

Factors associated with weight loss dieting among adolescents: the 11-year follow-up of the 1993 Pelotas (Brazil) birth cohort study

Fatores associados à realização de regime de emagrecimento entre adolescentes: a visita de 11 anos da coorte de nascimentos de Pelotas, Rio Grande do Sul, Brasil, 1993

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Abstract

Evidence has shown the negative effects of unsupervised diets and those with excessive calorie restriction. The aim of this study was to determine the proportion of adolescents engaging in weight loss dieting and associated factors. This was a cross-sectional study of 4,452 adolescents born in Pelotas, Rio Grande do Sul State, Brazil, in 1993. The outcome was defined as adolescents that reported having practiced some type of weight loss dieting in the previous 12 months. Prevalence of such dieting was 8.6% (95%CI: 7.7;9.4), and was higher in girls. Elevated maternal body mass index (BMI) was associated with dieting among girls. The adolescent's and parents' view of the adolescent's weight, excess weight, and consumption of diet or light soft drinks were associated with adolescent dieting. There was a positive association between dieting and socioeconomic status. The findings provide important backing for policies aimed at improving adolescents' diet, since they express a major concern over weight and thus a significant percentage of individuals with erroneous and unhealthy behaviors.

Weight Loss; Food Consumption; Nutritional Status; Cohort Studies

Introduction

Brazil, like other medium and/or low income countries, is undergoing a nutritional transition in which under-nutrition is being replaced by excessive food intake ¹. In addition, nutritional quality has declined, and one of the possible reasons is that the cheapest and most widely available foods for consumers are processed food products with high energy density, high in saturated and trans fats and low in food fiber ².

As a consequence of this transition, the nutritional status of populations has changed, including that of children and adolescents. The decrease in the prevalence of under-nutrition has been accompanied by an increase in the number of overweight individuals ³. This phenomenon and the resulting appearance of diseases related to excess weight, like diabetes, hypertension, and dyslipidemia, have led to studies seeking to understand individuals' attitudes towards this problem.

Weight loss dieting is one of the main methods for controlling and/or losing weight. However, one of the principal concerns with the use of this method, especially among adolescents, is the development of complications arising from eating disorders. Weight loss dieting, depending on the level of food restriction, is associated with various eating disorders, the main ones being anorexia and bulimia ⁴. In addition, individuals with unhealthy weight control behaviors are more prone to fall short of the great majority

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of recommended daily intake levels for various macro and micronutrients⁵.

The literature is still limited on the evaluation of the frequency of weight loss dieting at the population level. There are also few studies on factors associated with dieting, although there is some evidence that such behavior is affected by body self-image, parents' perceptions and influence, and other variables such as nutritional status, food intake, and physical activity.

The aim of this study was to determine the frequency of weight loss dieting and associated factors among adolescents 11 years of age in the 1993 Pelotas (Brazil) birth cohort study.

Methods

All hospital births in the city of Pelotas in 1993 were monitored. The mothers answered a questionnaire and the newborns were weighed and measured. Sub-samples of these individuals were visited at 1, 3, and 6 months and 1, 4, 6, and 9 years of age⁶. In 2004-2005, all the cohort members were searched for a new follow-up, the methodology of which has been described elsewhere⁷.

In this 2004-2005 follow-up, the adolescents answered questions on eating, including the outcome described in this study. "Weight loss dieting" was defined as the adolescent reporting some type of diet or eating restriction with the aim of losing weight, in the 12 months prior to the interview.

Food fiber and fat intake frequencies were obtained from the self-scored screening questionnaire proposed by Block, divided into two segments: fiber and fat intake⁸. Low-fiber diet was defined as a score of less than 20 points. High-fat diet was defined as a score greater than 27 points. Soft drink consumption was assessed with the following question: "When you drink soft drinks, what kind do you drink?".

The adolescents' nutritional status was assessed according to World Health Organization (WHO) criteria⁹, including body mass index (BMI) and tricipital and subscapular skinfolds. The categories "underweight" (BMI/age: percentile < 5) and "normal" (BMI/age: 5 ≤ percentile < 85) were grouped together, since the former included only a few individuals. Obesity and risk of overweight were defined according to the WHO: obesity (BMI/age ≥ P₈₅ and tricipital and subscapular skinfolds ≥ P₉₀) and risk of overweight (BMI/age ≥ P₈₅)⁹.

The other independent variables were: household assets index (in quintiles), skin color (self-reported by the interviewee), maternal schooling

(in complete number of years or passing school grades), maternal nutritional status according to WHO criteria (underweight: BMI < 18.5kg/m²; normal weight: BMI from 18.5 to 24.9kg/m²; overweight: BMI from 25.0 to 29.9kg/m²; obesity: BMI > 30.0kg/m²)¹⁰. The two variables "how the adolescent perceives his or her weight" and "what the parents think of their child's weight" used the same answers (thin/very thin, normal, or fat/very fat). In relation to physical activity, adolescents were defined as sedentary when they reported less than 300 minutes of physical activity per week¹¹.

The interviewers received 40 hours of training before applying the standardized, pre-coded questionnaires. Weight, height, and skinfold measurements were standardized according to the Technical Error Measurement (TEM) methodology¹², which analyzes intra and inter-observer errors.

Data analysis used a hierarchical model for determination of the outcome¹³, in which the first level (most distal) included the socioeconomic and demographic variables (skin color, maternal schooling, and household assets index). The second level (intermediate) included the health-related and weight perception variables (maternal BMI, adolescent's perception of own weight, and parents' perception of child's weight). The most proximal level in relation to the outcome included the nutritional and behavioral variables (fiber, fat, and soft drink consumption, sedentary lifestyle, and nutritional status).

Statistical analysis of the data used Stata 9 (Stata Corp., College Station, USA). Statistical significance was assessed with the Wald test using Poisson regression with robust variance and 5% significance level. The adjusted analysis maintained variables with $p \leq 0.20$ in the model. Adjustment for confounding factors used a hierarchical model in which each variable's effect on the outcome was controlled for those at the same level or above.

The research project was approved by the Institutional Review Board of the School of Medicine of the Federal University in Pelotas. The parents or guardians signed a free and informed consent form authorizing their children to participate in the study.

Results

The 2004-2005 follow-up included 4,452 adolescents, or 87.5% of the initial cohort. Prevalence of weight loss dieting was 8.6% (95%CI: 7.7; 9.4), with a higher rate in girls (10.1%) than boys (7%; $p < 0.001$).

Table 1 shows the proportion of adolescents that reported weight loss dieting in the previous year, according to the independent variables for the entire sample and separately for boys and girls. White skin color was only significantly associated with weight loss dieting for boys ($p = 0.048$). Maternal schooling was not associated with dieting among girls ($p = 0.061$). In both sexes, the household assets index was directly as-

sociated with weight loss dieting. For both the overall sample and separately for boys and girls, there was a positive linear trend in the association between maternal BMI and dieting ($p < 0.001$). In relation to perception of body weight (according to parents and the adolescents themselves), the proportion of adolescents that dieted was higher among those classified as fat or very fat ($p < 0.001$). Importantly, weight loss dieting was

Table 1

Description of the sample and prevalence of weight loss dieting, according to demographic, socioeconomic, and behavioral variables in adolescents. 1993 Pelotas (Brazil) birth cohort study, 2004-2005 follow-up (N = 4,452).

Variables	n	Total	p-value	n	Boys	p-value	n	Girls	p-value
		Prevalence (%)			Prevalence (%)			Prevalence (%)	
Self-reported skin color			0.423 *			0.048 *			0.985 *
White	2,953	8.9		1,481	7.8		1,472	10.1	
Black/Brown	1,259	7.7		587	4.8		672	10.3	
Maternal schooling (years)			< 0.001 **			< 0.001 **			0.061 **
0-4	1,145	6.6		567	4.2		578	9.0	
5-8	1,901	8.4		918	6.9		979	9.9	
9-11	947	9.0		475	8.6		472	9.3	
12 or more	421	13.3		210	11.4		211	15.2	
Household assets index (quintiles)			< 0.001 **			< 0.001 **			0.014 **
1 (lowest)	863	5.6		444	3.2		418	8.1	
2	851	6.9		414	4.1		437	9.6	
3	857	7.8		399	6.8		457	8.8	
4	857	10.8		413	9.4		442	12.0	
5 (highest)	856	12.3		437	11.9		419	12.7	
Maternal BMI ***			< 0.001 **			< 0.001 **			< 0.001 **
Underweight/Normal	1,727	6.7		891	5.6		903	7.4	
Overweight	1,410	9.5		670	8.1		739	10.8	
Obese	935	11.9		469	9.2		465	14.6	
Adolescent's perception of own weight			< 0.001 **			< 0.001 **			< 0.001 **
Very thin/Thin	860	0.9		424	0.2		436	1.6	
Normal	2,457	4.5		1,280	3.2		1,177	6.0	
Very fat/Fat	1,113	23.5		471	23.4		642	23.5	
Parents' perception of their child's weight			< 0.001 **			< 0.001 **			< 0.001 **
Very thin/Thin	1,273	1.6		653	0.5		620	2.7	
Normal	2,261	7.1		1,088	5.5		1,173	8.5	
Very fat/Fat	893	22.4		431	20.7		462	24.0	
Low-fiber diet			0.190 *			0.227 *			0.513 *
No	714	9.8		342	8.5		372	11.0	
Yes	3,732	8.3		1,844	6.7		1,888	9.9	
High-fat diet			0.994 *			0.584 *			0.653 *
No	2,817	8.6		1,382	6.7		1,435	10.3	
Yes	1,626	8.6		803	7.4		823	9.7	
Consumption of diet/light soft drinks			< 0.001 *			< 0.001 *			< 0.001 *
No	4,344	8.0		2,141	6.5		2,203	9.5	
Yes	103	32.0		46	30.4		57	33.3	

(continues)

Table 1 (continued)

Variables	Total			Boys			Girls		
	n	Prevalence (%)	p-value	n	Prevalence (%)	p-value	n	Prevalence (%)	p-value
Sedentary lifestyle			0.352 *			0.496 *			0.388 *
No	1,793	8.1		1,088	7.3		704	9.4	
Yes	2,496	8.9		1,029	6.5		1,466	10.6	
Adolescent's nutritional status **			< 0.001 **			< 0.001 **			< 0.001 **
Underweight/Normal	3,413	2.9		1,635	1.2		1,776	4.5	
Risk of overweight	514	22.4		220	15.5		294	27.6	
Obese	515	32.0		329	30.1		186	35.5	
Total	4,452	8.6		2,192	7.0		2,260	10.1	

BMI: body mass index.

* Chi-square test;

** Linear trend test;

*** Underweight maternal BMI was grouped with normal weight, since no dieting was observed among male adolescents with underweight mothers;

Underweight was grouped with normal weight, since no dieting was observed among underweight male adolescents.

present even among adolescents classified as thin or very thin or normal. Diet (low consumption of fiber and high consumption of fat) and sedentary lifestyle were not associated with the outcome in any of the subgroups. Consumption of "diet" or "light" soft drinks showed a strong association with dieting ($p < 0.001$). There was a positive linear trend association between the adolescents' nutritional status and dieting. Overweight adolescents dieted more than their thin or normal-weight peers ($p < 0.001$).

Table 2 shows the crude and adjusted prevalence ratios for the association between weight loss dieting and the independent variables in boys. The adjusted analysis shows that weight loss dieting was associated with higher household assets index ($p < 0.001$), parents' or adolescents' perception of the adolescents' body weight as fat or very fat ($p < 0.001$), consumption of diet/light soft drinks ($p = 0.002$), and adolescent's overweight/obesity ($p < 0.001$). Interestingly, there was no significant association between maternal BMI and adolescent's dieting ($p = 0.479$). It is important to recall that the variables with $p > 0.20$ were removed from the hierarchical model.

Among girls (Table 3), household assets index ($p = 0.015$) and maternal BMI ($p = 0.005$) were directly associated with dieting. Adolescents that classified themselves as fat or very fat, those whose parents also considered their child fat or very fat, and those that only consumed diet or light soft drinks showed significantly higher dieting rates. In relation to nutritional status, girls at risk of overweight and obesity showed a threefold likelihood of dieting as compared to underweight or normal-weight girls ($p < 0.001$).

Discussion

The current study was based on a population-based cohort and showed a high follow-up rate. The probability of selection bias is thus low. However, extrapolation of the results to adolescents in general should be done with caution, since the study population covered a narrow age bracket.

Weight loss dieting was more frequent in girls than boys. This finding is consistent with a study by Field et al.¹⁴ analyzing American adolescents 12 to 18 years of age, with 8% and 3% prevalence rates for dieting in the previous year by girls and boys, respectively. Calderon et al.¹⁵ evaluated adolescents from 13 to 17 years of age in public schools in Los Angeles, California, and found similar results (dieting was more prevalent in girls than boys). This different behavior between girls and boys appears to be well documented in the literature and may reflect a greater concern among girls, particularly in relation to appearance and health, as compared to their male peers^{14,15,16,17}.

As in Drewnowski et al.¹⁸, the current study found that higher-income individuals are more inclined to do weight loss dieting. One possible hypothesis for this finding is a greater concern over physical appearance among these adolescents. It is also likely that the parents of these more economically privileged adolescents are more alert to the problem of overweight, since they tend to be more knowledgeable about the harmful effects of excess body fat on their children's current and future health. A final aspect to be considered is the constant social pressure

Table 2

Crude and adjusted analyses of the association between weight loss dieting and independent variables in male adolescents. 1993 Pelotas (Brazil) birth cohort study, 2004-2005 follow-up (N = 2,192).

Variable	Crude analysis		Adjusted analysis	
	PR (95%CI)	p-value	PR (95%CI)	p-value
Skin color		0.015 *		0.532 *
White	1.00		1.00	
Black/Brown	0.61 (0.41; 0.91)		0.77 (0.50; 1.19)	
Maternal schooling (years)		< 0.001 **		0.706 **
0-4	1.00		1.00	
5-8	1.62 (1.03; 2.56)		1.17 (0.74; 1.86)	
9-11	2.04 (1.25; 3.32)		1.14 (0.66; 1.95)	
12 or more	2.70 (1.57; 4.65)		1.18 (0.61; 2.29)	
Household assets index (quintiles)		< 0.001 **		< 0.001 **
1 (lowest)	1.00		1.00	
2	1.30 (0.65; 2.61)		1.30 (0.65; 2.61)	
3	2.15 (1.14; 4.03)		2.15 (1.14; 4.03)	
4	2.99 (1.65; 5.43)		2.99 (1.65; 5.43)	
5 (highest)	3.77 (2.12; 6.71)		3.77 (2.12; 6.71)	
Maternal BMI		0.010 **		0.479 **
Underweight/Normal	1.00		1.00	
Overweight	1.44 (0.99; 2.08)		1.05 (0.74; 1.50)	
Obese	1.63 (1.10; 2.42)		1.15 (0.79; 1.66)	
Adolescent's perception of own weight		< 0.001 **		< 0.001 **
Very thin/Thin	1.00		1.00	
Normal	13.58 (1.87; 98.47)		5.18 (0.62; 43.52)	
Very fat/Fat	99.02 (13.88; 706.42)		23.21 (2.63; 205.19)	
Parents' perception of child's weight		< 0.001 **		< 0.001 **
Very thin/Thin	1.00		1.00	
Normal	12.00 (3.78; 38.13)		5.32 (1.53; 18.50)	
Very fat/Fat	44.95 (14.31; 141.15)		7.69 (2.15; 27.52)	
Low-fiber diet		0.225 *		0.132 *
No	1.27 (0.86; 1.87)		1.30 (0.92; 1.83)	
Yes	1.00		1.00	
High-fat diet		0.584 *		0.332 *
No	1.00		1.00	
Yes	1.09 (0.80; 1.50)		0.86 (0.64; 1.16)	
Consumption of diet/light soft drinks		< 0.001 *		0.002 *
No	1.00		1.00	
Yes	4.72 (2.96; 7.52)		1.92 (1.26; 2.93)	
Sedentary lifestyle		0.497 *		0.234 *
No	1.00		1.00	
Yes	0.90 (0.65; 1.23)		0.84 (0.63; 1.12)	
Nutritional status		< 0.001 **		< 0.001 **
Underweight/Normal	1.00		1.00	
Risk of overweight	13.30 (7.72; 22.90)		5.98 (3.19; 11.21)	
Obesity	25.89 (16.08; 41.70)		9.28 (4.89; 17.61)	

95%CI: 95% confidence interval; BMI: body mass index.

* Wald test for heterogeneity;

** Wald for linear trend.

Table 3

Crude and adjusted analyses of the association between weight loss dieting and independent variables in female adolescents. 1993 Pelotas (Brazil) birth cohort study, 2004-2005 follow-up (N = 2,260).

Variable	Crude analysis		Adjusted analysis	
	PR (95%CI)	p-value	PR (95%CI)	p-value
Skin color		0.879 *		0.322 *
White	1.00		1.00	
Black/Brown	1.02 (0.78; 1.34)		1.16 (0.87; 1.54)	
Maternal schooling (years)		0.068 **		0.643 **
0-4	1.00		1.00	
5-8	1.10 (0.80; 1.52)		1.02 (0.73; 1.43)	
9-11	1.04 (0.71; 1.52)		0.86 (0.57; 1.31)	
12 or more	1.69 (1.12; 2.54)		1.35 (0.81; 2.26)	
Household assets index (quintiles)		0.015 **		0.015 **
1 (lowest)	1.00		1.00	
2	1.18 (0.77; 1.82)		1.18 (0.77; 1.82)	
3	1.08 (0.69; 1.67)		1.08 (0.69; 1.67)	
4	1.47 (0.98; 2.22)		1.47 (0.98; 2.22)	
5 (highest)	1.56 (1.03; 2.34)		1.56 (1.03; 2.34)	
Maternal BMI		< 0.001 **		0.005 **
Underweight/Normal	1.00		1.00	
Overweight	1.46 (1.07; 1.99)		1.21 (0.89; 1.63)	
Obese	1.97 (1.43; 2.71)		1.58 (1.16; 2.16)	
Adolescent's perception of own weight		< 0.001 **		< 0.001 **
Very thin/Thin	1.00		1.00	
Normal	3.70 (1.72; 8.00)		2.37 (1.04; 5.42)	
Very fat/Fat	14.65 (6.93; 30.96)		6.46 (2.77; 15.08)	
Parents' perception of child's weight		< 0.001 **		< 0.001 **
Very thin/Thin	1.00		1.00	
Normal	3.11 (1.88; 5.15)		1.68 (0.97; 2.90)	
Very fat/Fat	8.76 (5.34; 14.39)		2.66 (1.49; 4.76)	
Low-fiber diet		0.512 *		0.250 *
No	1.11 (0.81; 1.53)		1.19 (0.89; 1.59)	
Yes	1.00		1.00	
High-fat diet		0.653 **		0.296 **
No	1.00		1.00	
Yes	0.94 (0.73; 1.22)		0.87 (0.67; 1.13)	
Consumption of diet/light soft drinks		< 0.001 *		0.008 *
No	1.00		1.00	
Yes	3.51 (2.38; 5.19)		1.73 (1.15; 2.61)	
Sedentary lifestyle		0.389 *		0.476 *
No	1.00		1.00	
Yes	1.13 (0.86; 1.48)		0.91 (0.69; 1.19)	
Nutritional status		< 0.001 **		< 0.001 **
Underweight/Normal	1.00		1.00	
Risk of overweight	6.12 (4.61; 8.12)		3.51 (2.36; 5.21)	
Obesity	7.88 (5.90; 10.52)		4.19 (2.77; 6.34)	

* Wald test for heterogeneity;

** Wald test for linear trend.

from classmates, friends, and the media to lose weight, sometimes even unnecessarily.

The current study found no association between the type of diet consumed by adolescents and weight loss dieting. The literature review found only one study that evaluated the association between weight gain, weight maintenance, and weight loss dieting and adolescents' food consumption. The study also failed to show a significant association between the types of foods consumed (in this case, carbohydrate, protein, fat, and energy) and dieting¹⁹. This point should be evaluated with care, since nutritional approaches in population-based studies are still a complex, due to the wide diversity of methods and instruments for evaluating individual diet.

Interestingly, maternal BMI was only associated with weight loss dieting among female adolescents. Perhaps the stronger identification of teenage girls with their mothers plus the mother's concern over not reproducing her own unwanted physical appearance may be influencing the decision by girls to engage in weight loss dieting, since the study showed that daughters of obese mothers were more inclined to diet. Adolescents whose mothers considered their weight important wanted to be thinner and dieted more often¹⁴.

Consumption of diet/light soft drinks was strongly associated with dieting. Since this was a cross-sectional analysis, this association is probably affected by a reverse causality bias, i.e., consumption of diet/light soft drinks may be part of the adolescent's weight loss strategy.

In this sample of adolescents, those that saw themselves as fatter showed higher odds of weight loss dieting. This finding suggests a greater concern over body image, beginning in childhood and adolescence, as already shown in other studies^{20,21,22}. The challenge is to steer this concern towards the development of healthy habits among adolescents, especially healthy, varied, and balanced diet, rather than merely crash di-

eting motivated by a preoccupation with body image.

Field et al.²³ showed that girls who perceive their parents' concern over their weight are also more preoccupied with their weight. The current study did not evaluate levels of concern in relation to weight, although it did find a significant association between weight loss dieting and parents' opinion of the adolescent's weight. Thus, the fact that parents considered their children fat may be influencing the children's behavior (among both boys and girls).

As for the adolescents' nutritional status, the current study found a clear linear trend between excess weight and weight loss dieting in both boys and girls, consistent with the literature. In addition, like Calderon et al.¹⁵, our study showed that weight loss dieting was more strongly associated with BMI among boys, with a twofold risk as compared to girls. One interesting finding is that the overall prevalence of excess weight among adolescents in the cohort was 23.2%. This association can be approached in two different ways. First, weight loss dieting is being done by those who really need it, namely adolescents with excess weight. On the other hand, it is worrisome that adolescents 11 years of age already show a high proportion of weight loss dieting, probably as a consequence of excess weight. In addition, these adolescents may be suffering from societal pressure to pursue a slim appearance.

In summary, the high rate of weight loss dieting in adolescents 11 years of age reflects a major preoccupation among adolescents concerning excess weight. Schools provide a setting that could be used strategically not only for food reeducation, but also for practicing good eating habits by consuming healthy foods through the school meal program. Prevention of excess weight among adolescents should be the main strategy, thus making weight loss dieting unnecessary in this stage of life.

Resumo

Evidências mostram efeitos negativos de dietas sem orientação e de alta restrição calórica. O objetivo do estudo foi determinar o percentual de adolescentes que realizaram regime de emagrecimento e os fatores associados a este comportamento. Estudo transversal incluindo 4.452 nascidos em Pelotas, Rio Grande do Sul, Brasil, no ano de 1993. Os adolescentes que relataram ter feito algum tipo de regime com a finalidade de emagrecimento nos últimos 12 meses foram positivos ao desfecho. A frequência de realização de regime foi de 8,6% (IC95%: 7,7;9,4), sendo maior entre as meninas. O índice de massa corporal (IMC) materno elevado associou-se à realização de regime entre meninas. O sentimento do adolescente e dos pais em relação ao peso do jovem, o excesso de peso e o consumo de refrigerantes diet/light mostraram-se associados ao desfecho. Encontrou-se associação positiva entre regime e nível econômico. Tais achados constituem-se um importante subsídio para formação de políticas a fim de melhorar a dieta de adolescentes, uma vez que expressa a grande preocupação com o peso, e assim, um percentual significativo de indivíduos tendo comportamentos equivocados.

Perda de Peso; Consumo de Alimentos; Estado Nutricional; Estudos de Coorte

Contributors

S. W. Madruga participated in the literature review, data analysis and interpretation, and writing of the manuscript. M. R. Azevedo collaborated in the data analysis and interpretation. C. L. Araújo, A. M. B. Menezes, and P. C. Hallal contributed to the coordination of the data collection, orientation, and revision of the manuscript.

Acknowledgments

The cohort study is supported by the Wellcome Trust. The initial phases of the cohort were funded by the European Union and the Brazilian National Program for Centers of Excellence (PRONEX), National Research Council (CNPq), and Ministry of Health.

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Submitted on 05/Feb/2009

Final version resubmitted on 10/May/2010

Approved on 07/Jun/2010