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Abdominal obesity in school children: prevalence and associated factors

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Abstract

This cross-sectional study aimed to estimate the prevalence of abdominal obesity and its association with demographic, socioeconomic, anthropometric, body image and behaviors related to its variables among children and their parents. Students (n = 717) from the 4th and 5th grades were randomly selected from 22 public schools of Itajai, in the state of Santa Catarina, Brazil. Variables were collected through a questionnaire applied to children and parents. Weight, height and waist circumference (indicator of abdominal obesity) measures were collected. Crude and adjusted odds ratios (OR) and 95% confidence intervals (95% CI) were calculated through unconditional logistic regression. All analyses were adjusted for design effect. Participants were 602 children (81.7%), with age average of 9.9 years. Prevalence of abdominal obesity was 11.3% (95% CI: 8.7 to 14.0%). Parents variables as having middle (OR: 3.7, 95% CI: 1.4 to 10.1) or high income (OR: 2.6, 95% CI 1.0 to 6.7), and overweight (OR: 4.9, 95% CI: 1.2 to 20.2) were associated with higher prevalence of abdominal obesity among school children. Dieting to lose weight (OR: 3.9, 95% CI 1.7 to 9.1), and assessment of children health by parents as inadequate or poor (OR 3.6 95% CI, 1 0.0 to 13, 2) were associated with the outcome. Intervention measures to reduce the prevalence of obesity among children investigated should include parents.

Keywords: Pediatric Obesity, Child Health. Abdominal obesity. Waist circumference. Parents. Overweight.

Introduction

In recent decades, there has been a quick and significant increase in the worldwide prevalence of obesity, especially during childhood and adolescence, with proportions of a worldwide epidemic. Obesity in childhood or adolescence may persist into adulthood, implying increased risk of vascular and metabolic problems.[1]

Different anthropometric measures have been deployed to identify obesity. Body mass index (BMI) refers to excess of total body fat and has been the most widely used anthropometric method to assess nutritional status and diagnose overweight and obesity. However, the type of fat distribution depot has become a considerable concern, since it relates to the prediction of risk for health problems. In the central adiposity, adipose tissue is preferably distributed at trunk level, with increased intra-abdominal deposition. [2,3] Risks associated with abdominal obesity make it one of the diagnostic criteria for the metabolic syndrome also in children.[4,5]

Children with abdominal obesity may have greater prevalence of risk factors for cardiovascular disease, including higher concentrations of triglycerides, insulin, leptin, systolic and diastolic blood pressure, and reduced HDL-C (*high density lipoprotein*).[6] Moreover, in a longitudinal study the authors found that more than half of children with abdominal obesity at age seven remained in the same risk category in adolescence, while only less than 2% went for lower risk categories at 15 years old.[7]

Most studies that examine the factors associated with abdominal obesity in children have focused on describing biochemical and / or anthropometric variables.[2,3,8] Maternal variables such as excess body weight have been associated with visceral fat deposition in children.[9]

Studies published in Brazil on factors associated with abdominal obesity in children were not found by the present authors. Most studies included adolescents.[6,10] Thus, in face of the lack of research studies and of the negative impact of abdominal obesity in children along with its significant likelihood of continuing into adulthood, estimating the prevalence of abdominal obesity and examining its association with family and child variables is an important strategy to find groups at increased risk.

Therefore, this study aimed to estimate the prevalence of abdominal obesity and analyze its association with demographic, socioeconomic, and anthropometric variables, body image and related behaviors in 4 and 5-graders at public schools from the city of Itajai, in the state of Santa Catarina, Brazil, along with their caregivers.

Methods

This article is included in a project that has assessed the prevalence of body dissatisfaction and associated factors in children living in Itajaí-SC, Brazil. This is a cross-sectional study on public school children from Itajaí, in the 4th and 5th grades of primary school, living in the urban and rural areas.

The city is located in Vale do Itajaí (Lower Valley of Itajai River), accounts for 183 388 people, it is located at 91 km from the state capital, Florianópolis, and its main economic activities are port marketing and fishing. In 2000, its Human Development Index was 0.825.[11]

The city had 39 public schools, with 4,587 students enrolled in the 4th and 5th grades. Sampling was made in two stages. The list of schools was provided by the Education Department of Itajaí. From this list, 22 schools were randomly selected to participate on this research, a number considered suitable for the size of the municipality.[12] Each randomly selected school provided a list of students enrolled, so that students could also be randomly selected for data collection.

Then, in the sample calculation, performed by the 6.04 Epi Info 6.04 application (USA – *Center for Control of Diseases* – CDC), an expected prevalence of 50 % was considered to maximize sample size and allow the analysis of other relevant outcomes with diverse prevalences. Confidence level of 95% and 5% margin of error were considered. Since sampling was performed in two stages, the design effect was estimated to 1.5 (n = 531), 20% was added to the result in order to compensate for losses and / or refusals, and 15 % to control confounding factors (n = 717).

The prevalence of abdominal obesity among the studied children was 11.3%, where, among the children included in this study, 547 had their data collected for this variable. Thus, the ex-post calculation allowed for the accuracy of three percentage points, in which the design effect of 1.5 and a confidence level of 95% were kept.

In the second stage, those to be included in the study were selected from the randomly selected schools: schoolers were numbered and then a systematic selection was carried out with a fraction of the sample (k) obtained by dividing the total number of enrolled schoolers by the sample size.

Data collection was conducted by Nutrition undergraduate students in charge of the project, from February to July 2010, and it included anthropometric data collection and questionnaires for children and parents. Signing of the informed consent form (ICF) was required for parents and children. This present study included rendomly selected students who presented their ICF properly signed. Students who were abscent in all three visits made to the school were considered to be losses, and those who did not have the consent form signed, refusals.

The questionnaire sent out to the parents included questions on age, education (up to 8 years, 9-11 years, and 12 or more years), *per capita* family income in minimum wages (R$ 510.00) divided into tertiles: low (0.11 to 0.47), middle (0.48 to 0.78), high (0.79 to 3.27), skin color (white, mulatto / black), habits of dieting to lose body mass (yes , no), perception of parents regarding their child and their own body mass (lower, adequate, and higher) and their assessment of childrens health (very good, good, and inadequate/bad). Students' skin color was classified by the researchers according to categories proposed by the Brazilian Institute of Geography and Statistics (IBGE).[13] In addition, parents answered a question on whether they were satisfied with their own body mass (no, yes), and whether they had tried to reduce it (no, yes).

Students were provided with a *Children's Figure Rating Scale*[14], consisting of nine numbered silhouettes, from extreme leanness to extreme fat; they should select a figure that matched their current body and another to represent how they wished to be.[14] Additionally, they answered yes or no questions, with regard to trying to lose weight or gain weight, to going on diets and to how they perceived their body mass.

For the assessment of nutritional status, students were weighed with a Kratos-Ca (São Paulo) adult digital scale, with a maximum capacity of 150 kg, with minimal clothing and no shoes. The scale was placed on a flat, firm, even surface away from the wall. Barefoot children were positioned in the center of the scale, with their feet together, outstretched arms along their body and without moving.[15]

After weighing, their height was measured with a Wiso (China) compact stadiometer, that ranged from 0 to 200 cm, and had 0.1 cm precision. Children were also barefoot and standing for this measurement, on a flat surface, with their back to the stadiometer, parallel feet and ankles together.[15]

Waist circumference was considered to be the indicator of abdominal obesity. It was determined with the aid of a measuring tape placed around the narrowest circumference between the lowest rib and the iliac crest without compressing children's tissues, and it was classified according to the cutoff points proposed by Taylor et al.[16]

BMI was determined in kg / m^2, by dividing body mass by squared height. Nutritional status was determined using the criteria established by the World Health Organization.[17] For the analyzes, cases of low-weight and low-weight risk were grouped, as well as cases of overweight and obesity; eutrophic remained separate.

Parents' body mass and height were self-reported, and based on these information their BMI was determined, and classified according to the WHO categories.[18] For the analyzes, malnutrition and eutrophic cases were grouped, and overweight and obesity were analyzed separately.

Data entry was inserted in the Epidata application, where protections were created for data entry. The questionnaires were reviewed and coded by the researchers , and, to ensure the quality of typing, data were double entered and verified through EpiInfo.

To describe the quantitative variables, the means, standard deviations, minimum, maximum, and median values were calculated. Categorical variables were described by means of their absolute frequencies (n) and relative (%), and confidence intervals of 95% (95% CI).

Pearson's chi-square test was used for the association between variables and abdominal obesity, with adjustment for complex designs. The prevalence of abdominal obesity was further compared among the categories of exposure variables by means of the odds ratios (ORs) and their 95% CI. Adjusted analysis was conducted using unconditional logistic regression with adjustment for complex designs. In the analysis were included variables that maintained confidence level of 25% in the bivariate analysis. Variable input in the adjusted analysis was performed in six successive levels and started with the variables of the parents, following a hierarchical model[19] (Figure 1).

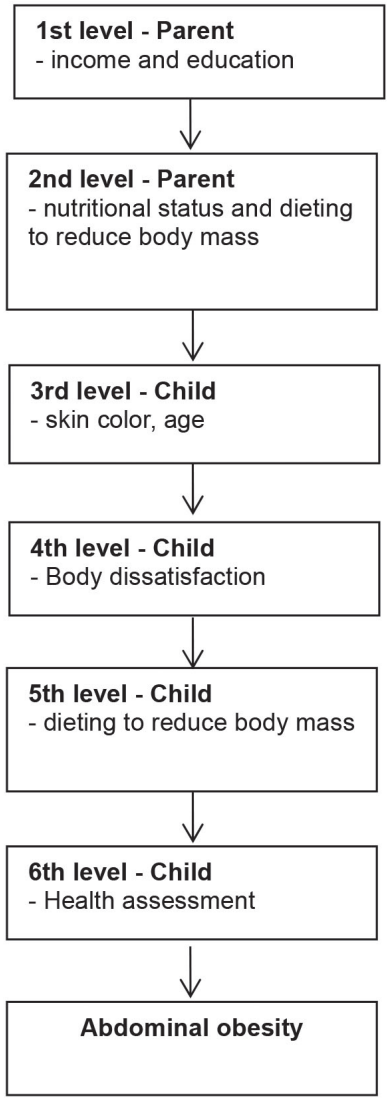

Figure 1: Multivariate analysis variable input hierarchical model

Associations were considered significant when $p \leq 0.05$. The analyzes were performed in Microsoft Excel, 6.04 EpiInfo and SE9 Stata applications.

This research project has been submitted and approved by the Research Ethics Committee of the institution, under protocol number 373/09A.

Results

Six hundred and two children participated in the survey (81.7%). The completion rate of the questions ranged from 67.4% to the variable "income" to 100% to those collected in the questionnaire completed by the children (Table 2).

Most questionnaires were answered by the mothers (82.0%), who self-reported skin color predominantly white (69.8%) and up to eight years of completed schooling (47.5%). The study included more girls than boys (56.3% *versus* 43.7%). The mean age was 9.9 years and ranged from 7.7 to 14.3 years, with a standard deviation of 0.7 years (Table 1). Approximately one third of the children had excess body mass (31.6%), according to Table 2.

The prevalence of abdominal obesity was 11.3% (95% CI, 8.7-14.0%). In the crude analysis, the caregiver variables associated with greater prevalence of obesity among the children evaluated were income, BMI, and own body mass perception and satisfaction. Among the variables for children, "body dissatisfaction", "attempts to lose body mass", "dieting", "body mass perceived as higher than ideal", as well as "parent assessment of child`s health as being inadequate/bad" were more frequent in children with abdominal obesity (Table 2). All children classified as having abdominal obesity had excess body mass (data not shown).

After adjusted analysis, the association between parental income and greater abdominal obesity remained. The odds for this outcome were 3.7 an 2.6 higher for children of parents with medium to high income, respectively. When the caregiver was overweight or obese, the odds of the child having abdominal obesity was 3.9 and 4.9 higher, respectively. Children with abdominal obesity were more dissatisfied with their body image (OR = 11.9, CI = 95% 1.3-108.6) and showed four times higher odds of mentioning having attempted to diet to lose weight. Besides, children with abdominal obesity showed 3.2 higher odds of having their health classified as regular or bad by their parents (Table 3.)

Table 1. Description of 4th and 5th graders from public schools located in Itajaí-SC, Brazil 2010.

Variables	Boys	Girls	Total
	Mean (SD)	Mean (SD)	Mean (SD)
Age (years)	9.9 (0.7)	9.8 (0.7)	9.9 (0.7)
Body mass (Kg)	34.4 (8.6)	33.8 (8.6)	34.1 (8.6)
Height (cm)	138.1 (7.4)	136.8 (7.6)	137.3 (7.5)
Waist circumference (cm)	59.9 (8.0)	57.9 (7.5)	58.7 (7.8)
BMI (Kg/m²)	17.9 (3.1)	17.9 (3.4)	17.9 (3.3)

BMI = Body Mass Index;

Table 2. Description of the variables for parent and 4th and 5th graders from public schools located in Itajaí-SC, Brazil 2010.

Variables	n	%	CI 95%
Caregiver			
Skin color (n= 503)			
White	351	69.8	65.5-73.7
Mulatto/black	139	27.7	22.2-34.2
Education (n=480)			
Up to 8 years	228	47.5	39.0-56.0
9 to 11 years	192	40.0	33.0-47.0
12 years or more	60	12.5	9.0-16.0
Per capita family income (n=406)			
1st tertile (low)	139	34.2	29.6-38.9
2nd tertile (middle)	132	32.5	27.9-37.1
3rd tertile (high)	135	33.3	28.6-37.9
BMI (n=417)			
Malnutrition/Eutrophia	201	48.2	43.4-53.0
Overweight	137	32.9	28.3-37.4
Obesity	79	18.9	15.2-22.7

Variables	n	%	CI 95%
Dieting to reduce body mass (n=490)			
Yes	130	26.5	22.7-30.7
No	360	73.5	69.3-77.3
Perception of body mass (n=485)			
Lower	27	5.6	3.8-8.1
Adequate	191	39.4	35.0-43.9
Above	267	55.1	50.5-59.5
Body mass satisfaction (n=485)			
Yes	157	32.4	28.2-36.5
No	328	67.6	63.5-71.8
Child			
Gender (n=602)			
Male	263	43.7	39.7-47.8
Female	339	56.3	52.2-60.3
Skin color (n= 597)			
White	433	71.9	68.1-75.4
Mulatto	95	15.8	13.0-19.0
Black	69	11.5	9.1-14.3
Age (n=602)			
Up to 10 years	380	63.1	59.3-67.0
11 years or more	222	36.9	33.0-40.7
Self-perception of body mass (n=602)			
Lower	128	21.3	16.7-25.8
Adequate	339	56.3	50.6-62.0
Above	135	22.4	18.3-26.5
Body image dissatisfaction (n=602)			
No	139	23.1	19.7-26.5
Yes	463	76.9	73.5-80.3

Variables	n	%	CI 95%
Parent perception of body mass (n=486)			
Lower	64	13.2	10.4-16.6
Adequate	309	63.6	59.1-67.8
Above	113	23.3	19.6-27.3
Attempts to gain weight (n=602)			
Yes	137	22.8	19.5-26.4
No	465	77.2	73.6-80.5
Attempts to lose weight (n=602)			
Yes	283	47.0	43.0- 51.1
No	319	53.0	48.9-57.0
Dieting to reduce body mass (n=602)			
Yes	198	32.9	29.2-36.8
No	404	67.1	29.2-36.8
Parental assessment of child's health (n=492)			
Very good	226	45.9	41.5-50.5
Good	209	42.5	38.1-47.0
Inadequate/Bad	57	11.6	8.1-17.3
Body Mass Index (n=602)			
Low	56	9.3	7.2-12.0
Adequate	356	59.1	55.1-63.1
High	190	31.6	27.9-35.5

Percentage (%) and Confidence Interval of 95% (CI = 95%)
BMI – Body Mass Index

Table 3. Adjusted and gross odds ratios, and their confidence intervals of 95% (95% CI) by unconditional logistic regression, of the association between abdominal obesity and children variables and parents from Itajaí-SC Brazil 2010.

Variables	n	%	Gross OR (CI 95%)	p*	Adjusted OR (CI 95%)	p**
Parent						
Skin color				0.740		
White	40	12.7	1.0			
Mulatto/black	13	10.4	0.80 (0.4-1.4)			
Education				0.332		
Up to 8 years	25	12.1	1.0			
9 to 11 years	18	10.8	0.9 (0.6-1.3)			
12 years or more	9	16.4	1.4 (0.6-3.0)			
Per capita family income				0.026		**0.026**
1st tertile (low)	7	5.5	1.0		1.0	
2nd tertile (middle)	20	17.7	3.7 (1.4-10.1)		3.7 (1.4-10.1)	
3rd tertile (high)	16	13.3	2.6 (1.0-6.7)		2.6 (1.0-6.7)	
BMI				0.005		**0.016**
Malnutrition/Eutrophia	11	6.2	1.0		1.0	
Overweight	19	15.4	2.8 (1.2-6.2)		3.9 (1.5- 10.0)	
Obesity	17	23.6	4.7 (1.6-13.3)		4.9 (1.2- 20.2)	
Dieting to lose weight				0.316		
No	37	11.5	1.0			
Yes	16	13.8	1.2 (0.8-1.9)			
Perception of body mass				0.021		
Lower	0	0	§			
Adequate	15	8.6	§			
Higher	38	16.1	§			
Body mass satisfaction				0.021		
Yes	9	6.3	1.0			
No	44	15.2	2.7 (1.2-6.2)			

Child						
Gender				0.081		
Male	34	14.7	1.0			
Female	28	8.9	0.6 (0.3-1.1)			
Skin color				0.920		
White	46	11.6	1.0			
Mulatto	9	10.2	0.9 (0.4-1.8)			
Black	7	11.2	1.0 (0.4-2.8)			
Age				0.020		**0.015**
Up to 10 years	45	72.6	1.0		1.0	
11 years or more	17	27.4	0.6 (0.4-0.9)		0.6 (0.4 – 0.9)	
Self-perception of body mass				<0.001		
Thin	0	0	§			
Normal	10	3.3	1.0			
Fat	52	41.9	§			
Parental perceptions of body mass				**<0.001**		
Lower	0	0	1.0			
Adequate	3	1.1	15.2 (5.8-39.5)			
Higher	49	52.1	101.2 (28.1-364.2)			
Body dissatisfaction				0.002		**0.031**
No	2	1.6	1.0		1.0	
Yes	60	14.3	10.4 (2.0-55.0)		11.9 (1.3-108.6)	
Attempts to lose weight				<0.001		
No	7	2.4	1.0			
Yes	55	21.5	11.1 (5.4-22.7)			
Dieting to lose weight				0.001		**0.003**
No	25	6.70	1.0		1.0	
Yes	37	21.3	3.7 (1.9-7.6)		3.9 (1.7-9.09)	

Parental assessment of child's health				0.012	**0.014**
Very good	16	7.9	1.0	1.0	
Good	27	14.2	1.9 (1.0-3.7)	2.0 (0.7-6.0)	
Inadequate/Bad	10	21.3	3.2 (1.4-6.8)	3.6 (1.0-13.2)	

BMI = Body Mass Index

*Pearson chi-square test, adjusted for design effect.

** Wald test adjusted for design effect.

§ some information have nulled value, thus the OR cannot be accounted.

Discussion

The present study aimed to identify the prevalence of abdominal obesity and its association with sociodemographic and anthropometric factors, perceptions and behaviors regarding the body mass of 4th and 5th graders at public schools in Itajaí-SC. The prevalence of abdominal obesity (11.3%) in the investigated population was similar to that observed among ten years old school children in Ontario (13.8%).[20]

Among the children studied, those in more favorable socioeconomic status had a higher prevalence of abdominal obesity. Fernandes et al.[10] have also observed greater chances of abdominal obesity for adolescents with high socioeconomic status, and mostly enrolled in private schools, as well as maternal body overweight, or of both parents, associated with abdominal obesity among adolescents.[10] Among urban adolescents with HDI considered to be on average/low, Minatto et al.[21] have observed more inadequate standards of body composition for high and middle socioeconomic strata.

It is important to note that the methods used to measure and assess the socioeconomic status of individuals in this present study differ from those used in the studies compared.[10,21] It is also important to consider the age group of schoolchildren, since it ranged from 7.7 to 14.3 years of age, considering that significant changes occur to the human body from childhood to adolescence.[7]

Evidence from the literature have shown that general obesity is a phenomenon of multiple origins and substantially influenced by genetic and environmental factors.[1,22] However, regardless of the different genetic or environmental factors associated with the development of obesity, it is common sense in the literature that family is a prospective agent associated with this process.[10]

Factors that explain greater prevalence of obesity in children and adolescents with higher income, include: highest income / food supply for that adolescent (fewer people in the household and better economic conditions) and higher sedentary behavior at home (number of televisions in the residence).[10]

Studies suggest parent food preferences influence and shape those of their children. [1,23] Exposure from early life to foods preferred by parents favors the child development of food preferences.[23]

Among the variables related to the perception and attitudes in relation to body mass, it was observed that children with abdominal obesity had a higher prevalence of perceiving their body mass as higher than ideal, and also had their body mass perceived by parents as inadequate more frequently. In addition, these children were more likely to be dissatisfied with their body image, as well as having attempted to reduce their body mass.

This research has shown that many children, especially girls, in the age of five, are dissatisfied with their bodies, and show concern about passing over the adequate body mass, thus they create strategies to lose body mass, such as eating less and exercising.[24] Although the onset of puberty increases the desire to become thinner, there is evidence that in the pre-pubertal stage children are worried about their bodies and seek to lose body mass.[25]

Biological, psychological and sociocultural factors have been relevant for the awareness on the development of concerns about body image and strategies to lose body mass among children, and the primary indicator of children using strategies to lose weight has been considered the pressure of parents, colleagues or the media.[26] The way parents perceive their children's body mass is associated with levels of child dissatisfaction and behaviors.[27]

Ricciardelli & McCabe,[28] in a review study that included 6-11 year-old children, found that 20 to 55.6% of girls reported performing diets to lose body mass; among boys the percentage ranged from 31 to 39%. Exercising with the intent to lose body weight was reported by 43.5 % of girls and 36.5 % of boys. Other practices, such as self-induced vomiting, were observed in 1.8 and 0.7 % of girls and boys, respectively.[28]

One of the reasons why obese children seek help for the problem of dissatisfaction with excess body weight is that they feel uncomfortable with their body image, which will interfere with their sense of self-esteem. Especially in a context where thin body, slim body, is valued, and fashionable clothes are made in small sizes, this seems to be most uncomfortable and experienced with feelings of anger, anxiety and guilt[29]

Thus, both parent and children variables were associated with the prevalence of abdominal obesity among the children in this study. However, it is important to be careful when interpreting our results, considering the cross-sectional design of this study. Moreover, the techniques used in the selection of schools and children, and the good participation of children in this study, indicate that data can be extended to children aged 4 and 5, enrolled in public schools in Itajai. Furthermore, the design effect was considered in the analysis.

There are discussions regarding the cutoff point for defining abdominal obesity in children. The cutoff points proposed by Taylor et al.[16] were based on a study using the absorptiometry for double beam (DXA) method that has been considered a benchmark in assessing body composition.[30]

Conclusions

Finally, a prevalence of abdominal obesity was observed among children included in this study, similar to those observed in other studies in Brazil. Higher family income, excess body mass, and children perceptions about adequate body mass remained associated with higher prevalence of abdominal obesity. In addition, children's perception of their nutritional status, their dissatisfaction with body image and the attempts to lose body weight were also associated with abdominal obesity.

Thus, the results observed hereby strengthen the importance of conducting multidisciplinary activity, involving the families of children, with the aim of reducing the prevalence of abdominal obesity and enabling greater quality of life for children.

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