Association of parents' nutritional status, and sociodemographic and dietary factors with overweight/obesity in schoolchildren 7 to 14 years old

Associação entre estado nutricional dos pais, variáveis sociodemográficas e dietéticas e o sobrepeso/obesidade em escolares de 7 a 14 anos

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Abstract

To assess the association of parents' nutritional status, and dietary and sociodemographic factors with overweight/obesity in schoolchildren in Florianópolis Island, Santa Catarina State, Brazil, this cross-sectional epidemiological study examined 2,826 schoolchildren 7 to 14 years old, classified according to body mass index curves for age and sex recommended by the International Obesity Task Force. Data were analyzed using Poisson regression. The final model showed overweight/obesity in boys associated directly with father's educational level, mother's age, and parents' nutritional status, and inversely with mother's educational level, and number of daily meals. Among girls, it associated directly with parents' nutritional status and the schoolchildren's age, and inversely with consumption of risk foods. The variables that associated with overweight/obesity differed between the sexes, except parents' nutritional status. Boys and girls with both parents overweight or obese were, respectively, 80% and 150% more likely to exhibit the same diagnosis, indicating the need for interventions that include the family environment.

Overweight; Obesity; Parent-Child Relations

Introduction

Obesity is a chronic, non-communicable disease of worldwide concern due to its rapidly increasing prevalence in both developed and developing countries [1,2]. The emergence of childhood and teenage obesity is even more worrying in that studies have shown significant likelihood of this disturbance lasting into adult life [3,4], and being responsible for increasing morbid-mortality in the population, because of its association with chronic, non-communicable diseases such as type-2 diabetes, dyslipedemias and arterial hypertension [1,2].

Wang et al. [5] studied overweight trends in children and teenagers from 6 to 18 years old, finding that in Brazil the prevalence of overweight had tripled from 4.1% to 13.9% between 1974 and 1997. According to Brazilian Household Budget Survey (POF) by the official statistics agency (Instituto Brasileiro de Geografia e Estatística – IBGE), the prevalence of overweight including obesity rose from 16.7% to 20.5% among adolescents from 10 to 19 years old in the period 2002-2003 to 2008-2009 [6].

A study by Ricardo et al. [7], in 2007, in Santa Catarina State, southern Brazil, identified 15.4% and 6% overweight and obesity, respectively. The study examined 140,878 schoolchildren 6 to 10 years old with a nutritional diagnosis classified by body mass index (BMI) for age and sex as proposed by Cole et al. [8] and recommended by the

International Obesity Task Force (IOTF). A 2002 study, also using the IOTF criteria, in Florianópolis, capital city of Santa Catarina State, found prevalence of overweight including obesity of 22.1% in children 7 to 10 years old [9].

Although the etiology of obesity is not completely clear, its genesis is known to involve many factors, comprising a complex set of biological, behavioral and environmental factors [10,11]. Lifestyle, including diet, is known to be preponderant in the increasing prevalence of childhood and teenage overweight/obesity. The number of daily meals, skipping breakfast, low intake of fruits, vegetables and grains, and high intake of sweets and fried foods have shown an association with overweight/obesity in schoolchildren [12,13,14].

Studies are indicating a significant association between overweight/obesity and sociodemographic and biological variables, such as parents' schooling [15], family income [16], the schoolchildren's sex [17] and, most importantly, obesity in the parents [10,11,18].

Sexual maturation in schoolchildren, understood as a process of individual development through a set of biological changes that lead to the whole organism to reach mature state [19], is pointed to by some authors as a factor associated with overweight/obesity in schoolchildren [20,21]. Studies indicate that in girls early sexual maturation is associated with higher prevalences of overweight/obesity, while in boys the findings are still divergent [20,21].

Aware that there is currently worldwide interest in studying overweight/obesity in schoolchildren and the related factors, and given the large number of studies currently being conducted on the subject, the authors decided to conduct a differential study, important for investigating not only sociodemographic variables and parents' nutritional status, but also the schoolchildren's dietary behavior, and also considering the schoolchildren's sexual maturation in the adjusted models. Accordingly, this article aims to examine how parents' nutritional status, sociodemographic variables (sex, school type, and schoolchildren's age, parents' age bracket and schooling, and per capita monthly income), and dietary variables (number of daily meals, skipping breakfast, consumption of health-risk and health-protective foods) associate with overweight/obesity in 7 to 14 year old schoolchildren in the municipality of Florianópolis.

Method

Study population, sample size and sampling

This cross-sectional study was conducted in 2007 in the municipality of Florianópolis, in connection with a broader research project. The city has among the highest social and health indicators in Brazil, with infant mortality at 8 per 1000 live births and a Human Development Index of 0.875, as compared with a national infant mortality rate of 19.5/1000 live births and HDI of 0.813 [22].

The study used a probabilistic sample of the population of 7 to 14 year old school children enrolled in public and private schools in the municipality. According to City Health Department (Secretaria Municipal de Saúde – SMS) figures, in 2006, the school population in this age range in the municipality comprised 53,679 pupils (25,619 from 7-10 years old and 28,060 from 11-14 years old).

The calculated sample size – considering 10% prevalence of obesity among children 7-10 years old [23] and 17% among adolescents 11-14 years old [24], with a 2 percentage point margin of error and a sample design effect of 1.3 – numbered 2,800 schoolchildren (1,100 for the 7-10 year age group and 1,700 for the 11-14 year olds). Also considering 10% random loss, the final total was 3,100 schoolchildren from 7-14 years old to be studied.

With this number of schoolchildren it would be possible, in testing the associations, to detect prevalence ratios (PRs) of 2.00 or less as statistically significant, always providing exposure prevalence was 10% or higher, for a 10% outcome prevalence, 5% alpha level, 80% power, 10% losses and 15% adjustment for confounders.

The study used a two-stage probabilistic sampling design. The first stage involved grouping the schools in the municipality of Florianópolis into four strata, by geographical area (center/mainland or beaches) and by school type (public or private). Within each stratum, schools were selected at random. Of the total of 87 schools (33 private and 54 public), approximately 20% were selected (17 schools: 11 public and 6 private). At the second stage, from each school selected, 30% of the pupils were drawn at random to attain the required sample of 3,100 schoolchildren. For the analyses, the design effect and the sampling plan were used both for estimating prevalences and for analyzing the related factors.

All schoolchildren aged from 7 to 14 years, enrolled in public and private schools in Florianópolis and residing in the municipality were considered eligible.

Data collection and analysis

The schoolchildren's anthropometric measurements were taken in 2007, according to a previously established protocol following World Health Organization (WHO) guidelines [25], which are based on recommendations by Lohman et al. [26]. Body weight was measured using Marte electronic scales, model PP 180 (Marte Balanças e Aparelhos de Precisão Ltda., São Paulo, Brazil), with capacity of 180kg and accurate to 100g, and height was measured using an Alturexata stadiometer (Alturexata Ltda., Belo Horizonte, Brazil), accurate to 1mm.

The team responsible for data collection comprised 10 previously trained examiners. Training was given at two points, in September 2006 and in March 2007, when intra-examiner and inter-examiner errors, respectively, were assessed. Theoretical and practical workshops on measurement technique were held on both occasions in order to standardize the anthropometric measurements. After the workshops, a pilot study involving anthropometric evaluations was run at two schools, one public and one private, in the municipality of Florianópolis, in order to gauge the technical measurement error, as published in a previous study [27]. Establishing the technical measurement error ensured the study's internal validity, minimizing the possibility of bias in the measurements.

The schoolchildren's nutritional diagnosis was established by way of sex- and age-matched BMI curves, as in Cole et al. [8], as recommended by the IOTF. Against this benchmark, the specific cut-off points for classifying overweight and obesity in under 18 year olds were defined on the basis of the BMI points for adults (overweight: BMI ≤ 25 to < 30kg/m^2 and obesity: ≥ 30kg/m^2). For the analyses, the schoolchildren were classified into two groups: not overweight or obese (values equivalent to BMI < 25kg/m^2 in adults) and overweight or obese (values equivalent to BMI ≥ 25kg/m^2 in adults).

Identification data on the schoolchildren (name, date of birth, grade, and type of school) were obtained from lists supplied by the schools. These data were transferred to the schoolchildren's anthropometric form, which was filled in by the data collection team. For the analyses, the schools were categorized into public and private, and the schoolchildren's ages were also categorized dichotomously into 7-10 years and 11-14 years.

The schoolchildren's dietary data (number of daily meals, skipping breakfast, and consumption of health-protective and -risk foods) were obtained using version 3 of the previous-day food questionnaire (*Questionário Alimentar do Dia Anterior* – QUADA) [28], a structured, illustrated instrument for application in school-age children. This version of the QUADA presents six meals ordered chronologically (breakfast, morning snack, lunch, afternoon snack, dinner, and evening snack), each meal illustrated with 21 foods or food groups. The foods were selected considering not only the dietary patterns of children in the age group under observation, but the foods available, the menu offered at the public schools, and a food guide for Brazil's population (*Guia Alimentar para a População Brasileira*) [29].

The questionnaire was applied in a room prepared for that purpose, where it was explained to the schoolchildren how to complete the instrument. In order to present the questionnaire to the pupils, four posters were prepared, each showing two meals, identical to those on the questionnaire supplied to the children. After distributing the questionnaires, the researchers explained all the meals and foods illustrated, and the schoolchildren were then instructed to circle on their questionnaire what they had eaten at each meal on the previous day. In this process, for each meal represented on the poster, the researcher went through all the foods shown and the possible times that the meal might take place. The schoolchildren were instructed to leave blank the part of the form relating to any meal they had not eaten.

For purposes of analysis, the number of meals daily was divided into four categories: up to 3 meals; 4 meals; 5 meals; and 6 meals daily. Skipping breakfast was categorized into: Yes (if the schoolchildren omitted this meal, and consumed no food of any kind) and No (if the schoolchildren had this meal, and consumed at least one kind of food). In analyzing consumption of health-protective and health-risk foods, foods of the group of fruits, natural juices, leaf vegetables, other vegetables, and vegetable soup. Health-risk foods were those belonging to the group of chocolate products, soft drinks and artificial juices, sweets, packaged snacks, French fries and fast-food snacks. Consumption of health-protective foods was categorized as: appropriate (≥ 5 times a day) and inappropriate (≤ 4 times a day). Consumption of health-risk foods was classified as: appropriate (up to once a day) and inappropriate (≥ 2 times a day), as recommended by the *Guia Alimentar para a População Brasileira* [29].

At the request of the participating schools, data on sexual maturation were collected from only the 11-14 year old schoolchildren. These data were obtained using the self-assessment technique [21]. After answering the dietary questionnaire, the schoolchildren were directed

individually to a separate room, where they received the worksheets with drawings of the figures corresponding to the sexual maturation stages proposed by Tanner [19], and answered a questionnaire on their age at menarche/spermarche and about the stages of sexual maturation. The worksheets contained drawings showing the growth stages of pubic hair and breasts in girls, and pubic and genital hair in boys. The five growth stages were numbered from 1 to 5, with one representing immaturity and 5, maximum maturity. For purposes of analysis, the schoolchildren's sexual maturity was classified in two ways: by age at menarche/spermarche, and by pubic hair and breast/genital development stages. The former was classified dichotomously: ≤ 11 years and ≥ 12 years. The latter was classified by pubic hair and breast/genital growth stage matching differences: matching stages (same stage for pubic hair and breast/genital development); pubic hair one or two stages ahead of breast/genital development; or pubic hair one or two stages behind breast/genital development. The two variables were used as covariables during statistical analysis for the 11 to 14 year old schoolchildren.

The self-reported data for weight, height, age, schooling and parents' monthly income – and the number of residents in the household, for subsequent calculation of per capita income – were taken from the sociodemographic and anthropometric questionnaire sent to the parents together with the declaration of free, informed consent. The parents' nutritional status was diagnosed by way of BMI, using WHO cut-offs: adults were considered underweight with BMI < 18.5kg/m^2; eutrophic with BMI ≥ 18.5 and < 25kg/m^2; overweight with BMI ≥ 25 and < 30kg/m^2; and obese with BMI ≥ 30kg/m^2 [25]. For purposes of analysis, the parents were categorized into: neither parent overweight/obese; only father overweight/obese; only mother overweight/obese; or both parents overweight/obese. Age was categorized dichotomously: 20-39 years and ≥ 40 years; schooling was divided into: 0-8 years schooling, 9-11 years schooling, and ≥ 12 years schooling; and monthly per capita income was classified by terciles (1st tercile: ≤ R$240.00; 2nd tercile: > R$240.00 and ≤ R$500.00; and 3rd tercile: > R$500.00).

All data collected were double-input into EpiData version 3.2 software (Epidata Assoc., Odense, Denmark) by previously trained data inputters. After verification of data consistency, the analyses were performed using the statistics program Stata version 11.0 (Stata Corp., College Station, USA). The analyses were corrected for design effect and study sampling plan by using the Stata *svy* command both for the overweight/obesity prevalence estimates and for the association analyses.

Bivariate and multivariate analyses were conducted for boys and girls using Poisson regression [30] based on the analytical model shown in Table 1. At level 1 were the demographic and socioeconomic variables for the parents and schoolchildren; at level 2, the parents' nutritional status and the type of school; and, at level 3, the behavioral data for the schoolchildren. The schoolchildren's sexual maturity was used as a covariable, because it associates with variables at different levels.

The analyses were stratified by sex, because the outcome prevalences differed between boys and girls. First of all, bivariate analysis was conducted to ascertain the associations between the dependent variable (prevalence of overweight/obesity) and each independent variable, to derive the prevalence ratios and respective 95% confidence intervals (95%CI). Then multivariate analysis was conducted, adjusting among the variables at each level, and for those at the next highest level. The variables were selected using the backward method, and those with p-values ≤ 0.20 were retained. The statistically significant variables ($p \leq 0.05$) were retained in the final model. The results are shown as prevalence ratios and respective 95%CI.

The research protocol was approved by the ethics committee for research with human subjects of Santa Catarina Federal University (Universidade Federal de Santa Catarina; nº. 028/2006). The schoolchildren's parents or guardians signed a declaration of free and informed consent.

Results

Data were obtained for 2863 (92.3%) of the total of 3100 schoolchildren selected for the study. Of these, 37 schoolchildren were excluded for being over 7 or under 14 years old, leaving 2826 (91.2%) schoolchildren participating, satisfying the calculated minimum sample size (2800 schoolchildren).

The overall prevalence of overweight/obesity among school children 7 to 14 years old in Florianópolis was 21.9%, that is, 25.4% (95%CI: 23.0-28.0) of boys and 18.7% (95%CI: 16.3-21.5) of girls, according to criteria recommended by the IOTF [8]. There was significant difference between the sexes ($p < 0.001$). The prevalence of overweight/obesity among fathers and mothers was 55.1% and 34.1%, respectively.

In the sample distribution, shown in Table 2, the proportions of male and female schoolchildren were similar. Forty-four percent of the

Table 1

Analytical model indicating relationship between the independent variables investigated and the outcome. Florianópolis, Santa Catarina State, Brazil, 2007.

Level	Variables	
1	Parents' age group	Schoolchildren's sexual maturity
	Parents' schooling	
	Per capita monthly income	
	Schoolchildren's age groups	
2	Parents' nutritional state	
	Public/private school	
3	Schoolchildren's dietary behavior:	
	Consumption of protective foods	
	Consumption of risk foods	
	Skipping breakfast	
	Number of meals daily	
4	Prevalence of overweight/obesity among the schoolchildren	

schoolchildren were from 7 to 10 years old and 56%, from 11 to 14 years old, and the great majority (75%) were at public schools. As regards the fathers and mothers ages, 54% of the fathers were 40 years old or older, while most of the mother's (62%) were from 20 to 39 years old. In terms of schooling, fathers and mothers displayed similar proportions of years of schooling. Regarding the parents' nutritional status, 31.7% of the schoolchildren had fathers and mothers with no overweight/obesity, 34.7% had only the father overweight/obese, 13.2% only the mother, and 20.4% had both parents overweight/obese. The dietary variables showed that 87.6% of the schoolchildren's consumption of health-protective foods was inappropriate (fewer than five times a day); 80.4% consumed health-risk foods twice or more times a day; 94.5% had breakfast; 23% ate up to 3 meals; 27.9% had 4 meals; 32%, 5 meals; and 17.1%, 6 meals daily.

The crude analyses and the analyses adjusted between the independent variables and overweight/obesity among the male schoolchildren are shown in Table 3. In the crude analysis, the prevalence of overweight/obesity was greater among boys whose mother and father were 40 years old or more, earned higher per capita income, whose parents had more schooling, and who went to private schools. The parents' nutritional status also associated with the outcome, with the hazard of overweight/obesity approximately 80% greater when both parents were overweight/obese than when neither parent was. When only the father was overweight/obese, the hazard was intermediate (PR = 1.48; 95%CI: 1.18-1.86), and when only the mother was overweight/obese, the hazard was lower (PR = 1.23; 95%CI: 0.91-1.68). Of the dietary variables, only the number of meals daily associated with the outcome, with a larger number of meals displaying a protective effect on hazard of overweight/obesity.

At the first level of the adjusted analysis, the mother's age, the father's schooling, and the mother's schooling showed an association with the outcome. At the second level, the parents' nutritional status continued to show a strong association. Of the dietary variables, at the third level of the analytical model, the number of meals daily continue to be associated with overweight/obesity in the schoolchildren (Table 4).

The crude and adjusted analyses of the independent variables and overweight/obesity in the girls are shown in Table 5. In the crude analysis, the prevalence of overweight/obesity was greater among girls 7 to 10 years old. The parents' nutritional status showed a strong association: overweight/obesity in both parents increased the hazard of overweight/obesity in the girls by almost 200% as compared with those neither of whose parents were overweight/obese. Of the di-

Table 2

Distribution of the sample investigated, by independent variables and sex. Florianópolis, Santa Catarina State, Brazil, 2007.

Variables	Total		Male		Female	
	n	%	n	%	n	%
Level 1						
Father's age group (years) *						
20-39	1,187	46.3	586	47.6	601	45.2
≥ 40	1,375	53.7	645	52.4	730	54.8
Mother's age group (years) *						
20-39	1,724	62.5	831	63.2	893	61.8
≥ 40	1,035	37.5	483	36.8	552	38.2
Father's schooling (years) *						
0-8	890	35.1	417	34.0	473	36.1
9-11	820	32.3	409	33.4	411	31.4
≥ 12	826	32.6	400	32.6	426	32.5
Mother's schooling (years) *						
0-8	962	35.2	464	35.5	498	35.0
9-11	944	34.6	457	35.0	487	34.2
≥ 12	825	30.2	386	29.5	439	30.8
Per capita monthly income (R$) *						
1st tercile (≤ 240.00)	833	34.5	401	35.0	432	34.1
2nd tercile (> 240.00 and ≤ 500.00)	893	37.0	430	37.5	463	36.5
3rd tercile (> 500.00)	689	28.5	316	27.5	373	29.4
Schoolchild's age group (years)						
7-10	1,231	43.6	602	44.4	624	42.5
11-14	1,595	56.4	755	55.6	845	57.5
Level 2						
School type						
Public	2,131	75.4	1,021	75.2	1,110	75.6
Private	695	24.6	336	24.8	359	24.4
Parents' nutritional state *						
Neither overweight/obese	741	31.7	346	30.9	395	32.5
Father overweight/obese	809	34.7	401	35.8	408	33.6
Mother overweight/obese	308	13.2	149	13.3	159	13.1
Both overweight/obese	477	20.4	225	20.0	252	20.8
Level 3						
Consumption of protective foods **						
Appropriate (≥ 5 times/day)	350	12.4	162	12.0	188	12.7
Inappropriate (< 5 times/day)	2,476	87.6	1195	88.0	1,281	87.3
Consumption of risk foods ***						
Appropriate (< 2 times/day)	554	19.6	259	19.1	296	20.1
Inappropriate (≥ 2 times/day)	2,272	80.4	1,098	80.9	1,173	79.9
Skip breakfast						
No	2,666	94.3	1,291	95.1	1,375	93.6
Yes	160	5.7	66	4.9	94	6.4
Number of meals/day						
Up to 3	650	23.0	298	22.0	352	23.9
4	790	27.9	360	26.5	430	29.3
5	904	32.0	454	33.5	450	30.7
6	482	17.1	245	18.0	237	16.1
Total	2,826	100.0	1,357	48.0	1,469	52.0

* The total does not correspond to 2,826 because of data not completed on the parents' sociodemographic and anthropometric questionnaires;

** Fruit, natural juices, leaf vegetables, other vegetables, vegetable soup;

*** Chocolate products, soft drinks, artificial juices, sweets, packaged snacks, French fries and fast-food.

Table 3

Prevalence and crude and adjusted prevalence ratios for overweight/obesity in male schoolchildren, by independent variables. Florianópolis, Santa Catarina State, Brazil, 2007.

Variables	n	Overweight/Obesity % (95%CI)	Crude PR (95%CI)	Adjusted PR (95%CI)
Level 1				
Father's age group (years) *			p = 0.011	p = 0.202
20-39	586	21.7 (18.2-25.6)	1.00	1.00
≥ 40	645	29.0 (25.3-32.9)	1.33 (1.07-1.64)	1.25 (0.88-1.78)
Mother's age group (years) *			p = 0.009	p = 0.004
20-39	831	23.2 (20.9-25.7)	1.00	1.00
≥40	483	28.8 (24.9-32.9)	1.23 (1.06-1.42)	1.40 (1.12-1.74)
Father's schooling (years) *			p = 0.005 *	p = 0.009 *
0-8	417	22.3 (19.4-25.5)	1.00	1.00
9-11	409	24.9 (20.5-30.0)	1.11 (0.87-1.41)	1.09 (0.83-1.42)
≥ 12	400	29.0 (25.7-32.5)	1.29 (1.09-1.53)	1.51 (1.17-1.95)
Mother's schooling (years) *			p = 0.414 *	p = 0.008 *
0-8	464	24.6 (22.5-26.8)	1.00	1.00
9-11	457	25.2 (19.9-31.2)	1.01 (0.81-1.26)	0.81 (0.63-1.54)
≥ 12	386	26.4 (22.0-31.4)	1.08 (0.90-1.29)	0.66 (0.51-0.87)
Per capita monthly income (R$)			p = 0.033 *	p = 0.982 *
1st tercile (≤ 240.00)	401	21.7 (18.3-25.5)	1.00	1.00
2nd tercile (> 240.00 and ≤ 500.00)	430	24.4 (20.0-29.5)	1.11 (0.88-1.41)	1.00 (0.66-1.51)
3rd tercile (> 500.00)	316	29.1 (26.1-32.4)	1.34 (1.08-1.66)	1.05 (0.55-1.98)
Schoolchild's age group (years)			p = 0.584	p = 0.247
7-10	604	26.0 (23.1-29.1)	1.00	1.00
11-14	755	24.9 (21.6-28.5)	0.96 (0.81-1.13)	1.36 (0.80-2.30)
Level 2				
School type			p = 0.010	p = 0.905
Public	1,022	24.0 (20.8-27.5)	1.00	1.00
Private	337	29.7 (27.7-31.7)	1.23 (1.06-1.44)	1.03 (0.67-1.58)
Parents' nutritional state			p < 0.001	p = 0.002
Neither overweight/obese	346	18.5 (14.9-22.7)	1.00	1.00
Father overweight/obese	401	27.4 (23.8-31.4)	1.48 (1.18-1.86)	1.53 (1.13-2.07)
Mother overweight/obese	149	22.8 (18.0-28.4)	1.23 (0.91-1.68)	1.41 (0.99-2.01)
Both overweight/obese	225	34.2 (28.6-40.3)	1.83 (1.39-2.42)	1.83 (1.27-2.65)
Level 3				
Consumption of protective foods **			p = 0.139	p = 0.562
Appropriate (≥ 5 times/day)	163	22.1 (17.0-28.1)	1.00	1.00
Inappropriate (< 5 times/day)	1,196	25.8 (23.5-28.3)	1.19 (0.94-1.51)	1.09 (0.80-1.49)
Consumption of risk foods ***			p = 0.161	p = 0.319
Appropriate (< 2 times/day)	259	29.3 (23.4-36.0)	1.00	1.00
Inappropriate (≥ 2 times/day)	1,100	24.4 (21.6-27.6)	0.83 (0.63-1.08)	0.84 (0.59-1.19)
Skipping breakfast			p = 0.923	p = 0.382
No	1,293	25.3 (23.1-27.8)	1.00	1.00
Yes	66	25.7 (16.2-38.4)	1.02 (0.67-1.54)	0.77 (0.42-1.40)
Number of meals/day			p < 0.001	p = 0.051
Up to 3	298	30.5 (26.8-34.6)	1.00	1.00
4	360	28.9 (25.0-33.1)	0.95 (0.81-1.11)	0.84 (0.66-1.06)
5	454	22.5 (19.0-26.4)	0.74 (0.62-0.87)	0.73 (0.56-0.94)
6	245	18.8 (14.8-23.6)	0.61 (0.48-0.79)	0.78 (0.58-1.07)

* Trend p-value;

** Fruit, natural juices, leaf vegetables, other vegetables, vegetable soup;

*** Chocolate products, soft drinks, artificial juices, sweets, packaged snacks, French fries and fast-food.

Table 4

Adjusted analysis * for association between overweight/obesity in schoolchildren and the variables included in the final model, among males and females. Florianópolis, Santa Catarina State, Brazil, 2007.

Variables	Adjusted PR (95%CI)	p-value
Male **		
Father's age group (years)		p = 0.202
20-39	1.00	
≥ 40	1.25 (0.88-1.78)	
Mother's age group (years)		p = 0.004
20-39	1.00	
≥ 40	1.40 (1.12-1.74)	
Father's schooling (years)		p = 0.009
0-8	1.00	
9-11	1.09 (0.83-1.42)	
≥ 12	1.51 (1.17-1.95)	
Mother's schooling (years)		p = 0.008
0-8	1.00	
9-11	0.81 (0.63-1.54)	
≥ 12	0.66 (0.51-0.87)	
Parents' nutritional state		p = 0.002
Neither overweight/obese	1.00	
Father overweight/obese	1.53 (1.13-2.07)	
Mother overweight/obese	1.41 (0.99-2.01)	
Both overweight/obese	1.83 (1.27-2.65)	
Number of meals/day		p = 0.051
Up to 3	1.00	
4	0.84 (0.66-1.06)	
5	0.73 (0.56-0.94)	
6	0.78 (0.58-1.07)	
Female ***		
Schoolchild's age group (years)		p < 0.001
7-10	1.00	
11-14	0.37 (0.28-0.48)	
Parents' nutritional state		p < 0.001
Neither overweight/obese	1.00	
Father overweight/obese	1.18 (0.78-1.78)	
Mother overweight/obese	1.78 (1.29-2.47)	
Both overweight/obese	2.53 (1.82-3.51)	
Protective foods/day **		p = 0.185
Appropriate (≥ 5 times)	1.00	
Inappropriate (< 5 times)	0.81 (0.59-1.11)	
Risk foods/day		p = 0.029
Appropriate (< 2 times)	1.00	
Inappropriate (≥ 2 times)	0.67 (0.46-0.96)	

* The variables at each level were adjusted for each other and for those at the next highest level with p ≤ 0.20;
** At the first level the variables were adjusted for sexual maturity, father's and mother's age groups and father's and mother's schooling; at the second level, for parents' nutritional state and; at the third level, for number of meals daily;
*** At the first level the variables were adjusted for sexual maturity and schoolchild's age group; at the second level, for parents' nutritional state; and, at the third level, for consumption of protective and risk foods.

Table 5

Prevalence and crude and adjusted prevalence ratios for overweight/obesity in female schoolchildren, by independent variables. Florianópolis, Santa Catarina State, Brazil, 2007.

Variables	n	Overweight/Obesity % (95%CI)	Crude PR (95%CI)	Adjusted PR (95%CI)
Level 1				
Father's age group (years)			p = 0.436	p = 0.595
20-39	601	20.1 (17.1-23.5)	1.00	1.00
≥ 40	730	18.5 (15.4-22.0)	0.93 (0.77-1.13)	1.05 (0.86-1.29)
Mother's age group (years)			p = 0.596	p = 0.833
20-39	893	19.3 (16.3-22.6)	1.00	1.00
≥ 40	552	17.9 (14.7-21.6)	0.95 (0.77-1.17)	1.03 (0.76-1.40)
Father's schooling (years)			p = 0.059 *	p = 0.326
0-8	473	21.6 (17.7-26.0)	1.00	1.00
9-11	411	20.9 (17.5-24.8)	0.98 (0.79-1.22)	1.06 (0.86-1.29)
≥ 12	426	15.7 (11.9-20.5)	0.74 (0.54-1.01)	0.82 (0.59-1.14)
Mother's schooling (years)			p = 0.109	p = 0.454
0-8	498	19.5 (16.1-23.3)	1.00	1.00
9-11	487	21.1 (18.5-24.1)	1.10 (0.90-1.35)	1.06 (0.76-1.48)
≥ 12	439	15.3 (11.2-20.4)	0.78 (0.58-1.05)	0.80 (0.44-1.44)
Per capita monthly income (R$)			p = 0.604	p = 0.657
1st tercile (≤ 240.00)	432	21.8 (16.6-27.9)	1.00	1.00
2nd tercile (> 240.00 and ≤ 500.00)	463	16.6 (14.1-19.5)	0.76 (0.59-1.04)	0.85 (0.60-1.22)
3rd tercile (> 500.00)	373	19.8 (14.9-25.9)	0.91 (0.62-1.35)	1.12 (0.74-1.68)
Schoolchild's age group (years)			p = 0.010	p < 0.001
7-10	627	22.8 (19.9-25.9)	1.00	1.00
11-14	840	15.7 (12.0-20.2)	0.70 (0.53-0.92)	0.37 (0.28-0.48)
Level 2				
School type			p = 0.132	p = 0.919
Public	1,109	19.8 (17.0-23.0)	1.00	1.00
Private	358	15.3 (11.4-20.4)	0.78 (0.57-1.08)	0.98 (0.72-1.34)
Parents' nutritional state			p < 0.001 *	p < 0.001 *
Neither overweight/obese	395	11.9 (8.7-16.0)	1.00	1.00
Father overweight/obese	408	15.4 (12.0-19.6)	1.29 (0.89-1.89)	1.18 (0.78-1.78)
Mother overweight/obese	159	23.9 (17.5-31.7)	2.01 (1.45-2.79)	1.78 (1.29-2.47)
Both overweight/obese	252	34.9 (30.1-40.1)	2.96 (2.16-4.05)	2.53 (1.82-3.51)
Level 3				
Protective foods/day **			p = 0.505	p = 0.185
Appropriate (≥ 5 times)	187	20.3 (15.0-26.9)	1.00	1.00
Inappropriate (< 5 times)	1,280	18.5 (15.7-21.6)	0.90 (0.64-1.25)	0.81 (0.59-1.11)
Risk foods/day ***			p = 0.001	p = 0.029
Appropriate (< 2 times)	295	26.4 (22.1-31.3)	1.00	1.00
Inappropriate (≥ 2 times)	1,172	16.8 (13.9-20.1)	0.64 (0.50-0.83)	0.67 (0.46-0.96)
Skipping breakfast			p = 0.139	p = 0.352
No	1,373	18.2 (15.4-21.4)	1.00	1.00
Yes	94	26.6 (17.6-38.1)	1.45 (0.88-2.39)	1.28 (0.75-2.18)
Number of meals/day			p = 0.015	p = 0.894
Up to 3	352	21.9 (18.1-26.1)	1.00	1.00
4	430	20.3 (16.7-24.3)	0.92 (0.72-1.18)	1.19 (0.85-1.67)
5	450	17.1 (13.7-21.1)	0.78 (0.59-1.04)	1.02 (0.67-1.55)
6	237	15.2 (11.2-20.3)	0.69 (0.49-0.98)	1.10 (0.76-1.59)

* Trend p-value;

** Fruit, natural juices, leaf vegetables, other vegetables, vegetable soup;

*** Chocolate products, soft drinks, artificial juices, sweets, packaged snacks, French fries and fast-food.

etary variables, consumption of health-risk foods and the number of meals daily showed a protective effect on the outcome.

In the unadjusted analyses for the girls, at the first level, only the schoolgirls' age continued associated with the outcome. At the second level, the parents' nutritional status was strongly associated with the outcome and, at the third level of analysis, only consumption of health-risk foods continued to display the protective effect after adjustment (Table 4).

Discussion

The study indicated a prevalence of overweight/obesity of 21.9% in schoolchildren 7-14 years old in the city of Florianópolis, in 2007, according to IOTF criteria [8]. This finding reveals a high prevalence, corroborating studies of schoolchildren in various regions of Brazil [31,32]. Comparing these findings with international studies using the same diagnostic criteria, the prevalence observed is lower than in schoolchildren in Canada [2] and the United States [5], but higher than in Spanish schoolchildren [2].

Analyzing by sex, the outcome was more prevalent among boys than among girls, and the difference statistically significant, as in a study of adolescents 11-17 years old (n = 1,179) in Presidente Prudente, São Paulo State [33]. However, a study of schoolchildren of both sexes 7-14 years old (n = 1,257) in the Cotinguiba micro-region, in Sergipe State [34], showed a higher prevalence among girls. There are also studies showing no significant differences between the sexes [7,10,31].

A higher prevalence of overweight/obesity among the fathers than the mothers can be explained by the fact that most of the men were 40 years old or more, while most of the women were from 20 to 39 years old, and the trend is for the prevalence of overweight/obesity to increase with advancing age. Results of Brazil's 2008-2009 POF corroborate this higher prevalence of overweight/obesity among men than women in Brazil, as well as increasing prevalence with advancing age, in both sexes [6].

Various different variables showed an association with overweight/obesity in the schoolchildren, supporting studies that have investigated and identified its multifactorial origin [10,11,35]. In addition, the results differed between boys and girls, indicating sex-specific features.

By age group, the female schoolchildren showed an inverse association with overweight/obesity, as also found in studies of schoolchildren from 10 to 14 years old (n = 1,405) of both sexes in the city of Recife, Pernambuco State [36], and of schoolchildren 6 to 11 years old of both sexes (n = 20,084) in Pelotas, Rio Grande do Sul State [17]. In this present study, however, among the male schoolchildren, age group showed no association with overweight/obesity.

In addition, the adjusted analyses showed that, among the boys, there was an inverse association between mother's schooling and overweight/obesity in the schoolchildren, as in the findings by Giugliano & Carneiro [10]. The father's schooling, meanwhile, was directly associated with overweight/obesity in the boys, corroborating Bharati et al. [15]. In the girls, no associations were observed between overweight/obesity and parents' schooling.

Monthly per capita income showed no association with the outcome in this study after adjustment, although inverse associations have previously been found between family income and overweight/obesity in children and adolescents [37].

Of the dietary variables, the only association found in the girls was the protective effect of consumption of health-risk foods on overweight/obesity. This finding is similar to that of Hanley et al. [38] among 242 Canadian schoolchildren from 10 to 19 years old, although it disagrees with most studies of the association between the quality of food consumed and overweight/obesity in schoolchildren [12,39,40]. That consumption of health-risk foods displays a protective effect on overweight/obesity can be explained by the cross-sectional study design, which is prone to reverse causality, which prevents a clear cause-and-effect relationship being established between the variable analyzed and overweight/obesity in the schoolchildren. Another aspect to be considered is the use of the QUADA, which although developed for the age range under study, examines only one day's food intake, in addition to not allowing the exact quantities of food consumed to be measured. On the other hand, the instrument does make it possible to identify the nutritional quality of the foods consumed by the schoolchildren, and whether or not those considered a health risk are consumed more than once a day, which can then inform suggestions for changes and improvements in eating habits.

Among the boys, the number of meals daily showed a protective effect on overweight/obesity, corroborating Dutra et al. [13], who studied 810 schoolchildren 10 to 19 years old. Although the present study found no association between skipping breakfast and overweight/obesity in the schoolchildren, some studies have shown such an association [12,13]. One explanation offered by Nicklas et al. [12] is that the habit of eating breakfast tends to reduce dietary fat intake

by favoring greater intake of grains, fruits and dairy products in the meal. In this way it reduces consumption of fast-food snacks, which are generally high energy value and rich in fats, sugars and salt. A study of adolescents in South Korea showed obesity among the girls who ate meals most irregularly, and who consequently ate more fast-food snacks [40]. In this respect, skipping meals, including breakfast, favors unhealthy and inappropriate choices at later meals at irregular hours, while more meals per day at regular times is regarded as contributing to control of body weight.

The variable most strongly associated with overweight/obesity in schoolchildren, both boys and girls, was their parents' nutritional status. The hazard proved highest for boys both of whose parents were overweight/obese, followed by boys whose father alone was overweight/obese. Among the girls, has it was high for those both of whose parents were overweight/obese and, unlike the boys, this was followed by the girls whose mother alone was overweight/obese. Schoolchildren both of whose parents were overweight/obese displayed more than 100% higher hazard than the children of parents without overweight/obesity. Other Brazilian studies showing the association between fathers' and mothers' nutritional status and those of their sons and daughters can be found in the literature, such as Guimarães et al. [11], of schoolchildren of both sexes from 6 to 11 years old in Cuiabá; Giugliano & Carneiro [10], of school children 6 to 10 years old in Brasília; and Suñé et al. [18] of schoolchildren from 11 to 13 years old in Capão da Canoa.

In this present study, the fathers' nutritional status was observed to associate more with the sons' nutritional status, while the mothers' associated more with the daughters'. This finding was noted previously by Kosti et al. [41] and, of the studies that have investigated this association, another found a relationship only between the girls' nutritional status and their mothers', but not with their fathers' [42]. These findings may relate to the fact that parents serve as an example to their children, influencing the formation of their living habits, including dietary habits, which signals the importance of the parents' participating in activities to promote health and prevent overweight/obesity in schoolchildren.

As regards the limitations and potential of this present study, it is important to stress that, although there is no established definition of quality for anthropometric measurements self-reported by the parents, such measurements proved satisfactorily reliable in a previous study in Brazil [43]. In addition, the methodological rigor of the research endowed the findings with a high degree of reliability, given that the team of examiners was trained previously [27]. The study's limitations include its use of a QUADA to analyze food intake, because a validation study of this instrument, although finding sensitivity values in excess of 60% for most of the food groups considered (9/12), found low sensitivity as regards confectionary (43.4%) and soft drinks (36%) [28] consumed the previous day. Accordingly, it is suggested that future studies of the association between schoolchildren's dietary habits and nutritional status use a different methodology to analyze consumption, one that considers not only what the schoolchildren report, but also the information supplied by their parents about what foods their children eat.

Because the study was of the cross-sectional type it is subject to limitations relating to reverse causality, particularly as it addresses behavioral variables. It is suggested that studies with longitudinal design be used to investigate the relationship among the possible factors associated with overweight/obesity in schoolchildren in greater depth, so as to inform the development of strategies that can prevent the advance of this epidemic.

Resumo

O objetivo deste estudo foi analisar a associação entre estado nutricional dos pais, variáveis sociodemográficas, dietéticas e o sobrepeso/obesidade em escolares de 7-14 anos de Florianópolis, Santa Catarina, Brasil. Estudo transversal com 2.826 escolares, classificados com base nas curvas de índice de massa corporal para idade e sexo segundo a International Obesity Task Force. Para as análises utilizou-se a Regressão de Poisson. No modelo final, mostraram associação direta ao sobrepeso/obesidade em meninos: escolaridade do pai, idade da mãe e estado nutricional dos pais; e inversa: escolaridade da mãe e número de refeições diárias. Entre as meninas houve associação direta com estado nutricional dos pais, e inversa com idade do escolar e consumo de alimentos de risco. As variáveis associadas ao sobrepeso/obesidade diferiram entre os sexos, com exceção do estado nutricional dos pais. Filhos e filhas de ambos os pais com sobrepeso/obesidade têm risco cerca de, respectivamente, 80% e 150% maior de apresentar o mesmo diagnóstico, indicando a necessidade de intervenções também no ambiente familiar.

Sobrepeso; Obesidade; Relações Pai-Filho

Contributors

C. O. Bernardo was responsible for data collection, analysis and interpretation, drafting the article, and approving the final version for publication. F. A. G. Vasconcelos was responsible for formulating and coordinating the project, for substantial critical review of the intellectual content, and final approval of the version for publication.

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