health perception, smoking and alcohol (intermediate level) and behavioral factors (proximal level); **All variables are controlled for the others at the same level and for variables in the previous level. 95%CI: Confidence internal of 95%; PR: prevalence ratio.

prevalence rates of overweight and obesity based on location of residence. However after adjustment for confounding variables, location of residence was associated with obesity. People living in urban areas had a 2.23 times greater likelihood of being obese when compared with those living in rural areas. Family income was not related to a significant difference in prevalence, which is possibly related to the fact that the sample was entirely drawn from students at public schools who were possibly from lower socioeconomic strata. Socioeconomic status can be an important determinant of obesity prevalence because it interferes with food availability and access to information and may also determine physical activity patterns[5].

This study has shown that studying in the evening was a protective factor against overweight and obesity, at least during the crude analysis, which may be explainable by the fact that many people who study at night work during the day which in turn possibly contributes to reducing sedentary behavior and increasing physical activity. After adjustment for confounding variables, the association between study period and overweight and obesity could no longer be detected.

Many different studies have been conducted with the objective of identifying possible risk factors associated with the occurrence of overweight and obesity among adolescents[14,17,24,29]. High calorie intakes and reduced levels of physical activity have been identified as the principal environmental factors responsible for increasing rates of obesity[8], Silva *et al*[13] found an association between overweight and reduced physical activity among boys. Lima *et al*[12] found that adolescents with overweight or obesity had unhealthy habitual diets with nutrient imbalances and Toral *et al*[3] found that an excessive percentage of adolescents had reduced intake of fruit and greens and intakes of fats and sweets that were above the recommended levels. Another study has also shown that reduced intake of fruit, greens and vegetables and elevated intake of sweets and also absence or very little physical activity are all associated with overweight[1].

Sedentary behavior, manifest in passive leisure activities such as watching television, playing electronic games and using the internet, was associated with overweight and obesity in a study conducted by Frutuoso *et al*[15]. However, Nunes *et al*[8] were unable to demonstrate significant differences between adolescents with and without overweight/obesity in terms of leisure-time physical activity, hours spent watching TV or dietary habits.

This study did find an association between insufficient physical activity and overweight, with prevalence ratios that indicated 1.60 and 2.97 times greater likelihood of developing overweight and obesity, respectively, when compared with the physically active. Furthermore, adolescents who reported sedentary behavior, manifest as watching TV for more than three hours per day, had 1.49 and 2.74 times greater likelihood of overweight and obesity, respectively. With relation to food intakes, no association was detected between overweight and consumption of fruit, greens, vegetables, sweets or sodas, but those who reported eating sweets with a frequency greater than or equal to 4 times per week had a 3.98 times greater likelihood of being obese than those who reported eating sweets 3 times per week or less.

Additionally, perceived stress level was associated with overweight, while perceived quality of sleep was associated with obesity. When adjusted for confounding variables, perceived stress level was also associated with obesity. A study conducted by Kunkel *et al*[18] assessed the association between overweight in adolescents and quality of life, including difficulties with sleeping and other stress-related issues, and found that the chance of overweight adolescents having poor quality of life was 3.54 times greater than for adolescents who were not overweight.

Alcohol consumption was also associated with overweight. Considering its energy content (7.1kcal/g), alcohol is capable of contributing to overweight, depending on quantity, frequency and mode of consumption[30]. However, in contrast with the results observed here, Terres *et al*[17] did not detect any association between alcohol and overweight or obesity.

In this study, elevated prevalence rates of overweight and obesity were found to be associated with modifiable risk factors, such as physical inactivity, alcohol consumption, negative perceptions of quality of sleep, more than 3 hours per day spent watching TV and eating sweets more than 3 times per week. These data underscore the need to implement dietary education programs and to encourage physical activity and healthy lifestyle habits at school, with the objective of reducing the prevalence of overweight and obesity, their maintenance throughout life and the morbid conditions associated with them.

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