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Original

Risk factors for overweight and obesity in adolescents of a Brazilian university: a case-control study

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Abstract

Objective: **To analyze the risk factors associated to overweight and obesity in freshmen of a public university in the Center-West region of Brazil.**

Methods: **A case-control study comprising 1,465 adolescents, identifying 106 cases (Body Mass Index (BMI) > = 85th percentile of National Center for Health Statistics -NCHS) and 233 controls (BMI > 5th and < 85th percentile of NCHS). Interviews were made to collect information on socioeconomic data, eating habits, physical activity and health habits. Information on parents' height and weight were obtained over the telephone.**

Results: **Non-conditional multivariate and hierarchical logistic regression showed that overweight and obesity were positively associated to males (odds ratio (OR) 2.25, 95% confidence interval (CI) 1.37-3.69), mother's BMI (OR 3.45, 95% CI 2.16-5.8), overweight in childhood (OR 2.81, 95% CI 1.62-4.85), consumption of fruits less than once a day (OR 1.84, 95% CI 1.05-3.21) and the habit of weight-loss dieting (OR 6.33, 95% CI 2.68-14.94).**

Conclusion: **Results emphasize the need for educational interventions at early ages involving the whole family to control the excess of weight.**

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Key words: *Adolescent. Case-control study. Chronic disease. Developing countries. Obesity. Overweight. Risk factors. Universities. Weight loss.*

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FACTORES DE RIESGO PARA EL SOBREPESO Y LA OBESIDAD EN ADOLESCENTES DE UNA UNIVERSIDAD DE BRASIL: UN ESTUDIO DE CASOS-CONTROL

Resumen

Objetivo: **Analizar los factores de riesgo asociados con el sobrepeso y la obesidad en estudiantes de primer curso de una universidad pública en la zona centro-oeste de Brasil.**

Métodos: **Estudio de casos-control en 1465 adolescentes, identificando 106 casos (IMC = índice de masa corporal > percentil 85 del Centro Nacional de Estadística Sanitaria (NCHS)) y 233 controles (IMC > percentil 5, < percentil 85 de NCHS). Se realizaron entrevistas para recopilar datos sobre condiciones socio-económicas, hábitos alimentarios, actividad física y hábitos saludables. Se obtuvieron por vía telefónica los datos sobre el peso y la talla de los padres.**

Resultados: **El análisis de regresión logística multivariable y jerárquica, no condicional, mostró que el sobrepeso y la obesidad se asociaban de forma positiva al sexo masculino (odds ratio (OR) 2,25, con un intervalo de confianza (IC) del 95% de 1,37-3,69), al IMC materno (OR 3,45, con IC 95% de 2,16-5,8), al sobrepeso en la infancia (OR 2,81, IC 95% de 1,62-4,85), consumo de frutas inferior a una vez al día (OR 1,84, IC 95% de 1,05-3,21) y el hábito de dietas de adelgazamiento (OR 6,33, IC 95% de 2,68-14,94).**

Conclusión: Los resultados refuerzan la necesidad de intervenciones educativas en edades tempranas, implicando a toda la familia, para controlar el exceso de peso.

Palabras clave: **adolescente, estudio casos-control, enfermedad crónica, países desarrollados, obesidad, sobrepeso, factores de riesgo, universidades, pérdida de peso.**

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Palabras clave: *Adolescente. Estudio casos-control. Enfermedad crónica. Países desarrollados. Obesidad. Sobrepeso. Factores de riesgo. Universidades. Pérdida de peso.*

Introduction

Obesity is defined as abnormal or excessive fat within adipose tissue with adverse consequences for health, jeopardizing the quality of life and increasing the risk for precocious diseases, incapacity and death.[1]

The increase of the prevalence of obesity in children and adolescents is a reality in all developed or developing countries. Worldwide 10% of children and adolescents ranging from 5 to 17 years of age are overweight with obesity prevalence varying between 2 and 3%. The global averages reflect prevalences that vary from 10% in Africa and Asia to over than 20% in the USA and Europe. The occurrence of obesity is increasingly insidious and has been rated at 0.5% over the last years in Brazil and the USA, and approximately 1% in Canada, Australia and UK.[2] Brazilian population studies performed between the 70's and 90's showed that the prevalence for overweight tripled, varying from 4.1 to 13.9% among children and adolescents ranging from 6 to 18 years of age according to IOTF criteria.[3]

Obesity is an important risk factor for other non-transmissible chronic diseases, representing an overload for the health services of upcoming generations. The combination of direct and indirect costs of obesity is estimated at US 117 billion, based on its prevalence and proportion of attributable diseases.[4]

Until recently, obesity was viewed as deriving from the intake of calories in relation to consumption. Nowadays, however, it has been demonstrated that genetic, environmental and psychological factors participate in this equation. Some individuals are more, and others are less efficient in storing, spending and mobilizing the fat reserve.[4-5] The risk factors may vary within and among population groups exposed to different environmental influences.[6]

This is a public health issue that characterizes the modern times and must be efficiently, addressed due to its magnitude and relevance. It is of utter importance to gauge the prevailing risks in each population group so that proper strategies can be drawn and deployed to prevent and treat obesity. This study aims at analyzing the risk factors associated to overweight and obesity in students in their freshmen year of a Public University in the Center-West region of Brazil.

Methodology

The present study was descriptive and analytic, based on the comparison between case/control groups at the Federal University of Goiás (UFG), campus of Goiânia, Center-West Region of Brazil. For the selection of cases between March and June 2004, a cross-sectional study was performed with all 1,538 freshmen students of UFG who had not completed 20 years of age by the date of their enrollment (February 20-21, 2004) considering they were not pregnant; were not under maternity-license, and were not physically malformed or suffered from any infirmity that might not enable the collection of anthropometric data.

During this period, UFG Nutrition students duly trained to guarantee the necessary standardization of data collection weighed and measured 1,465 adolescents (95.2% of the studied population). At that stage of the study 6 students were excluded (2 were pregnant, 2 under maternity-license and 2 injured) and 67 did not participate (37 dropped out, 15 declined to participate and 15 were not found in classrooms after 5 visits in different hours).

Portable electronic scales, accurate to within 0.1 kg were used for weighing purposes. Adolescents were weighed wearing light clothes and shoeless. Height was measured by means of a portable 0.1 cm precision anthropometer; adolescents were shoeless and with their heads placed at Frankfurt plan. Two measurements of height and weight for each student were registered, and additionally a third one for those cases where the difference between the two previous measurements was greater than 0.5 cm or 0.1 kg. In the final analyses the average of the two closest measurements were considered. The data collection was performed during the class hours according to a previous schedule agreed to by the teacher responsible for each group.[7]

Based on height and weight measurements, the Body Mass Index (BMI) for each student was calculated (defined as weight in kg divided by square height in m).[8]

The case-control study was performed between September and December 2004. The considered cases considered were those of 121 adolescents presenting a BMI $\geq$ 85 percentile of the reference pattern adopted in the cross-sectional study.[8]

For each case, two controls were randomly selected among adolescents with BMI between percentiles 5 and 85[8]. For possible losses and refusals, 17 extra controls were selected (5% of the whole) totalizing 380 individuals. The sample size allowed for the detection of a 2.2 odds ratio (OR) given a prevalence of 60% among the nonexposed, with 80% of power and 5% significance. Such calculation considered an exposition period of $\geq$ 2 hours/day watching TV, playing videogames or using the computer.

A standardized and pre-coded questionnaire was used, concerning the variables on gender; age; schooling; number of siblings; parents' education level and civil status; sedentarism; (distribution of day time into hours of sleep, hours spent with TV programs, videogames or computer); eating habits (number of meals, frequency of consumption of different types of food, frequency of breakfasting, the habit of eating while watching TV, and consumption of fast food, deep fries, and visible fat in meat); consumption of liquor and smoking. Also investigated was the perception the adolescent had on his own weight ten years previously and the practice of weight-loss dieting in the previous month. The socioeconomic level was evaluated and categorized into five decreasing classes identified by letters from A to E, following stratification the Brazilian Economic

Condition Criteria,[9] which is based upon the information on the availability of domestic appliances and the education of the head of family. The physical activity performed by the adolescent was evaluated using the standard questionnaire "International Physical Activity Questionnaire/IPAQ", in its short version.[10]

The food consumption was evaluated using the standard foods frequency questionnaire for adolescents.[11] The foods were classified in seven consumption categories: (f_1) never; (f_2) less than once a month; (f_3) one to three times per month; (f_4) once a week; (f_5) two to four times a week; (f_6) once per day and (f_7) more than twice per day. The frequency of consumption of each food was treated as a quantitative variable; a value was given to each frequency as described by Fornés et al.[12] Those values were 0; 0.033; 0.067; 0.143; 0.286; 1.0 and 2.0, respectively for f_1 through f_7.

Foods were distributed into eight groups:[13] 1. bread and cereals; 2. greens and vegetables; 3. fruits; 4. milk, cheeses, yogurt; 5. meat and eggs; 6. beans; 7. oil and fat; 8. sugar and sweets.

The interview, previously set by telephone with each adolescent, was made by duly trained nutritionists and lasted approximately 40 minutes; 10 adolescents dropped out of college, and for this reason, were interviewed at home.

Information on weight and height of both mother and father, as well as information on the adolescent (birth weight, and duration of maternal breastfeeding) were collected over the telephone with the adolescent's parents, whose nutritional status was classified according to their BMI.

The study coordinator reviewed the questionnaires identifying possible code errors, losses and refusals, and inconsistent answers. Data were processed using the computer program Epi info 6.0, double entered and automatically checked for consistency and fullness.

Analyses were processed with SPSS for Windows 13.0 and Stata 7.0 computer programs. The univariate analysis allowed for the calculation of proportions for each category variable. Bivariate analyses showed the prevalence of exposure factors between cases and controls and enabled the application of association tests (chi-square and odds ratio) accepting alpha error of 5%. A multivariate analysis was made using non-conditional logistic regression, built on hierarchical model of determination[14] that defined the entry order of variables. For confounding control purposes the variables that were associated to the outcome with a p value < 0.20 were kept in the multivariate analysis.[15]

The study was approved by the Ethics Committee of Unifesp-Universidade Federal de São Paulo.

Results

At the end of the data collection, 339 adolescents were interviewed (106 cases and 233 controls). Losses and refusals were 10.8%. The refusal to participate in study accounted for 7.37% of losses (11 cases and 17 controls); four cases and six controls (2.63%) dropped out of the course; three losses in control group were due to accident (0.26%); pregnancy accounted for 0.26% and siblings in sample group for 0.26% as well.

The great majority of adolescents (73.45%) were aged between 16 and 18 years (mean and median = 18.0) and belonged to the highest socioeconomic levels (68.4%). Among cases 82 (77.36%) were overweight and 24 (22.64%) were obese (BMI > = 95).

Table I presents the distribution of risk factors for cases and controls, crude ORs, respective CIs and statistical significance tests for category variables.

The case and control groups presented similar behavior in relation to the socioeconomic aspects, family composition (number of siblings, school level, civil status and father's BMI); birth weight and maternal breastfeeding; some types of ingested foods (fast food, deep fried foods, fat in meat, bread and cereals, milk and derivates, greens and vegetables, protein rich foods) liquor drinking and smoking.

In a crude analysis, being a male was characterized as a risk factor for overweight and obesity (OR 2.27) and a child of a mother with a BMI > = 25 kgm^2 runs 3 times greater risk (OR 3.56) when compared to a youngster of lean mother. The adolescent's awareness of excess of weight 10 years preciously was also a risk factor in the crude analysis (OR 2.96).

There was no difference between cases and controls regarding physical activity. However, watching TV, using the computer and playing videogames for over 120 minutes increased the chances for overweight or obesity twofold.

When analyzing the effects of eating habits, we noticed that less than three meals per day (OR 2.86), no daily breakfast (OR 2.31) and no regular consumption of fruits (OR 2.05) were statistically associated to obesity and overweight. Also, as observed in other field studies, controls reported a higher consumption of sugar, sweets, oils and fat. Moreover, overweight and obesity revealed to be related to weight loss dieting in the month preceding the interview (OR 4.72).

Table II depicts the results of the multivariate analysis performed through non-conditional logistic regression according to the hierarchical model adopted in this investigation.

Eating habits included the number of meals per day and the frequency of breakfasting as two variables, which duplicated their weight in the multivariate analysis. In view of colinearity ($r = 0.4$ with $p < 0.01$), we opted to include the variable frequency of breakfasting only as it presented stronger association with the outcome.

The variables gender and mother's BMI remained statistically significant in all stages of the multivariate analysis as did overweight in childhood when adjusted to the previous level.

By the time the variables related to life style controlled by the preceding variables were analyzed, it was

Table I

Odds ratio (OR) and respective 95% confidence interval (CI) for characteristics related to obesity in college students aged 16 to 19 years

Variables	*Cases*		*Controls*		*Crude OR (IC 95%)*	*p-value*
	n	*%*	*n*	*%*		
Socioeconomic and demographic						
Gender						
Male	66	62.26	98	42.06	2.27 (1.38-3.74)	**< 0.0006**
Age						
16-18	74	69.81	175	75.11	0.77 (0.45-1.32)	0.306
Socioeconomic level*						
C, D, E	37	34.91	70	30.04	1.25 (0.74-2.09)	0.372
Mother's education level						
< = 8 anos	19	17.92	31	13.30	0.70 (0.36-1.37)	0.266
Father's education level[a]						
< = 8 anos	20	19.42	45	19.31	0.99 (0.53-1.86)	0.982
Parents' civil status						
Divorced, deceased	27	25.57	49	21.03	1.28 (0.72-2.27)	0.363
Nr of siblings						
None	9	8.49	13	5.58	1.57 (0.60-4.09)	0.313
Parents' history						
Father's BMI[b]						
> = 25.00	67	68.37	146	66.06	1.11 (0.65-1.91)	0.687
Mother's BMI[c]						
> = 25.00	65	62.50	73	31.88	3.56 (2.13-5.96)	**< 0.0001**
Adolescent's history						
Birth weight[d]						
> = 4,000 g	18	18.00	33	15.14	1.23 (0.62-2.4)	0.518
Maternal breastfeeding						
< 6 months	43	40.57	90	38.63	1.08 (0.66-1.78)	0.735
Excess of weight ten years ago[e]						
Yes	45	44.12	49	21.03	2.96 (1.74-5 .05)	**< 0.0001**
Physical activity pattern						
Physical activity						
Sedentary	49	46.23	113	48.50	0.91 (0.56-1.48)	0.698
Minutes on Tv + minutes on video						
> = 120 min/day	81	76.42	143	61.37	2.04 (1.18-3.55)	**0.0067**
Hours of sleep						
> 8 hours	36	33.96	81	34.76	0.97 (0.58-1.61)	0.886
Eating habits						
Number of meals						
0 a 2	54	50.94	62	26.61	2.86 (1.73-4.76)	**< 0.0001**
Frequency of breakfasting						
Others	58	54.72	80	34.33	2.31 (1.41-3.79)	**< 0.0004**
Eat watching TV						
More than once a day	62	58.49	136	58.37	1.01 (0.61-1.65)	0.98
Consumption of fast food						
> = 3 times/week	24	22.64	58	24.89	0.88 (0.49-1.57)	0.654
Consumption of fried foods						
> = 3 times/week	41	38.68	90	38.63	1.0 (0.67-1.65)	0.993
Consumption of chicken with skin						
Yes	34	32.08	69	29.61	1.12 (0.66-1.90)	0.648
Consumption of apparent fat meat						
Yes	33	31.13	68	29.18	1.10 (0.65-1.86)	0.716
Consumption breads/cereals[f]						
> Once a day	103	98.10	231	99.57	0.2 (0.01-3.17)	0.230
Consumption greens/ vegetables[f]						
< Once a day	31	29.52	63	27.16	0.89 (0.52-1.53)	0.653
Consumption of fruits[f]						
< Once a day	63	60.00	98	42.24	2.05 (1.25-3.37)	**0.0025**
Milk and derivates[f]						
> Once a day	47	44.76	117	50.43	0.80 (0.49-1.30)	0.335
Consumption of oils/fats[f]						
> Once a day	36	34.29	103	44.40	0.65 (0.39-1.08)	**0.0808**
Sugars and sweets[g]						
> Once a day	81	77.88	208	89.66	0.41 (0.21-0.80)	**0.004**
Consumption of meat and eggs[g]						
> Once a day	70	67.31	149	64.22	1.15 (0.68-1.93)	0.58
Consumption of beans[g]						
< Once a day	31	29.81	63	27.16	1.14 (0.66-1.96)	0.616
Health habits						
Smoking						
Yes	10	9.43	16	6.87	1.41 (0.57-3.44)	0.41
Drinking of liquor						
Yes	49	46.23	106	45.49	1.03 (0.63-1.68)	0.90
Weight loss dieting on previous month						
Yes	26	24.53	15	6.44	4.72 (2.27-9.92)	**0.0001**

* Criteria of Economic Classification Brasil[8]. BMI: Body Mass Index. [a] Total of 336: father's education level not informed by 3 adolescents. [b]Total of 319: 15 fathers deceased, 4 adolescents had no recent contact with fathers, 1 not informed. [c]Total de 333: 4 mothers deceased, 1 adolescent had no recent contact with mother, 1 not informed. [d]Total of 318: 18 born with weight < 2,500 g e 3 not informed. [e]Total of 335: 4 did not remember whether had excess of weight 10 years ago. [f]Total of 337: 2 not informed. [g]Total of 336: 3 not informed.

Table II
Hierarchical non-conditional logistic regression of risk factors for obesity in universities adolescents aged 16 to 19 years

Variables	*Adjusted OR* (IC 95%)	*P-value*	*Model*[a]
Demographic variable			
Male	2.25 (1.37-3.69)	**< 0.001**	1
Parents' history			
Mother's BMI (> = 25.00)	3.54 (2.16-5.8)	**< 0.0001**	1
Adolescent's history			
Perception of overweight 10 yrs previously	2.81 (1.62-4.85)	**< 0.0001**	2
Life style			
Weight loss diet on previous month	6.33 (2.68-14.94)	**< 0.0001**	3
Frequency of breakfasting (not daily)	1.53(0.84-2.77)	0.16	3
Consumption of fruits (less than once a day)	1.84 (1.05-3.21)	**0.030**	3
Consumption of sugars and sweets(more than once a day)	0.58 (0.27-1.27)	0.18	3
Consumption of oils and fats (more than once a day)	0.84 (0.46-1.53)	0.57	3
Physical activity pattern			
Minutes on TV + video (> = 120 min/day)	1.62 (0.86-3.06)	0.13	3

OR: Odds Ratio. IC: Confidence Interval; BMI: Body Mass Index.
[a]Model 1 – gender + mother's BMI; Model 2 – Model 1 + perception of overweight 10y previously; Model 3 – Model 2 + weight loss diet on previous month, frequency of breakfasting, consumption of fruits, consumption of sugars and sweets, consumption of oils and fats, minutes on TV + video.

observed that the low consumption of fruits was directly and significantly associated to overweight and obesity. The variables frequency of breakfasting, total consumption of oils and fats and minutes spent watching TV and video lost their statistical significance when adjusted to the previous levels.

Among all the reported variables, to be on a weight loss diet by the time of the interview was the one most strongly associated to overweight and obesity in adolescence. Even adjusted to all the preceding variables in the model, it represented relevant increase of risk (OR 6.33).

Discussion

The prevalence of obesity and overweight among children and adolescents is increasing at different speeds and patterns in different continents.[2] The present study analyzed the prevalences and risks for overweight and obesity among Brazilian university students aged 16 to 19 years. From a total of 1465 students submitted to the anthropometric evaluation, 121 (8.26%) overweight or obese adolescents were registered. Other Brazilian studies with similar populations and methodology showed prevalence of 8.45% in the Northeast, 11.53% in the Southeast[16] and 16.42% in South.[17] In the USA Ogden et al.[18] indicated 14.9%.

The group studied is included within the range of age that inherently is a risky one, since the weight gain between 18 and 20 years of age is not characteristic of normal growth and may reflect pathologic conditions.[19] Also, it should be noted that university population is an especially vulnerable group regarding eating habits and lifestyle.[20-23] Preventive and therapeutic approaches are therefore justified.

The present work aims at stratifying the risk factors associated to the excess of weight among adolescents (students enrolled at UFG for the first time in 2004), in an attempt to identify strategies for the prevention and control of this nutritional disturbance. Longitudinal studies have shown that obesity in childhood and in adolescence, particularly during the second decade of life, is a strong predictor of obesity in adult life.[24-26]

The measurements were taken in a short period of time, which contributed to curbing information bias. Data on risk factors were collected using questionnaires answered by the adolescents and information given by their parents. Information provided by the adolescents regarded their life and eating habits. The instrument to collect information on eating habits was validated for a population similar to the group studied.[11] Although the instrument used to evaluate the physical activity had not been a specific one for adolescents, it was validated in a population that included individuals aged from 12 years old on.[10]

The calculation of parents' BMI was made based on their own information on weight and height. This strategy was validated by accuracy studies[27] that indicated correlation where r = 0.94 and by a population based inquiry performed in the city of Goiânia, Brazil, that confirmed the existence of correlation between values referred by adults and the measurements taken by the researchers.[28]

Excess of weight was positively associated to males. Other studies performed in Canada,[29] Italy[30] and Spain[23]

showed similar results; however it seems there was no homogeneity in this association in different places. Studies performed in the USA[31] and in Saudi Arabia[32] showed inverse association between males and obesity. A cross-sectional study carried out in Brazil showed greater frequency of overweight among male students in the age range of 15 to 17 years. Boys presented greater prevalence of obesity evaluated by triceps and subscapular skinfolds.[33] Yet National Brazilian surveys carried out in the years 1975, 1989 and 1997 showed progressive increase in the prevalence of overweight for both genders (increase of 4.5 times more among boys and 2.5 among girls). This increase was more evident in the Southern region, the richest region of the country. The authors suggest that such a difference between genders may be due to a great concern among girls in that society where the esthetic standards set forth slender human beings. This behavior is more frequently observed as the girls grew older.[34]

The present work shows that the risk for obesity among adolescents is 3.54 greater when the mother is overweight or obese. The literature shows association between overweight and obesity in adolescence and parents' present obesity,[24-26,35] although it has already been demonstrated that this relation is greater between mother and child than between father and child when examined separately.[25] The mother being overweight increases 3.19 times the risk of a child being included in that category, a figure that pairs closely to our results.[35]

Obesity tends to aggregate in families as a result of interaction among environmental, genetic factors and life style.[36] Even when the mother has an active participation in the labor market, out of her home, she has an effective role in the selection and preparation of foods consumed by her family.

A case-control study on risk factors for obesity and overweight in adolescents of private schools carried out in the city of Pelotas, Brazil, showed that obese father (OR 2.43), obese mother (OR 2.86), and overweight in childhood (OR 2.26) significantly increased the risk for overweight and obesity.[17]

In this study it has been verified that an adolescent with overweight in childhood presented 2.63 greater risk of inadequate weight in the current evaluation. A cohort study in New Zealand in the years 1972 and 1973 showed that children with greater BMIs are more likely to become overweight when adults.[25]

The act of consuming fruits less than once a day increased the risk of overweight/obesity in1.84. In Canada, Jansen & Katzmarzyk[29] have also shown that no fruit consumption was associated to elevated BMI values among adolescents. In a study on adolescents' profile in the USA, Neumaker-Sztainer et al.[37] showed that overweight adolescents or those not satisfied with their own weights, surprisingly consumed less fruits and greens. A study with university students carried out in Spain identified low consumption of fruits and vegetables when compared to the Diet Quality Index.[23]

Epidemiological studies suggest that the consumption of a major quantity of fruits and vegetables is associated to the reduction of risk for cancer and is beneficial in cardiovascular diseases, diabetes, obesity and cerebral vascular accidents.[38]

Fruits and vegetables have low energetic density and therefore increased a larger volume of food that is consumed to obtain a certain level of calories. The reduction of energetic density increases satiety, an effect that occurs after the end of a meal, which may help energetic balancing and weight control;[39] and is therefore recommended to incorporate such a habit in the family life.[37] The inclusion of fruits and vegetables in the diet was found to be related to the socioeconomic level and to parents' profession.[40]

In this crude analysis, the habit of no breakfasting daily proved to be a risk factor for overweight and obesity. However, after adjustment in the multivariate analysis such association showed no significance. A cross-sectional study by Kumar et al.[41] showed that overweight children had breakfast less frequently than the thin ones. The irregular habit of breakfasting in the morning was appointed as an indicator of life style[42] and a marker of improper diet ingestion[43]. Breakfasting regularly in the morning was associated to lower levels of cholesterol and to low weight.[43]

A review of the literature by Rampersaud et al.[44] showed that although there is no consensus, there does seem to be a strong relation between breakfasting and nutritional adequation.

Other dietetic factors in this investigation showed no association with excess weight and it should be stressed that the information on sugar and fat consumption was smaller among the obese which leads to the presumption that what was reported by cases was less reliable when that information regarded the consumption of certain groups of foods.[29,38,45]

Our data showed no association between the practice of physical activity and overweight or obesity; however this information should be analyzed carefully once the tool used to evaluate this kind of activity was not specific for adolescents. The literature is controversial regarding the association between physical activity patterns and obesity in adolescence. A study performed in Spain comprising adolescents with and without weight gain showed that the level of activity among eutrophic boys was significantly greater.[45] A case control linked to a cohort study carried out in a Southern city of Brazil by Monteiro et al.[46] showed no association between physical activity and overweight or obesity. Similar results were described in other Brazilian case control studies by Neutzling et al.,[17] Fonseca et al.[33] and Silveira et al.[47]

The results of this assessment showed that the time spent watching TV, videogames and computers (indirect indicators of sedentarism) presented a significant association with weight in crude analysis, losing significance in the multivariate analysis.

Some authors however, do not consider the habit of

watching TV, playing videogame or using the computer as markers for inactivity in the association between sedentarism and health problems.[48]

The information that adolescents had dieted to lose weight during the preceding month of data collection was the strongest factor associated to overweight and obesity in the present study. Nevertheless, the sequence of events of this association cannot be duly elucidated. It is possible that overweight or obese adolescents undergo more restrictive diets in order to improve their body image or simply aiming at adopting coherent behavior with their anthropometrics.[17] Therefore, one of the limitations of the present study is the reverse causality, a bias frequently observed in case-control studies.[49] Kumar et al.,[41] however, considers impossible to state that losing weight is the only reason for dieting, once adolescents with normal weight or low weight also diet.

The main findings of this investigation showed that being a male, family history of obesity, overweight in childhood, low consumption of fruits and the habit of weight loss dieting characterize risk factors for overweight and obesity in adolescence.

Data collection may be instrumental in developing new educational measures that might ultimately lead to weight gain control and preventing its morbid consequences.

Results emphasize the need for educational interventions at early ages involving the whole family to control the excess of weight.

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